United States Department of the Interior

U. S. FISH AND WILDLIFE SERVICE

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IN REPLY REFER TO:

FWS Log No. 04EF1000-2017-F-0122

October 18, 2017

Mr. Michael Blaylock, Chief, Environmental Conservation
Department of the Air Force, 45th Space Wing
45 CES/CEIE
1224 Jupiter Street
Patrick AFB, Florida 32925-3343
(Attn: Keitha Dattilo-Bain)

Subject: Biological Opinion – Patrick Air Force Base Dune Restoration
FWS Log #: 04EF1000-2017-F-0122

Dear Mr. Michael Blaylock:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion (BO) based on our review of the proposed 2017/2018 dune nourishment projects as well as future full template beach restoration located along the shoreline of Patrick Air Force Base (PAFB) in Brevard County, Florida, and its effects on the Florida manatee (*Trichechus manatus*), piping plover (*Charadrius melodus*), red knot (*Calidris canutus*), southeastern beach mouse (*Peromyscus polionotus niveiventris*), eastern indigo snake (*Drymarchon couperi)*, loggerhead (*Caretta caretta*), green (*Chelonia mydas),* leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), and Kemp's ridley (*Lepidochelys kempii*) sea turtles in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Your May 23, 2017, request for reinitiation of formal consultation under USFWS BO 2009-F-0336 and BO 2009-F-0037 was received on May 24, 2017.

The Service has prepared the following BO using the requested re-initiation letter and the relevant components of the 2009-F-0336 and 2009-F-0037 and the 2013 BO Amendment, 2013-F-0262, have been consolidated into one opinion to cover the proposed dune restoration project. The BO will also cover a full template restoration of the shoreline addressed by the Service's 2015 Sand Placement Biological Opinion (SPBO) dated, February, 27, 2015 given the Air Force agrees to comply with all the terms and conditions with the exception of PAFB's Joint Coastal Permit (0294526-001-JC; expiration 22 Feb 2021) in regards to nighttime leatherback surveys. The Service revised the environmental baseline to reflect the exempted incidental take that has occurred with the action area and updated the status of the species for our analysis. The Air Force reviewed the proposed conservation measures on August 31, 2017, and agreed to abide by the previous 2009 BO terms and conditions as stated in the re-initiation of consultation letter and confirmed that these measures shall be binding commitments of the proposed project description for the protective coverage of section 7(o)(2) of the Act.

The Air Force determined that this project may affect the loggerhead, green, leatherback, and hawksbill and Kemp's Ridley sea turtles. In addition, the Air Force made a determination that the project may affect but is not likely to adversely affect the Florida manatee, piping plover, and red knot. The Service concurs with these determinations. The following sections have the rationale for each species and any associated agreed upon conservation measures to reduce the likelihood of take.

Florida manatee

The Air Force determined that the proposed project may affect but is not likely to adversely affect the Florida manatee. The Service concurs that, if the Standard Manatee Construction Conditions are implemented, then these activities are not likely to adversely affect the Florida manatee. We also conclude that these activities will not adversely modify its critical habitat. These findings fulfill section 7 requirements of the Act in regard to manatees. In addition, because no incidental take of manatees is anticipated, no such authorization under the Marine Mammal Protection Act (MMPA) is needed.

Piping Plover and Red Knot

Beaches in the vicinity of the proposed dune restoration at PAFB may be utilized by migrating or wintering piping plover; however, winter shorebird surveys at PAFB have not documented use. Conditions proposed in the 2013 BO Amendment (FWS log number: 04EF1000-2013-F-0262) to avoid possible impacts to piping plover included a pre-construction meeting where wintering migratory birds, associated regulations, and measures to avoid impacts would be discussed. In addition, the AF has agreed follow the on-beach driving protocol to avoid wintering and nesting migratory birds and to conduct pre-construction surveys for the piping plover and red knot in conjunction with the daily sea turtle surveys.

Our 2005 BO for the borrow area at CCAFS included a provision that, "Prior to the proposed excavation, a shorebird survey will be conducted to ensure that the piping plover is not present within the action area." While piping plover have been recorded using beaches in the project area, a February Winter Shorebird Survey conducted for the last 4 years has not documented use of CCAFS by wintering piping plovers. Overall, piping plovers are reportedly rare at CCAFS. Recent site visits, including daily visits by turtle monitors, have not reported piping plover presence in the vicinity of the borrow site.

In addition, for the red knot, the proposed action may affect migrating and wintering red knots and their habitat within the action area. Construction activities can lead to temporarily diminished quantity and quality of intertidal foraging and roosting habitats, resulting in decreased survivorship of migrating and wintering knots and temporary adverse effects to suitable foraging and roosting habitat. The AF states it will apply minimization measures for non-optimal piping plover habitat for the red knot including pre-construction surveys and the on-beach driving protocol.

Given the above, we concur with the Air Force's determination that the proposed project is not likely to adversely affect the piping plover or the red knot.

Southeastern Beach Mouse and Eastern Indigo Snake

Because the CCAFS borrow site is directly on the beach and would only excavate material from unvegetated areas waterward of the primary dune and access to the beach would be via an established road along the jetty, the AF has determined that the currently proposed excavation at the CCAFS borrow site would not affect the southeastern beach mouse, eastern indigo snake, or their habitat. AF has agreed to mark areas with low density of beach mice as designated avoidance areas. The Service concurs with the determination of a "may affect but is not likely to adversely affect" per 2013 BO Amendment.

The BO includes an Incidental Take Statement that requires the Air Force to implement reasonable and prudent measures that the Service considers necessary or appropriate to minimize the impacts of anticipated taking on the listed wildlife species. Incidental taking of listed wildlife species that is compliant with the terms and conditions of this statement is exempted from the prohibitions against taking under the ESA.

Reinitiating consultation is required if the Corps retains discretionary involvement or control over the Action (or is authorized by law) when:

a. the amount or extent of incidental take is exceeded;
b. new information reveals that the Action may affect listed species or designated critical habitat in a manner or to an extent not considered in this BO;
c. the Action is modified in a manner that causes effects to listed species or designated critical habitat not considered in this BO; or
d. a new species is listed or critical habitat designated that the Action may affect.

A complete administrative record of this consultation is on file in our office at the letter-head address. If you have any questions about the BO, please contact Tina Nguyen by phone at 904-731-3098 or by email at Tina_nguyen@fws.gov.

Sincerely,

Jay B. Herrington
Field Supervisor

Enclosure
Biological Opinion

Biological Opinion

Patrick Air Force Base Dune Restoration

FWS Log #: 04EF1000-2017-F-0122

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10/19/2017
Date

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Consultation History

On November 15, 2004, the Service issued a BO for a beach nourishment project along the shoreline of PAFB (FWS Log number: 05-258). The nourishment occurred along 11,482 linear feet of beach beginning at the South Beach North (Pineda Crossing) north to the Main Gate. The borrow site for this project was from the Space Coast Shoal (Borrow Area Canaveral Shoals II) and an access channel into Borrow Area 1. On October 20, 2006, the Service issued a modified BO for an upland borrow source immediately north of Canaveral Harbor Inlet (41910-2009-F-0037). The upland borrow source was designated to be used as sand placement on the shoreline of PAFB. On February 15, 2008, the Service issued a BO for an emergency dune restoration project to rebuild the PAFB central and south beach dune profile. The dune restoration extended from the Florida Department of Environmental Protection (FDEP) R-Monument 65 to R-Monument 70. This action did not occur.

On April 7, 2009, the Air Force submitted a letter requesting formal consultation for the proposed dune restoration project. On May 5, 2009, the Air Force sent via email an addendum to the letter with a determination for the Florida manatee. The Air Force sent another email on May 22, 2009, with additional information on the proposed dune profile.

On May 24, 2017, the Air Force sent email correspondence requesting reinitiation of Section 7 consultation for a dune restoration project to repair damage from Hurricane Mattthew from November 2017 to April 2018.

On June 26, 2017, the Air Force sent email correspondence requesting updating the projection description to include a full template restoration project should there be catastrophic storm damage causing the need for significantly greater amounts of sand for renourishment (350,000 cubic yards).

The Service had sufficient information to issue a BO for the proposed project. Information for this BO was obtained by email correspondence, meetings, site visits, telephone conversations and other sources of information. A complete administrative record of this consultation is on file at the Service's Jacksonville Field Office.

BIOLOGICAL OPINION

A biological opinion (BO) is the document that states the opinion of the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) (collectively, the "Services") under section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA), as to whether a Federal action is likely to:

a) jeopardize the continued existence of species listed as endangered or threatened; or
b) result in the destruction or adverse modification of designated critical habitat.

This BO addresses action that the 45th Space Wing (45 SW) authorized between November 2017 and April 2018 in response to beach erosion that occurred from Hurricane Matthew as well as a full template restoration along Patrick Air Force Base (PAFB), Florida. This BO considers the effects of the Action on the following species:

- leatherback sea turtle,
- loggerhead sea turtle;
- green sea turtle;

The Service previously concurred with the 45 SW determinations that the Action is not likely to adversely affect Florida manatee, piping plover, red knot, southeastern beach mouse, and eastern indigo snake by letter dated May 23, 2017. Per the SPBO, the proposed projects "may affect, but are not likely to adversely affect" the terrestrial critical habitat of the Northwest Atlantic Ocean loggerhead sea turtle population. The proposed projects do not contain any designated critical habitat within the action area. Although there are three units (LOGG-T-FL-06, 07, 08) near the project, the Service does not anticipate any affects to these units. The Service concurs that the proposed projects will not adversely modify the terrestrial critical habitat of the Northwest Atlantic Ocean loggerhead sea turtle population. The Service designated terrestrial critical habitat for Northwest Atlantic loggerhead population on July 10, 2014. The final rule of terrestrial critical habitat includes 88 units encompassing approximately 1,102 kilometers (685 miles) of mapped shoreline along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, and Mississippi. These species and critical habitats are not further addressed in this BO. The Action does not affect designated critical habitat; therefore, this BO does not further address critical habitat.

A BO evaluates the effects of a Federal action along with those resulting from interrelated and interdependent actions, and from non-federal actions unrelated to the proposed Action (cumulative effects), relative to the status of listed species and the status of designated critical habitat. A BO that finds a proposed Federal action is *not* likely to jeopardize species and is *not* likely to destroy or adversely modify critical habitat concludes the action agency's responsibilities under §7(a)(2) of the ESA.

"*Jeopardize the continued existence*" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02). "*Destruction or adverse modification*" means a direct or indirect alteration that appreciably diminishes the value of designated critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the

physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features (50 CFR §402.02).

1. PROPOSED ACTION

Due to beach erosion from Hurricane Matthew, the 45th Space Wing (45 SW) is proposing to perform a small dune restoration project from November 2017 to April 2018 2018 at PAFB utilizing sand from the Cape Canaveral Air Force Station (CCAFS) borrow site just north of the Port Canaveral Inlet jetty. No dredging or night work will occur with this project. The project will require excavation of 25,500 cubic yards of sand from the CCAFS beach borrow site with truck haul of the sand to PAFB beach for dune restoration for six specific areas. Exact volume and placement however will be dependent on pre-construction PAFB beach surveying/profiling. The restored dune will be in a FEMA template, all above mean high water, and will roughly cover 5,000 linear feet with total construction area at PAFB including approximately 11,000 linear feet due to equipment traversing the beach to reach identified dune restoration locations (Figure 1). Construction boundaries for PAFB dune restoration are northern limit, 200-300 ft north of monument R-64, and southern limit, 200-300 ft south of monument R-75. The six areas requiring dune restoration are the Central/Hangars Beach access north and south of R-64, from R-68 north of the Tides Club to R-69 south of the Club, around the Radar (Facility 969/970) near R-70, around the Temporary Lodging Facility (TLF) north and south of R-71, and around the South/Pineda Beach access north and south of R-75.

The 45th Space Wing (45 SW) is proposing to perform a full template beach restoration project at PAFB should catastrophic hurricane/storm erosion occur similar to a previous project after severe loss of beach and dune in 2004. The PAFB project area is between R-54.5, north boundary, to R-75.3, south boundary, and roughly covers 22,176 linear feet of beach. Sand would be dredged from Canaveral Shoals about two to five miles offshore of Cape Canaveral Air Force Station (CCAFS) and 12 miles north of PAFB. A Memorandum of Agreement is established with the Bureau of Ocean Energy Management (BOEM) for use of Canaveral Shoals II sand resources. The project will require excavation of up to 350,000 cubic yards of sand with vessel/barge haul from Canaveral Shoals to offshore of PAFB, hydraulically pumping of sand from the barge to the beach at a location along PAFB north beach, stockpiling sand at a designated area on PAFB beach (approximately within a location between R-61 to R-65), and truck hauling from the stockpile to the central and south sections of PAFB beach for beach/dune profile placement. Some sand placement may be below mean high water depending on beach/dune profile requirements. However, under consultation with NMFS for protection of nearshore worm rock reef designated as Essential Fish Habitat parallel to the southern extent of PAFB, the project template will be designed essentially as dune profile repair above mean high water, and minimal grading between mean high and mean low water where nearshore hardbottom is present. Exact volume, pumping location, stockpile location and sand placement will be dependent on pre-construction PAFB beach surveying/ profiling.

For clarity and brevity, our analysis of the Action in this BO is limited to those activities that may have adversely affected the listed species and critical habitats under USFWS jurisdiction, which occurred in onshore environments. The USFWS has previously concurred (see Consultation History) with the 45th Space Wings determinations that listed species and critical

habitats under USFWS jurisdiction which could have been exposed to Action-caused stressors in deeper water away from the shoreline (West Indian Manatee) or beach dune area that provided foraging habitat (piping plover, red knot, and southeastern beach mouse) or were not present (eastern indigo snake) were likely not adversely affected by response activities. Therefore, we do not further address these components of the Action in this BO.

Restoration Activities that occurred in onshore environments to be addressed in this BO include:

1) Sand Placement
2) Equipment and Staging
3) On-Beach Driving
4) Monitoring and Relocation

We briefly describe these activities in section 1.2, and describe the spatial extent and duration of these activities in section 1.3.

1.1 Action Area

The Service has described the action area to include dune restoration 5,000 linear feet of beach, from the north of the Hangar's Beach to the PAFB South Beach boundary (FDEP monuments R-64 to FDEP R-75), the area where the equipment will traverse between the construction boundaries and the boundaries of the CCAFS borrow site north of the jetty.

A full template restoration for the entire PAFB beach consisting of 4.2 miles (22,176 linear feet from FDEP monuments R-54.5 to R-75.3) will be addressed should there be catastrophic storm damage causing the need for significantly greater amounts of sand for renourishment, on the order of 350,000 cubic yards of beach compatible sand that will be covered under the 2015 Sand Placement Biological Opinion (SPBO). The proposed action would be similar to the 2009 BO involving dredging of the Canaveral Shoals offshore sand, hydraulically pumping sand along PAFB north beach, stockpiling sand at a designated area on PAFB beach (location between FDEP R-61 to R-65), and truck hauling from the stockpile to the central and south sections of PAFB beach.

1.2 Description of Sand Placement Activities

Sand Placement. Deposition of compatible beach quality sand suitable for sea turtle nesting, successful incubation, and hatchling emergence will be used to address beach erosion impacts of Hurricane Matthew to conditions prior to the storm. No dredging or nighttime work would occur during this project.

Equipment Staging. Restoration required staging personnel and equipment in many locations throughout the Action Area. Staging areas are unknown at this time, but shall be located off the beach during early (before April 30) and late (after November 1) nesting season and peak nesting season (May 1 through October 31) and outside of the littoral zone or affecting surface waters except where pumping pipes may need to remain. A variety of heavy machinery will be used during the construction project including bulldozers and dump trucks. A barge and pumping pipes will be used if the Canaveral Shoals offshore sand is utilized and must impact the least

amount of nesting habitat as stated in the former FWS 2009 BO. Staging areas will be located off the beach to the maximum extent possible.

On-Beach Driving. The operation of motor vehicles or equipment on the beach includes transportation from the borrow site and to the placement of compatible beach quality sand in the project area. Sand compaction and escarpment formation could result from heavy machinery use on beaches and will be monitored immediately following completion of construction of the project.

Monitoring and Relocation. To locate and monitor nests within the project area to minimize and reduce impacts to nesting and hatching sea turtles pre-, post- and during construction.

1.3 Extent of Restoration Activities

The restoration operations occurred mainly during daylight hours with the exception of nesting surveys and relocation efforts that could occur prior to a 9am start time. Sand placement activities and on-beach driving include the immediate construction area where the sand will be placed (total of 5000 linear feet) as well as an additional 11000 linear feet to include transportation of sand by equipment to designated locations (Figure 1). No dredging or nighttime work would occur during this project.

Full template restoration sand placement would roughly cover the entirety of PAFB (22,176 linear feet) during daylight hours but could be until dusk and start at dawn from November to February due to the nature of shorter days. Sand placement will consist of dune and beach profile restoration. Dredging may occur for this project and sand would be hydraulically pimped onto the north PAFB beach. Should dredging or nighttime work occur during the full template restoration, direct lighting of the beach and nearshore waters shall be limited to the immediate construction area during early (before April 30) and late (after November 1) nesting season, shall comply with safety requirements, and a light management plan shall be submitted for approval by the Service and FWC prior to the pre-construction meeting per the 2011 SPBO.

1.4 Interrelated and Interdependent Actions

In its request for consultation, PAFB did not describe, and the Service is not aware of, any interrelated or interdependent actions to the Action. Therefore, this BO does not further address the topic of interrelated or interdependent actions.

1.5 Tables and Figures for the Proposed Action

FIGURE 1: PAFB 2017 DUNE RESTORATION LOCATIONS

TABLE 1: SEA TURTLE NESTING DATA AFTER 1 SEPTEMBER FROM 2012 to 2016

Number of nests after 31 Aug in area of concern	Patrick AFB			CCAFS (Borrow Site)		
	Loggerhead	Green	Leatherback	Loggerhead	Green	Leatherback
2016	0	0	0	0	0	0
2015	0	0	0	0	0	0
2014	0	0	0	0	0	0
2013	2 (last 9/22)	6 (last 9/10)	0	0	0	0
2012	2 (last 9/16)	2 (last 9/13)	0	0	0	0

1.6 Conservation Measures

Conservation measures are actions to benefit or promote the recovery of a listed species that are included by the Federal agency as an integral part of the proposed action. These actions will be taken by the Federal agency or applicant and serve to minimize impacts or compensate for

project efforts on the listed species. These measures were generated using the 2009 Biological Opinion (FWS Log Number: 41910-2009-F-0336) are binding commitments from the PAFB to implement as described below.

1. The Air Force will place material on the beach between November 1 and April 30 to avoid the majority of sea turtle nesting activities.

2. Beach quality sand suitable for sea turtle nesting, successful incubation, and hatchling emergence must be used on the project site.

3. Daily early morning sea turtle nesting surveys will be conducted 60 days prior to the official construction start date and will continue up to 30 September at CCAFS and PAFB. Daily surveys will be conducted up to two weeks after 30 September if nesting is observed the week of 30 September at both sites; however, that isn't anticipated as the last nest in five years at PAFB was laid on 22 September and no nests have been laid after 30 September within the CCAFS borrow site over the past five years (Table 1).

4. Only trained and experienced persons will be conducting the surveys and relocations, and they will be conducted before 9 AM.

5. If a nest is found in the 60 days prior to construction date the nest shall be marked for avoidance at PAFB. If a nest can't be avoided, it shall be relocated. However, recent hurricane activity (September 2017) has resulted in missed survey days, nest/clutch loss and nest inundation due to extreme high water and tides which have eroded the dune significantly as well as overwashed these areas repeatedly and almost daily for more than 10 days where most late season sea turtle nests were deposited. Surveys have been conducted after the missed days and these extreme high water events have been observed and daily survey times had to be adjusted due to lack of beach at/close to high tide in the mornings (prior to 0900). It is very unlikely that any nests laid during this period will survive to hatch. Additional hurricane activity is expected. Nests that can't be avoided and can be relocated outside of these extreme high water/high tides events will be relocated to a safe location further north where the beach is wider and in accordance with #6 below.

6. The relocation site for PAFB shall be selected to prevent nests from being affected by daily inundation, erosion, or artificial lighting, will not include placement of nests/clutches in organized grouping, and will randomly stagger relocated nests. Any nests in the CCAFS borrow site will be marked for avoidance.

7. To continue to follow hatching, bi-weekly sea turtle nesting surveys will continue through 31 October at both sites.

8. Sand compaction and escarpment formation shall be monitored in the area of sand placement immediately after completion of the project and prior to March 1 for 3 subsequent years. Tilling should occur in non-vegetated areas if tilling is required or escarpments must be leveled, the following protocol (a-e) shall be followed. If tilling is

needed, the area must be tilled to a depth of 36 inches. Each pass of the tilling equipment must be overlapped to allow more thorough and even tilling. All tilling activity must be completed at least once prior to nesting season. A report on the results of the compaction monitoring must be submitted to the Service's field office prior to any tilling actions being taken. (NOTE: Beach quality sand suitable for sea turtle nesting, successful incubation, and hatchling emergence must be used on the project site. The requirement for compaction monitoring can be eliminated if the decision is made to till regardless of post-construction compaction levels. Additionally, out-year compaction monitoring and remediation are not required if placed material no longer remains on the dry beach.)

a) Compaction sampling stations must be located at 500-foot intervals along the project area. One station must be at the seaward edge of the dune/bulkhead line (when material is placed in this area), and one station must be midway between the dune line and the high water line (normal wrack line).

b) At each station, the cone penetrometer must be pushed to a depth of 6, 12, and 18 inches three times (three replicates). Material may be removed from the hole if necessary to ensure accurate readings of successive levels of sediment. The penetrometer may need to be reset between pushes, especially if sediment layering exists. Layers of highly compact material may lie over less compact layers. Replicates must be located as close to each other as possible, without interacting with the previous hole and/or disturbed sediments. The three replicate compaction values for each depth must be averaged to produce final values for each depth at each station. Reports will include all 18 values for each transect line, and the final 6 averaged compaction values.

c) If the average value for any depth exceeds 500 pounds per square inch (psi) for any two or more adjacent stations, then that area must be tilled immediately prior to the dates listed above.

d) If values exceeding 500 psi are distributed throughout the project area but in no case do those values exist at two adjacent stations at the same depth, then consultation with the Service will be required to determine if tilling is required. If a few values exceeding 500 psi are present randomly within the project area, tilling will not be required.

e) Tilling must occur landward of the wrack line and avoid all vegetated areas 3 square feet or greater with a 3 square foot buffer around the vegetated areas.

2. STATUS OF SPECIES

2.1 Status of Leatherback Sea Turtle

This section summarizes best available data about the biology and current condition of the leatherback sea turtle (*Dermochelys coriacea*) that are relevant to formulating an opinion about the Action. The Services published the decision to list the leatherback sea turtle as endangered throughout its range on June 2, 1970 (35 FR 8491). The leatherback occurs in Atlantic, Pacific, and Indian Oceans.

2.1.1 Description of Leatherback Sea Turtle

The adult leatherback can reach four to eight feet in length and weigh 500 to 2,000 pounds. The carapace is distinguished by a rubber-like texture, about 1.6 inches thick, made primarily of tough, oil-saturated connective tissue. Hatchlings are dorsally mostly black and are covered with tiny scales; the flippers are edged in white, and rows of white scales appear as stripes along the length of the back (NMFS 2009c). Jellyfish are the main staple of its diet, but it is also known to feed on sea urchins, squid, crustaceans, tunicates, fish, blue-green algae, and floating seaweed. This is the largest, deepest diving of all sea turtle species.

2.1.2 Life History of Leatherback Sea Turtle

The leatherback is the most pelagic [open ocean dwelling] of the sea turtles. Jellyfish are the main staple of the leatherback diet, but the species feeds also on sea urchins, squid, crustaceans, tunicates, fish, blue-green algae, and floating seaweed.

Age at sexual maturity is unclear. Researchers using different methods report a range from 2–29 years, with most estimates falling between 12–16 years (NMFS and USFWS 2013: p. 16). For nesting, adult females require sandy beaches backed with vegetation. Both nesting and hatchling emergence occurs at night, although daylight nesting does occur.

Leatherbacks nest an average of five to seven times within a nesting season, with an observed maximum of 11 nests (NMFS and Service 1992). The interval between nesting events within a season is about nine to 10 days. Clutch size averages 80 to 85 yolked eggs, with the addition of usually a few dozen smaller, yolkless eggs, mostly laid toward the end of the clutch (Pritchard 1992). Nesting migration intervals of two to three years were observed in leatherbacks nesting on the Sandy Point National Wildlife Refuge, St. Croix, U.S. Virgin Islands (McDonald and Dutton 1996). Leatherbacks are believed to reach sexual maturity in six to 10 years (Zug and Parham 1996).

2.1.3 Numbers, Reproduction, and Distribution of Leatherback Sea Turtle

The leatherback sea turtle nesting and hatching season for Southern Florida Atlantic beaches extends from February 15 through November 15. Incubation ranges from about 55 to 75 days.

Leatherback turtle nesting grounds are distributed worldwide in the Atlantic, Pacific and Indian Oceans on beaches in the tropics and sub-tropics. The Pacific Coast of Mexico historically supported the world's largest known concentration of nesting leatherbacks.

The leatherback turtle regularly nests in the U.S. Caribbean in Puerto Rico and the U.S. Virgin Islands. Along the U.S. Atlantic coast, most nesting occurs in Florida (NMFS and Service 1992).

Leatherback nesting has also been reported on the northwest coast of Florida (LeBuff 1990, FWC 2009a); and in southwest Florida a false crawl (nonnesting emergence) has been observed on Sanibel Island (LeBuff 1990). Nesting has also been reported in Georgia, South Carolina, and North Carolina (Rabon *et al.* 2003) and in Texas (Shaver 2008).

Adult females require sandy nesting beaches backed with vegetation and sloped sufficiently so the distance to dry sand is limited. Their preferred beaches have proximity to deep water and generally rough seas.

Marine and terrestrial critical habitat for the leatherback sea turtle has been designated at Sandy Point on the western end of the island of St. Croix, U.S. Virgin Islands (50 Code of Federal Regulations (CFR) 17.95).
A dramatic drop in nesting numbers has been recorded on major nesting beaches in the Pacific. Spotila *et al.* (2000) have highlighted the dramatic decline and possible extirpation of leatherbacks in the Pacific.

The East Pacific and Malaysia leatherback populations have collapsed. Spotila *et al.* (1996) estimated that only 34,500 females nested annually worldwide in 1995, which is a dramatic decline from the 115,000 estimated in 1980 (Pritchard 1982). In the eastern Pacific, the major nesting beaches occur in Costa Rica and Mexico. At Playa Grande, Costa Rica, considered the most important nesting beach in the eastern Pacific, numbers have dropped from 1,367 leatherbacks in 1988-1989 to an average of 188 females nesting between 2000-2001 and 2003-2004. In Pacific Mexico, 1982 aerial surveys of adult female leatherbacks indicated this area had become the most important leatherback nesting beach in the world. Tens of thousands of nests were laid on the beaches in 1980s, but during the 2003-2004 seasons a total of 120 nests was recorded. In the western Pacific, the major nesting beaches lie in Papua New Guinea, Papua, Indonesia, and the Solomon Islands. These are some of the last remaining significant nesting assemblages in the Pacific. Compiled nesting data estimated approximately 5,000 to 9,200 nests annually with 75 percent of the nests being laid in Papua, Indonesia.

However, the most recent population size estimate for the North Atlantic alone is a range of 34,000 to 94,000 adult leatherbacks (TEWG 2007). In Florida, the number of nests has been increasing since 1979 (Stewart *et al.* 2011). The average annual number of nests in the 1980s was 63 nests, which rose to 263 nests in the 1990s and to 754 nests in the 2000s (Stewart *et al.* 2011). In 2012, 1,712 nests were recorded statewide (http://myfwc.com/research/wildlife/sea-turtles/nesting/).

Nesting in the Southern Caribbean occurs in the Guianas (Guyana, Suriname, and French Guiana), Trinidad, Dominica, and Venezuela. The largest nesting populations at present occur in the western Atlantic in French Guiana with nesting varying between a low of 5,029 nests in 1967 to a high of 63,294 nests in 2005, which represents a 92 percent increase since 1967 (TEWG 2007). Trinidad supports an estimated 6,000 leatherbacks nesting annually, which represents more than 80 percent of the nesting in the insular Caribbean Sea. Leatherback nesting along the Caribbean Central American coast takes place between Honduras and Colombia. In Atlantic Costa Rica, at Tortuguero, the number of nests laid annually between 1995 and 2006 was estimated to range from 199 to 1,623.

In Puerto Rico, the main nesting areas are at Fajardo on the main island of Puerto Rico and on the island of Culebra. Between 1978 and 2005, annual population growth rate was estimated to be 1.10 percent (TEWG 2007). Recorded leatherback nesting on the Sandy Point National Wildlife Refuge on the island of St. Croix, U.S. Virgin Islands between 1990 and 2005, ranged from a low of 143 in 1990 to a high of 1,008 in 2001 (Garner *et al*. 2005). In the British Virgin Islands, annual nest numbers have increased in Tortola from zero to six nests per year in the late 1980s to 35 to 65 nests per year in the 2000s (TEWG 2007).

The most important nesting beach for leatherbacks in the eastern Atlantic lies in Gabon, Africa. It was estimated there were 30,000 nests along 60 miles of Mayumba Beach in southern Gabon during the 1999-2000 nesting season (Billes *et al*. 2000). Some nesting has been reported in Mauritania, Senegal, the Bijagos Archipelago of Guinea-Bissau, Turtle Islands and Sherbro Island of Sierra Leone, Liberia, Togo, Benin, Nigeria, Cameroon, Sao Tome and Principe, continental Equatorial Guinea, Islands of Corisco in the Gulf of Guinea and the Democratic Republic of the Congo, and Angola. In addition, a large nesting population is found on the island of Bioko (Equatorial Guinea) (Fretey *et al*. 2007).

2.1.4 Conservation Needs of Leatherback Sea Turtle

As noted in section 5.1, the Services classify the leatherback as an endangered species throughout its range worldwide. In the Services' most recent 5-year status review for the species, we indicated that application of the Distinct Population Segment policy is possibly warranted, pending further analysis of new data on population structure and distribution (NMFS and USFWS 2013: p. 4). The status review noted also that the 1998 recovery plan for the U.S. Pacific populations, and the 1992 recovery plan for the U.S. Atlantic populations, do not define recovery criteria that correspond to the species' classification as "endangered wherever found." However, the assessment of threats and the strategies to promote recovery outlined in both plans have informed conservation actions for the leatherback turtle within the geographic scope of each plan.

The threats to leatherback populations are comparable to those discussed previously for the loggerhead (section 2.1.4), Kemp's ridley (section 3.1.4), and green sea turtle (section 4.1.4), such as mortality in fisheries bycatch, coastal development, and nest harvest and predation. Ongoing conservation efforts to address these threats include bycatch reduction measures, nesting beach acquisitions, and nest protection programs to reduce harvest and predation. Such

efforts have contributed to the stability or limited growth of several Atlantic leatherback populations, but are lacking or ineffective for many Pacific and Indian Ocean populations.

Recovery Criteria

The U.S. Atlantic population of leatherbacks can be considered for delisting when the following conditions are met:

1. The adult female population increases over the next 25 years, as evidenced by a statistically significant trend in the number of nests at Culebra, Puerto Rico, St. Croix, U.S. Virgin Island, and along the east coast of Florida.

2. Nesting habitat encompassing at least 75 percent of nesting activity in U.S. Virgin Islands, Puerto Rico, and Florida is in public ownership.

3. All priority one tasks identified in the recovery plan have been successfully implemented.

The current "Recovery Plan for the Leatherback Turtles (*Dermochelys coriacea*)" in the U.S. Caribbean, Atlantic, and Gulf of Mexico" was signed in 1992 and the "Recovery Plan for U.S. Pacific Populations of the Leatherback Turtle (*Dermochelys coriacea*)" was signed in 1998. The recovery criteria contained in the plans, while not strictly adhering to all elements of the Recovery Planning Guidelines (Service and NOAA), are a viable measure of the species status.

2.2 Status of Loggerhead Sea Turtle

This section summarizes best available data about the biology and current condition of the loggerhead sea turtle (Caretta caretta), Northwest Atlantic Distinct Population Segment (DPS), that are relevant to formulating this opinion about the Action. The loggerhead occurs throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. The Services listed the species worldwide as threatened on July 28, 1978 (43 FR 32800). The Services revised this classification on September 22, 2011, identifying four DPSs classified as threatened and five DPSs classified as endangered (76 FR 58868-58952).

2.2.1 Description of Loggerhead Sea Turtle

The loggerhead sea turtle grows to an average weight of about 200 pounds and is characterized by a large head with blunt jaws. Adults and subadults have a reddish-brown carapace. Scales on the top of the head and top of the flippers are also reddish-brown with yellow on the borders. Hatchlings are a dull brown color (NMFS 2009a). The loggerhead feeds on mollusks, crustaceans, fish, and other marine animals.

2.2.2 Life History of Loggerhead Sea Turtle

Loggerheads are long-lived, slow-growing animals that use multiple habitats across entire ocean basins throughout their life history. This complex life history encompasses terrestrial (nesting beaches), nearshore, and open ocean habitats. The loggerhead feeds on mollusks, crustaceans, fish, and other marine animals. The species is found hundreds of miles off shore, and in near-shore areas such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers. Coral reefs, rocky places, and ship wrecks are often used as feeding areas.

Nesting

Loggerheads nest on ocean beaches and occasionally on estuarine shorelines with suitable sand. Nests are typically laid between the high tide line and the dune front (Routa 1968, Witherington 1986, Hailman and Elowson 1992). Wood and Bjorndal (2000) evaluated four environmental factors (slope, temperature, moisture, and salinity) and found that slope had the greatest influence on loggerhead nest-site selection on a beach in Florida. Loggerheads appear to prefer relatively narrow, steeply sloped, coarse-grained beaches, although nearshore contours may also play a role in nesting beach site selection (Mortimer 1982; Provancha and Ehrhart 1987).

Numbers of nests and nesting females are often highly variable from year to year due to a number of factors including environmental stochasticity, periodicity in ocean conditions, anthropogenic effects, and density-dependent and density-independent factors affecting survival, somatic growth, and reproduction (Meylan 1982, Hays 2000, Chaloupka 2001, Solow *et al.* 2002). Despite these sources of variation, and because female turtles exhibit strong nest site fidelity, a nesting beach survey can provide a valuable assessment of changes in the adult female population, provided that the study is sufficiently long and effort and methods are standardized (Meylan 1982, Gerrodette and Brandon 2000, Reina *et al*. 2002).

The loggerhead sea turtle nesting and hatching season for Southern Florida Atlantic beaches extends from March 15 through November 30. Incubation ranges from about 45 to 95 days.

Early Development

The warmer the sand surrounding the egg chamber, the faster the embryos develop (Mrosovsky and Yntema 1980). Sand temperatures prevailing during the middle third of the incubation period also determine the sex of hatchling sea turtles (Mrosovsky and Yntema 1980). Incubation temperatures near the upper end of the tolerable range produce only female hatchlings while incubation temperatures near the lower end of the tolerable range produce only male hatchlings.

Loggerhead hatchlings pip and escape from their eggs over a one to three day interval and move upward and out of the nest over a two to four day interval (Christens 1990). The time from pipping to emergence ranges from four to seven days with an average of 4.1 days (Godfrey and Mrosovsky 1997). Hatchlings emerge from their nests en masse almost exclusively at night, and presumably using decreasing sand temperature as a cue (Hendrickson 1958, Mrosovsky 1968, Witherington *et al.* 1990). Moran *et al*. (1999) concluded that a lowering of sand temperatures below a critical threshold, which most typically occurs after nightfall, is the most probable

trigger for hatchling emergence from a nest. After an initial emergence, there may be secondary emergences on subsequent nights (Carr and Ogren 1960, Witherington 1986, Ernest and Martin 1993, Houghton and Hays 2001).

Hatchlings use a progression of orientation cues to guide their movement from the nest to the marine environments where they spend their early years (Lohmann and Lohmann 2003). Hatchlings first use light cues to find the ocean. On naturally lighted beaches without artificial lighting, ambient light from the open sky creates a relatively bright horizon compared to the dark silhouette of the dune and vegetation landward of the nest. This contrast guides the hatchlings to the ocean (Daniel and Smith 1947, Limpus 1971, Salmon *et al.* 1992, Witherington and Martin 1996, Witherington 1997, Stewart and Wyneken 2004).

2.2.3 Numbers, Reproduction, and Distribution of Loggerhead Sea Turtle

The PFRU is the largest loggerhead nesting assemblage in the Northwest Atlantic. A near-complete nest census of the PFRU undertaken from 1989 to 2007 reveals a mean of 64,513 loggerhead nests per year representing approximately 15,735 females nesting per year (4.1 nests per female, Murphy and Hopkins 1984) (FWC 2008d).

Five recovery units have been identified in the Northwest Atlantic based on genetic differences and a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries (NMFS and Service 2008). Recovery units are subunits of a listed species that are geographically or otherwise identifiable and essential to the recovery of the species. Recovery units are individually necessary to conserve genetic robustness, demographic robustness, important life history stages, or some other feature necessary for long-term sustainability of the species. The five recovery units identified in the Northwest Atlantic (**Figure 2**) are:

1. Northern Recovery Unit (NRU) - defined as loggerheads originating from nesting beaches from the Florida-Georgia border through southern Virginia (the northern extent of the nesting range);

2. Peninsula Florida Recovery Unit (PFRU) - defined as loggerheads originating from nesting beaches from the Florida-Georgia border through Pinellas County on the west coast of Florida, excluding the islands west of Key West, Florida;

3. Dry Tortugas Recovery Unit (DTRU) - defined as loggerheads originating from nesting beaches throughout the islands located west of Key West, Florida;

4. Northern Gulf of Mexico Recovery Unit (NGMRU) - defined as loggerheads originating from nesting beaches from Franklin County on the northwest Gulf coast of Florida through Texas; and

5. Greater Caribbean Recovery Unit (GCRU) - composed of loggerheads originating from all other nesting assemblages within the Greater Caribbean (Mexico through French Guiana, The Bahamas, Lesser Antilles, and Greater Antilles).

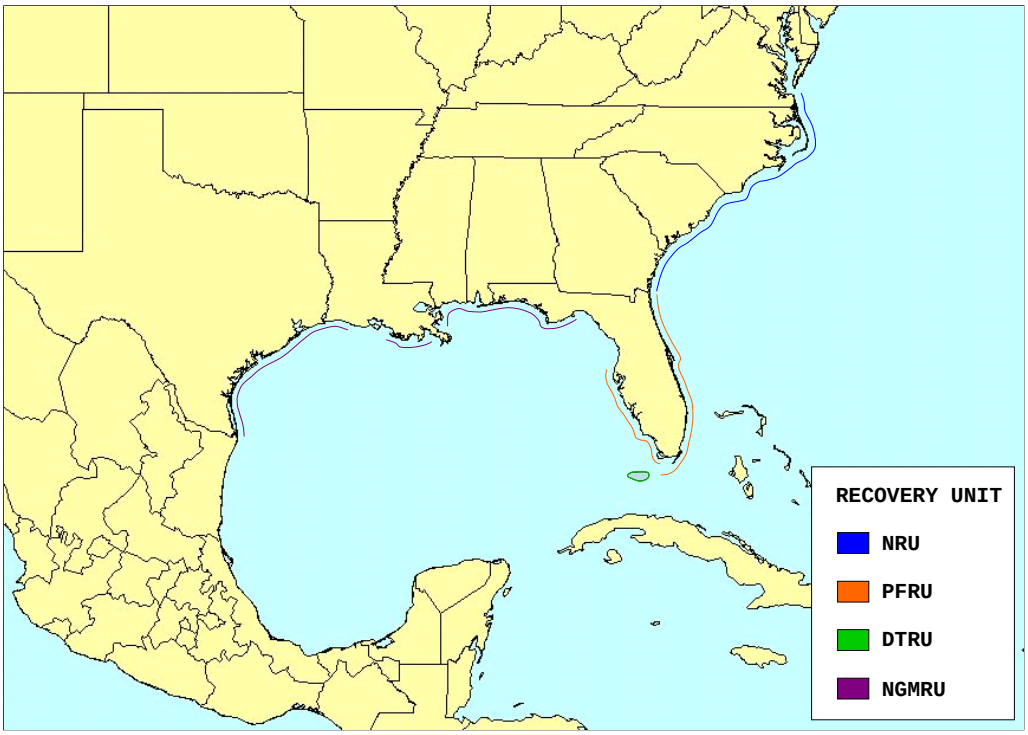

Figure 2.2-1. Map of the distribution of the loggerhead recovery units.

Within the Northwest Atlantic, the majority of nesting activity occurs from April through September, with a peak in June and July (Williams-Walls *et al*. 1983, Dodd 1988, Weishampel *et al*. 2006). Nesting occurs within the Northwest Atlantic along the coasts of North America, Central America, northern South America, the Antilles, Bahamas, and Bermuda, but is concentrated in the southeastern U.S. and on the Yucatán Peninsula in Mexico on open beaches or along narrow bays having suitable sand (Sternberg 1981, Ehrhart 1989, Ehrhart *et al*. 2003, NMFS and Service 2008).

Critical habitat has been designated for the NWAO DPS of the loggerhead sea turtle.

The loggerhead occurs throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. However, the majority of loggerhead nesting is at the western rims of the Atlantic and Indian Oceans. The most recent reviews show that only two loggerhead nesting beaches have greater than 10,000 females nesting per year (Baldwin *et al.* 2003, Ehrhart *et al.* 2003, Kamezaki *et al.* 2003, Limpus and Limpus 2003, Margaritoulis *et al.* 2003): South Florida (U.S.) and Masirah (Oman). Those beaches with 1,000 to 9,999 females nesting each year are Georgia through North Carolina (U.S.), Quintana Roo and Yucatán (Mexico), Cape Verde Islands (Cape Verde, eastern Atlantic off Africa), and Western Australia (Australia). Smaller nesting aggregations with 100 to 999 nesting females annually occur in the Northern Gulf of Mexico (U.S.), Dry Tortugas (U.S.), Cay Sal Bank (Bahamas), Sergipe and Northern Bahia (Brazil), Southern Bahia to Rio de Janerio (Brazil), Tongaland (South Africa), Mozambique, Arabian Sea Coast (Oman), Halaniyat Islands (Oman), Cyprus, Peloponnesus (Greece), Island of Zakynthos (Greece), Turkey, Queensland (Australia), and Japan.

The loggerhead is commonly found throughout the North Atlantic including the Gulf of Mexico, the northern Caribbean, the Bahamas archipelago, and eastward to West Africa, the western Mediterranean, and the west coast of Europe.

The major nesting concentrations in the U.S. are found in South Florida. However, loggerheads nest from Texas to Virginia. Total estimated nesting in Florida, where 90 percent of nesting occurs, has fluctuated between 52,374 and 98,602 nests per year from 2009-2013 (FWC 2014,http://myfwc.com/media/2786250/loggerheadnestingdata09-13.pdf). About 80 percent of loggerhead nesting in the southeast U.S. occurs in six Florida counties (Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties). Adult loggerheads are known to make considerable migrations between foraging areas and nesting beaches (Schroeder *et al.* 2003, Foley *et al.* 2008). During non-nesting years, adult females from U.S. beaches are distributed in waters off the eastern U.S. and throughout the Gulf of Mexico, Bahamas, Greater Antilles, and Yucatán.

From a global perspective, the U.S. nesting aggregation is of paramount importance to the survival of the species as is the population that nests on islands in the Arabian Sea off Oman (Ross 1982, Ehrhart 1989). The status of the Oman loggerhead nesting population, reported to be the largest in the world (Ross 1979), is uncertain because of the lack of long-term standardized nesting or foraging ground surveys and its vulnerability to increasing development pressures near major nesting beaches and threats from fisheries interaction on foraging grounds and migration routes (Possardt 2005). The loggerhead nesting aggregations in Oman and the U.S. account for the majority of nesting worldwide.

2.2.4 Conservation Needs of Loggerhead Sea Turtle

The Services 2011 final rule (76 FR 58868-58952) classifying the loggerhead as nine DPSs provides the most recent summary of the species' status and conservation needs range wide. The Services' 2008 Recovery Plan (NMFS and USFWS 2008), although it preceded this rule, was limited in scope to the Northwest Atlantic Population that was later designated as one of the nine DPSs. Due to its focus on the DPS, the Recovery Plan is the primary source for information in

this section. We summarize the key points that are relevant to this consultation, but please refer to the full Plan for additional details.

Population Growth

Maximum intrinsic population growth rates of sea turtles are limited by the extremely long duration of the juvenile stage. Loggerheads require high survival rates in the juvenile and adult stages to achieve positive or stable long-term population growth (Congdon *et al.* 1993, Heppell 1998, Crouse 1999, Heppell *et al.* 1999, 2003, Musick 1999).

The Recovery Plan established the following demographic objectives, measured by number of nests sustained for 50 years, for each recovery unit of the Northwest Atlantic DPS.

Unit	# Nests
Peninsular Florida	106,100
Northern	14,000
Northern Gulf	4,000
Dry Tortugas	1,100
Greater Caribbean	100
Total	125,300

The Recovery Plan specifies criteria (e.g., statistical significance, distribution by state in multi-jurisdiction units) for each nesting objective, which must correspond to increases in numbers of nesting females estimated from nests, clutch frequency, and remigration interval (time between successive nesting migrations).

The Recovery Plan identifies two demographic criteria in addition to the recovery-unit-specific nesting objectives:

1) relative abundance is increasing for at least one generation, as measured in the water by a network of oceanic and neritic (waters where sunlight reaches the bottom) sites across the foraging range; and
2) the relative abundance trend of #1 above must exceed the rate of neritic stranding for similar age classes for at least one generation.

Reducing Threats

The loggerhead's use of a geographically broad range of beaches, near-shore, and marine habitats in the Northwest Atlantic basin exposes the species to a wide array of threats to individual survival, reproductive success, and population recovery. The Recovery Plan (NMFS and USFWS 2008) specifies the broad goals of strategies that will lessen or eliminate the most significant of these threats. The strategies that are most relevant to this consultation, which is limited to the terrestrial sea turtle environment, are intended to promote the following conservation outcomes:

- the percentage of nesting beaches free of barriers to nesting is stable or increasing;
- beach sand placement projects do not degrade or eliminate nesting habitat;
- nests are protected from natural and manmade impacts;

- less than 10 percent of U.S. nests are lost to predation; and
- artificial lighting disorients the hatchlings from less than 10 percent of U.S. nests.

Additional factors affecting loggerhead conservation in the terrestrial context include hurricanes, beach erosion, beach driving, climate change, and recreational beach use. Details regarding these factors are not relevant to this consultation; but are discussed in the Recovery Plan.

Recovery Criteria

1. Number of Nests and Number of Nesting Female**s**

a. Northern Recovery Unit

(i) The annual rate of increase over a generation time of 50 years is 2% or greater.
(ii) This increase in number of nests must be a result of corresponding increases in number of nesting females.

b. Peninsular Florida Recovery Unit

(i) The annual rate of increase over a generation time of 50 years is statistically detectable (1%) resulting in a total annual number of nests of 106,100 or greater.
(ii) This increase in number of nests must be a result of corresponding increases in number of nesting females.

c. Dry Tortugas Recovery Unit

(i) The annual rate of increase over a generation time of 50 years is 3% or greater.
(ii) This increase in number of nests must be a result of corresponding increases in number of nesting females.

d. Northern Gulf of Mexico Recovery Unit

(i) There is statistical confidence (95%) that the annual rate of increase over a generation time of 50 years is 3% or greater resulting in a total annual number of nests of 4,000 or greater.
(ii) This increase in number of nests must be a result of corresponding increases in number of nesting females.

e. Greater Caribbean Recovery Unit

(i) The total annual number of nests at a minimum of three nesting assemblages, averaging greater than 100 nests annually (e.g., Yucatán, Mexico; Cay Sal Bank, The Bahamas) has increased over a generation time of 50 years.
(ii) This increase in number of nests must be a result of corresponding increases in number of nesting females.

2.3 Status of Green Sea Turtle

This section summarizes best available data about the biology and current condition of green sea turtle (*Chelonia mydas*), North Atlantic Distinct Population Segment (DPS), that are relevant to formulating an opinion about the Action. The green sea turtle has a worldwide distribution in

tropical and subtropical waters. The Services classified the species as threatened range-wide in 1978, except for the Florida and Mexican Pacific coast breeding populations, which we classified as endangered (43 FR 32800). The Services currently recognize eleven DPSs of the species, and published a final rule to classify three of these as endangered and eight as threatened on April 6, 2016 (81 FR 20058-20090).

2.3.1 Description of Green Sea Turtle

The green sea turtle grows to a maximum size of about four feet and a weight of 440 pounds. It has a heart-shaped shell, small head, and single-clawed flippers. The carapace is smooth and colored gray, green, brown and black. Hatchlings are black on top and white on the bottom (NMFS 2009b). Hatchling green turtles eat a variety of plants and animals, but adults feed almost exclusively on seagrasses and marine algae.

Most green turtles spend the majority of their lives in coastal foraging grounds. These areas include fairly shallow waters both open coastline and protected bays and lagoons. While in these areas, green turtles rely on marine algae and seagrass as their primary diet constituents, although some populations also forage heavily on invertebrates. These marine habitats are often highly dynamic and in areas with annual fluctuations in seawater and air temperatures, which can cause the distribution and abundance of potential green turtle food items to vary substantially between seasons and years (Carballo *et al.*, 2002). Many prey species that are abundant during winter and spring periods become patchy during warm summer periods. Some species may altogether vanish during extreme temperatures, such as those that occur during El Niño Southern Oscillation events (Carballo *et al.*, 2002).

Open beaches with a sloping platform and minimal disturbance are required for nesting.

2.3.2 Life History of Green Sea Turtle

Except when migrating or nesting, green sea turtles generally inhabit reefs, bays, and inlets. The green turtle is attracted to lagoons and shoals with an abundance of marine grass and algae. Open beaches with minimal disturbance are required for nesting.

The nesting season varies with the locality. In the Southeastern U.S., it is roughly June through September. Adult females nest at night and at 2-, 3-, or 4-year intervals, but occasionally in successive years (NMFS and USFWS 2016). A female may lay as a many as nine clutches within a nesting season (overall average is 3.3 nests per season) at about 13-day intervals (Hirth 1997). Clutch size varies from 75–200 eggs, with an average clutch size of 136 eggs reported for Florida nests (Witherington and Ehrhart 1989). Incubation ranges from about 45–75 days, depending on incubation temperatures. Hatchlings generally emerge at night. Age at sexual maturity is 20–50 years (Hirth 1997).

2.3.3 Numbers, Reproduction, and Distribution of Green Sea Turtle

The green sea turtle nesting and hatching season for Southern Florida Atlantic extends from May 1 through November 30. Incubation ranges from about 45 to 75 days.

Major green turtle nesting colonies in the Atlantic occur on Ascension Island, Aves Island, Costa Rica, and Surinam. Within the U.S., green turtles nest in small numbers in the U.S. Virgin Islands and Puerto Rico, and in larger numbers along the east coast of Florida, particularly in Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties (NMFS and Service 1991). Nesting also has been documented along the Gulf coast of Florida from Escambia County through Santa Rosa County in northwest Florida and from Pinellas County through Collier County in southwest Florida (FWC 2009a).

The Services estimate that the North Atlantic DPS population consists of 167,424 adult females nesting at 73 sites (NMFS and USFWS 2016). More than 100,000 females nest at Tortuguero, Costa Rica, and more than 10,000 females nest at Quintana Roo, Mexico. Nesting data indicate long-term increases at all major nesting sites. Genetic substructure within the DPS is not evident, and turtles from multiple nesting beaches share common foraging areas. Nesting is geographically widespread and occurs at a diversity of mainland and island sites.

Most green turtles spend the majority of their lives in coastal foraging grounds. These areas include fairly shallow waters both open coastline and protected bays and lagoons. While in these areas, green turtles rely on marine algae and seagrass as their primary diet constituents, although some populations also forage heavily on invertebrates. These marine habitats are often highly dynamic and in areas with annual fluctuations in seawater and air temperatures, which can cause the distribution and abundance of potential green turtle food items to vary substantially between seasons and years (Carballo *et al.*, 2002). Many prey species that are abundant during winter and spring periods become patchy during warm summer periods. Some species may altogether vanish during extreme temperatures, such as those that occur during El Niño Southern Oscillation events (Carballo *et al.*, 2002).

Open beaches with a sloping platform and minimal disturbance are required for nesting.

Critical habitat for the green sea turtle has been designated for the waters surrounding Culebra Island, Puerto Rico, and its outlying keys.

The majority of nesting occurs along the Atlantic coast of eastern central Florida, with an average of 10,377 each year from 2008 to 2012 (B. Witherington, Florida Fish and Wildlife Conservation Commission, pers. comm., 2013). In the U.S. Pacific, over 90 percent of nesting throughout the Hawaiian archipelago occurs at the French Frigate Shoals, where about 200 to 700 females nest each year (NMFS and Service 1998b). Elsewhere in the U.S. Pacific, nesting takes place at scattered locations in the Commonwealth of the Northern Marianas, Guam, and American Samoa. In the western Pacific, the largest green turtle nesting aggregation in the world occurs on Raine Island, Australia, where thousands of females nest nightly in an average nesting season (Limpus *et al.* 1993). In the Indian Ocean, major nesting beaches occur in Oman where 30,000 females are reported to nest annually (Ross and Barwani 1995).

2.3.4 Conservation Needs of Green Sea Turtle

The Services' 1991 Recovery Plan for the population of the green turtle in U.S. Atlantic waters (NMFS and USFWS 1991) predates the Services' 2016 reclassification of the species as eleven Distinct Population Segments (DPS) (81 FR 20058-20090). When the Recovery Plan was

approved, Florida populations of the green turtle were classified as endangered. The 2016 final rule determined that the Florida populations were part of the larger North Atlantic DPS that warranted classification as threatened.

Past and ongoing threats contributing the North Atlantic DPS's status as a threatened taxon that the Services cited in the 2016 final rule include:

- coastal development, armoring, erosion, lighting, beach driving, and other human activities that degrade nesting habitats and reduce nesting success;
- pollution and other impacts to foraging habitats;
- harvest of green turtles and their eggs, which is legal in some countries and occurs illegally in many areas;
- the chronic and often lethal disease Fibropapillomatosis;
- egg and hatchling predation;
- mortality as fisheries bycatch;
- vessel strikes;
- marine debris entanglement; and
- sea level rise that alters nesting habitats and warming temperatures that may addle eggs or skew temperature-determined sex ratios.

Ongoing conservation efforts to address these threats include bycatch reduction measures, nesting beach acquisitions, and nest protection programs to reduce harvest and predation. These efforts have likely contributed to population growth within the DPS in recent years, but have not reduced the threats listed above to a degree that warrants removing the protections afforded as a threatened taxon under the ESA.

Recovery Criteria

The U.S. Atlantic population of green sea turtles can be considered for delisting when, over a period of 25 years the following conditions are met:

1. The level of nesting in Florida has increased to an average of 5,000 nests per year for at least six years. Nesting data shall be based on standardized surveys.

2. At least 25 percent (65 miles) of all available nesting beaches (260 miles) are in public ownership and encompass at least 50 percent of the nesting activity.

3. A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.

4. All priority one tasks identified in the recovery plan have been successfully implemented.

The current "Recovery Plan for the U.S. Population of Atlantic Green Turtle (*Chelonia mydas*)" was completed in 1991, the Recovery Plan for U.S. Pacific Populations of the Green Turtle (*Chelonia mydas*)" was completed in 1998, and the "Recovery Plan for U.S. Pacific Populations of the East Pacific Green Turtle (*Chelonia mydas*)" was completed in 1998. The recovery

criteria contained in the plans, while not strictly adhering to all elements of the Recovery Planning Guidelines (Service and NOAA), are a viable measure of the species status.

3. ENVIRONMENTAL BASELINE

The "Environmental Baseline" section summarizes information on status and trends of nesting sea turtles and the effects of past and ongoing human and natural factors leading to the present status of sea turtles, their habitat, and ecosystem specifically within the action area. This section also details the past consultations within the action area and the associated incidental take that was exempted. These summaries provide the foundation for our assessment of the effects of the proposed action, as presented in the "Effects of the Action" section.

The proposed action has the potential to adversely affect nesting females, nests, and hatchlings within the proposed project area. The effects of the proposed action on sea turtles will be considered further in the remaining sections of this biological opinion. Potential effects include destruction of nests deposited within the boundaries of the proposed project, harassment in the form of disturbing or interfering with female turtles attempting to nest within the construction area or on adjacent beaches as a result of construction activities, disorientation of hatchling turtles on beaches adjacent to the construction area as they emerge from the nest and crawl to the water as a result of project lighting, behavior modification of nesting females due to escarpment formation within the project area during a nesting season resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs. The quality of the placed sand could affect the ability of female turtles to nest, the suitability of the nest incubation environment, and the ability of hatchlings to emerge from the nest.

Past Consultations within the action area

The Service issued a BO for a beach nourishment project along the shoreline of PAFB (FWS Log number: 2005-258, November). The nourishment occurred along 11,482 linear feet of beach beginning at the South Beach North (Pineda Crossing) north to the Main Gate. The borrow site for this project was from the Space Coast Canaveral Shoals (Borrow Area II) and an access channel into Borrow Area 1. Sand placement occurred in March to April 2005 (FDEP monuments R-54.5 to R-75.3) for 11,482 linear feet of beach.

On February 15, 2008, the Service issued a BO for an emergency dune restoration project to rebuild the PAFB central and south beach dune profile. The dune restoration extended from the Florida Department of Environmental Protection (FDEP) monuments R-65 to R-70. However, no funding was available therefore, the project was never completed.

The Service issued a modified BO for an upland borrow source immediately north of Canaveral Harbor Inlet (41910-2009-F-0037). The upland borrow source was designated to be used as sand placement on the shoreline of PAFB.

The Service issued a BO for the beach nourishment and dune restoration at PAFB (FWS Log number 2009-F-0336, June 2009). The BO addressed the proposed dune restoration of 8,500

linear feet of beach from Florida Department of Environmental Protection R-Monument 65 to R-Monument 75, using 80,000 cubic yards of sand excavated and truck hauled from the CCAFS borrow site. It also included beach restoration of 11,580 linear feet from R-Monument 53 to R-Monument 65 using 350,000 cubic yards of sand dredged from offshore. From January to March 2011, a smaller in scope dune restoration project was completed at PAFB (R-Monument 65 to R-Monument 75). The project used approximately 56,000 cubic yards of sand excavated from the CCAFS borrow site to restore dunes, however; the dune restoration footprint covered 10,032 linear feet of shoreline.

The Service issued an amendment to our June 2009 BO for the beach nourishment and dune restoration (2009-F-0336) to address some update terms and conditions, address piping plovers, and increased the exempted incidental take for a 2014 PAFB dune restoration project (FWS Log Number 2013-F-0262). The total construction area included approximately 7,392 linear feet (R-Monument 63 to R-Monument 71) due to equipment traversing the beach to access restoration areas. The project required 16,000 cubic yards of beach compatible fill, trucked from the CCAFS borrow site. The project was completed in February to March 2014 and the Service received a final report on the project on 24 February 2017.

3.1. Action Area Numbers, Reproduction, and Distribution of Leatherback Sea Turtle

The leatherback sea turtle nesting and hatching season for Southern Florida Atlantic beaches extends from February 15 through November 15. Incubation ranges from about 55 to 75 days.

The PAFB project area has had an increasing number of leatherback nests over the years. Between 0 and 3 leatherback turtle nests were deposited annually on PAFB beach from 2003 through 2008. Between 0 and 6 leatherback turtle nests were deposited annually on PAFB beach from 2008 to 2017 (September 30).

3.2. Action Area Numbers, Reproduction, and Distribution of Loggerhead Sea Turtle

The loggerhead sea turtle nesting and hatching season for Southern Florida Atlantic beaches extends from March 15 through November 30. Incubation ranges from about 45 to 95 days.

The PAFB project area has a significant number of loggerhead nests. Between 889 and 1,457 loggerhead nests were deposited annually on PAFB beach from 2003 through 2008. Between 661 and 1531 loggerhead nests were deposited annually from 2008 to 2017 (September 30).

3.3. Action Area Numbers, Reproduction, and Distribution of Green Sea Turtle

The green sea turtle nesting and hatching season for Southern Florida Atlantic extends from May 1 through November 30. Incubation ranges from about 45 to 75 days.

The PAFB project area has a significant number of green turtle nests. Between 4 and 39 green turtle nests were deposited annually on PAFB beach from 2003 through 2008. Between 4 and 146 green sea turtle nests were deposited annually from 2008 to 2017 (September 2017).

4. EFFECTS OF THE ACTION

This section is an analysis of the beneficial, direct, and indirect effects of the proposed actions on nesting sea turtles, nests, eggs, and hatchling sea turtles within the Action Area. The analysis includes effects interrelated and interdependent of the project activities. An interrelated activity is an activity that is part of a proposed action and depends on the proposed activity. An interdependent activity is an activity that has no independent utility apart from the action.

Factors affecting the species environment within the action area

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat that would be added to the environmental baseline, along with the effects of other activities that are interrelated or interdependent with that action.

Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur. Indirect effects can be both spatial and temporal in nature. In contrast to direct effects, indirect effects can often be more subtle, and may affect species and habitat quality over an extended period, long after project activities have been completed. Indirect effects are of particular concern for long-lived species such as sea turtles, because project-related effects may not become evident in individuals or populations until years later.

Hurricanes

Hurricanes were probably responsible for maintaining coastal beach habitat upon which sea turtles depend through repeated cycles of destruction, alteration, and recovery of beach and dune habitat. Hurricanes generally produce damaging winds, storm tides and surges, and rain and can result in severe erosion of the beach and dune systems. Overwash and blowouts are common on barrier islands. Hurricanes and other storms can result in the direct or indirect loss of sea turtle nests, either by erosion or washing away of the nests by wave action or inundation or "drowning" of the eggs or hatchlings developing within the nest or indirectly by loss of nesting habitat. Depending on their frequency, storms can affect sea turtles on either a short-term basis (nests lost for one season and/or temporary loss of nesting habitat) or long term, if frequent (habitat unable to recover). How hurricanes affect sea turtle nesting also depends on its characteristics (winds, storm surge, rainfall), the time of year (within or outside of the nesting season), and where the northeast edge of the hurricane crosses land.

Because of the limited remaining nesting habitat, frequent or successive severe weather events could threaten the ability of certain sea turtle populations to survive and recover. Sea turtles

evolved under natural coastal environmental events such as hurricanes. The extensive amount of pre-development coastal beach and dune habitat allowed sea turtles to survive even the most severe hurricane events. It is only within the last 20 to 30 years that the combination of habitat loss to beachfront development and destruction of remaining habitat by hurricanes has increased the threat to sea turtle survival and recovery. On developed beaches, typically little space remains for sandy beaches to become re- established after periodic storms. While the beach itself moves landward during such
storms, reconstruction or persistence of structures at their pre-storm locations can result in a major loss of nesting habitat.

Erosion

The designation of a Critically Eroded Beach is a planning requirement of the State's Beach Erosion Control Funding Assistance Program. A segment of beach shall first be designated as critically eroded in order to be eligible for State funding. A critically eroded area is a segment of the shoreline where natural processes or human activity have caused or contributed to erosion and recession of the beach or dune system to such a degree that upland development, recreational interests, wildlife habitat, or important cultural resources are threatened or lost. Critically eroded areas may also include peripheral segments or gaps between identified critically eroded areas because their inclusion is necessary for continuity of management of the coastal system or for the design integrity of adjacent beach management projects (FDEP 2005). It is important to note, that for an erosion problem area to be critical, there shall exist a threat to or loss of one of four specific interests – upland development, recreation, wildlife habitat, or important cultural resources. The total of critically eroded beaches statewide in Florida for 2007 is 388 miles of 497 miles of shoreline. Seventy-eight (78) percent of the State’s shoreline is considered to be critically eroded.

Beachfront Lighting

Artificial beachfront lighting may cause disorientation (loss of bearings) and misorientation (incorrect orientation) of sea turtle hatchlings. Visual signs are the primary sea-finding mechanism for hatchlings (Mrosovsky and Carr 1967; Mrosovsky and Shettleworth 1968; Dickerson and Nelson 1989; Witherington and Bjorndal 1991). Artificial beachfront lighting is a documented cause of hatchling disorientation and misorientation on nesting beaches (Philibosian 1976; Mann 1977; FWC 2006). The emergence from the nest and crawl to the sea is one of the most critical periods of a sea turtle’s life. Hatchlings that do not make it to the sea quickly are eaten by ghost crabs, birds, and other predators or become dehydrated and die before reaching the ocean. Some types of beachfront lighting attract hatchlings away from the sea while some lights cause adult turtles to avoid stretches of brightly illuminated beach. Research has documented significant reduction in sea turtle nesting activity on beaches illuminated with artificial lights (Witherington 1992). During the 2007 sea turtle nesting season in Florida, over 64,000 turtle hatchlings were documented as being disoriented (**Table 1**) (FWC/FWRI 2007, http://www.myfwc.com/seaturtle/Lighting/Light_Disorient.htm). Exterior and interior lighting associated with condominiums had the greatest impact causing approximately 42 percent of documented hatchling disorientation/misorientation. Other causes included urban sky glow and street lights (http://www.myfwc.com/seaturtle/Lighting/Light_Disorient.htm).

Table 4-1. Documented Disorientations along the Florida coast.

Year	Total Number of Hatchling Disorientation Events	Total Number of Hatchlings Involved in Disorientation Events	Total Number of Adult Disorientation Events
2001	743	28,674	19
2002	896	43,226	37
2003	1,446	79,357	18
2004	888	46,487	24
2005	976	41,521	50
2006	1,521	71,798	40
2007	1,410	64,433	25
2008	1192	49,623	62

Predation

Depredation of sea turtle eggs and hatchlings by natural and introduced species occurs on almost all nesting beaches. Depredation by a variety of predators can considerably decrease sea turtle nest hatching success. The most common predators in the southeastern United States are ghost crabs (*Ocypode quadrata*), raccoons (*Procyon lotor*), feral hogs (*Sus scrofa*), foxes (*Urocyon cinereoargenteus* and *Vulpes vulpes*), coyotes (*Canis latrans*), armadillos (*Dasypus novemcinctus*), cats (*Felis catus)*, and fire ants (*Solenopsis* spp.) (Dodd 1988, Stancyk 1995). Raccoons are particularly destructive on the Atlantic coast and may take up to 96 percent of all nests deposited on a beach (Davis and Whiting 1977, Hopkins and Murphy 1980, Stancyk et al. 1980, Talbert et al. 1980, Schroeder 1981, Labisky et al. 1986). As nesting habitat dwindles, it is essential that nest production be naturally maximized so the turtles may continue to exist in the wild.

In response to increasing depredation of sea turtle nests by coyote, fox, hog, and raccoon, multi-agency cooperative efforts have been initiated and are ongoing throughout Florida, particularly on public lands.

Climate Change

Based on the present level of available information concerning the effects of global climate change on the status of sea turtles, the Service acknowledges the potential for changes to occur in the action area, but presently has no basis to evaluate if or how these changes are affecting sea turtles or its designated critical habitat. Nor does our present knowledge allow the Service to project what the future effects from global climate change may be or the magnitude of these potential effects.

4.1 Effects of Sand Placement/Restoration

Sand placement projects are anticipated to result in decreased nesting and loss of nests that do get laid within the project area for two subsequent nesting seasons following the completion of the proposed sand placement. However, it is important to note that it is unknown whether nests that would have been laid in a project area during the two subsequent nesting seasons had the project not occurred are actually lost from the population or if nesting is simply displaced to adjacent beaches. Regardless, eggs and hatchlings have a low reproductive value; each egg or hatchling has been estimated to have only 0.004 percent of the value of a nesting female (NMFS and Service 2008). Thus, even if the majority of the eggs and hatchlings that would have been produced on the project beach are not realized for up to 2 years following project completion, the Service would not expect this loss to have a significant effect on the recovery and survival of the species, for the following reasons: 1) some nesting is likely just displaced to adjacent non-project beaches, 2) not all eggs will produce hatchlings, and 3) destruction and/or failure of nests will not always result from a sand placement project. A variety of natural and unknown factors negatively affect incubating egg clutches, including tidal inundation, storm events, and predation.

Beneficial Effects

The placement of sand on a beach with reduced dry foredune habitat may increase sea turtle nesting habitat if the placed sand is highly compatible (*i.e.*, grain size, shape, color, etc.) with naturally occurring beach sediments in the area, and compaction and escarpment remediation measures are incorporated into the project. In addition, a nourished beach that is designed and constructed to mimic a natural beach system may benefit sea turtles more than an eroding beach it replaces.

Adverse Effects

Through many years of research, it has been documented that beach nourishment can have adverse effects on nesting female sea turtles and hatchlings and sea turtle nests. Results of monitoring sea turtle nesting and beach nourishment activities provide additional information on how sea turtles respond to nourished beaches, minimization measures, and other factors that influence nesting, hatching, and emerging success. Science-based information on sea turtle nesting biology and review of empirical data on beach nourishment monitoring is used to manage beach nourishment activities to eliminate or reduce impacts to nesting and hatchling sea turtles and sea turtle nests so that beach nourishment can be accomplished. Measures can be incorporated pre-, during, and post-construction to reduce impacts to sea turtles. Because of the long history of sea turtle monitoring in Florida, it is not necessary to require studies on each project beach to document those effects each time.

4.2 Effects of Equipment and Staging

The use of heavy machinery on beaches during a construction project may also have adverse effects on sea turtles. Equipment left on the nesting beach overnight can create barriers to nesting females emerging from the surf and crawling up the beach, causing a higher incidence of false crawls and unnecessary energy expenditure.

The operation of motor vehicles or equipment on the beach to complete the project work at night affects sea turtle nesting by: interrupting or colliding with a female turtle on the beach; headlights disorienting or misorienting emergent hatchlings; vehicles running over nesting females or hatchlings attempting to reach the ocean, and vehicle tracks traversing the beach interfering with hatchlings crawling to the ocean. Apparently, hatchlings become diverted not because they cannot physically climb out of the rut (Hughes and Caine 1994), but because the sides of the track cast a shadow and the hatchlings lose their line of sight to the ocean horizon (Mann 1977). The extended period of travel required to negotiate tire tracks and ruts may increase the susceptibility of hatchlings to dehydration and depredation during migration to the ocean (Hosier *et al*. 1981). Driving directly above or over incubating egg clutches or on the beach can cause sand compaction which may result in adverse impacts on nest site selection, digging behavior, clutch viability, and emergence by hatchlings, decreasing nest success and directly killing preemergent hatchlings (Mann 1977, Nelson and Dickerson 1987, Nelson 1988).

Depending on when the dune project is completed, dune vegetation may have become established in the vicinity of dune restoration sites. The physical changes and loss of plant cover caused by vehicles on vegetated areas or dunes can lead to various degrees of instability and cause dune migration. As vehicles move over the sand, sand is displaced downward, lowering the substrate. Since the vehicles also inhibit plant growth, and open the area to wind erosion, the beach and dunes may become unstable. Vehicular traffic on the beach or through dune breaches or low dunes may cause acceleration of overwash and erosion (Godfrey *et al.* 1978). Driving along the beachfront should be limited to between the low and high tide water lines. To minimize the impacts to the beach and recovering dunes, transport and access to the dune restoration sites should be from the road. However, if the work needs to be conducted from the beach, work areas for the truck transport and bulldozer/bobcat equipment should be designated and marked.

4.3 Effects of On-Beach Driving

The operation of motor vehicles on the beach affects sea turtle nesting by interrupting or striking a female turtle on the beach, headlights disorienting or misorienting emergent hatchlings, vehicles running over nests or hatchlings attempting to reach the ocean, and vehicle tracks traversing the beach which interfere with hatchlings crawling to the ocean. Hatchlings appear to become diverted not because they cannot physically climb out of the rut (Hughes and Caine 1994), but because the sides of the track cast a shadow and the hatchlings lose their line of sight to the ocean horizon (Mann 1977). The extended period of travel required to negotiate tire tracks and ruts may increase the susceptibility of hatchlings to dehydration and depredation during migration to the ocean (Hosier *et al.* 1981). Driving

on the beach can cause sand compaction which may result in adverse impacts on nest site selection, digging behavior, clutch viability, and emergence by hatchlings, decreasing nest success and directly killing preemergent hatchlings (Mann 1977, Nelson and Dickerson 1987, Nelson 1988).

The physical changes and loss of plant cover caused by vehicles on dunes can lead to various degrees of instability, and therefore encourage dune migration. As vehicles move either up or down a slope, sand is displaced downward. Since the vehicles also inhibit plant growth, and open the area to wind erosion, dunes may become unstable, and begin to migrate. Unvegetated sand dunes may continue to migrate across stable areas as long as vehicle traffic continues. Vehicular traffic through dune breaches or low dunes on an eroding beach may cause an accelerated rate of overwash and beach erosion (Godfrey *et al.* 1978). If driving is required, the area where the least amount of impact occurs is the beach between the low and high tide water lines. Vegetation on the dunes can quickly reestablish provided the mechanical impact is removed.

4.4 Effects of Monitoring and Relocation

During project construction, direct mortality of the developing embryos in nests within the project area may occur for nests that are missed and not relocated. The exact number of these missed nests is not known. However, in two separate monitoring programs on the east coast of Florida where hand digging was performed to confirm the presence of nests and thus reduce the chance of missing nests through misinterpretation, trained observers still missed about 6 to 8 percent of the nests because of natural elements (Martin 1992, Ernest and Martin 1993). This must be considered a conservative number, because nests missed during surveys are not always discovered after hatching. In another study, Schroeder (1994) found that even under the best of conditions, about 7 percent of nests can be misidentified as false crawls by highly experienced sea turtle nest surveyors. Missed nests are usually identified by signs of hatchling emergences in areas where no nest was previously documented. Signs of hatchling emergence are very easily obliterated by the same elements that interfere with detection of nests.

Besides the potential for missing nests during surveys and a nest relocation program, there is a potential for eggs to be damaged by nest movement or relocation, particularly if eggs are not relocated within 12 hours of deposition (Limpus *et al.* 1979). Nest relocation can have adverse impacts on incubation temperature (and hence sex ratios), gas exchange parameters, hydric environment of nests, hatching success, and hatchling emergence (Limpus *et al.* 1979, Ackerman 1980, Parmenter 1980, Spotila *et al.* 1983, McGehee 1990). Relocating nests into sands deficient in oxygen or moisture can result in mortality, morbidity, and reduced behavioral competence of hatchlings. Water availability is known to influence the incubation environment of the embryos and hatchlings of turtles with flexible-shelled eggs, which has been shown to affect nitrogen excretion (Packard *et al.* 1984), mobilization of calcium (Packard and Packard 1986), mobilization of yolk nutrients (Packard *et al.* 1985), hatchling size (Packard *et al.* 1981, McGehee 1990), energy reserves in the yolk at hatching (Packard *et al.* 1988), and locomotory ability of hatchlings (Miller *et al.* 1987).

In a 1994 Florida study comparing loggerhead hatching and emerging success of relocated nests with nests left in their original location, Moody (1998) found that hatching success was lower in relocated nests at nine of 12 beaches evaluated. In addition, emerging success was lower in relocated nests at 10 of 12 beaches surveyed in 1993 and 1994. Many of the direct effects of beach nourishment may persist over time. These direct effects include increased susceptibility of relocated nests to catastrophic events, the consequences of potential increased beachfront development, changes in the physical characteristics of the beach, the formation of escarpments, repair/replacement of groins and jetties and future sand migration.

5. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The Service is not aware of any cumulative effects in the project area.

6. CONCLUSION

After reviewing the current status of the loggerhead, green, and leatherback turtle, the environmental baseline for the action area, the effects of the proposed beach nourishment, and the cumulative effects, it is the Service's biological opinion that the beach nourishment project, as proposed, is not likely to jeopardize the continued existence of the loggerhead, green, and leatherback turtle, and is not likely to destroy or adversely modify designated critical habitat. No critical habitat has been designated for the loggerhead, green, and leatherback turtle, in the continental United States; therefore, none will be affected.

The proposed project will affect only 15,000 linear feet for the small dune restoration and 22,176 linear feet for full template beach renourishment for the entire beach profile of the approximately 1,400 miles of available sea turtle nesting habitat in the southeastern U.S. Although a variety of controllable and uncontrollable factors can influence the performance of a nourishment project from an engineering perspective, measures can be implemented to minimize impacts to sea turtles.

Research has shown that the principal effect of sand placement on sea turtle reproduction is a reduction in nesting success, and this reduction is most often limited to the first year following project construction. Research has also shown that the impacts of a nourishment project on sea turtle nesting habitat are typically short-term because a nourished beach will be reworked by natural processes in subsequent years, and beach compaction and the frequency of escarpment formation will decline. Although a variety of factors, including some that cannot be controlled, can influence how a nourishment project will perform from an engineering perspective, measures can be implemented to minimize impacts to sea turtles.

7. INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered or threatened species, respectively, without 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 the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be implemented by the Air Force so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The Air Force has a continuing duty to regulate the activity covered by this incidental take statement. If the Air Force (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Air Force must report the progress of the action and its impacts on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

7.1 AMOUNT OR EXTENT OF ANTICIPATED TAKE

The Service anticipates 5,000 linear feet for dune restoration and 11,000 linear feet for beach renourishment for the entire beach profile identified for sand placement of the small dune restoration project. For the full template restoration project the Service anticipates a maximum of 22,176 linear feet. The take is expected to be in the form of: (1) destruction of all nests missed by a nest survey and egg relocation program within the boundaries of the proposed project; (2) destruction of all nests deposited from October 1 through February 28 (or 29 as applicable) when a nest survey and egg relocation program is not required to be in place within the boundaries of the proposed project; (3) reduced hatching success due to egg mortality during relocation and adverse conditions at the relocation site; (4) harassment in the form of disturbing or interfering with female turtles attempting to nest within the construction area or on adjacent beaches as a result of construction activities; (5) misdirection of hatchling turtles on beaches adjacent to the construction area as they emerge from the nest and crawl to the water as a result of project lighting; (6) behavior modification of nesting females due to escarpment formation within the project area during a nesting season, resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs; and (7) destruction of nests from escarpment leveling within a nesting season when such leveling has been approved by the Service.

Incidental take is anticipated for a total of 15,000 linear feet for the small dune restoration project and a total of 22,176 linear feet for the full template restoration project. The Service anticipates incidental take of sea turtles will be difficult to detect for the following reasons: (1) the turtles nest primarily at night and all nests are not found because [a] natural factors, such as rainfall, wind, and tides may obscure crawls and [b] human-caused factors, such as pedestrian and vehicular traffic, may obscure crawls, and result in nests being destroyed because they were missed during a nesting survey and egg relocation program; (2) the total number of hatchlings per undiscovered nest is unknown; (3) the reduction in percent hatching and emerging success per relocated nest over the natural nest site is unknown; (4) an unknown number of females may avoid the project beach and be forced to nest in a less than optimal area; (5) lights may misdirect an unknown number of hatchlings and cause death; and (6) escarpments may form and cause an unknown number of females from accessing a suitable nesting site. However, the level of take of these species can be anticipated by the disturbance and renourishment of suitable turtle nesting beach habitat because: (1) turtles nest within the project site; (2) beach renourishment will likely occur during a portion of the nesting season; (3) the renourishment project will modify the incubation substrate, beach slope, and sand compaction; and (4) artificial lighting will deter and/or misdirect nesting females and hatchlings.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species. Critical habitat has not been designated in the action area; therefore, the project will not result in destruction or adverse modification of critical habitat.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. The Service believes that no more than the following types of incidental take will result from the proposed action: (1) destruction of all nests that may be constructed and eggs that may be deposited and missed by a nest survey and egg relocation program within the boundaries of the proposed project; (2) destruction of all nests deposited during the period when a nest survey and egg relocation program is not required to be in place within the boundaries of the proposed project; (3) reduced hatching success due to egg mortality during relocation and adverse conditions at the relocation site; (4) harassment in the form of disturbing or interfering with female turtles attempting to nest within the construction area or on adjacent beaches as a result of construction activities; (5) disorientation of hatchling turtles on beaches adjacent to the construction area as they emerge from the nest and crawl to the water as a result of project lighting; (6) behavior modification of nesting females due to escarpment formation within the project area during a nesting season, resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs; and (7) destruction of nests from escarpment leveling within a nesting season when such leveling has been approved by the Service. The amount or extent of incidental take for sea turtles will be considered exceeded if the project results in more than a one-time placement of sand to the 8,500 linear feet for dune restoration and 11,235 linear feet for beach renourishment for the entire beach profile of beach that have been identified for sand placement. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Air Force must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

The Service considered all conservation measures which were agreed to implement in the 2009 Biological Opinion (FWS Log. 41910-2009-F-0336) when analyzing the effects of the action. The conservation measures on page 9-11 are binding measures for the protective coverage of section 7(o)(2). The shelter that section 7(o)2 provides from section 9 liabilities applies to both the applicants and the action agency provided all conservation measures and the following reasonable and prudent measures and associated terms and conditions. The Service believes the following reasonable and prudent measures are necessary and appropriate to further minimize take of sea turtles.

7.2 REASONABLE AND PRUDENT MEASURES

For the full template restoration, the 45th SW will implement the Reasonable and Prudent Measures and Terms and Conditions of the Sand Placement Biological Opinion (FWS Log.49410-2011-F-0170) or most recent version. Special conditions and exclusions for the PAFB are outlined in the Terms and Conditions.

7.3 TERMS AND CONDITIONS

1. From March 1 through April 30, and November 1 through November 30, the contractor must not excavate the nesting beach or extend the beach fill more than 300 feet along the shoreline between dusk and the following day unless nighttime nesting surveys are conducted (as outlined in the Joint Coastal Permit 0294526-001-JC; expiration 22 Feb 2021). If nighttime surveys are not conducted, no construction activities, including vehicular traffic, may proceed outside the 300 feet of shoreline (outlined above), until completion of the morning sea turtle surveys and the necessary nest relocations have been completed.

8. CONSERVATION RECOMMENDATIONS

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

1. Appropriate native salt-resistant dune vegetation should be established on the restored dunes. The Florida Department of Environmental Protection, Bureau of Beaches and Wetland Resources, can provide technical assistance on the specifications for design and implementation.

2. Surveys for nesting success of sea turtles should be continued for a minimum of 3 years following beach nourishment to determine whether sea turtle nesting success has been adversely impacted.

3. Educational signs should be placed where appropriate at beach access points explaining the importance of the area to sea turtles and/or the life history of sea turtle species that nest in the area.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

9. REINITIATION NOTICE

This concludes formal consultation on the action outlined in the request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any questions regarding this BO, please contact Tina Nguyen of this office at (904)731-3196.

Sincerely,

Jay Herrington
Field Supervisor

cc:
FWC (R. Trindell)

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