NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7
BIOLOGICAL OPINION

Title: Biological Opinion on the Proposed Issuance of Incidental Take Permit No. 21316, Barney Davis Power Plant, Corpus Christi, Texas Pursuant to Section 10(a)(1)(B) of the Endangered Species Act

Consultation Conducted By: Endangered Species Act Interagency Cooperation Division, Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce

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

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1 INTRODUCTION

The Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et seq.) establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat they depend on. Section 7(a)(2) of the ESA requires Federal agencies to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. Federal agencies must do so in consultation with National Marine Fisheries Service (NMFS) for threatened or endangered species (ESA-listed), or designated critical habitat that may be affected by the action that are under NMFS jurisdiction (50 C.F.R. §402.14(a)). If a Federal action agency determines that an action "may affect, but is not likely to adversely affect" endangered species, threatened species, or designated critical habitat and NMFS concurs with that determination for species under NMFS jurisdiction, consultation concludes informally (50 C.F.R. §402.14(b)).

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, NMFS provides an opinion stating whether the Federal agency's action is likely to jeopardize ESA-listed species or destroy or adversely modify designated critical habitat. If NMFS determines that the action is likely to jeopardize listed species or destroy or adversely modify critical habitat, NMFS provides a reasonable and prudent alternative that allows the action to proceed in compliance with section 7(a)(2) of the ESA. If an incidental take is expected, section 7(b)(4) requires NMFS to provide an incidental take statement that specifies the impact of any incidental taking and includes reasonable and prudent measures (RPMs) to minimize such impacts and terms and conditions to implement the RPMs. Updates to the regulations governing interagency consultation (50 C.F.R. 402) became effective on October 28, 2019 (84 FR 44976). This consultation was pending at the time the regulations became effective and we are applying the updated regulations to the consultation. As the preamble to the final rule adopting the regulations noted, "This final rule does not lower or raise the bar on section 7 consultations, and it does not alter what is required or analyzed during a consultation. Instead, it improves clarity and consistency, streamlines consultations, and codifies existing practice." We have reviewed the information and analyses relied upon to complete this biological opinion (Opinion) in light of the updated regulations and conclude the Opinion is fully consistent with the updated regulations.

The action agency for this consultation is the NMFS, Office of Protected Resources, Marine Mammal and Sea Turtle Conservation Division for its issuance of an incidental take permit (ITP) pursuant to section 10(a)(1)(B) of the ESA. Permit No. 21316 authorizes the take of North Atlantic Distinct Population Segment (DPS) green sea turtles and Kemp's ridley sea turtles as part of the operation of the Barney Davis, LLC fired electric power generating station, located in Corpus Christi, Texas. The Marine Mammal and Sea Turtle Conservation Division proposes to issue ITP No. 21316 for the duration of ten years after the date of issuance, and may be extended up to one year per Federal regulations (50 C.F.R. §§222.304-222.307). The proposed permit would authorize, for the entire 10-year duration of the permit, the incidental take of up to 206

North Atlantic DPS green sea turtles (up to 24 dead), and four live (no mortalities) Kemp's ridley sea turtles.

This consultation, biological opinion, and incidental take statement, were completed in accordance with section 7, associated implementing regulations (50 C.F.R. §§402.01-402.16), and agency policy and guidance. This consultation was conducted by NMFS Office of Protected Resources Endangered Species Act Interagency Cooperation Division (hereafter referred to as "we").

This document represents the NMFS opinion on the effects of these actions on ESA-listed species and designated critical habitat. These species include: Green sea turtle (*Chelonia mydas*) North Atlantic Distinct Population Segment; Kemp's ridley sea turtle (*Lepidochelys kempii*); Hawksbill sea turtle (*Eretmochelys imbricata*); Leatherback sea turtle (*Dermochelys coriacea*); and Loggerhead sea turtle (*Caretta caretta*) Northwest Atlantic Ocean. None of these species have designated critical habitat in the action area.

A complete record of this consultation is on file at NMFS Office of Protected Resources in Silver Spring, Maryland.

1.1 Background

The Barney Davis Power Plant is a natural gas-fired electric power generating facility. The facility is located at 4301 Waldron Road, Corpus Christi, Nueces County, Texas. The facility has approximately 1,992 acres of land between the Laguna Madre and Oso Creek and is comprised of two natural gas fired combustion turbines, two Heat Recovery Steam Generators, one steam turbine, and one gas-fired boiler driving a Westinghouse steam turbine. There are continuous emission monitoring buildings, multiple warehouses, the main building (administrative offices, control room, and laboratory), switch gear house, resources center, emergency generator building, and two chillers. Electric generation occurs year-round, with outage periods as necessary.

The facility has a 0.75-mile intake canal into the Laguna Madre leading to the facility's cooling water intake structure. The phenomenon of "cold-stunning" occurs to sea turtles in the waters around the facility's intake structure. During cooler months, sea turtles in the Laguna Madre cross the entrance of the facility's intake canal to where water is cooler, and become "cold-stunned" and therefore unable to swim. Once the sea turtles are cold-stunned, they float into the facility's intake canal, toward the facility. The facility has experienced an increased occurrence in the number of sea turtles in the intake canal during the winter months (December-March). The facility currently coordinates with Texas Parks and Wildlife Department (TPWD) in the Coastal Conservation Association Marine Development Center to collect and relocate sea turtles that have migrated into the intake canal. The facility currently coordinates with TPWD in the Coastal and Conservation Associate Marine Development Center to collect and relocate sea turtles that have migrated into the intake canal.

The proposed permit, ITP No. 21316, would authorize, for the entire 10-year duration of the permit, the incidental take of up to 206 North Atlantic DPS green sea turtles (up to 24 dead), and four live Kemp's ridley sea turtles (no mortalities).

1.2 Consultation History

The following dates are important to the history of the current consultation:

- On December 23, 2015, Barney Davis, LLC applied for an incidental take permit.
- After discussions with NMFS Marine Mammal and Sea Turtle Conservation Division, Barney Davis submitted an updated application on November 4, 2016 with additional information submitted on August 25, 2017, when the application was considered complete.
- On September 14, 2017, NMFS Marine Mammal and Sea Turtle Conservation Division published a notice of receipt of the Barney Davis, LLC application (ITP 21316) in the Federal Register (82 FR 43224). After additional discussions between NMFS Marine Mammal and Sea Turtle Conservation Division and the applicant, additional revisions were made to the application and Conservation Plan, and final application was submitted on October 19, 2018.
- On May 16, 2019, the Marine Mammal and Sea Turtle Conservation Division sent an ESA section 7 consultation initiation package to the ESA Interagency Cooperation Division.
- On June 15, 2019, the ESA Interagency Cooperation Division determined that the initiation package was complete and initiated formal consultation on ITP No. 21316.
- On September 27, 2019, NMFS Marine Mammal and Sea Turtle Conservation Division published a second notice of availability in the *Federal Register* (84 FR 51116) to request public comment on the Draft Environmental Assessment (EA) and revised application and conservation plan. No public comments were received on either the Draft EA or the revised application.
- In February 2020, the NMFS Marine Mammal and Sea Turtle Conservation Division , requested further revisions to the application and conservation plan based on the availability of more recent Barney Davis intake canal sea turtle capture data (through 2019), which was documented and provided by the Texas Sea Turtle Stranding and Salvage Network. This updated data allowed for discussions on the structure and level of take the applicant requested in their application. Barney Davis resubmitted their revised application and conservation plan on June 26, 2020. In light of the more recent data, NMFS Marine Mammal and Sea Turtle Conservation Division updated the EA, and we updated the Biological Opinion with the best available data on past captures at the Barney Davis facility.

2 THE ASSESSMENT FRAMEWORK

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species; or adversely modify or destroy their designated critical habitat.

"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 recovery of an ESA-listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 C.F.R. §402.02).

"Destruction or adverse modification" means a direct or indirect alteration that appreciably diminishes the value of designated critical habitat for the conservation of an ESA-listed species as a whole (50 C.F.R. §402.02).

An ESA section 7 assessment involves the following steps:

Description of the Proposed Action (Section 3) and *Action Area* (Section 4) describe the proposed action, identify any consequences of the action, and describe the action area with the spatial extent of the stressors of the action that may have effects on the physical, chemical, and biotic environment.

Status of Endangered Species Act Protected Resources (Section 5): We identify the ESA-listed species and designated critical habitat that are likely to co-occur with those stressors in space and time and evaluate the status of those species and habitat. In this Section, we also identify those *Species and Designated Critical Habitat Not Likely to be Adversely Affected* (Section 5.1), and those *Species and Designated Critical Habitat Likely to be Adversely Affected* (Section 5.2).

Environmental Baseline (Section 6): We describe the environmental baseline as the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.

Effects of the Action (Section 7): Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. We identify the number, age (or life stage), and gender of ESA-listed individuals that are likely to be exposed to the stressors and the populations or

subpopulations to which those individuals belong. We also consider whether the action "may affect" designated critical habitat. This is our exposure analysis. We evaluate the available evidence to determine how individuals of those ESA-listed species are likely to respond given their probable exposure. We also consider how the action may affect designated critical habitat. This is our response analyses. We assess the consequences of these responses of individuals that are likely to be exposed to the populations those individuals represent, and the species those populations comprise. The risk analysis also considers the impacts of the proposed action on the physical and biological features (PBFs) and conservation value of designated critical habitat. This is our risk analysis.

Cumulative Effects (Section 8): Cumulative effects are the effects to ESA-listed species and designated critical habitat of future state or private activities that are reasonably certain to occur within the action area 50 C.F.R. §402.02. Effects from future Federal actions that are unrelated to the proposed action are not considered because they require separate ESA section 7 compliance.

Integration and Synthesis (Section 9): In this section, we integrate the analyses in the opinion to summarize the consequences to ESA-listed species and designated critical habitat under NMFS' jurisdiction. With full consideration of the status of the species and the designated critical habitat, we consider the effects of the action within the action area on populations or subpopulations and on PBFs when added to the environmental baseline and the cumulative effects to determine whether the action could reasonably be expected to:

- Reduce appreciably the likelihood of survival and recovery of ESA-listed species in the wild by reducing its numbers, reproduction, or distribution, and state our conclusion as to whether the action is likely to jeopardize the continued existence of such species; or
- Appreciably diminish the value of designated critical habitat for the conservation of an ESA-listed species, and state our conclusion as to whether the action is likely to destroy or adversely modify designated critical habitat.

The results of our jeopardy analysis are summarized in the *Conclusion* (Section 10). If, in completing the last step in the analysis, we determine that the action under consultation is likely to jeopardize the continued existence of ESA-listed species or destroy or adversely modify designated critical habitat, then we must identify reasonable and prudent alternative(s) to the action, if any, or indicate that to the best of our knowledge there are no reasonable and prudent alternatives (see 50 C.F.R. §402.14(h)(3)).

In addition, we include an *Incidental Take Statement* (Section 11) that specifies the impact of the take, reasonable and prudent measures to minimize the impact of the take, and terms and conditions to implement the reasonable and prudent measures (ESA section 7 (b)(4); 50 C.F.R. §402.14 (i)). We also provide discretionary *Conservation Recommendations* (Section 12) that may be implemented by action agency. 50 C.F.R. §402.14 (j). Finally, we identify the circumstances in which *Reinitiation of Consultation* (Section 13) is required (50 C.F.R. §402.16).

To comply with our obligation to use the best scientific and commercial data available, we collected information identified through searches of Google Scholar, Web of Science, literature cited sections of peer reviewed articles, species listing documentation, and reports published by government and private entities. This opinion is based on our review and analysis of various information sources, including:

- Information submitted by the Marine Mammal and Sea Turtle Conservation Division and the applicant
- Government reports (including NMFS biological opinions and stock assessment reports)
- NOAA technical memos
- Peer-reviewed scientific literature

These resources were used to identify information relevant to the potential stressors and responses of ESA-listed species and designated critical habitat under NMFS' jurisdiction that may be affected by the proposed action to draw conclusions on risks the action may pose to the continued existence of these species and the value of designated critical habitat for the conservation of ESA-listed species.

3 DESCRIPTION OF THE PROPOSED ACTION

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies (50 C.F.R. §402.02). The proposed action in this Opinion is Marine Mammal and Sea Turtle Conservation Division's issuance of an ITP pursuant to Section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C.1531 et seq.) and the regulations governing the incidental taking of endangered and threatened species (50 CFR 222.307), to incidentally take North Atlantic DPS green sea turtles and Kemp's ridley sea turtles during the course of an otherwise lawful activity.

The ITP will be valid for ten years from the date issuance and will authorize incidental take of up to 206 live and 24 dead green sea turtles and four live and 0 dead Kemp's ridley sea turtles during any consecutive three-year period for the ten-year duration of the ITP. The ITP does not delineate these takes by sex or by lifestage and all sea turtles are assumed to be juveniles/adults.

Because Marine Mammal and Sea Turtle Conservation Division's proposed action is a direct outcome of Barney Davis's request for a permit to take ESA-listed sea turtles incidental to conducting an otherwise lawful activity, the purpose of NMFS Marine Mammal and Sea Turtle Conservation Division's action is to evaluate Barney Davis's application pursuant to Section 10(a)(1)(B) of the ESA. The need for NMFS's action is to meet its obligation to grant or deny the permit request under the ESA. Barney Davis, LLC submitted an adequate and complete application demonstrating the potential eligibility for the ITP, thus NMFS ESA Interagency Cooperation Division has a corresponding duty to determine whether and how to authorize take of the ESA-listed sea turtles incidental to the activities described in the application.

To authorize take of ESA-listed species, NMFS ESA Interagency Cooperation Division evaluates the application to determine if the taking is incidental to, not the purpose of, an

otherwise lawful activity and that the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. NMFS ESA Interagency Cooperation Division also evaluates the best available scientific information to determine whether the mitigation proposed by the applicant, to the maximum extent practicable, will minimize and mitigate the impacts of such take and whether any additional conservation measures are required to ensure that the taking will not jeopardize the survival and recovery of the ESA-listed species and that the applicant can ensure adequate funding to implement its commitments under the conservation plan and ITP. An ITP must also include requirements or conditions pertaining to monitoring and reporting. NMFS Marine Mammal and Sea Turtle Conservation Division cannot issue an ITP if this criterion cannot be met.

3.1 Conservation Plan

Section 10 of the ESA specifies that no ITP may be issued unless an applicant submits an adequate conservation plan. The conservation plan prepared by Barney Davis LLC describes measures designed to minimize and mitigate the impacts of any incidental takes of ESA-listed sea turtles.

The facility utilizes a 0.75-mile cooling water intake canal leading to the cooling water intake structure (CWIS) from the Laguna Madre. Although the facility has been in operation since 1974, the presence of sea turtles in the intake canal has only occurred during the past ten years, and is primarily associated with cold-stunning events. The facility has experienced an increased occurrence of cold-stunned sea turtles in the intake canal during the winter months and currently coordinates with TPWD in the Coastal Conservation Association (CCA) Marine Development Center to collect and relocate sea turtles that have migrated into the intake canal.

The facility monitors the intake canal and bulkhead in an effort to intercept sea turtles prior to their contact with the traveling trash racks. When a sea turtle is located during business hours, the sea turtle is collected by TPWD and held at their nearby facility (CCA Marine Development Center) located within the facility property until the U.S. Fish and Wildlife Service collects the sea turtle(s) for tagging and rehabilitation at the Animal Rehabilitation Keep prior to release in the Gulf. If TPWD is unable to collect the turtle, they will instruct facility personnel to collect the animal. A telescopic pole with a net attached will be utilized to collect the turtle. The turtle will then be placed in an open-top container to be measured and documented prior to being transferred to a secure area inside and placed in a dry plastic pool to await collection by TPWD. If a turtle is located after hours, trained facility personnel will collect the animal utilizing the same procedure identified above. These procedures were developed in accordance with communications between the National Park Service, Division of Sea Turtle Science and Recovery, Padre Island National Seashore.

Although every effort will be made to intercept sea turtles prior to the cooling water intake structure, it is possible that a stunned sea turtle may become impinged in the automatic rake prior to entering the structure. Any impingement of turtles could be lethal.

3.2 Minimization and Mitigation Measures

Facility personnel will visually monitor from the area immediately surrounding the cribhouse, which includes the bulkhead, trash racks, and intake canal on a seasonal schedule. From December 1 through March 31 each year, monitoring will be conducted a minimum of four times per twelve-hour shift, spaced at approximately three hour intervals. From April 1 through November 30 each year, monitoring will be conducted one time per shift, or once approximately every twelve hours. Visual monitoring will last for approximately fifteen minutes during each monitoring event. The frequency and length of each monitoring event provides sufficient opportunity to identify turtles in the intake canal and bulkhead prior to the turtles reaching the traveling trash racks. Monitoring will be conducted from the crib house due to safety concerns at the facility (i.e. lighting, guardrails, and safe walking surfaces are not available for the entire length of the intake canal). Upon sighting a turtle, personnel will leave the crib house to collect the animal.

Facility personnel responsible for monitoring the intake canal will be trained upon hire, and again annually, in the proper procedures required for the collection of turtles. This training will include proper recordkeeping procedures, as well as turtle identification training, in order to maintain accurate facility records. This training will be conducted by the National Park Service, Division of Sea Turtle Science and Recovery, Padre Island National Seashore (Sea Turtle Stranding and Salvage Network). Training records will be maintained on-site for review and/or inspection. Official procedures for monitoring and mitigation activities at the facility are located in the "Incidental Take and Conservation Plan" (ITCP) (Davis 2020). The ITCP requires photos of species that may enter the canal to assist personnel with species identification. The ITCP also requires facility personnel to obtain the length of the turtle(s) collected and assist personel in estimating the age of the turtle(s) collected. Copies of these records will be maintained on-site for ten years, on a rolling basis.

3.3 Incidental Take

Incidental take under the proposed permit is estimated on an annual basis, with the majority of take occurring during the colder winter months (December to March) (Table 1).

Table 1. Historically documented takes for sea turtles at the Barney Davis facility between 2009 and 2019.

Year	Sea Turtle Species	Alive	Dead	Total
2019	Green	1	0	1
2018	Green	5	0	5
2017	Green	7	1	8
2016	Green	12	1	13
2015	Green	6	1	7
2014	Green	67	6	73
2014	Kemp's Ridley	1	0	1
2013	Green	70	13	83
2012	Green	8	2	10
2010	Green	5	0	5
2009	Green	1	0	1

Data provided by the Texas Sea Turtle Salvage and Stranding Network, Padre Island National Seashore Division of Sea Turtle Science and Recovery, and Barney Davis Facility Records.

Typically, turtles are located in the intake canal and/or bulkhead prior to reaching the traveling-trash racks; however, it is possible that a sea turtle may become impinged on the travelling-trash rack. Due to the arrangement and operations of the intake structure, impingement of turtles may be lethal. The historical take data above includes turtles that were located in the intake canal and/or bulkhead, as well as any turtles that may have been impinged on the trash racks. Records specifying the location of the turtles are unavailable for historic takes. However, discussions with facility personnel indicate that the majority of turtles have been and continue to be located at the intake canal and bulkhead prior to entering other components of the intake structure. The facility has implemented recordkeeping procedures to document takes of sea turtles including the location of the take. The recovery of turtles will follow the procedure identified in the ITCP (Davis LLC 2020).

The estimated incidental take of sea turtles for ITP No. 21316 (Table 2) was calculated based on a review of the cumulative takes over the last 10 years, between 2010-2019 by the applicant. No estimates of life-stages or sex ratios are specified.

Table 2. Proposed take of sea turtles under Incidental Take Permit No. 21316.

Species	**Listing Unit**	Total Captures Over 10-year period **(includes turtles found in the intake canal and cooling water intake structure)**	Mortalities Over 10-year period **(*subset of total captures)**
Green Sea Turtle	North Atlantic Distinct Population Segment	206	24*
Kemp's Ridley Sea Turtle	Range-wide	4	0

The incidental take authorization applies to sea turtles that are observed and collected from the facility property, including free swimming animals collected from the intake canal (cold-stunned or healthy), dead animals collected from the intake canal, and live or dead animals that are collected from the CWIS after impingement. This take authorization is based on the best available science.

4 ACTION AREA

Action area means all areas affected directly, or indirectly, by the Federal action, and not just the immediate area involved in the action (50 C.F.R. §402.02). The proposed action would occur in the Barney Davis Power Plant property (Figure 1).

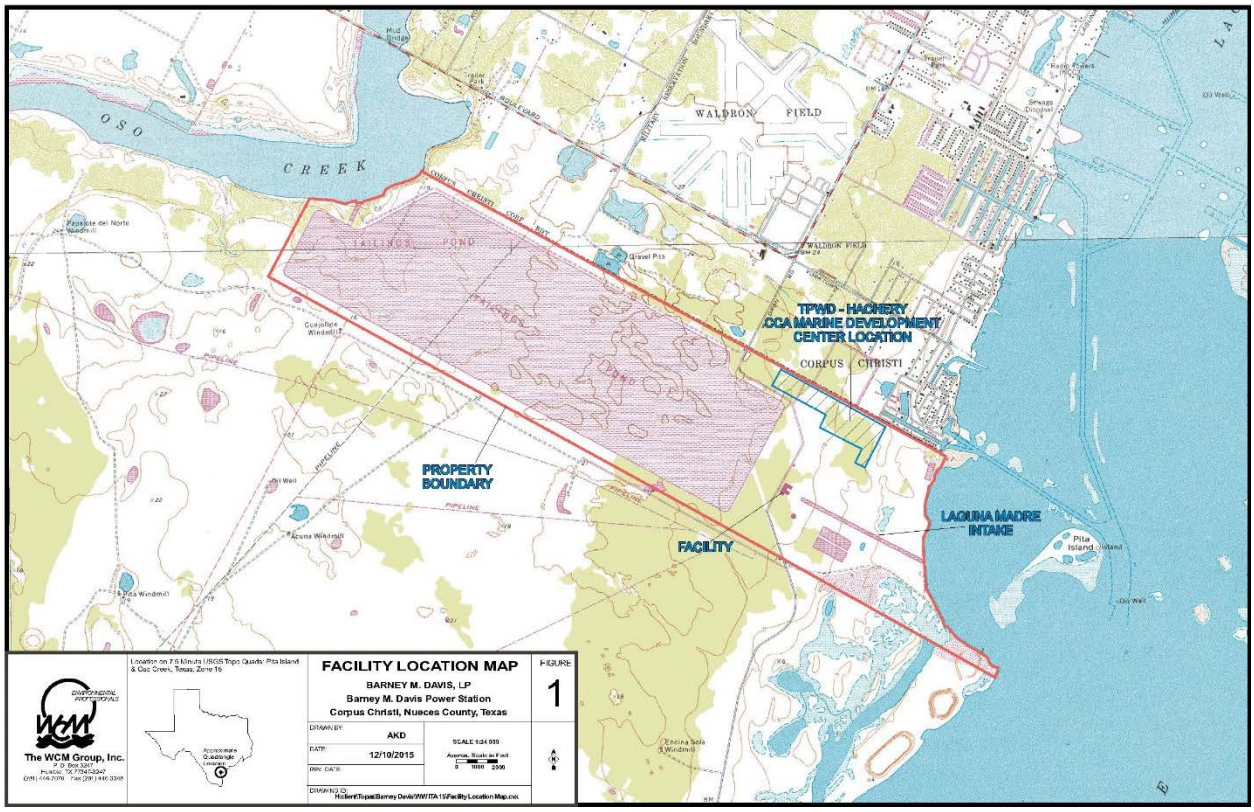


Figure 1. Action area for Incidental Take Permit No. 21316. The Barney Davis Power Plant property and Laguna Madre area.

The facility has approximately 1,992 acres of land between the Laguna Madre and Oso Creek and is comprised of two natural gas fired combustion turbines, two Heat Recovery Steam Generators, one steam turbine, and one gas-fired boiler driving a Westinghouse steam turbine. There are Continuous Emission Monitoring buildings, multiple warehouses, the main building (administrative offices, control room, and laboratory), switch gear house, resources center, emergency generator building, and two chillers. Electric generation occurs year-round, with outage periods as necessary (Figure 2).

Up to 540 million gallons per day of water are drawn from the Laguna Madre to be used for non-contact cooling at the facility. This water travels down a 0.75-mile intake canal into the Laguna Madre leading to the facility's Cooling Water Intake Structure (Figure 3). Cooling water passes through the bulkhead where dead and dying seagrass fragments, referred to as "wrack," are removed. The water for each unit then passes through a traveling-trash rack composed of 0.5-inch steel bars on 3.5-inch centers, a concrete receiving area that is 13 feet wide, traveling water screens, and then to sumps for the cooling water pumps. Passavant fine-mesh, center-flow screens are operated continuously to reduce the numbers of entrained organisms. The current screens are constructed with 1 by 2 millimeter rectangular nylon mesh to reduce clogging with a calculated maximum through-screen velocity of 1.15 foot per second. As the screens rotate, high-pressure wash water flushes the back side of each panel at the top of the vertical cycle into an

overhead trough which carries the impinged organisms and debris to a peripheral fish handling device. The screen-wash water goes to a sluiceway which empties into a concrete sump and from there is pumped directly into the facility's cooling pond via pipeline.

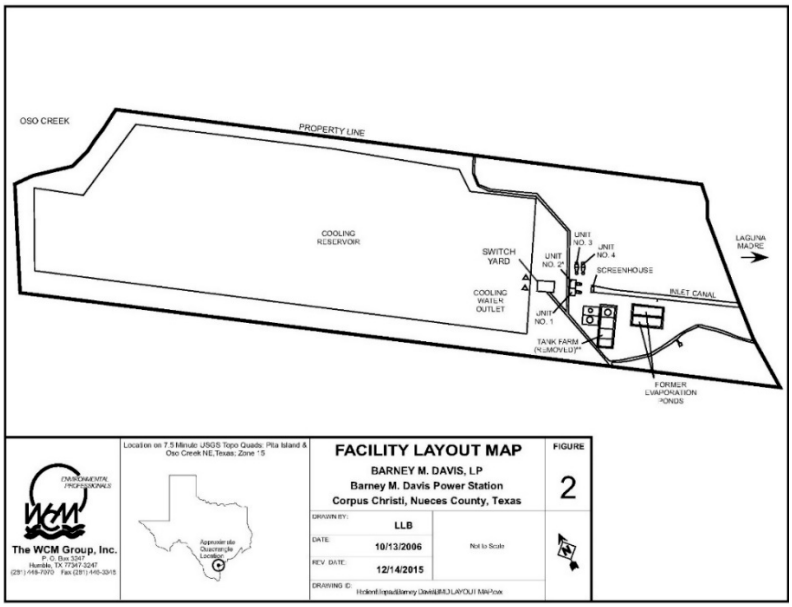


Figure 2. The Barney Davis Power Plant facility layout.

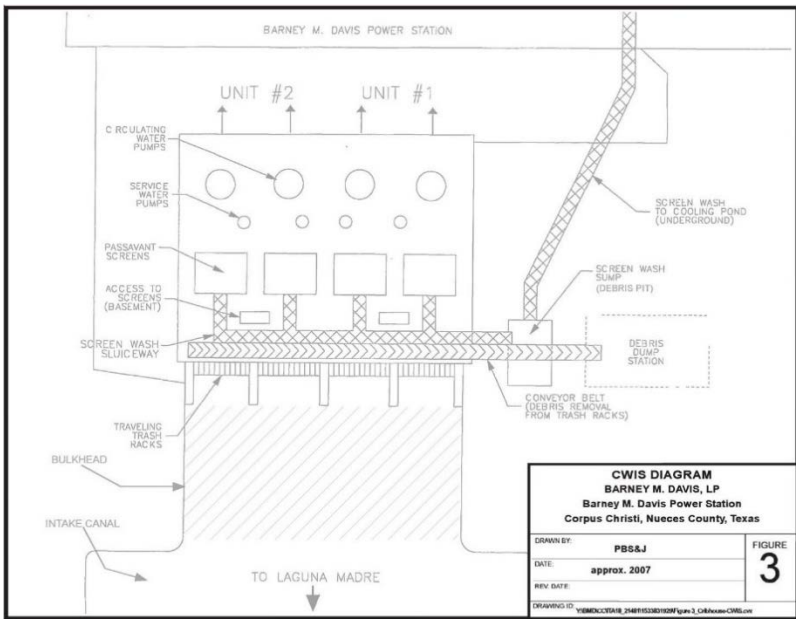


Figure 3. Cold Water Intake Structure diagram.

Water intake volumes for Barney Davis Power Plant varied by month during 2018 and 2019 from approximately 6,000 million gallons per month in January to almost 15,000 million gallons per month in August (Table 3). The monthly variability in intake volume is likely related to the seasonal needs for cooling water volumes due to air and temperatures.

Table 3. Monthly cooling water intake volumes (million gallons/month) for the Barney Davis LLC during 2018 and 2019.

Month	2018	2019
January	5929.80	5045.09
February	4422.30	1968.06
March	3408.30	1303.98
April	5945.80	6452.66
May	10114.00	11314.90
June	11845.80	10519.87
July	13512.60	14472.40
August	13650.40	14871.52
September	9350.60	13228.33
October	7327.60	9271.56
November	2916.10	5229.67
December	3293.70	5157.67
Total:	91717.00	98835.71

5 STATUS OF ENDANGERED SPECIES ACT PROTECTED RESOURCES

This section identifies the ESA-listed species that potentially occur within the action area that may be affected by the issuance of ITP No. 21316. It then summarizes the biology and ecology of those species and what is known about their life histories in the action area. The ESA-listed species and designated critical habitat potentially occurring within the action area are shown in Table 4 along with their regulatory status.

Table 4. ESA-listed species and designated critical habitat that may be affected by the issuance of Incidental Take Permit No. 21316.

Species	ESA Status	Critical Habitat	Recovery Plan
Green sea turtle (*Chelonia mydas*) North Atlantic DPS	Threatened 81 FR 20057 04/06/2016	Designated, Not in the Action Area	FR Notice Not Available U.S. Atlantic 1991
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered 35 FR 18319 12/02/1970	Not Designated	75 FR 12496 U.S. Caribbean, Atlantic, and Gulf of Mexico (2nd) 2011
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered 35 FR 8491 6/2/1970	Designated, Not in the Action Area	57 FR 38818 Atlantic 1992
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered 35 FR 8491 6/2/1970	Designated, Not in the Action Area	FR Not Available Atlantic 1992
Loggerhead sea turtle (*Caretta caretta*) Northwest Atlantic Ocean	Threatened 76 FR 58868 09/22/2011 43 FR 32800 07/28/1978	Designated, Not in the Action Area	74 FR 2995 2008

5.1 Species and Designated Critical Habitat Not Likely to be Adversely Affected

NMFS uses two criteria to identify the ESA-listed or critical habitat that are not likely to be adversely affected by the proposed action. The first criterion is exposure, or some reasonable expectation of a co-occurrence, between one or more potential stressors associated with the proposed activities and ESA-listed species or designated critical habitat. If we conclude that an ESA-listed species or designated critical habitat is not likely to be exposed to the proposed activities, we must also conclude that the species or critical habitat is not likely to be adversely affected by those activities.

The second criterion is the probability of a response given exposure. ESA-listed species or designated critical habitat that is exposed to a potential stressor but is likely to be unaffected by the exposure is also not likely to be adversely affected by the proposed action. We applied these criteria to the ESA-listed species in Table 4 and we summarize our results below. An action warrants a "may affect, not likely to be adversely affected" finding when its effects are wholly *beneficial, insignificant* or *discountable*. *Beneficial* effects have an immediate positive effect without any adverse effects to the species or habitat. Beneficial effects are usually discussed when the project has a clear link to the ESA-listed species or its specific habitat needs and consultation is required because the species may be affected.

Insignificant effects relate to the size or severity of the impact and include those effects that are undetectable, not measurable, or so minor that they cannot be meaningfully evaluated. Insignificant is the appropriate effect conclusion when plausible effects are going to happen, but will not rise to the level of constituting an adverse effect.

Discountable effects are those that are extremely unlikely to occur. For an effect to be discountable, there must be a plausible adverse effect (i.e., a credible effect that could result from the action and that would be an adverse effect if it did impact a listed species), but it is very unlikely to occur. When the terms "discountable" or "discountable effects" appear in this document, they refer to potential effects that are found to support a "not likely to adversely affect" conclusion because they are extremely unlikely to occur. The use of these terms should not be interpreted as having any meaning inconsistent with our regulatory definition of "effects of the action."

ESA-listed sea species that could potentially occur within the action area include hawksbill, leatherback, and loggerhead sea turtles. There is no historic take of these species at the Barney Davis Facility, nor scientific data to indicate their likely presence in the Laguna Madre.

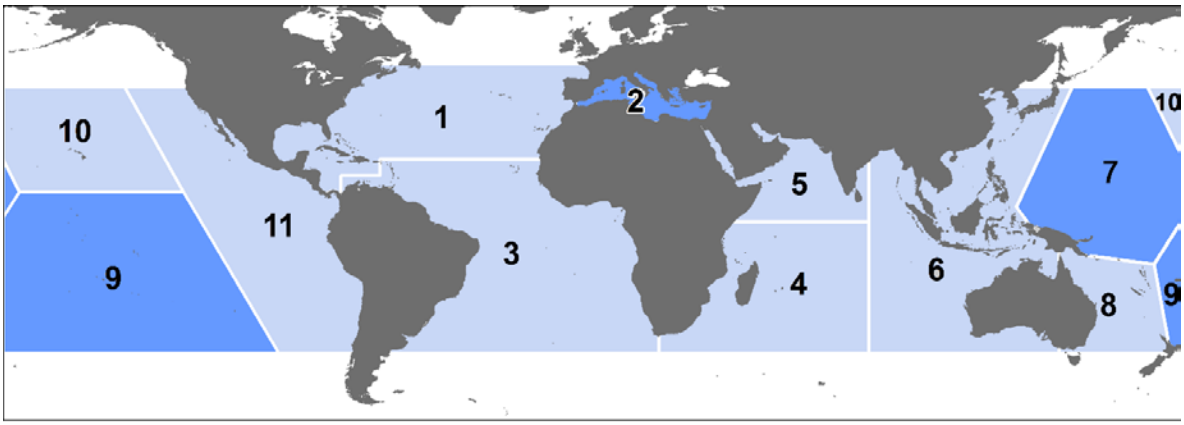
Given the extremely low likelihood of interaction between these sea turtle species and the area of the Barney Davis Facility, we determine that the proposed action is not likely to adversely affect hawksbill, leatherback, and loggerhead sea turtles. There is no designated critical habitat in the action area.

5.2 Species and Critical Habitat Likely to be Adversely Affected

During consultation, we examine the status of each species that may be adversely affected by the proposed action. The evaluation of adverse effects in this Opinion begins by summarizing the biology and ecology of those species that are likely to be adversely affected and what is known about their life histories in the action area. The status is determined by the level of risk that the ESA-listed species face based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. The species status section helps to inform the description of the species' current "reproduction, numbers, or distribution" that is part of the jeopardy determination as described in 50 C.F.R. §402.02. More detailed information on the status and trends of these ESA-listed species, and their biology and ecology can be found in the listing regulations and critical habitat designations published in the Federal Register, status reviews, recovery plans, and on the NMFS Web site.

5.2.1 Green Sea Turtle, North Atlantic Distinct Population Segment

The green sea turtle is globally distributed (Figure 4) and commonly inhabits nearshore and inshore waters, occurring throughout tropical, subtropical and, to a lesser extent, temperate waters. The North Atlantic DPS green turtle is found in the north Atlantic Ocean and Gulf of Mexico (Figure 5).



Threatened (light blue) and endangered (dark blue) 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.

Figure 4. Map depicting range and distinct population segment boundaries for green turtles worldwide.

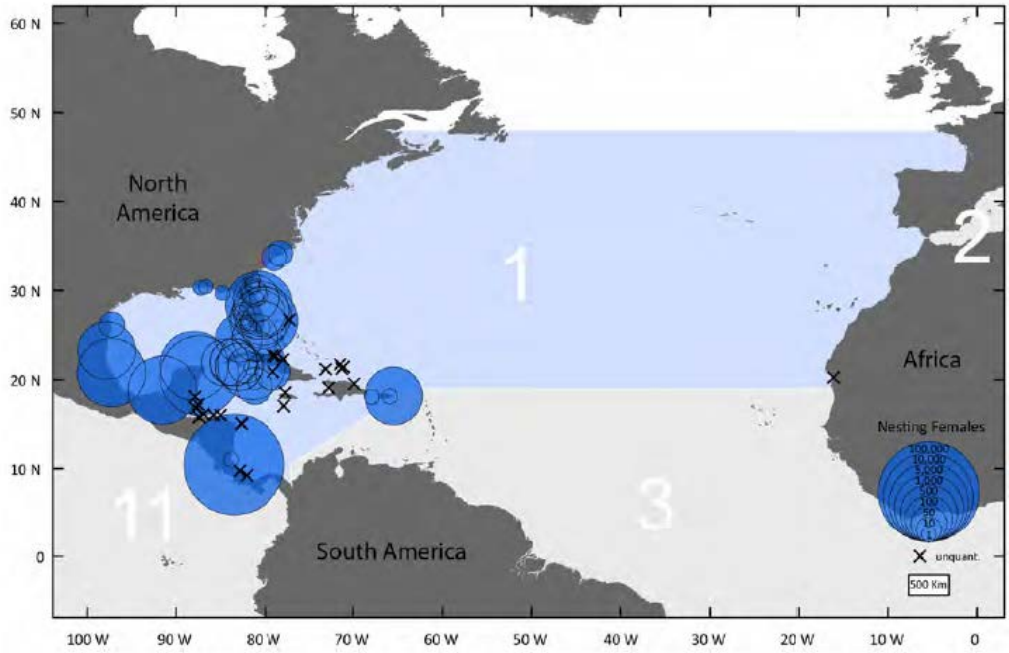


Figure 5. Geographic range of the North Atlantic distinct population segment green turtle, with location and abundance of nesting females (Seminoff et al. 2015).

The green sea turtle is the largest of the hardshell marine turtles, growing to a weight of 350 pounds (159 kilograms) and a straight carapace length of greater than 3.3 feet (1 meter) (Figure 6). The species was listed under the ESA on July 28, 1978.

Figure 6. Green sea turtle. Credit: Mark Sullivan, NOAA.

On April 6, 2016, NMFS listed eleven DPSs of green sea turtles under the ESA; eight as threatened and three as endangered. The DPSs considered in this opinion that occurs within in the action area is the North Atlantic, which is listed as threatened (Table 5).

Table 5. Summary of North Atlantic distinct population segment green sea turtle listing and recovery plan information.

Species	Common Name	Distinct Population Segment	ESA Status	Critical Habitat	Recovery Plan
Chelonia mydas	Green sea turtle	North Atlantic DPS	Threatened 81 FR 20057 04/06/2016	63 FR 46693 Puerto Rico 1998	FR Notice Not Available U.S. Atlantic 1991

We used information available in the 2007 Five Year Review (NMFS and USFWS 2007a) and 2015 Status Review (Seminoff et al. 2015) to summarize the life history, population dynamics and status of the species, as follows.

Life History

Age at first reproduction for females is twenty to forty years. Green sea turtles lay an average of three nests per season with an average of 100 eggs per nest. The remigration interval (i.e., return to natal beaches) is two to five years. Nesting occurs primarily on beaches with intact dune structure, native vegetation and appropriate incubation temperatures during summer months. 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. Adult turtles exhibit site fidelity and migrate hundreds to thousands of kilometers from nesting beaches to foraging areas. Green sea turtles spend the majority of their lives in coastal foraging grounds, which include open coastlines and protected bays and lagoons.

Adult green turtles feed primarily on seagrasses and algae, although they also eat jellyfish, sponges and other invertebrate prey.

Population Dynamics

The following is a discussion of the species' population and its variance over time. This section includes abundance, population growth rate, genetic diversity, and spatial distribution as it relates to the North Atlantic DPS green sea turtle.

Worldwide, nesting data at 464 sites indicate that 563,826 to 564,464 females nest each year. The North Atlantic DPS of green turtles has an estimated 30,058 to 64,396 female nesters in 2010 with an increasing population (Seminoff et al. 2015). Compared to other DPSs, the North Atlantic DPS exhibits the highest nester abundance, with approximately 167,424 females at seventy-three nesting sites and available data indicate an increasing trend in nesting. The largest nesting site in the North Atlantic DPS is in Tortuguero, Costa Rica, which hosts seventy-nine percent of nesting females for the DPS (Seminoff et al. 2015).

There are no reliable estimates of population growth rate for the DPS as a whole, but estimates have been developed at a localized level. Modeling by Chaloupka et al. (2008) using data sets of 25 years or more show the Florida nesting stock at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9 percent, and the Tortuguero, Costa Rica, population growing at 4.9 percent.

The North Atlantic DPS has a globally unique haplotype, which was a factor in defining the discreteness of the population for the DPS. Evidence from mitochondrial DNA studies indicates that there are at least 4 independent nesting subpopulations in Florida, Cuba, Mexico and Costa Rica (Seminoff et al. 2015). More recent genetic analysis indicates that designating a new western Gulf of Mexico management unit might be appropriate (Shamblin et al. 2016).

Green turtles from the North Atlantic DPS range from the boundary of South and Central America (7.5°N, 77°W) in the south, throughout the Caribbean, the Gulf of Mexico, and the U.S. Atlantic coast to New Brunswick, Canada (48°N, 77°W) in the north. The range of the DPS then extends due east along latitudes 48°N and 19°N to the western coasts of Europe and Africa. Nesting occurs primarily in Costa Rica, Mexico, Florida and Cuba.

Distribution

The green sea turtle occupies the coastal waters of over 140 countries worldwide; nesting occurs in more than eighty countries. The green sea turtle is distributed in tropical, subtropical, and to a lesser extent, temperate waters.

Green turtles from the North Atlantic DPS range from the boundary of South and Central America (7.5°N, 77°W) in the south, throughout the Caribbean, the Gulf of Mexico, and the U.S. Atlantic coast to New Brunswick, Canada (48°N, 77°W) in the north. The range of the DPS then extends due east along latitudes 48°N and 19°N to the western coasts of Europe and Africa. Nesting occurs primarily in Costa Rica, Mexico, Florida and Cuba (Figure 7).

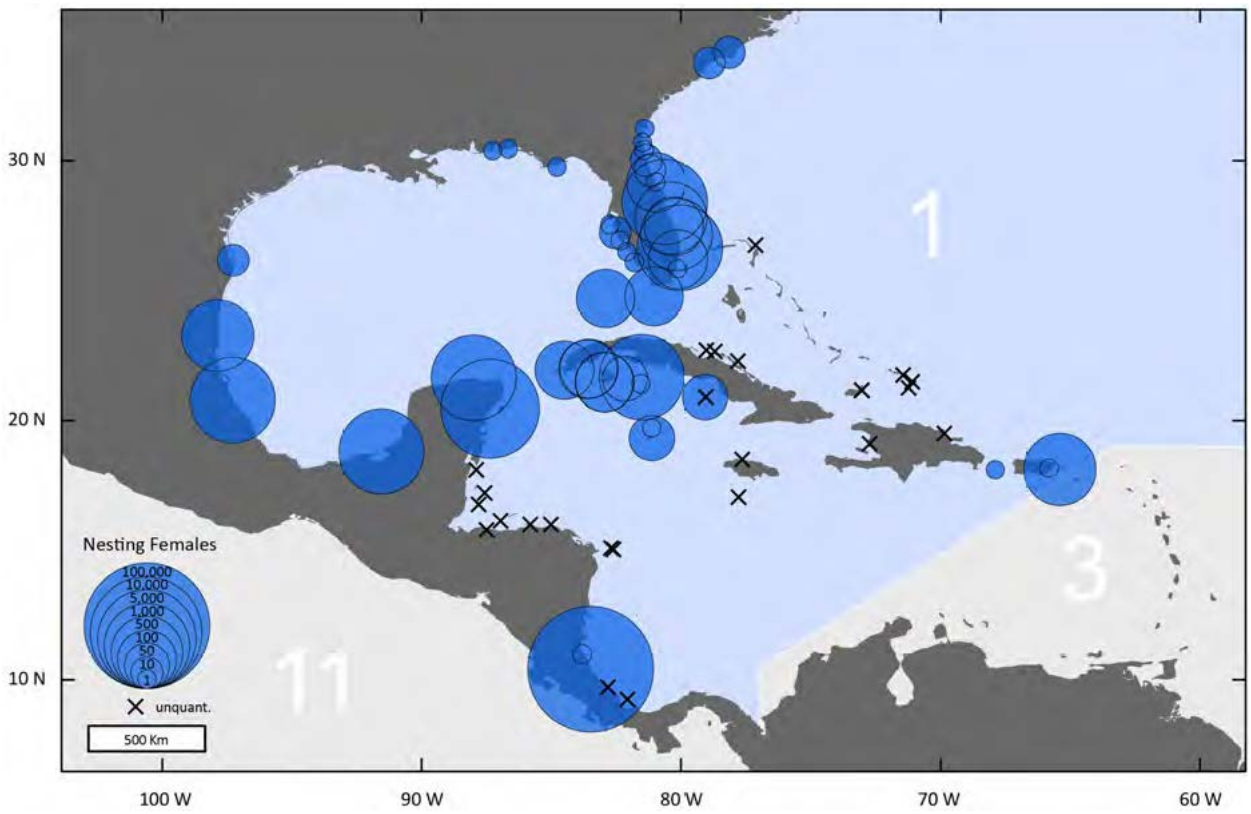


Figure 7. Close up of nesting distribution of green turtles in the western North Atlantic DPS (water body labeled '1'). Size of circles indicates estimated nester abundance. Locations marked with an 'x' indicate sites lacking abundance information (Seminoff et al. 2015).

Status

Once abundant in tropical and subtropical waters, green sea turtles worldwide exist at a fraction of their historical abundance, as a result of over-exploitation. Globally, egg harvest, the harvest of females on nesting beaches and directed hunting of turtles in foraging areas remain the three greatest threats to their recovery. In addition, bycatch in drift-net, long-line, set-net, pound-net and trawl fisheries kill thousands of green sea turtles annually. Increasing coastal development (including beach erosion and re-nourishment, construction and artificial lighting) threatens nesting success and hatchling survival. On a regional scale, the different DPSs experience these threats as well, to varying degrees. Differing levels of abundance combined with different intensities of threats and effectiveness of regional regulatory mechanisms make each DPS uniquely susceptible to future perturbations.

Status Within the Action Area

Four regions support nesting concentrations of particular interest in the North Atlantic DPS: Costa Rica (Tortuguero), Mexico (Campeche, Yucatan, and Quintana Roo); U.S. (Florida), and Cuba. Seminoff et al. (2015) identified 73 nesting sites within the North Atlantic DPS, although

some represent numerous individual beaches. Tortuguero, Costa Rica is the most important nesting concentration for green turtles in the North Atlantic DPS. In 2010, the estimated number of nesters was 30,052-64,396 (Seminoff et al. 2015). In the U.S., green turtles nest primarily along the central and southeast coast of Florida where an estimated 8,426 females nest annually.

Historically, green turtles in the North Atlantic DPS were hunted for food, which was the principle cause of the population's decline. Apparent increases in nester abundance for the North Atlantic DPS in recent years are encouraging but must be viewed cautiously, as the datasets represent a fraction of a green sea turtle generation, up to 50 years. While the threats of pollution, habitat loss through coastal development, beachfront lighting, and fisheries bycatch continue, the North Atlantic DPS appears to be somewhat resilient to future perturbations.

Critical Habitat

On September 2, 1998, NMFS designated critical habitat for green sea turtles (63 FR 46694), which include coastal waters surrounding Culebra Island, Puerto Rico. Seagrass beds surrounding Culebra provide important foraging resources for juvenile, subadult and adult green sea turtles. Additionally, coral reefs surrounding the island provide resting shelter and protection from predators. This area provides important developmental habitat for the species. Activities that may affect the critical habitat include beach renourishment, dredge and fill activities, coastal construction, and freshwater discharge. Due to its location, this critical habitat would be accessible by individuals of the North Atlantic DPS. The designated critical habitat is not found in the action area of this proposed permit.

Recovery Goals

See the 1998 and 1991 recovery plans for the Pacific, East Pacific and Atlantic populations of green turtles for complete down-listing/delisting criteria for recovery goals for the species (NMFS and USFWS 1991, 1998). Broadly, recovery plan goals emphasize the need to protect and manage nesting and marine habitat, protect and manage populations on nesting beaches and in the marine environment, increase public education, and promote international cooperation on sea turtle conservation topics.

5.2.2 Kemp's Ridley Sea Turtle

The Kemp's ridley turtle is considered to be the most endangered sea turtle, internationally (Zwinenberg 1977, Groombridge 1982, TEWG 2000). Its range extends from the Gulf of Mexico to the Atlantic coast, with nesting beaches limited to a few sites in Mexico and Texas (Figure 8).

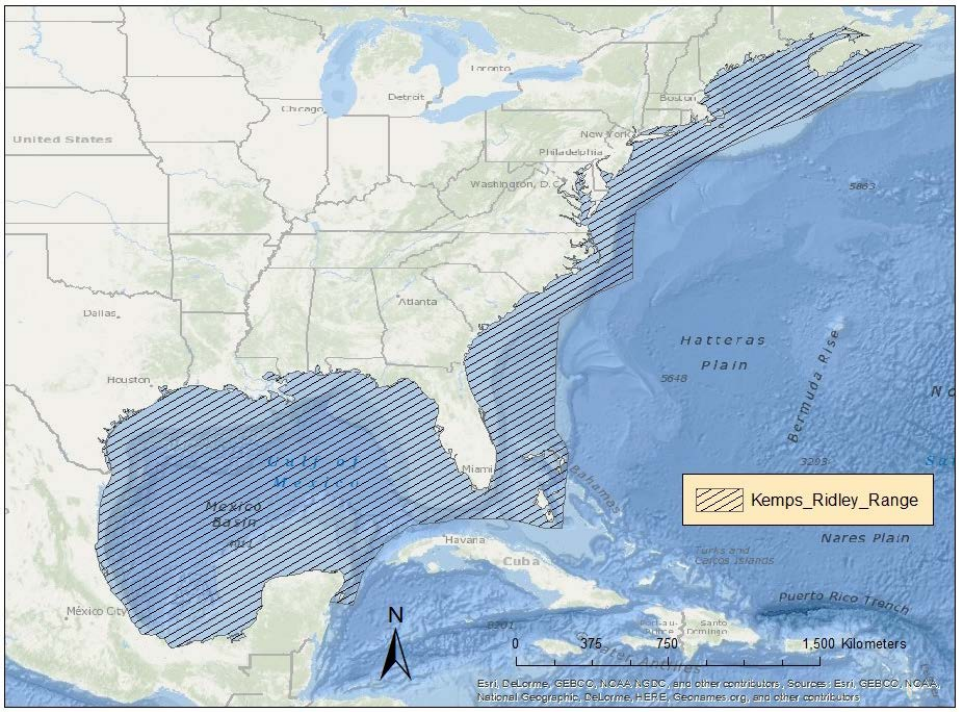


Figure 8. Map identifying the range of the Kemp's ridley sea turtle.

Kemp's ridley sea turtles the smallest of all sea turtle species, with a nearly circular top shell and a pale yellowish bottom shell (Figure 9).

Figure 9. Kemp's ridley sea turtle. Credit: National Oceanic and Atmospheric Administration.

The species was first listed under the Endangered Species Conservation Act (35 FR 8491) and listed as endangered under the ESA since 1970 (Table 6).

Table 6. Summary of Kemp's ridley sea turtle listing and recovery information.

Species	Common Name	Distinct Population Segment	ESA Status	Critical Habitat	Recovery Plan
Lepidochelys kempii	Kemp's ridley sea turtle	Range-wide	Endangered 35 FR 18319 12/02/1970	Not Designated	75 FR 12496 U.S. Caribbean, Atlantic, and Gulf of Mexico (2nd) 2011

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

Life History

Females mature at twelve years of age. The average remigration is two years. Nesting occurs from April to July in large arribadas, primarily at Rancho Nuevo, Mexico. Females lay an average of 2.5 clutches per season. The annual average clutch size is ninety-seven to one hundred eggs per nest. The nesting location may be particularly important because hatchlings can more easily migrate to foraging grounds in deeper oceanic waters, where they remain for approximately two years before returning to nearshore coastal habitats. Juvenile Kemp's ridley sea turtles use these nearshore coastal habitats from April through November, but move towards more suitable overwintering habitat in deeper offshore waters (or more southern waters along the Atlantic coast) as water temperature drops. Adult habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 feet (37 meters) deep, although they can also be found in deeper offshore waters. As adults, Kemp's ridleys forage on swimming crabs, fish, jellyfish, mollusks, and tunicates (NMFS and USFWS 2011).

Population Dynamics

The following is a discussion of the species' population and its variance over time. This section includes: abundance, population growth rate, genetic diversity, and spatial distribution as it relates to the Kemp's ridley sea turtle.

Of the sea turtles species in the world, the Kemp's ridley has declined to the lowest population level. Nesting aggregations at a single location (Rancho Nuevo, Mexico) were estimated at 40,000 females in 1947. By the mid-1980s, the population had declined to an estimated 300 nesting females. In 2014, there were an estimated 10,987 nests and 519,000 hatchlings released from three primary nesting beaches in Mexico (NMFS and USFWS 2015). The number of nests in Padre Island, Texas has increased over the past two decades, with one nest observed in 1985, four in 1995, fifty in 2005, 197 in 2009, and 119 in 2014 (NMFS and USFWS 2015).

From 1980 to 2003, the number of nests at three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) increased fifteen percent annually (Heppell et al. 2005); however,

due to recent declines in nest counts, decreased survival at other life stages, and updated population modeling, this rate is not expected to continue (NMFS 2015).

Genetic variability in Kemp's ridley turtles is considered to be high, as measured by heterozygosis at microsatellite loci (NMFS and USFWS 2011). Additional analysis of the mitochondrial DNA taken from samples of Kemp's ridley turtles at Padre Island, Texas, showed six distinct haplotypes, with one found at both Padre Island and Rancho Nuevo (Dutton et al. 2006).

The Kemp's ridley occurs from the Gulf of Mexico and along the Atlantic coast of the U.S. (TEWG 2000). Kemp's ridley sea turtles have occasionally been found in the Mediterranean Sea, which may be due to migration expansion or increased hatchling production (Tomás and Raga 2008). The vast majority of individuals stem from breeding beaches at Rancho Nuevo on the Gulf of Mexico coast of Mexico. During spring and summer, juvenile Kemp's ridleys occur in the shallow coastal waters of the northern Gulf of Mexico from south Texas to north Florida. In the fall, most Kemp's ridleys migrate to deeper or more southern, warmer waters and remain there through the winter (Schmid 1998). As adults, many turtles remain in the Gulf of Mexico, with only occasional occurrence in the Atlantic Ocean (NMFS and USFWS 2011).

Status

The Kemp's ridley was listed as endangered in response to a severe population decline, primarily the result of egg collection. In 1973, legal ordinances prohibited the harvest of sea turtles from May to August, and in 1990, the harvest of all sea turtles was prohibited by presidential decree. In 2002, Rancho Nuevo was declared a Sanctuary. A successful head-start program has resulted in the reestablishment of nesting at Texan beaches. While fisheries bycatch remains a threat, the use of turtle excluder devices (TED) mitigates take. Fishery interactions and strandings, possibly due to forced submergence, appear to be the main threats to the species. It is clear that the species is steadily increasing; however, the species' limited range and low global abundance make it vulnerable to new sources of mortality as well as demographic and environmental randomness, all of which are often difficult to predict with any certainty. Therefore, its resilience to future perturbation is low.

Status within the Action Area

During the mid-20th century, the Kemp's ridley was abundant in the Gulf of Mexico. Historic information indicates that tens of thousands of Kemp's ridleys nested near Rancho Nuevo, Mexico, during the late 1940s (Hildebrand 1963). From 1978 through the 1980s, arribadas were 200 turtles or less, and by 1985, the total number of nests at Rancho Nuevo had dropped to approximately 740 for the entire nesting season, which was a projection of roughly 234 turtles (USFWS and NMFS 1992, TEWG 2000). Beginning in the 1990s, an increasing number of beaches in Mexico were being monitored for nesting, and the total number of nests on all beaches in Tamaulipas and Veracruz in 2002 was over 6,000; the rate of increase from 1985 ranged from 14-16 percent (TEWG 2000, USFWS 2002, Heppell et al. 2005). In 2006, approximately 7,866 nests were laid at Rancho Nuevo with the total number of nests for all the

beaches in Mexico estimated at about 12,000 nests, which amounted to about 4,000 nesting females based on three nests per female per season (Rostal et al. 1997, USFWS 2006, Rostal 2007). Considering remigration rates, the population included approximately 7,000 to 8,000 adult female turtles at that time (Márquez et al. 1989, TEWG 2000, Rostal 2007). The 2007 nesting season included an arribada of over 4,000 turtles over a three-day period at Rancho Nuevo (NMFS and USFWS 2007b). The increased recruitment of new adults is illustrated in the proportion of first time nesters, which has increased from 6 percent in 1981 to 41 percent in 1994. NMFS (2015) identified noticeable drops in the number of nests in Texas and Mexico in 2010, 2013, and 2014.

Critical Habitat

No critical habitat has been designated for Kemp's ridley turtles.

Recovery Goals

See the 2011 Final Bi-National (U.S. and Mexico) Revised Recovery Plan for Kemp's ridley sea turtles for complete down listing/delisting criteria for each of their respective recovery goals. The following items were identified as priorities to recover Kemp's ridley sea turtles:

1) Protect and manage nesting and marine habitats.

2) Protect and manage populations on the nesting beaches and in the marine environment.

3) Maintain a stranding network.

4) Manage captive stocks.

5) Sustain education and partnership programs.

6) Maintain, promote awareness of and expand U.S. and Mexican laws.

7) Implement international agreements.

8) Enforce laws.

6 ENVIRONMENTAL BASELINE

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 C.F.R. §402.02; 84 FR 44976 published August 27, 2019).

6.1 Climate Change

There is a large and growing body of literature on past, present, and future impacts of global climate change, exacerbated and accelerated by human activities. Effects of climate change include sea level rise, increased frequency and magnitude of severe weather events, changes in air and water temperatures, and changes in precipitation patterns, all of which are likely to impact ESA resources. NOAA's climate information portal provides basic background information on these and other measured or anticipated climate change effects (see https://www.climate.gov).

In order to evaluate the implications of different climate outcomes and associated impacts throughout the 21st century, many factors have to be considered. The amount of future greenhouse gas emissions is a key variable. Developments in technology, changes in energy generation and land use, global and regional economic circumstances, and population growth must also be considered.

Global annually averaged surface air temperature has increased by about 1.8 degrees Fahrenheit (1.0 degrees Celsius) over the last 115 years (1901 to 2016) (Wuebbles et al. 2017). The globally-averaged combined land and ocean surface temperature data, as calculated by a linear trend, show a warming of approximately 1.0°C from 1901 through 2016 (Hayhoe 2018). This period is now the warmest in the history of modern civilization. These global trends are expected to continue over climate timescales. The magnitude of climate change beyond the next few decades will depend primarily on the amount of greenhouse gases (especially carbon dioxide) emitted globally. A set of four scenarios was developed by the Intergovernmental Panel on Climate Change (IPCC) to ensure that starting conditions, historical data, and projections are employed consistently across the various branches of climate science. The scenarios are referred to as representative concentration pathways (RCPs), which capture a range of potential greenhouse gas emissions pathways and associated atmospheric concentration levels through 2100 (IPCC 2014). The RCP scenarios drive climate model projections for temperature, precipitation, sea level, and other variables: RCP2.6 is a stringent mitigation scenario; RCP4.5 and RCP6.0 are intermediate scenarios; and RCP8.5 is a scenario with no mitigation or reduction

in the use of fossil fuels. IPCC future global climate predictions and national and regional climate predictions included in the Fourth National Climate Assessment for U.S. states and territories (USGCRP 2018) use the RCP scenarios. The increase of global mean surface temperature change by 2100 is projected to be 0.3 to 1.7°C under RCP2.6, 1.1 to 2.6°C under RCP4.5, 1.4 to 3.1°C under RCP6.0, and 2.6 to 4.8°C under RCP8.5 with the Arctic region warming more rapidly than the global mean under all scenarios (IPCC 2014).

Changes in surface, atmospheric, and oceanic temperatures and other climatic changes have resulted in melting glaciers, diminishing snow cover, shrinking sea ice, rising sea levels, ocean acidification, and increasing atmospheric water vapor. Global average sea level has risen by about seven to eight inches since 1900, with almost half (about three inches) of that rise occurring since 1993. Human-caused climate change has made a substantial contribution to this rise since 1900, contributing to a rate of rise that is greater than during any preceding century in at least 2,800 years (Wuebbles et al. 2017). Global sea level rise has already affected the U.S.; the incidence of daily tidal flooding is accelerating in more than 25 Atlantic and Gulf Coast cities. Global average sea levels are expected to continue to rise by at least several inches in the next 15 years and by one to four feet by 2100. Sea level rise will be higher than the global average on the East and Gulf Coasts of the U.S. (Wuebbles et al. 2017). Climate change has been linked to changing ocean currents as well. Rising carbon dioxide levels have been identified as a reason for a poleward shift in the Eastern Australian Current, shifting warm waters into the Tasman Sea and altering biotic features of the area (Poloczanska et al. 2009). Similarly, the Kuroshio Current in the western North Pacific (an important foraging area for juvenile sea turtles) has shifted southward as a result of altered long-term wind patterns over the Pacific Ocean (Poloczanska et al. 2009).

Changes in air and sea surface temperatures can affect marine ecosystems in several ways. Direct effects decreases in sea ice and changes in ocean acidity, precipitation patterns, and sea level. Indirect effects of climate change include altered reproductive seasons/locations, shifts in migration patterns, reduced distribution and abundance of prey, and changes in the abundance of competitors and/or predators. Variations in sea surface temperature can affect an ecological community's composition and structure, alter migration and breeding patterns of fauna and flora and change the frequency and intensity of extreme weather events. For species that undergo long migrations, individual movements are usually associated with prey availability or habitat suitability. If either is disrupted, the timing of migration can change or negatively impact population sustainability (Simmonds and Eliott. 2009). Over the long term, increases in sea surface temperature can also reduce the amount of nutrients supplied to surface waters from the deep sea leading to declines in fish populations (EPA 2010), and, therefore, declines in those species whose diets are dominated by fish. Acevedo-Whitehouse and Duffus (2009) proposed that the rapidity of environmental changes, such as those resulting from global warming, can harm immunocompetence and reproductive parameters in wildlife to the detriment of population viability and persistence.

The potential for invasive species to spread may increase under the influence of climatic change. If water temperatures warm in marine ecosystems, native species may shift poleward to cooler habitats, opening ecological niches that can be occupied by invasive species introduced via ships ballast water or other sources (Ruiz et al. 1999, Philippart et al. 2011). Invasive species that are better adapted to warmer water temperatures can also outcompete native species that are physiologically geared towards lower water temperatures (Lockwood and Somero 2011). Altered ranges can also result in the spread of novel diseases to new areas via shifts in host ranges (Simmonds and Eliott. 2009). For example, it has been suggested that increases in harmful algal blooms could result from increases in sea surface temperature (Simmonds and Eliott. 2009). Moore et al. (2011) estimated that the impacts of a dinoflagellate establishment would likely intensify with a warming climate, resulting in roughly 13 more days of potential bloom conditions per year by the end of the 21st century.

Climate change will likely have its most pronounced effects on vulnerable species whose populations are already in tenuous positions (Williams et al. 2008). As such, we expect the risk of extinction to listed species to rise with the degree of climate shift associated with global warming. Increasing atmospheric temperatures have already contributed to documented changes in the quality of freshwater, coastal, and marine ecosystems and to the decline of endangered and threatened species populations (Mantua et al. 1997, Karl 2009).

Changes in the marine ecosystem caused by global climate change (e.g., ocean acidification, salinity, oceanic currents, dissolved oxygen levels, nutrient distribution) could influence the distribution and abundance of lower trophic levels (e.g., phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish), ultimately affecting primary foraging areas of ESA-listed species including marine mammals, sea turtles, and fish. Marine species ranges are expected to shift as they align their distributions to match their physiological tolerances under changing environmental conditions (Doney et al. 2011). Hazen et al. (2013) examined top predator distribution and diversity in the Pacific Ocean in light of rising sea surface temperatures using a database of electronic tags and output from a global climate model. They predicted up to a 35 percent change in core habitat area for some key marine predators in the Pacific Ocean, with some species predicted to experience gains in available core habitat and some predicted to experience losses. Notably, leatherback turtles were predicted to gain core habitat area, whereas loggerhead turtles and blue whales were predicted to experience losses in available core habitat. McMahon and Hays (2006) predicted increased ocean temperatures will expand the distribution of leatherback turtles into more northern latitudes. The authors noted this is already occurring in the Atlantic Ocean. MacLeod (2009) estimated, based upon expected shifts in water temperature, 88 percent of cetaceans will be affected by climate change, with 47 percent predicted to experience unfavorable conditions (e.g., range contraction). Willis-Norton et al. (2015) acknowledged there will be both habitat loss and gain, but overall climate change could result in a 15 percent loss of core pelagic habitat for leatherback turtles in the eastern South Pacific Ocean.

Sea turtles occupy a wide range of terrestrial and marine habitats, and many aspects of their life history have been demonstrated to be closely tied to climatic variables such as ambient temperature and storminess (Hawkes et al. 2009). Sea turtles have temperature-dependent sex determination, and many populations produce highly female-biased offspring sex ratios, a skew likely to increase further with global warming (Newson et al. 2009, Patrício et al. 2017). Genetic analyses and behavioral data suggest that populations with temperature-dependent sex determination may be unable to evolve rapidly enough to counteract the negative fitness consequences of rapid global temperature change (Hays 2008 as cited in Newson et al. 2009). Altered sex ratios have been observed in sea turtle populations worldwide (Mazaris et al. 2008, Reina et al. 2008, Robinson et al. 2008, Fuentes et al. 2009a). This does not yet appear to have affected population viabilities through reduced reproductive success, although average nesting and emergence dates have changed over the past several decades by days to weeks in some locations (Poloczanska et al. 2009). Hayes et al. (2010) suggests that because of the increased frequency of male loggerhead breeding (based on visits to breeding sites) versus female breeding, the ability of males to breed with many females and the ability of females to store sperm and fertilize many clutches, skewed sex ratios due to climate change could be compensated for in some turtle populations and population effects may be ameliorated. However, such a fundamental shift in population demographics may cause a fundamental instability in the viability of some populations. In addition to altering sex ratios, increased temperatures in sea turtle nests can result in reduced incubation times (producing smaller hatchling), reduced clutch size, and reduced nesting success due to exceeded thermal tolerances (Fuentes et al. 2009b, Fuentes et al. 2010, Fuentes et al. 2011, Azanza-Ricardo et al. 2017).

Other climatic aspects, such as extreme weather events, precipitation, ocean acidification and sea level rise also have potential to affect marine turtle populations. Changes in global climatic patterns will likely have profound effects on the coastlines of every continent, thus directly impacting sea turtle nesting habitat (Wilkinson and Souter 2008). In some areas, increases in sea level alone may be sufficient to inundate turtle nests and reduce hatching success by creating hypoxic conditions within inundated eggs (Caut et al. 2009, Pike et al. 2015). Flatter beaches, preferred by smaller sea turtle species, would likely be inundated sooner than would steeper beaches preferred by larger species (Hawkes et al. 2014). Relatively small increases in sea level can result in the loss of a large proportion of nesting beaches in some locations. For example, a study in the northwestern Hawaiian Islands predicted that up to 40 percent of green turtle nesting beaches could be flooded with 0.9 meters of sea level rise (Baker et al. 2006). The loss of nesting beaches would have catastrophic effects on sea turtle populations globally if they are unable to colonize new beaches that form, or if the newly formed beaches do not provide the habitat attributes (sand depth, temperature regimes, refuge) necessary for egg survival.

Changing patterns of coastal erosion and sand accretion, combined with an anticipated increase in the number and severity of extreme weather events, may further exacerbate the effects of sea level rise on turtle nesting beaches (Wilkinson and Souter 2008). Climate change is expected to affect the intensity of hurricanes through increasing sea surface temperatures, a key factor that

influences hurricane formation and behavior (EPA 2010). The intensity of tropical storms in the Atlantic Ocean, Caribbean, and Gulf of Mexico has risen noticeably over the past 20 years and six of the 10 most active hurricane seasons have occurred since the mid-1990s (EPA 2010). Extreme weather events may directly harm sea turtles, causing “mass” strandings and mortality (Poloczanska et al. 2009). Studies examining the spatio-temporal coincidence of marine turtle nesting with hurricanes, cyclones and storms suggest that cyclical loss of nesting beaches, decreased hatching success and hatchling emergence success could occur with greater frequency in the future due to global climate change (Hawkes et al. 2009). Pike et al. (2006) concluded that warming sea surface temperatures may lead to potential fitness consequences in sea turtles resulting from altered seasonality and duration of nesting. Sea turtles may expand their range as temperature-dependent distribution limits change (McMahon and Hays 2006). Warming ocean temperatures may extend poleward the habitat which sea turtles can utilize (Poloczanska et al. 2009).

6.2 Fisheries

Bycatch occurs when fisheries interact with living marine resources (e.g., marine mammals, sea turtles, non-market fish species, corals, or seabirds) that are not the target species for commercial sale. Bycatch represents a global threat to many ESA-listed species. Populations of marine megafauna (e.g., turtles, mammals, sharks) can be particularly sensitive to the detrimental effects of bycatch due to life history parameters such as slow growth, late age at maturity, and low reproductive rates (Hall et al. 2017). Highly migratory, transboundary species that spend large amounts of time in ocean jurisdictions lacking adequate bycatch mitigation measures, monitoring, or enforcement are often most vulnerable to this threat.

While mitigation and minimization measures have reduced fisheries bycatch in the United States in recent years, large numbers of ESA-listed species are still routinely captured in federal and state commercial fisheries targeting other species. Some ESA-listed species also interact with recreational hook-and-line fisheries. Fisheries management plans (FMPs) developed for federally regulated fisheries with ESA-listed species bycatch are required to undergo section 7 consultation, including a NMFS issued opinion and an ITS. The ITS includes the anticipated amount of take (lethal and nonlethal) and reasonable and prudent measures with specific terms and conditions for mitigating and minimizing the adverse effects of the proposed action on ESA-listed species and designated critical habitat. Some state-managed fisheries with ESA-listed species bycatch have also been the subject of section 7 consultations with NMFS for issuance of ESA section 10(a)(1)(B) incidental take permits (ITPs). ITPs are issued based on NMFS approval of a state’s Conservation Plan, which includes ESA-listed species mitigation and minimization measures.

Bycatch of ESA-listed sea turtles occurs in a diversity of fisheries throughout the broad geographic oceanic ranges of these species. Sea turtle bycatch occurs in both large-scale commercial fishing operations as well as small-scale, artisanal fisheries throughout the world. Fishing gears that are known to interact with sea turtles include trawls, longlines, purse seines,

gillnets, pound nets, dredges and to a lesser extent, pots and traps (Finkbeiner et al. 2011, Lewison et al. 2013).

Sea turtle bycatch rates (i.e., individuals captured per unit of fishing effort) and mortality rates (i.e., individuals killed per number captured) can vary widely both within and across particular fisheries due to a combination of factors. These include gear types and gear configurations, fishing methods (e.g., depth fished, soak times), fishing locations, fishing seasons, time fished (i.e., day versus night), and turtle handling and release techniques used (Wallace et al. 2010, Lewison et al. 2013). Henwood (1987) found a strong positive correlation between shrimp trawl tow time and mortality rate of turtles bycaught in commercial shrimp trawlers. Similarly, Murray (2009) found that sea turtle mortality rates in sink gillnet gear was largely a function of soak time. Differences in bycatch rates among gear deployment practices and gear configurations have driven many of the bycatch reduction strategies in longline ships (Watson et al. 2005, Lewison et al. 2013). Shallow-set longlines (less than 50 meters) have been shown to result in higher turtle bycatch rates than deeper sets (Gilman et al. 2006, Beverly et al. 2009); leatherbacks are caught more often during nighttime longline sets compared to daytime sets; increased longline soak times have resulted in higher catches of loggerhead turtles (Gilman et al. 2006); and switching from J-shaped hooks with squid bait to circle hooks with fish bait resulted in significant declines in loggerhead (83 percent) and leatherback (90 percent) bycatch in the Hawaii longline swordfish fishery (Gilman et al. 2007). Estimated turtle mortality rates from capture in longline gear have also been shown to vary widely (8 percent to over 30 percent) depending on numerous factors including hook type used, set depth, and hook location (Chaloupka et al. 2004, Casale et al. 2008).

If mortality is not directly observed during gear retrieval, it may occur after the turtle is released due to physiological stress and injury suffered during capture. Entanglement in fishing gear and/or plastics can result in severe ulcerative dermatitis, and amputation of flippers (Orós et al. 2005). Although rates of post-release mortality and serious injury are essential to understanding the impact of bycatch on sea turtle populations, it is a major knowledge gap for many fisheries that interact with turtles (Lewison et al. 2013).

There have been some major advancements in sea turtle bycatch reduction technologies and management approaches in the past few decades. Direct gear and fishery modifications such as changes to bait type, modifying gear to make it less visible or attractive to sea turtles, making gear less likely to cause direct mortality, or changing the way that gear is deployed are all examples of bycatch mitigation techniques that have been employed to reduce sea turtle bycatch in trawl, passive net, and longline large-scale fisheries (Lewison et al. 2013, Hall et al. 2017). Time-area closures have also proven effective at reducing sea turtle bycatch in commercial fishing gear (Dunn et al. 2011). Swimmer et al. (2017) analyzed 20 years of U.S. longline observer data from the Atlantic and Pacific Ocean basins during periods before and after sea turtle bycatch reduction regulations to assess the effectiveness of the regulations. They found that in two federally managed longline fisheries, rates of sea turtle bycatch significantly declined after the regulations. Capture probabilities were lowest when using a combination of circle hooks

(versus J-hooks) and fish bait (versus squid bait). In the Atlantic (all regions), rates declined by 40 and 61 percent for leatherback and loggerhead turtles, respectively, after the regulations. In the Pacific shallow set fishery, mean bycatch rates declined by 84 and 95 percent, for leatherback and loggerhead turtles, respectively, for the post-regulation period (Swimmer et al. 2017).

In 2003, NMFS developed a National Bycatch Strategy that identified concrete actions necessary for reducing bycatch in U.S. fisheries (Benaka and Dobrzynski 2004). This document was recently updated and expanded to enhance the effectiveness of existing bycatch reduction approaches. The 2016 National Bycatch Reduction Strategy identifies several key objectives including: (1) improved monitoring of bycatch and bycatch mortality, (2) conduct research to improve bycatch estimates, (3) implement management measures to further reduce the effects of bycatch, and (4) more emphasis on enforcement to ensure compliance with bycatch measures (NMFS 2016b). The most effective way to monitor sea turtle bycatch is to place trained observers aboard fishing ships. Although observer programs have increased in recent decades, many fisheries still lack the level of observer coverage necessary to produce reliable estimates of bycatch and associated mortalities needed to assess fishery impacts on ESA-listed species. In 2007, NMFS established a new regulation (72 FR 43176) to annually review sea turtle interactions across fisheries, identify those that require monitoring, and require fishermen to accommodate observers if requested. This annual process should help NMFS and the fishing industry learn more about sea turtle interactions with fishing operations, continually evaluate existing measures to reduce sea turtle takes, and determine whether additional measures to address prohibited sea turtle takes may be necessary to avoid exceeding established take limits.

6.2.1.1 Gulf of Mexico

The primary turtle species captured in U.S. fisheries in Atlantic and Gulf of Mexico is the loggerhead (Moore et al. 2009). The southeastern United States comprises one of the largest aggregate nesting rookeries for loggerhead sea turtles in the world, and the continental shelf provides critical ontogenetic habitats for this population. Thus, because a large number of individuals are present throughout areas of high fishing activity, loggerheads interact with a greater number of fishing fleets and gear types in the Atlantic than other sea turtle species (Moore et al. 2009).

The Southeast shrimp trawl fishery in the Atlantic and Gulf of Mexico has historically accounted for the overwhelming majority (up to 98 percent) of sea turtle bycatch in U.S. fisheries (Finkbeiner et al. 2011). Regulations that went into effect in the early 1990's require shrimp trawlers in the Atlantic and Gulf of Mexico to modify their gear with TED designed to allow turtles to escape trawl nets and avoid drowning. Although mitigation measures have greatly reduced the impact on sea turtle populations, the shrimp trawl fishery is still responsible for large numbers of turtle mortalities each year. The Gulf of Mexico fleet accounts for a large percentage of the sea turtle bycatch in this fishery. In 2010, the Gulf of Mexico shrimp trawl fishery had an estimated bycatch mortality of 5,166 turtles (18 leatherback, 778 loggerhead, 486 green and 3,884 Kemp's ridley). By comparison, the southeast Atlantic fishery had an estimated bycatch

mortality of 1,033 turtles (8 leatherback, 673 loggerhead, 28 green and 324 Kemp's ridley) in 2010 (NMFS 2014).

The U.S. Atlantic pelagic longline fishery began in the early 1960s. This fishery is currently comprised of five distinct fishing sectors: Gulf of Mexico yellowfin tuna fishery; southern Atlantic swordfish fishery; Mid-Atlantic and New England swordfish and tuna fishery; U.S. Atlantic Distant Water swordfish fishery; and the Caribbean tuna and swordfish fishery. The pelagic longline fishery mainly interacts with leatherback sea turtles and pelagic juvenile loggerhead sea turtles. The estimated average annual bycatch in this fishery (all geographic areas combined) between 1992 to 2002 was 912 loggerhead interactions (including seven captured dead) and 846 leatherback interactions (including 11 captured dead) (NMFS 2004). These mortality estimates do not account for post-release mortality, which historically was likely substantial (NMFS 2014).

6.3 Ship Strike

Marine habitats occupied by ESA-listed species often feature both heavy commercial and recreational ship traffic. Ship strikes represent a recognized threat to large, air breathing marine species including sea turtles. This threat is increasing as commercial shipping lanes cross important breeding and feeding habitats and as ESA-listed species populations recover and populate new areas or areas where they were previously extirpated (Swingle et al. 1993, Wiley et al. 1995). As ships continue to become faster and more widespread, an increase in ship interactions with ESA-listed species is expected.

Sea turtles must surface to breathe and several species are known to bask at the surface for long periods making them more susceptible to ship strike. Ship strikes have been identified as one of the important mortality factors in several nearshore turtle habitats worldwide (Denkinger et al. 2013). However, available information is sparse regarding the overall magnitude of this threat or the impact on sea turtle populations globally. Although sea turtles can move somewhat rapidly, they apparently are not adept at avoiding ships that are moving at more than 4 km per hour; most ships move far faster than this in open water (Hazel and Gyuris 2006, Hazel et al. 2007, Work et al. 2010). Hazel et al. (2007) suggests that green turtles may use auditory cues to react to approaching ships rather than visual cues, making them more susceptible to strike as ship speed increases. Since turtles that were previously killed or injured as a result of some other stressor (e.g., fishing net entanglement or disease) may be more susceptible to a ship strike, it is not always known what proportion of ship wounds were sustained ante-mortem versus post mortem (or post injury). In one study from Virginia, Barco et al. (2016) found that all fifteen dead loggerhead turtles encountered with signs of acute ship interaction were apparently normal and healthy prior to being struck by a ship.

High levels of ship traffic in nearshore areas along the U.S. Atlantic and Gulf of Mexico coasts result in frequent sea turtle ship strikes. The incidence of propeller wounds of stranded turtles from the U.S. Atlantic and Gulf of Mexico doubled from about ten percent in the late 1980s to about twenty percent in 2004. Singel et al. (2007) reported a tripling of boat strike injuries in

Florida from the 1980's to 2005. Over this time period, in Florida alone over 4,000 (approximately 500 live; approximately 3500 dead) sea turtle strandings were documented with propeller wounds, which represents 30 percent of all sea turtle strandings for the state (Singel et al. 2007). These studies suggest that the threat of ship strikes to sea turtles may be increasing over time as ship traffic continues to increase in the United States.

6.4 Coastal Development and Land Use Changes

The modification and destruction of habitat remains one of the primary threats to many threatened and endangered species. In this section, we summarize the impacts of general anthropogenic stressors associated with coastal development and other land use changes on the aquatic habitats used by ESA-listed species. The effects of human activities on aquatic habitats are discussed in more detail in subsequent sections addressing the following specific threats: dredging, oil pollution, contaminants, nutrient loading, marine debris, and sound.

Many stream, riparian, and coastal areas within the action area have been degraded by the effects of land and water use associated with urbanization, road construction, forest management, agriculture, mining, transportation, water development, and other human activities. Development activities contribute to a variety of consequential factors that lead to the decline of ESA-listed anadromous fish species considered in this opinion. These include reduced in-channel and off-channel habitat, restricted lateral channel movement, increased flow velocities, increased erosion, decreased cover, reduced prey sources, increased contaminants, increased water temperatures, degraded water quality, and decreased water quantity.

Urbanization and increased human population density within a watershed result in changes in stream habitat, water chemistry, and the biota (plants and animals) that live there. In many cases, these changes negatively impact species, particularly those with small population sizes like some of the ESA-listed species within the action area. The most obvious effect of urbanization is the loss of natural vegetation, which results in an increase in impervious cover and dramatic changes to the natural hydrology of urban and suburban streams (O'Driscoll et al. 2010). Urbanization generally results in land clearing, soil compaction, modification and/or loss of riparian buffers, and modifications to natural drainage features. The increased impervious cover in urban areas leads to increased volumes of runoff, increased peak flows and flow duration, and greater stream velocity during storm events (Booth et al. 1995, Bledsoe and Watson 2001). Runoff from urban areas also contains chemical pollutants from vehicles and roads, industrial sources, and residential sources (Connor et al. 2003). Urban runoff is typically warmer than receiving waters and can significantly increase temperatures, particularly in smaller streams (O'Driscoll et al. 2010).

Municipal wastewater treatment plants replace septic systems, resulting in point discharges of nutrients and other contaminants not removed in the processing (Booth et al. 1995). Municipalities with combined sewer/stormwater overflows or older treatment systems may directly discharge untreated sewage following heavy rainstorms. Urban and suburban nonpoint and point source discharges affect water quality and quantity in basin surface waters (O'Driscoll

et al. 2010). Dikes and levees constructed to protect infrastructure and agriculture have isolated floodplains from their river channels and restricted fish access (Bayley 1995). The many miles of roads and rail lines that parallel streams within the action area have degraded stream bank conditions and decreased floodplain connectivity by adding fill to floodplains (O'Driscoll et al. 2010). Culvert and bridge stream crossings have similar effects and create additional problems for fish when they act as physical or hydraulic barriers that prevent fish access to spawning or rearing habitat, or contribute to adverse stream morphological changes upstream and downstream of the crossing itself.

6.5 Dredging

Riverine, nearshore, and offshore coastal areas are often dredged to support commercial shipping, recreational boating, construction of infrastructure, and marine mining. In addition to the indirect impacts described above, hydraulic dredging operations can directly harm large marine animals (e.g., sea turtles) by lethally entraining them through the dredge drag-arms and impeller pumps. Large animals that are entrained in hydraulic dredges rarely survive the encounter. Hopper dredges, in particular, are capable of moving relatively quickly compared to turtles which can be overtaken and entrained by the suction draghead of the advancing dredge.

An estimated 609 incidental takes (lethal or sublethal interactions) of sea turtles were documented from hopper dredging activity in the southeastern U.S. from 1980 through 2006 (Dickerson et al. 2007). Reductions in dredge entrainment rates for sea turtles have been achieved through mitigation measures including gear modifications, operational changes, time-area restrictions, and the capture and relocation of turtles away from dredge sites (Dickerson et al. 2007). Dickerson et al. (2007) studied the effectiveness of turtle relocation trawling in reducing the incidental take of sea turtles in hopper dredge operations. They found that relocation trawling can be an effective management option provided that a substantial amount of trawling effort is conducted either at the onset of dredging or early in the project.

A recent paper (*Evaluating Effects of Dredging-Induced Underwater Sound on Aquatic Species: A Literature Review*; (USACE 2019)) compared available acoustic studies. This literature review found that sounds generated by dredging are low frequencies under 1,000 Hz (Reine et al. 2014, Reine and Dickerson Jr. 2014). Sound decibel levels recorded from various dredging types range from approximately 100 -190 dB re 1 μPa at 1 m (Dickerson Jr. et al. 2001, Todd et al. 2014).

6.6 Pollution

Many different types of pollution can adversely affect ESA-listed species and habitats within the action area. In this section, we focus on four major categories of marine and estuarine pollution: oil pollution, contaminants and pesticides, nutrient loading and algal blooms, and marine debris. Considering the large area covered by the proposed action, we do not attempt to provide a detailed analysis of the effects of pollution throughout the entire action area. Instead, this section provides a more general discussion of the four pollution categories above, including the stressor

pathways and anticipated effects on ESA-listed resources, with an emphasis on geographic areas, habitats or species that are particularly susceptible to these threats.

6.6.1.1 Oil Pollution

Oil released into the marine environment contains aromatic organic chemicals known to be toxic to a variety of marine life (Yender et al. 2002). Oil spills can impact wildlife directly through three primary pathways: (1) ingestion—when animals swallow oil particles directly or consume prey items that have been exposed to oil, (2) absorption—when animals come into direct contact with oil, and (3) inhalation—when animals breath volatile organics released from oil or from "dispersants" applied by response teams in an effort to increase the rate of degradation of the oil in seawater. Direct exposure to oil can cause acute damage including skin, eye, and respiratory irritation, reduced respiration, burns to mucous membranes such as the mouth and eyes, diarrhea, gastrointestinal ulcers and bleeding, poor digestion, anemia, reduced immune response, damage to kidneys or liver, cessation of salt gland function, reproductive failure, and death (Vargo et al. 1986, NOAA 2003).

Nearshore spills or large offshore spills that reach shore can oil beaches on which sea turtles lay their eggs, causing birth defects or mortality in the nests (NOAA 2003). Disruption of other essential behaviors, such as breeding, communication, and feeding may also occur. The loss of invertebrate communities due to oiling or oil toxicity would also decrease prey availability for hawksbill, Kemp's ridley, and loggerhead sea turtles (NOAA 2003). Sea turtles species which commonly forage on crustaceans and mollusks may be vulnerable to oil ingestion due to oil adhering to the shells of these prey and the tendency for these organisms to bioaccumulate toxins found in oil (NOAA 2003).

Seagrass beds may be particularly susceptible to oiling as oil contacts grass blades and sticks to them, hampering photosynthesis and gas exchange (Wolfe et al. 1988). If spill cleanup is attempted, mechanical damage to seagrass can result in further injury and long-term scarring. Loss of seagrass due to oiling would be important to green sea turtles, as this is a significant component of their diets (NOAA 2003). Sea turtles are known to ingest and attempt to ingest tar balls, which can block their digestive systems, impairing foraging or digestion and potentially causing death (NOAA 2003).

The Gulf of Mexico is an area of high-density offshore oil extraction with chronic, low-level spills and occasional massive spills (such as the *Deepwater Horizon* oil spill, *IXTOC I* oil well blowout and fire in the Bay of Campeche in 1979, and the explosion and destruction of a loaded supertanker, the Mega Borg, near Galveston in 1990). Oil spills remain a significant threat to marine ecosystems in the Gulf of Mexico due to the large amount of extraction and refining activity in the region. There are approximately 4,000 oil and gas structures in the northern Gulf of Mexico, 90 percent of which are off Louisiana and Texas (USN 2009).

The largest spill within the action area occurred in April of 2010 as a result of a fire and explosion aboard the semisubmersible drilling platform Deepwater Horizon roughly 80 km southeast of the Mississippi Delta (Ramseur 2010). Once the platform sank, the riser pipe

connecting the platform to the wellhead on the seafloor broke in multiple locations, initiating an uncontrolled release of oil from the exploratory well. Over the next three months, oil was released into the Gulf of Mexico, resulting in oiled regions of Texas, Louisiana, Mississippi, Alabama, and Florida and widespread oil slicks throughout the northern Gulf of Mexico that closed more than one-third of the Gulf of Mexico Economic Exclusion Zone to fishing due to contamination concerns. Apart from the widespread surface slick, massive undersea oil plumes formed, possibly through the widespread use of dispersants, and reports of tarballs washing ashore throughout the region were common. NOAA has estimated that 4.9 million barrels of oil were released (Lubchenco et al. 2010).

In addition to oil spills, routine oil discharges into the northern Gulf of Mexico (not including oil spills) account for roughly 88,200 barrels of petroleum per year from municipal and industrial wastewater treatment plants, and roughly 19,250 barrels from produced water discharges during oil and gas operations (MMS 2007, USN 2008). Another major source of oil found in the northern Gulf of Mexico is natural seepage. Estimates of natural seepage are highly imprecise, ranging from 120,000 to 980,000 barrels of oil annually (MacDonald et al. 1993, MMS 2007).

6.7 Nutrient Loading and Algal Blooms

Industrial and municipal activities can result in the discharge of large quantities of nutrients into coastal waters. Excessive nutrient enrichment results in eutrophication, a condition associated with degraded water quality, algal blooms (including harmful algal blooms), oxygen depletion, loss of seagrass and coral reef habitat, and in some instances the formation of hypoxic “dead zones” (USCOP 2004). Hypoxia (low DO concentration) occurs when waters become overloaded with nutrients such as nitrogen and phosphorus, which enter oceans from agricultural runoff, sewage treatment plants, bilge water, atmospheric deposition, and other sources. An overabundance of nutrients can stimulate algal blooms resulting in a rapid expansion of microscopic algae (phytoplankton).

When excess nutrients are consumed, the algae population dies off and the remains are consumed by bacteria. Bacterial consumption decreases the DO level in the water which may result in mortality of fish and crustaceans, reduced benthic and demersal organism abundance, reduced biomass and species richness, and abandonment of habitat to areas that are sufficiently oxygenated (Craig et al. 2001, Rabalais et al. 2002). Higher trophic level species (e.g. turtles and marine mammals) may be impacted by the reduction of available prey as a result of hypoxic conditions. High nutrient loads from the Mississippi River create a massive hypoxic “dead zone” in the northern Gulf of Mexico each year. This hypoxic event occurs annually from as early as February to as late as October, spanning from the Mississippi River Delta to Galveston, Texas. In 2017, NOAA estimated that the Gulf of Mexico Dead Zone covered over 8,000 square miles, an area about the size of New Jersey.

Marine algal toxins are produced by unicellular algae that are often present at low concentrations but that may proliferate to form dense concentrations under certain environmental conditions (National Academies of Sciences and Medicine 2016). When high cell concentrations form, the

toxins that they produce can harm marine life, and this is referred to as a harmful algal bloom (HAB). Marine mammals can be exposed to HAB toxins directly by inhalation or indirectly through food web transfer, and these toxins can cause severe neurotoxic effects (Van Dolah 2005). Mortality and morbidity related to HAB toxins have been increasingly reported over the past several decades, and biotoxicosis has been a primary contributor to large scale die-offs across marine mammal taxa (Van Dolah 2005, Simeone et al. 2015).

Domoic acid has also been detected in tissues of marine mammals along the southeast U.S. coast (Twiner et al. 2011), but perhaps of greater concern in this area are the brevetoxins produced by Gulf of Mexico red tides. Brevetoxin has been implicated in multiple die-offs involving common bottlenose dolphins, as well as the endangered Florida manatee (Flewelling et al. 2005, Twiner et al. 2012, Simeone et al. 2015). Capper et al. (2013) found that both turtles and manatees were exposed to multiple HAB toxins (okadaic acid, brevetoxins, saxitoxins, and likely others) in Florida. A recent survey of the peer reviewed literature on marine mammal diseases and reports of marine mammal mass mortality events suggests an increase in the frequency of marine mammal die-offs resulting from exposure to harmful algal blooms over the past 40 years (Gulland and Hall 2007).

6.8 Marine Debris

Marine debris has become a widespread threat for a wide range of marine species that are increasingly exposed to it on a global scale. Plastic is the most abundant material type worldwide, accounting for more than 80 percent of all marine debris (Poeta et al. 2017). The most common impacts of marine debris are associated with ingestion or entanglement and both types of interactions can cause the injury or death of animals of many different species. Ingestion occurs when debris items are intentionally or accidentally eaten (e.g. through predation on already contaminated organisms or by filter feeding activity, in the case of large filter feeding marine organisms, such as whales) and enter in the digestive tract. Ingested debris can damage digestive systems and plastic ingestion can also facilitate the transfer of lipophilic chemicals (especially persistant organic pollutants) into an animal's body. An estimated 640,000 tons of fishing gear is lost, abandoned, or discarded at sea each year throughout the world's oceans (Macfadyen et al. 2009). These "ghost nets" drift in the ocean and can fish unattended for decades (ghost fishing), killing large numbers of marine animals through entanglement.

Marine debris is a significant concern for ESA-listed species, particularly sea turtles. The initial developmental stages of all turtle species are spent in the open sea. During this time both juvenile turtles and their buoyant food are drawn by advection into fronts (convergences, rips, and drift lines). The same process accumulates large volumes of marine debris, such as plastics and lost fishing gear, in ocean gyres (Carr 1987). An estimated four to twelve million metric tons of plastic enter the oceans annually (Jambeck et al. 2015). It is thought that some sea turtles eat plastic because it closely resembles jellyfish, a common natural prey item (Schuyler 2014). Ingestion of plastic debris can block the digestive tract which can cause turtle mortality as well

as sub-lethal effects including dietary dilution, reduced fitness, and absorption of toxic compounds (Lutcavage et al. 1997, Laist et al. 1999).

Santos et al. (2015) found that a surprisingly small amount of plastic debris was sufficient to block the digestive tract and cause death. They reported that 10.7 percent of green turtles in Brazilian waters were killed by plastic ingestion, while 39.4 percent had ingested enough plastic to have killed them. These results suggest that debris ingestion is a potentially important source of turtle mortality, one that may be masked by other causes of death. Gulko and Eckert (2003) estimated that between one-third and one-half of all sea turtles ingest plastic at some point in their lives. A more recent study by Schuyler et al. (2016) estimates that 52 percent of sea turtles globally have ingested plastic debris. Schuyler et al. (2016) synthesized the factors influencing debris ingestion by turtles into a global risk model, taking into account the area where turtles are likely to live, their life history stage, the distribution of debris, the time scale, and the distance from stranding location. They found that oceanic life stage turtles are at the highest risk of debris ingestion. Based on this model, olive ridley turtles are the most at-risk species; green, loggerhead, and leatherback turtles were also found to be at a high and increasing risk from plastic ingestion (Schuyler 2014).

The regions of highest risk to global turtle populations are off the east coasts of the United States, Australia, and South Africa; the east Indian Ocean, and southeast Asia. In addition to ingestion risks, sea turtles can also become entangled in marine debris such as fishing nets, monofilament line, and fish-aggregating devices (FAD) (NRC 1990, Lutcavage et al. 1997, Laist et al. 1999). Turtles are particularly vulnerable to ghost nets due to their tendency to use floating objects for shelter and as foraging stations (Kiessling 2003, Dagorn et al. 2013).

6.9 Anthropogenic Sound

The ESA-listed species that occur in the action area are regularly exposed to multiple sources of anthropogenic sounds. Anthropogenic sound is generated by commercial and recreational ships, aircraft, sonar, ocean research activities, dredging, construction, offshore mineral exploration, military activities, seismic surveys, and other human activities. These activities occur within the action area to varying degrees throughout the year. ESA-listed species have the potential to be impacted by increased levels of both background sound and high intensity, short-term sounds. Sources of anthropogenic noise are becoming both more pervasive and more powerful, increasing both oceanic background sound levels and peak intensity levels (Hildebrand 2004).

Sounds are often considered to fall into one of two general types: impulsive and non-impulsive, which differ in the potential to cause physical effects to animals (Southall et al. 2007). Impulsive sound sources produce brief, broadband signals that are atonal transients and occur as isolated events or repeated in some succession. They are characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures, and generally have an increased capacity to induce physical injury. Non-impulsive sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or non-continuous. Some can be

transient signals of short duration but without the essential properties of pulses (e.g., rapid rise time). The duration of non-impulsive sounds, as received at a distance, can be greatly extended in a highly reverberant environment.

Anthropogenic sound within the marine environment is recognized as a potential stressor that can harm marine animals and significantly interfere with their normal activities (NRC 2005). The sea turtle species considered in this opinion may be impacted by anthropogenic sound in various ways. There are limited data on the hearing abilities of sea turtles, their uses of sounds, and their vulnerability to sound exposure. The functional morphology of the sea turtle ear is poorly understood and debated. Some evidence suggests that sea turtles are able to detect (Ridgway et al. 1969, Bartol et al. 1999, Bartol and Ketten 2006, Martin et al. 2012) and behaviorally respond to acoustic stimuli (O'Hara and Wilcox 1990, Moein et al. 1995, McCauley et al. 2000, DeRuiter and Doukara 2012). Sea turtles may use sound for navigation, locating prey, avoiding predators, and general environmental awareness (Dow Piniak et al. 2012).

Despite the potential impacts on individual ESA-listed sea turtles, information is not currently available to determine the potential population level effects of cumulative anthropogenic sound sources in the marine environment (MMC 2007). For example, we currently lack empirical data on how sound impacts growth, survival, reproduction, and vital rates, nor do we understand the relative influence of such effects on the population being considered. As a result, the consequences of anthropogenic sound on ESA-listed sea turtles at the population or species scale remain uncertain.

6.10 Entrainment, Entrapment, and Impingement in Power Plants

There are dozens of power plants in coastal areas of the United States, from South Carolina to Texas (Muyskens et al. 2015). Sea turtles have been affected by operation of cooling-water systems of electrical generating plants. We do not have data for many of these, but have reason to believe that impacts to particularly loggerhead and green sea turtles may be important. For example, in over 40 years of operation at the St. Lucie Nuclear Power Plant in Florida, 16,600 sea turtles have been captured to avoid being drawn into cooling structures (which likely would kill sea turtles that enter), and 297 have died (NMFS 2016a). These included: 9552 loggerheads (including 180 mortalities), 6886 green (including 112 mortalities), 42 leatherback (no mortalities), 67 Kemp’s ridley (including four mortalities), and 65 hawksbill sea turtles (including one mortality) (NMFS 2016a). Only since 2001 have the mortalities been classified as causally (or non-causally) related to operation of St. Lucie Nuclear Power Plant, and not all mortalities were causal to St. Lucie Nuclear Power Plant operations: 59 percent of dead loggerheads were causal to St. Lucie Nuclear Power Plant operation, 46 percent of greens, and none of hawksbills (no leatherback or Kemp’s ridley mortalities occurred since 2001) (NMFS 2016a). The current incidental take limits for operation at the St. Lucie Nuclear Power Plant for severe causal injury are: seven green turtles annually and three loggerheads (Northwest Atlantic DPS) annually (NMFS 2016a). The current incidental take limits for causal mortalities are: five

green turtles annually, and three loggerhead (Northwest Atlantic DPS) turtles annually (NMFS 2016a).

Effects from cooling system operations generally involve stress, injury, and mortality from being captured, entrained, or impinged by cooling water intake systems. Cooling water discharge (which is warmer than the surrounding water temperature) can alter habitat around the outflow pipe. This can present advantages (such as shelter from cold water temperatures that may stun sea turtles and allow for unseasonal growth of marine plants that green sea turtles may forage upon) and disadvantages (such as altering normal ecology sea turtles and sturgeon rely upon and result in individuals depending on unnatural conditions that can be problematic if a plant is decommissioned or goes offline) for ESA-listed species.

6.11 Disease and Non-native Species Introductions

A disease known as fibropapilloma, is a major threat to green turtles in some areas of the world. Fibropapilloma is characterized by tumorous growths, which can range in size from very small to extremely large, and are found both internally and externally. Large tumors can interfere with feeding and essential behaviors, and tumors on the eyes can cause permanent blindness (Foley et al. 2005). Fibropapilloma was first described in green turtles in the Florida Keys in the 1930s. Since then it has been recorded in many green turtle populations around the world, most notably present in green turtles of Hawaii, Florida, and the Caribbean. In Florida, up to 50 percent of the immature green turtles captured in the Indian River Lagoon are infected, and there are similar reports from other sites in Florida, including Florida Bay. In addition, scientists have documented fibropapilloma in populations of loggerhead, olive ridley, and flatback turtles (Huerta et al. 2000). The effects of fibropapilloma at the population level are not well understood and could be a serious threat to their recovery. The cause of the disease remains unknown. Research to determine the cause of this disease is a high priority and is underway.

An increased human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs and an increased presence of native species (e.g. raccoons, armadillos, and opossums) which raid and feed on turtle eggs. Non-native vegetation has invaded many coastal areas and often outcompetes native species. Non-native vegetation is usually less-stabilizing and can lead to increased erosion and degradation of suitable nesting habitat. Non-native vegetation may also form impenetrable root mats that can prevent proper nest cavity excavation, invade and desiccate eggs, or trap hatchlings. In light of these issues, conservation and long-term protection of sea turtle nesting and foraging habitats is an urgent and high priority need.

6.12 United States Oil and Gas Exploration

The U.S. Army Corps of Engineers and the Minerals Management Service authorize oil and gas exploration, well development, production, and abandonment/rig removal activities that may adversely affect sea turtles. Both of these agencies have consulted numerously with the NMFS on these types of activities. These activities include the use of seismic arrays for oil and gas exploration in the Gulf of Mexico, the impacts of which have been analyzed in opinions for

individual and multi-lease sales. NMFS anticipates incidental takes of sea turtles from vessel strikes, noise, marine debris, and the use of explosives to remove oil and gas structures.

The northern Gulf of Mexico is the location of massive industrial activity associated with oil and gas extraction and processing. Over 4,000 oil and gas structures are located outside of state waters in the northern Gulf of Mexico; 90 percent of these occur off Louisiana and Texas (USN 2009). This is both detrimental and beneficial for sea turtles. These structures appreciably increase the amount of hard substrate in the marine environment and provide shelter and foraging opportunities for species like loggerhead sea turtles (Parker Jr. et al. 1983, Stanley and Wilson 1989). However, the Bureau of Ocean Energy Management requires that structures must be removed within one year of lease termination. Many of these structures are removed by explosively severing the underwater supportive elements, which produces a shock wave that kills, injures, or disrupts marine life in the blast radius (Gitschlag et al. 1997).

For sea turtles, this means death or serious injury for individuals within a few hundred meters of the structure and overt behavioral (potentially physiological) impacts for individuals further away from the structure (Duronslet et al. 1986, Klima et al. 1988). Although observers and procedures are in place to mitigate impacts to sea turtles (i.e., not blasting when sea turtles are present), not all sea turtles are observed all the time, and low-level sea turtle injury and mortality still occurs (Gitschlag and Herczeg 1994, Gitschlag et al. 1997). Two loggerheads were killed in August 2010, and one Kemp's ridley was killed in July 2013, along with several additional stunning or sub-lethal injuries reported over the past five years. In an August 28, 2006 opinion, NMFS issued incidental take for Bureau of Ocean Energy Management-permitted explosive structure removals of three sea turtles per year, or eighteen sea turtles during the following six years of detonations (NMFS 2006a). These levels were far surpassed by the *Deepwater Horizon* incident.

6.13 Scientific Research and Permits

Authorized research on ESA-listed sea turtles includes: capturing/handling; satellite, sonic or passive integrate transponder tagging; blood/tissue collecting, lavage, ultrasound, laparoscopy, and imaging. Annual takes of ESA-listed species resulting from research activities that are currently permitted by NMFS within the action area can be seen in Table 7 for green and Table 8 for Kemp's ridley sea turtles from 2009 to 2016. The actual number of individual sea turtles affected by scientific research is not known. However, for all species, the number affected is assumed to be less than the total number authorized. This is because, if researchers meets or exceed the number of turtle takes allowed in their permit, they must stop the activity and notify the Permits Division of the Office of Protected Resources. A permit modification or new permit and a new or re-initiated ESA section 7 consultation would be done prior to the continuation of the research activity. In 2017, the Permits Division implemented a sea turtle research program. In 2018, there were 418 reported takes of green and 60 takes of Kemp's ridley sea turtle in the Atlantic Ocean with no mortalities (NMFS 2019).

Table 7. Green sea turtle takes permitted in the Atlantic Ocean from 2009 to 2016.

Year	Capture/ Handling/ Restraint	Satellite, sonic or PIT tagging	Blood/ tissue collection	Lavage	Ultrasound	Laparoscopy	Imaging	Mortality
2009	3,093	3,093	3,009	1,860	555	74	72	6
2010	3,753	3,753	3,669	2,480	555	74	72	6
2011	4,255	4,255	3,505	2,990	564	74	72	20
2012	3,354	3,354	2,622	2,210	704	74	72	18.2
2013	5,001	5,001	4,325	3,654	1,903	398	396	4.2
2014	4,336	3,686	3,660	3,044	1,408	324	324	4.2
2015	4,280	3,630	3,610	3,044	1,408	324	324	4.2
2016	2,960	2,960	2,940	1,734	1,408	324	324	4.2
Total	**31,032**	**29,732**	**27,340**	**21,016**	**8,505**	**1666**	**1656**	**67**

Permit Nos.: 1450, 1462, 1501, 1506, 1507, 1518, 1522, 1526, 1527, 1540, 1544, 1551, 1552, 1570, 1571, 1576, 10014, 10022, 13306, 13307, 13543, 13544, 13573, 14506, 14508,14622, 14655, 14726, 14949, 15112, 15135, 15552, 15556, 15575, 15606, 15802, 16134, 16146, 16174, 16194, 16253, 16556, 16598, 16733, 17183, 17304, 17355, 17381, 17506, and 18069. All DPSs included, but numbers are mostly the Atlantic Ocean DPS.

Table 8. Kemp's ridley sea turtle takes in the Atlantic Ocean from 2009 to 2016.

Year	Capture/ Handling/ Restraint	Satellite, sonic or PIT tagging	Blood/ tissue collection	Lavage	Ultrasound	Laparoscopy	Imaging	Mortality
2009	1,394	1,394	1,195	425	371	53	53	5
2010	1,402	1,402	1,203	426	371	53	53	5
2011	2,210	2,210	1,368	976	400	53	53	9
2012	2,229	2,219	1,561	972	450	53	53	7.2
2013	2,836	2,852	2,190	1,627	990	213	218	3.2
2014	2,010	2,026	1,964	706	619	160	165	3.2
2015	1,833	1,849	1,819	706	619	160	165	3.2
2016	1,420	1,436	1,406	300	264	125	125	3.2
Total	**15,334**	**15,388**	**12,706**	**6,138**	**4084**	**870**	**885**	**39**

Permit Nos.: 1462, 1501, 1506, 1507, 1526, 1527, 1540, 1544, 1551, 1552, 1570, 1571, 1576, 10014, 10022, 13306, 13543, 13544, 14508, 14726, 14506, 14622, 14655, 14726, 15112, 15135, 15552, 15566, 15575, 15606, 15802, 16134, 16194, 16253, 16556, 16598, 16733, 17183, 17304, 17355, 17381, 17506, and 18069.

7 EFFECTS OF THE ACTION

"Effects of the action" has been recently revised to mean all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur (50 C.F.R. §402.02). Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 C.F.R. §402.17).

This effects analyses section is organized following the stressor, exposure, response, risk assessment framework.

In this section, we describe the potential stressors associated with the proposed action, the probability of individuals of ESA-listed species being exposed to these stressors based on the best scientific and commercial evidence available, and the probable responses of those individuals (given probable exposures) based on the available evidence. As described in Section 2 of this opinion, for any responses that would be expected to reduce an individual's fitness (i.e., growth, survival, annual reproductive success, or lifetime reproductive success), the assessment considers the risk posed to the viability of the population(s) those individuals comprise and to the ESA-listed species those populations represent. For this consultation, we are particularly concerned about behavioral and stress-based physiological disruptions and potential unintentional mortality that may result in animals that fail to feed, reproduce, or survive because these responses are likely to have population-level consequences, as well as the potential for mortality. The purpose of this assessment and, ultimately, of this consultation is to determine if it is reasonable to expect the proposed action to have effects on ESA-listed species that could appreciably reduce their likelihood of surviving and recovering in the wild. We do not expect different responses to each activity based on the species of sea turtle. Hence, we summarize the likely stress and risk to each species together.

7.1 Stressors Associated with the Proposed Action

Stressors are any physical, chemical, or biological entity that may induce an adverse response in an ESA-listed species. The issuance of ITP No. 21316 would authorize the incidental take of green and Kemp's ridley sea turtles during the course of an otherwise lawful activity. The possible stressors are listed below according to the operation of the Barney Davis Power Plant.

1) cold stunning;

2) travel through the intake canal;

3) impingement on the CWIS travelling trash rack;

4) capture with a dip net and release.

7.2 Exposure Analysis

The exposure analysis identifies the ESA-listed species that are likely to co-occur with the actions' effects on the environment in space and time, and identify the nature of that co-

occurrence. The exposure analysis also identifies, as possible, the number, age or life stage, and gender of the individuals likely to be exposed to the actions' effects and the population(s) or subpopulation(s) those individuals represent. The issuance of ITP No. 21316 will authorize up to 206 green sea turtles (including up to 24 dead), and four Kemp's ridley sea turtles (no mortalities) throughout the permit duration of ten years Table 2). Data related to lifestage and/or gender were not available and are not addressed in the analysis.

The incidental take anticipated from the operation of the facility applies to sea turtles that are observed and collected from the facility property, including free-swimming animals collected from the intake canal (cold-stunned or healthy), dead animals collected from the intake canal, and live or dead animals that are collected from the CWIS after impingement.

The requested takes are based on historical data obtained from the Texas Sea Turtle Stranding and Salvage Network (TX STSSN). Given that the facility records on historic sea turtle takes are incomplete, the data provided by the TX STSSN is still considered the best scientific data available on past sea turtle interactions at the facility. If an animal was found on facility grounds, either in the canal or in the trash rack, it would have been immediately reported to TPWD, who in turn would have reported the animal to the TX STSSN.

The NMFS Marine Mammal and Sea Turtle Conservation Division accepted the incidental take analysis by the applicant and did not expect additional harmful exposure from the proposed action. The NMFS ESA Interagency Cooperation Division agrees with the NMFS Marine Mammal and Sea Turtle Conservation Division assessment and has accepted their approach.

Worldwide, nesting data at 464 sites indicate that 563,826 to 564,464 females nest each year. The North Atlantic DPS of green turtles has an estimated 30,058 to 64,396 female nesters in 2010 with an increasing population (Seminoff et al. 2015). Gallaway et al. (2013) estimated that nearly 189,000 female Kemp's ridley sea turtles over the age of two years were alive in 2012. Extrapolating based on sex bias, the authors estimated that nearly a quarter million age-two or older Kemp's ridleys alive now with counts show that the population trend is increasing towards recovery. Based on these current population estimates, the anticipated exposure to the proposed action represents a small portion of the population for each species of sea turtle.

7.3 Mitigation to Minimize or Avoid Exposure

Several aspects of the proposed action are designed to minimize ESA-listed species' exposure to the potential stressors associated with the facility operations. These include the experience and measures taken by the facility staff themselves and the terms and conditions specified in the permit, as proposed by the NMFS Marine Mammal and Sea Turtle Conservation Division and discussed in the ITCP (Davis LLC 2020).

Impingement on the CWIS travelling trash rack is expected to result in severe injury or mortality. To minimize injuries to sea turtles at the CWIS, the facility will implement a robust monitoring program to intercept the sea turtles in the intake canal, prior to their arrival at the CWIS. This

activity is expected to reduce the total number of lethal takes. Additionally, the sighting and removal of cold-stunned sea turtles from the canal as quickly as possible will improve outcomes for those animals. Although water temperature during cold stunning events is unrelated to the operation of the facility, the sooner a cold-stunned turtle is located and removed from the water, the higher their chance of survival. As such, to prevent as many turtles as possible from reaching the CWIS and to get cold-stunned turtles out of the canal as fast as possible, the facility will implement a canal monitoring program to mitigate and minimize the severity of exposure.

Following the *Minimization and Mitigation Measures* discussed in Section 3.2 above and described in detail in the ITCP (Davis LLC 2020), will minimize the effects of the actions proposed for the current permit.

The Marine Mammal and Sea Turtle Conservation Division will require annual reports and that general permit conditions are followed as described in the ITCP (Davis LLC 2020).

7.4 Response Analysis

Given the exposure estimates above, in this section we describe the range of responses among ESA-listed sea turtles that may result from the stressors associated with the activities authorized under ITP No. 21316. These include stressors associated the following: cold stunning, travel through the intake canal, impingement on the CWIS travelling trash rack, and capture with a dip net and release.

For the purposes of consultation, our assessment tries to detect potential lethal, sub-lethal (or physiological), or behavioral responses that might reduce the fitness of individuals. Our response analysis considers and weighs evidence of adverse consequences, as well as evidence suggesting the absence of such consequences.

There is mounting evidence that wild animals respond to human disturbance in the same way that they respond to predators (Harrington and Veitch 1992, Lima 1998, Gill et al. 2001, Frid 2003, Beale and Monaghan 2004, Romero 2004). These responses manifest themselves as stress responses (in which an animal perceives human activity as a potential threat and undergoes physiological changes to prepare for a flight or fight response), interruptions of essential behavioral or physiological events, alteration of an animal's time budget, or some combinations of these responses (Sapolsky et al. 2000, Frid and Dill 2002, Romero 2004, Walker et al. 2005). These responses have been associated with abandonment of sites (Sutherland and Crockford 1993), reduced reproductive success (Giese 1996, Müllner et al. 2004), and the death of individual animals (Feare 1976, Daan 1996, Bearzi 2000).

Stress is an adaptive response and does not normally place an animal at risk. However, distress involves a stress response resulting in a biological consequence to the individual. The stress response of fish and reptiles involves the hypothalamic-pituitary-adrenal axis being stimulated by a stressor, causing a cascade of physiological responses, such as the release of the stress hormones cortisol, adrenaline (epinephrine), glucocorticosteroids, and others (Barton 2002, Bayunova et al. 2002, Wagner et al. 2002, Lankford et al. 2005, Busch and Hayward 2009,

Mcconnachie et al. 2012, Atkinson et al. 2015). These hormones subsequently can cause short-term weight loss, the release of glucose into the blood stream, impairment of the immune and nervous systems, elevated heart rate, body temperature, blood pressure, fatigue, cardiovascular damage, and alertness, and other responses (Aguilera and Rabadan-Diehl 2000, Guyton and Hall 2000, Dierauf and Gulland 2001, Wagner et al. 2002, Romero 2004, NMFS 2006b, Busch and Hayward 2009, Omsjoe et al. 2009, Queisser and Schupp 2012), particularly over long periods of continued stress (Sapolsky et al. 2000, Desantis et al. 2013).

In some species, stress can also increase an individual's susceptibility to gastrointestinal parasitism (Greer 2008). In highly-stressful circumstances, or in species prone to strong "fight-or-flight" responses, more extreme consequences can result, including muscle damage and death (Curry and Edwards 1998, Cowan and Curry 2002, Herraez et al. 2007, Cowan and Curry 2008). The most widely-recognized indicator of vertebrate stress, cortisol, normally takes hours to days to return to baseline levels following a significantly stressful event, but other hormones of the hypothalamic-pituitary-adrenal axis may persist for weeks.

Several studies have suggested that stress can adversely impact female reproduction through alterations in the estrus cycle (Herrenkohl and Politch 1979, Moberg 1991, Rivier and Rivest 1991, Mourlon et al. 2011). This is likely due to changes in sex steroids and growth hormone levels associated with the stress response (Sapolsky et al. 2000). Komesaroff et al. (1998) found that estrus may inhibit the stress response to some extent, although several studies suggest estrus and the follicular stage may be susceptible to stress-induced disruption (see Rivier (1991) and Moberg (1991) for reviews). Most of these studies were conducted with single or multiple invasive methodologies or chronic stress; we do not expect stressors associated with the facility operation to be as stressful as those of the studies.

7.4.1 Cold Stunning

"Cold stunning" refers to the hypothermic reaction that occurs when sea turtles are exposed to prolonged cold water temperatures. Initial symptoms include a decreased heart rate, decreased circulation, and lethargy, followed by shock, pneumonia and possibly death. Sea turtles are cold-blooded reptiles that depend on external sources of heat to determine their body temperature (i.e., they assume the temperature of their surroundings). Therefore, in cold water they do not have the ability to warm themselves, and must instead migrate to warmer waters. When sea turtles are exposed to frigid water temperatures (about 50 degrees Faranheight) over a period of several days, their circulatory systems can slow to the point that they become cold-stunned and unable to swim or function properly.

The phenomenon of "cold stunning" appears to occur to the green and Kemp's ridley sea turtles in the waters around the facility's intake, the Laguna Madre. During cooler months, green and Kemp's ridley sea turtles in the Laguna Madre may become "cold-stunned" and therefore unable to swim. Once the green and Kemp's ridley sea turtles are cold-stunned, they float into the facility's intake canal, toward the CWIS.

Water temperatures in the Laguna Madre and intake canal were compared to determine if water temperatures in the intake canal were a contributing factor to the cold stunning of sea turtles. The application included water temperature data showing that waters in the canal are similar to Laguna Madre, indicating that the water temperature in the facility's intake canal is not solely or directly related to the cold stunning of the green and Kemp's ridley sea turtles, rather it is consistent with the surrounding habitat (Table 9 and Table 10).

Table 9. Average Monthly Temperatures for the Barney Davis Canal and Laguna Madre

2016 Average Monthly Temperature (Degrees F) Barney Davis Intake Canal (BMD) and Laguna Madre (LM)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BMD	58	66	72	73	*	88	88	87	87	81	74	62
LM	62	69	72	77	80	**	**	**	**	80	73	63

*Temperature data not available, facility was off-line.
**Temperature data not available on the NOAA Tides and Currents website.

Table 10. Maximum Monthly Temperatures for the Barney Davis Canal and Laguna Madre

2017 Maximum Monthly Temperature (Degrees F) Barney Davis Intake Canal (BMD) and Laguna Madre (LM)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BMD	62	69	72	77	80	86	87	83	84	78	72	60
LM	62	70	73	78	81	87	88	88	85	78	73	61

When water temperatures drop rapidly, green sea turtles experience cold stunning that affects their ability to swim and dive and occasionally leads to death (Milton and Lutz 2003). During January 2010, an unusually large cold-stunning event in the southeastern U.S. resulted in around 4,600 sea turtles, mostly greens, found cold-stunned, with hundreds found dead, or dying after they were gathered. Another cold-stunning event occurred in the western Gulf of Mexico in February 2011, resulting in approximately 1,500 green turtles found cold-stunned off Texas, and another 300 or so off Mexico, with an as yet undetermined number found dead or dying after they were found.

7.4.2 Travel Through the Intake Canal

The facility monitors the intake canal and bulkhead in an effort to intercept sea turtles prior to their contact with the traveling trash racks. When an animal, particularly a cold-stunned sea turtle, enters the intake canal, the water velocitymay be too high for the animal to escape by swimming back towards the entrance. Because fouling organisms or limited debris occasionally occupy the inside of the canal, animals traveling through the canal may be injured.

When a sea turtle is located during business hours of TPWD, the sea turtle is collected and held at their nearby facility (CCA Marine Development Center) located within the facility property (4301 Waldron Road) until the U.S. Fish and Wildlife Service, operating as part of the Texas Sea Turtle Stranding and Salvage Network collects the sea turtle(s) for tagging and transfer to rehabilitation at the Animal Rehabilitation Keep, or another permitted rehabilitation facility, prior to release in the Gulf of Mexico.

7.4.3 Impingement on the Travelling Trash Rack

There are dozens of power plants in coastal areas of the U.S., from South Carolina to Texas (Muyskens et al. 2015). Sea turtles have been affected by operation of cooling-water systems of electrical generating plants. We do not have data for many of these, but have reason to believe that impacts to particularly loggerhead and green sea turtles may be important. For example, in over 40 years of operation at the St. Lucie Nuclear Power Plant in Florida, 16,600 sea turtles have been captured to avoid being drawn into cooling structures (which likely would kill sea turtles that enter), and 297 have died (NMFS 2016a). These included: 9,552 loggerheads (including 180 mortalities), 6,886 green (including 112 mortalities), 42 leatherback (no mortalities), 67 Kemp's ridley (including four mortalities), and 65 hawksbill sea turtles (including one mortality) (NMFS 2016a). Only since 2001 have the mortalities been classified as causally (or non-causally) related to operation of St. Lucie Nuclear Power Plant, and not all mortalities were causal to St. Lucie Nuclear Power Plant operations: 59 percent of dead loggerheads were causal to St. Lucie Nuclear Power Plant operation, 46 percent of greens, and none of hawksbills (no leatherback or Kemp's ridley mortalities occurred since 2001) (NMFS 2016a). The current incidental take limits for operation at the St. Lucie Nuclear Power Plant for severe causal injury are: seven green turtles annually and three loggerheads (Northwest Atlantic DPS) annually (NMFS 2016a). The current incidental take limits for causal mortalities are: five green turtles annually, and three loggerhead (Northwest Atlantic DPS) turtles annually (NMFS 2016a).

Based on the information provided in the application, Barney Davis LP has indicated turtles are typically found in the intake canal prior to reaching the CWIS, however, it is also possible that a green or Kemp's ridley sea turtle may become impinged on the automated rake system or travelling-trash rack prior to entering the CWIS. Due to the equipment type and operation of the CWIS, impingement of these turtles can be lethal. Based on facility records, lethality is not certain for all green and Kemp's ridley sea turtles located on the automated rake system or travelling trash rack, but for the purposes of this analysis, it is assumed that impingement in the CWIS will result in a lethal interaction. There have been twenty-four mortalities of green turtles at the Barney Davis facility between 2009 and 2019 and zero mortalities of Kemp's ridley sea turtles (Table 11).

7.4.4 Capture with a Dip Net and Release

The Barney Davis facility staff and Texas Parks and Wildlife staff will use dip nets to extract turtles from the canal. This capture method poses a low risk to the sea turtles because staff are

able to immediately remove individuals from the water and eliminate the possibility of drowning or other injury. This capture method is considered simple and non-invasive but may result in raised levels of stressor hormones.

Capture can cause stress responses in sea turtles (Gregory 1994, Hoopes et al. 1998, Gregory and Schmid 2001, Jessop et al. 2003, 2004, Thomson and Heithaus 2014). We also expect behavioral responses (attempts to break away via rapid swimming and biting) as well as physiological responses such as the release of stress hormones (Stabenau et al. 1991, Gregory et al. 1996, Hoopes et al. 2000, Gregory and Schmid 2001, Harms et al. 2003).

NMFS expects no mortality or long-term adverse effects as a result of capture and release of a sea turtle. Animals are known to attempt to evade researchers when approached, indicating some level of stress. The stress is expected to be short-term and animals should quickly resume normal behavior once released. These capture techniques are already permitted and used by researchers in the field and represent a negligible risk of injury or mortality. Individuals will be constantly monitored once captured and all work will stop if an animal appears to be in danger. No mortality is expected using any type of capture technique or gear. Additionally, these methods will not affect the physical or biological environment.

7.5 Risk Analysis

In this section we assess the consequences of the responses to the individuals that have been exposed, the populations those individuals represent, and the species those populations comprise. Whereas the *Response Analysis* identified the potential responses of ESA-listed species to the proposed action, this section summarizes our analysis of the expected risk to individuals, populations, and species given the expected exposure to those stressors and the expected responses to those stressors.

We measure risks to individuals of endangered or threatened species using changes in the individuals' fitness, which may be indicated by changes the individual's growth, survival, annual reproductive success, and lifetime reproductive success. When we do not expect ESA-listed animals exposed to an action's effects to experience reductions in fitness, we would not expect the action to have adverse consequences on the viability of the populations those individuals represent or the species those populations comprise.

Any time a turtle is captured and handled, it undoubtedly experiences stress. However, based on observations over decades of research, this should only cause minor, short-term stress to the animal. The conservation plan and ITP includes a requirement for continual visual monitoring of the intake canal by staff.

We anticipate two types of impacts. The first is the presence and confinement of a sea turtle in the intake canal, requiring capture as described above. The second is a direct interaction with the facility CWIS, resulting in contact with the traveling trash racks and other facility equipment and cause impingement or entrainment. While the monitoring requirements in the conservation plan and ITP seek to minimize injuries and time in the canal, the activities that would take place under

ITP No. 21316 are expected to result in a small number of sea turtle mortalities of North Atlantic green sea turtles over the 10-year duration of the permit.

8 CUMULATIVE EFFECTS

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action areas of the Federal actions subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

During this consultation, we searched for information on future state, tribal, local, or private (non-Federal) actions reasonably certain to occur in the action area. We did not find any information about non-Federal actions other than what has already been described in the Environmental Baseline, which we expect will continue in the future. Anthropogenic effects include climate change, ship strikes, sound, fisheries, pollution, and scientific research, although some of these activities would involve a federal nexus and thus, but subject to future ESA section 7 consultation. An increase in these activities could result in an increased effect on ESA-listed species; however, the magnitude and significance of any anticipated effects remain unknown at this time. The best scientific and commercial data available provide little specific information on any long-term effects of these potential sources of disturbance on sea turtle populations.

9 INTEGRATION AND SYNTHESIS

The *Integration and Synthesis* section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the *Effects of the Action* (Section 7) to the *Environmental Baseline* (Section 6) and the *Cumulative Effects* (Section 8) to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a ESA-listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the *Status of the Species and Critical Habitat* (Section 5).

Here we summarize the probable risks the proposed action poses to threatened and endangered species that are likely to be exposed. These summaries integrate the exposure profiles presented previously with the results of our response analyses for each of the actions considered in this opinion. Other ESA-listed sea turtle species (hawksbill, leatherback, and loggerhead sea turtles) may be located in the action area but the effects of the action on these ESA resources were determined to be insignificant or discountable (Section 5.1)

The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of a listed species," which is "to engage in an action that would be expected, directly or

indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 C.F.R. §402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

9.1 Survival and Recovery of Green Sea Turtles

The proposed action may result in up to 206 non-lethal takes of green turtles over the ten-year permit. All turtles that have sustained injuries (e.g., scrapes) requiring treatment would be collected by Texas Parks and Wildlife Hatchery Rescue immediately. The effects of these non-lethal captures are not expected to have any measurable impact on the reproduction, numbers, or distribution of green sea turtles because the animals are released back into the wild within approximately one to four days from capture. The individuals are expected to fully recover such that no reductions in reproduction or numbers of green sea turtles are anticipated. Since the animals are returned back to the area where they were captured, no change in the distribution of green sea turtles is anticipated.

Up to 24 green turtles may be killed by plant operations over the ten-year permit. These lethal takes will reduce the number of green sea turtles compared to their numbers in the absence of the proposed action. Lethal takes could also result in a potential reduction in future reproduction, assuming the individuals were females and would have survived to reproduce. For example, an adult green sea turtle can lay one to seven clutches (usually two to three) every two to four years, with 110 to 115 eggs per nest. The loss of five adult female sea turtles per year until 2030 could preclude the production of potentially thousands of eggs and hatchlings, of which a fractional percentage are expected to survive to sexual maturity. The overall percent of hatchling sea turtles that reach sexual maturity has been generally estimated (without regard to species) by the sea turtle scientific community as ranging from 0.002 percent (1 in 500 hatchlings) to 0.001 percent (1 in 1,000 hatchlings). The attainment of sexual maturity in green sea turtles has been estimated at between 20 and 50 years.

Whether the reductions in numbers and reproduction of these species attributed to the continued operation of the Barney Davis facility would appreciably reduce their likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends. The recent status review for green sea turtles states that all major nesting populations in the North Atlantic are stable or increasing (Seminoff et al. 2015). Although the anticipated mortalities would result in an instantaneous reduction in absolute population numbers, the U.S. populations of green sea turtles would not be appreciably affected.

For a population to remain stable, sea turtles must replace themselves through successful reproduction at least once over the course of their reproductive lives, and at least one offspring must survive to reproduce itself. If the hatchling survival rate to maturity is greater than the mortality rate of the population, the loss of breeding individuals would be replaced through recruitment of new breeding individuals from successful reproduction of non-taken sea turtles. The population abundance trend information for green sea turtles appears to show that they are

either stable or increasing. The loss of a small number (annually from the date of this biological opinion to 2030) of green turtles, even if they were reproductive females, would not have any measurable effect on that trend.

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

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

The potential non-lethal capture of up to 206 green sea turtles over ten years and the lethal take of up to 24 green turtles from the date of this biological opinion until 2030 are not likely to reduce population numbers over time due to current population sizes and expected recruitment. Non-lethal takes of sea turtles would not affect the adult female nesting population or number of nests per nesting season. Thus, the proposed action is not in opposition to the recovery objectives above and would not result in an appreciable reduction in the likelihood of green sea turtle's recovery in the wild.

9.2 Survival and Recovery of Kemp's Ridley Sea Turtles

The proposed action may result in the non-lethal capture of up to four Kemp's ridley sea turtles over the ten-year permit. These non-lethal takes are not expected to have any measurable impact on the reproduction, numbers, or distribution of these species. The captured sea turtles would be returned to the wild and are expected to fully recover such that no reductions in reproduction or numbers of these species are anticipated. Since sea turtles taken in the Barney Davis facility are returned to the wild in the general area where caught (on average, within four days of capture), no change in the distribution Kemp's ridley sea turtles is anticipated.

No lethal or severely injurious takes of any of these species has resulted from Barney Davis operations from 2009 to 2019. However, injury or death is possible, albeit unlikely. No lethal takes are expected or authorized over the ten-year permit.. As previously stated, all turtles that have sustained injuries (e.g., scrapes) requiring treatment would be sent to a rehabilitation facility after contacting Texas Parks and Wildlife Hatchery Response. The effects of non-lethal capture, handling, and release of these species are not expected to injure them. Thus, the

proposed action is not in opposition to the recovery objectives and would not result in an appreciable reduction in the likelihood of Kemp's ridley recoveries in the wild.

10 CONCLUSION

After reviewing the current status of the ESA-listed species, the environmental baseline within the action area, the effects of the proposed action, effects of the action, and cumulative effects, it is NMFS' biological opinion that the proposed actions are not likely to jeopardize the continued existence or recovery of the North Atlantic DPS green, or Kemp's ridley sea turtles. Further, we do not expect the issuance of ITP No. 21316 to destroy or adversely modify any designated critical habitat since there is no designated critical habitat in the action area.

11 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.

Harass is further defined as an act that "creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (NMFSPD 02-110-19).

Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of an incidental take statement.

This incidental take statement specifies the impact of any incidental taking of endangered or threatened species, as well as the specific levels of incidental take allowed. It also provides reasonable and prudent measures that are necessary or appropriate to minimize impacts of the take, and sets forth mandatory terms and conditions in order to implement the reasonable and prudent measures.

11.1 Amount or Extent of Take

For this proposed action, take is authorized for green and Kemp's ridley sea turtles. We anticipated the operation of the Barney Davis Power plant will result in the take of ESA-listed sea turtles in the intake canal. These takes are termed "captures" (Table 11).

Beyond captures, we anticipate takes resulting from the continued operation of the Barney Davis facility (causal takes) and from activities not related to facility operations (non-causal takes). Non-causal takes are attributed to activities that occur outside of plant operations (e.g., before

turtles enter the plant's intake 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 facility.

An animal that survives capture and any causal injury is categorized as a non-lethal take. Anticipated takes for captures, and causal mortalities of sea turtles are quantified (Table 11). Under the ITP, turtles that survive capture must be rehabilitated and returned to the wild. If a turtle's injuries are so serious that they prevent the animal from being returned to the wild, then the take is counted as a mortality. If the cause of death of an animal is determined to be from plant operations, the lethal take is counted against authorized incidental take. Conversely, if the death is determined to be from an activity outside plant operations, then the mortality is not counted against the incidental take limit. Takes in excess of levels established in Table 11 are not authorized.

Table 11. Incidental Take Limits for the Barney Davis facility.

Species	**Listing Unit**	Total Captures Over 10-year period **(includes turtles found in the intake canal and cooling water intake structure)**	Mortalities Over 10-year period **(*subset of total captures)**
Green Sea Turtle	North Atlantic Distinct Population Segment	206	24*
Kemp's Ridley Sea Turtle	Range-wide	4	0

11.1.1 Green and Kemp's Ridley Sea Turtle Takes

Based on sea turtle capture data at the Barney Davis facility from 2009 to 2019 (Table 1), green and Kemp's ridley sea turtles occur in the action area and may be taken by the operation of the facility. NMFS expects the proposed action may result in the capture of up to 206 green sea turtles over the ten-year permit period; and four Kemp's ridley captures over the ten-year permit period. Of the 206 authorized green sea turtles, up to 24 causal takes (lethal or severe injury) of green sea turtles is expected over the ten-year permit. No lethal takes are expected for Kemp's ridley sea turtles or authorized. Exceeding take limits will require reinitiation of consultation with NMFS.

11.1.2 Sea Turtle Takes Not Attributed to Operations at the Barney Davis Facility

Sea turtles may enter the Barney Davis facility with fishing gear on them, 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 Laguna Madre or Gulf of Mexico.

The number of takes caused by actions outside the action area can vary. The facility staff must consult with the TX STSSN to determine the cause of death. Lethal and severe injuries that are not caused by the operation of the Barney Davis facility will not be counted against the take limits for mortalities.

11.2 Effect of the Take

NMFS determined that the level of anticipated incidental take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the ESA-listed species nor destruction or adverse modification of critical habitat.

11.3 Reasonable and Prudent Measures

Reasonable and Prudent Measures are non-discretionary measures to minimize take that may or may not already be part of the description of the proposed action. They must be implemented as binding conditions for the exemption in section 7(o)(2) to apply. NMFS has a duty to ensure that the Barney Davis facility operates within the Conservation Plan and Incidental Take Permit in accordance with the monitoring, minimization, and mitigation measures included in the plan and permit. If the Barney Davis facility fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to this document, or fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. Activities which do not comply with all relevant Reasonable and Prudent Measures will require further consultation.

NMFS believes it is necessary and appropriate to minimize take of listed species via implementation of the Conservation Plan, permit conditions, and annual reporting to the NMFS Office of Protected Resources.

11.4 Terms and Conditions

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

To be exempt from the prohibitions of section 9 of the ESA, OPR must:

Monitor the Barney Davis facility’s compliance with the monitoring, minimization, and mitigation requirements detailed in the Conservation Plan and included in the Incidental Take Permit;

Monitor the extent of incidental take occurring under the Incidental Take Permit to ensure that the amount or extent of take set forth in this Incidental Take Permit is not exceeded;

Immediately coordinate with the Barney Davis facility to develop and implement additional protective measures under the terms of the Incidental Take Permit should the facility fail to implement required monitoring, minimization, or mitigation measures;

Immediately coordinate with the Barney Davis facility to develop and implement additional protective measures under the terms of the Incidental Take Permit should the covered activities exceed the amount or level of take specified in this Incidental Take Statement.

12 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, to help implement recovery plans or develop information (50 C.F.R. §402.02).

The Marine Mammal and Sea Turtle Conservation Division should continue to work with the Barney Davis facility to determine post-capture release information on sea turtles released into the wild, and they should promote improvement of procedures for determining the total residency time for captured sea turtles in the intake canal. NMFS requests information on the results of implementing any conservation recommendations.

13 REINITIATION NOTICE

This concludes formal consultation for the Marine Mammal and Sea Turtle Conservation Division's proposed issuance of Permit No. 21316. As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect ESA-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 to the ESA-listed species or designated critical habitat that was not considered in this opinion, or (4) a new species is ESA-listed or designated critical habitat designated that may be affected by the action.

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