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F/SER31:HA

SERO-2021-02156

<https://doi.org/10.25923/s7nj-bv16>

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Ref: SAJ-2018-01543 (SP-CGR), Arrecife de Condado, Condado, San Juan, Puerto Rico

Dear Sir or Madam:

The enclosed Biological Opinion (Opinion) was prepared by the National Marine Fisheries Service (NMFS) pursuant to Section 7(a)(2) of the Endangered Species Act (ESA). The Opinion considers the effects of a proposal by the Jacksonville District of the United States Army Corps of Engineers to authorize the construction of 3 submerged rubble mound structures with variable dimensions and width. NMFS concludes the proposed action may affect, but is not likely to adversely affect the Northwest Atlantic Ocean Distinct Population Segment (NWA DPS) of the loggerhead sea turtle, the North Atlantic (NA) DPS and the South Atlantic (SA) DPS of the green sea turtle, the hawksbill sea turtle, sperm whale, Nassau grouper, giant manta ray, oceanic whitetip shark, and the Central and Southwest Atlantic DPS of the scalloped hammerhead shark. NMFS concludes the proposed action is likely to adversely affect, but will not jeopardize the continued existence of the leatherback sea turtle.

The project has been assigned the tracking number SERO-2021-02156 in our NMFS Environmental Consultation Organizer (ECO). Please refer to the ECO number in all future inquiries regarding this consultation. Please direct questions regarding this Opinion to Helena Antoun, Consultation Biologist, by phone at (939) 438-3123, or by email at Helena.Antoun@noaa.gov.

Sincerely,

Andrew J. Strelcheck
Regional Administrator

Enclosure: Biological Opinion
File: 1514-22.f.4



**Endangered Species Act - Section 7 Consultation
Biological Opinion**

Action Agency: U.S. Army Corps of Engineers, Jacksonville District

Applicant: Mr. Frank Iserni

Permit Number SAJ-2018-01543 (SP-CGR)

Activity: Arrecife de Condado Breakwaters, Condado, San Juan, Puerto Rico

Consulting Agency: National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Regional Office, Protected Resources Division, St. Petersburg, Florida

Consultation Tracking Number SERO-2021-02156

Approved By:

Andrew J. Strelcheck, Regional Administrator
NMFS, Southeast Regional Office
St. Petersburg, Florida

Date Issued:

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ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
DPS	Distinct Population Segment
ECO	NMFS Environmental Consultation Organizer
ESA	Endangered Species Act
ITS	Incidental Take Statement
JAXBO	Jacksonville District’s Programmatic Biological Opinion

NGOs	Non-Governmental Organizations
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
Opinion	Biological Opinion
PCB	Polychlorinated biphenyls
PRD	NMFS Southeast Regional Office Protected Resources Division
PRDNER	Puerto Rico Department of Natural and Environmental Resources
PRMs	Reasonable and Prudent Measures
STSSN	Sea Turtle Stranding and Salvage Network
T&C	Terms and Conditions
U.S.	United States
USACE	U.S. Army Corps of Engineers

UNITS OF MEASUREMENT

ac	acre(s)
ft	foot/feet
ft ²	square foot/feet
in	inch(es)
km	kilometer(s)
m	meters
m ²	square meters

INTRODUCTION

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

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

This document represents NMFS’s Opinion based on our review of impacts associated with the proposed action within Condado-San Juan, Puerto Rico. This Opinion analyzes the project’s effects on threatened and endangered species and designated critical habitat, in accordance with Section 7 of the ESA. We based our Opinion on project information provided by the Jacksonville District of the U.S. Army Corps of Engineers (USACE) and other sources of information, including the published literature cited herein.

1 CONSULTATION HISTORY

On September 2, 2021, NMFS received a request for informal consultation under Section 7 of the ESA from the USACE for construction permit application SAJ-2018-01543 (SP-CGR) in a letter dated September 2, 2021. NMFS requested additional information (RAI) on November 2, 2021, and received a response on November 3, 2021. After reviewing the information, NMFS sent another RAI on November 4, 2021 and received a response on November 15, 2021. After careful evaluation, NMFS sent an email on February 14, 2022, to the USACE notifying them that NMFS would be initiating formal consultation. On March 14, 2022, NMFS sent another RAI. NMFS received a response on April 8, 2022, and initiated consultation that day.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 (“2019 Regulations,” see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court’s July 5 order. As a result, the 2019 regulations are once again in effect, and we are applying the 2019 regulations here. For purposes of this consultation, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

2 DESCRIPTION OF THE PROPOSED ACTION AND ACTION AREA

2.1 Proposed Action

The USACE proposes to permit the applicant to construct 3 submerged, rubble-mound breakwaters to mitigate dangerous rip currents that have caused several drownings over the years at the Condado sector and induce waves to break offshore, providing a safe beach for swimmers and users of this sector.

The proposed structures consist of 2 layers of armor stone over the under layer stone. The core of the structure segments will consist of conventional granite rock, and the perimeter and toe will consist of a reef-like or karst stone. The source for fill material will come from quarries from the Municipalities of Guaynabo or Bayamón and from Cantera del Este or Canóvanas. The total approximate volume of rock to be placed is approximately 51,945 cubic meters (m³). The dimensions, in meters (m), for each breakwater (termed by the applicant as Reef #1, #2 and #3) can be found in Table 1 below.

Table 1. Breakwater dimensions.

Structure	Length (m)		Variable Width (m)		Variable Height (m)	
	Base	Top	Base	Top	Inshore	Offshore
Reef #1	193.5	160	33.3 to 38.9	3.5 to 6.5	2.1 to 6.9	1.2 to 7.3
Reef #2	202.9	180.3	25.9 to 29.8	3.6 to 4.8	2.4 to 5.8	1.2 to 7.4
Reef #3	198	173.7	22.4 to 29.7	3.1 to 4.2	1.7 to 6.1	1.2 to 6.6

Based on the information provided by the applicant, the expected depth between the breakwater crest and the ocean surface during high and low tides for all 3 breakwaters is 0.400 m [1.3 feet (ft)] during Mean High Water (MHW), 0.232 m (0.76 ft) during Mean Tide Level, and 0.0 m (0 ft) during Mean Lower Low Water (MLLW).

The proposed work will be performed using 2 types of construction vessels: a derrick barge with a mounted crane that will move the rocks from the rock barge to the proposed structure location; and a rock barge that will bring the fill material from staging areas at wharf 12-14 to the proposed location each morning with the assistance of a tugboat (Figure 1). The derrick barge, with a draft of approximately 9 ft, will be in-situ during the construction period and remain at the construction site for the duration of the construction activities, which is approximately between 2 to 3 months. The rock barge will remain on site each day for approximately 8-12 hours.



Figure 1. Staging area and project location. Image provided by the applicant.

Construction activities (this includes all construction and material transport activities) will occur during daylight hours only. The applicant will comply with NMFS's [*Protected Species Construction Conditions*](#) (NMFS, 2021). In addition, the applicant will adhere to the following best management practices to avoid and minimize effects to ESA-listed species:

- The applicant shall have a designated observer for marine mammals and sea turtles at all times at the proposed project site. If marine mammals and/or sea turtles are observed at or near the project site, then construction activity shall stop until the animal(s) leaves the area on its own, and the construction activity will re-start once the animal(s) leaves the area.

- The proposed project shall not take place during high swells or unfavorable weather conditions or during severe currents. The construction activity shall immediately cease should adverse weather conditions, including heavy swells, strong winds, heavy rains, storm conditions, or unexpected severe currents arise during deployment of rocks/fill.
- The applicant shall install temporary spur buoys at the seaward edge of existing hard ground habitat that is adjacent to the project site.
- The applicant (prior to commencement of work) shall mark the limits of proposed submerged structures at the project site with temporary markers such as the placement of temporary floating buoys on sand bottom to avoid impacts to the adjacent patch reef and to ensure submerged structures are built in the proposed site without deviating from the authorized footprint.
- Impacts to the adjacent patch reef located to the south side of the proposed submerged structures are not permitted.
- The applicant shall use only clean fill material for this project. The fill material shall be free from items such as trash, debris, automotive parts, asphalt, construction materials, concrete block with exposed reinforcement bars, and soils contaminated with any toxic substance, in toxic amounts in accordance with Section 307 of the Clean Water Act.
- The applicant shall conduct a water quality monitoring program at the project site during project construction, specifically at adjacent areas of nearby reefs, and shall comply with the following:
 - The applicant shall conduct a baseline of turbidity levels at the project site and adjacent areas prior to commencement of the authorized project to determine the ambient water quality conditions, and submit the baseline report of turbidity levels to the USACE, including also the date of the measurements, and aerial photos showing and identifying the control baseline sample locations within 30 days of the completion of baseline.
 - The monitoring will include control baseline locations, which will be used to determine whether a high reading is caused by the project or is due to ambient conditions once the project commences. The applicant shall record all turbidity readings performed; results of turbidity level readings; including date/hour of these readings, and construction stop/re-start works when high readings are found.
 - If high readings are found to be the result of the project, then the construction activity shall stop, the source of the turbidity shall be located and floating turbidity barriers shall be installed, as applicable. The authorized activity shall resume once turbidity levels returns to ambient conditions or are below the turbidity standards established on the water quality certificate issued for this project.
 - Once the construction of the 3 submerged rubble structures is complete, the applicant shall submit a report of the results of the water quality monitoring program performed during the construction of the project in comparison with the baseline report within 30 days of the completion date to the USACE.

- The applicant will mark the closest edge of the adjacent patch reef (approximately 82 ft away from the project footprint) before construction begins in order to ensure that no construction vessels anchor or spud on the patch reef.

2.2 Action Area

The proposed project site is located at the north side of Condado Beach, San Juan, in the Atlantic Ocean (Figure 2). The approximate central coordinates for each breakwater (referred to as Reef 1, 2 and 3) are in Table 2.



Figure 2. Image showing the project site (red pin) (ArcGIS)

Table 2. Approximate central coordinates for each structure [North American Datum 1983].

	North Quadrant	South Quadrant
Reef #1	18.459297°N, 66.072975°W	18.459003°N, 66.073042°W
Reef #2	18.458667°N, 66.071658°W	18.458439°N, 66.071725°W
Reef #3	18.458603°N, 66.070033°W	18.458406°N, 66.070083°W

According to the drawings provided by the applicant (Figure 3), the project site is located between 35 m (115 ft) to 125 m (410 ft) offshore from the Condado public beach (1 m = 3.28 ft).

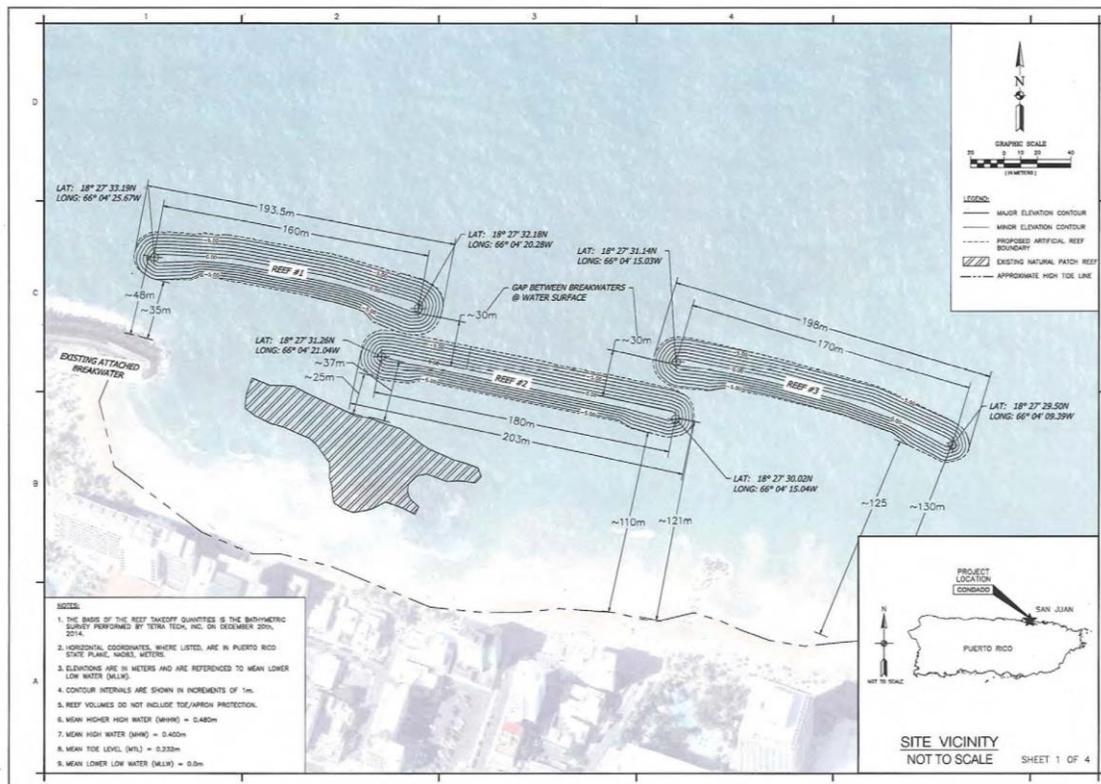


Figure 3. Image of project site showing proposed structures and their relative distance from shore. Image provided by the applicant.

A benthic assessment was performed by Reef Research, Inc. from April to June, 2015. A reconnaissance benthic survey was performed by Tetra Tech on June 17, 2018. The existing site conditions within the action area consist mostly of sand substrate. Hardbottom habitat associated with a low relief patch reef exists inshore of the western most breakwaters. The patch reef was mostly colonized by macroalgae and small isolated colonies of live coral and sponges. Water depths ranged from 16 ft to 22 ft at mean low water (MLW), with rough surf and rip currents. There are no seagrasses or ESA-listed corals in the action area.

The action area is defined by regulation as all areas to be affected by the Federal action and not merely the immediate area involved in the action (50 Code of Federal Regulations [CFR] 402.02). As such, the action area includes the areas in which construction will take place, as well as the immediate surrounding areas that may be affected by the proposed action and its associated activities. For purposes of this analysis, the action area will include the project site where construction will take place, as well as the transportation route that will be used to transport construction materials from the holding facility to the construction site (Figure 5).



Figure 4. Image showing the action area defined by the project site where construction will take place (yellow pin, center structure) as well as the transportation route. Image provided by the applicant.

3 STATUS OF LISTED SPECIES AND CRITICAL HABITAT

Table 3 provides the effect determinations for ESA-listed species the USACE and NMFS believe may be affected by the proposed action. Please note abbreviations used in the table below: E = endangered; T = threatened; NLAA = may affect, not likely to adversely affect; NE = no effect; LAA = likely to adversely affect.

Table 3. Effects Determinations for Species the Action Agency and NMFS Believe May Be Affected by the Proposed Action

Species	ESA Listing Status	Action Agency Effect Determination	NMFS Effect Determination
Sea Turtles			
Green (North Atlantic [NA] distinct population segment [DPS])	T	NLAA	NLAA
Green (South Atlantic [SA] DPS)	T	NLAA	NLAA
Leatherback (Northwest Atlantic [NWA] DPS)	E	NLAA	LAA
Loggerhead (Northwest Atlantic [NWA] DPS)	T	NLAA	NLAA
Hawksbill	E	NLAA	NLAA
Fish			
Nassau grouper	T	NLAA	NLAA
Giant manta ray	T	NLAA	NLAA
Scalloped hammerhead shark (Central and Southwest Atlantic DPS)	T	NLAA	NLAA
Oceanic whitetip shark	T	NLAA	NLAA
Mammals			
Blue whale	E	NLAA	NE
Fin whale	E	NLAA	NE
Sei whale	E	NLAA	NE
Sperm whale	E	NLAA	NE

We believe the project will have no effect on blue whale, fin whale, sei whale, and sperm whale. ESA-listed whales are pelagic species, usually found in deep oceanic waters; thus, we would not expect them to be present in the project area.

The USACE determined that there would be no effect to elkhorn and staghorn coral critical habitat as a result of the proposed activities. However, the project is located within the boundary of elkhorn and staghorn coral designated critical habitat (Puerto Rico Area) and is located within 82 ft of a small patch reef. The physical feature essential to the conservation of elkhorn and staghorn corals is: substrate of suitable quality and availability to support larval settlement and recruitment, and reattachment and recruitment of asexual fragments. “Substrate of suitable quality and availability” is defined as natural, consolidated hard substrate or dead coral skeleton that is free from fleshy or turf macroalgae cover and sediment cover. We do not believe the essential feature may be affected by the proposed action because there is no natural consolidated hard substrate or dead coral skeleton located within the project footprint, where adverse effects from construction activities could result. Based on the benthic survey report provided by the USACE, unconsolidated sand completely covers the area under the proposed breakwaters. Additionally, based on images provided, the designated transit route that will be used to transport materials will avoid transiting over hardbottom. The applicant has agreed to demarcate and avoid the patch reef located inshore of the proposed breakwater locations. We do not anticipate any indirect effects (e.g., turbidity and sedimentation) to the patch reef adjacent to the project

footprint as the applicant has proposed a turbidity and monitoring program to verify no impact, or to stop work and take corrective action if turbidity levels are trending higher than expected.

3.1 Potential Routes of Effect Not Likely to Adversely Affect ESA-Listed Species

Effects to sea turtles and ESA-listed fish species include the potential for injury from construction equipment, transiting construction vessels, or materials. We believe this effect is extremely unlikely to occur. Because these species are highly mobile, we expect them to move away from the project site and into nearby suitable habitat, if disturbed. The applicant has also agreed to adhere to NMFS's *Protected Species Construction Conditions*, which will further reduce the risk by requiring all construction personnel to watch for ESA-listed species. Operation of any mechanical construction equipment will cease immediately if a protected species is seen within a 150-ft radius of the equipment. Activities will not resume until the protected species has departed the project area of its own volition.

3.2 Potential Routes of Effect Likely to Adversely Affect ESA-Listed Species

NMFS determined the proposed breakwaters could be an obstruction to female leatherback sea turtles trying to reach the beach in order to nest, which may result in lost nesting opportunities. Also, breakwaters may obstruct the path for hatchlings trying to exit out to sea during low tide and may increase their vulnerability to predators. Hence, NMFS believes the proposed action is likely to adversely affect leatherback sea turtles. We provide greater detail on the potential effects these breakwaters may have in the Effects of the Action below (Section 5).

The species' discussions in this section will focus primarily on the Northwest Atlantic Ocean populations of these species since these are the populations that may be affected by the proposed action. The following subsections are synopses of the best available information on general threats faced by all sea turtle species and specific information on the life history, distribution, population trends, and current status of the leatherback sea turtle. Additional background information on the status of sea turtle species can be found in a number of published documents, including: recovery plans for the Atlantic green sea turtle (NMFS and USFWS, 1991b), hawksbill sea turtle (NMFS and USFWS, 1993), leatherback sea turtle (NMFS and USFWS, 1992), and loggerhead sea turtle (NMFS and USFWS, 2009); and sea turtle status reviews and biological reports (NMFS and USFWS, 2007e) (NMFS and USFWS, 2007d) (NMFS and USFWS, 2007b) (NMFS and USFWS, 2007a).

3.3 Status of Sea Turtles

The following sections address the general threats that confront all sea turtle species as well as information on the distribution, life history, population structure, abundance, population trends, and unique threats to leatherback sea turtles that are likely to be adversely affected by the proposed action (status of sea turtles uploaded from O-drive, August 2022).

General Threats Faced by All Sea Turtle Species

Sea turtles face numerous natural and man-made threats that shape their status and affect their ability to recover. Many of the threats are either the same or similar in nature for all ESA-listed sea turtle species. The threats identified in this section are discussed in a general sense for all sea turtles. Threat information specific to a particular species (in this case, leatherback sea turtles) is discussed in the corresponding Status of the Species, where appropriate.

Fisheries

Incidental bycatch in commercial fisheries is identified as a major contributor to past declines, and a threat to future recovery, for all of the sea turtle species (NMFS and USFWS, 1991a) (NMFS and USFWS, 1992) (NMFS and USFWS, 1993) (USFWS, 2008) (NMFS-NEFSC, 2011). Domestic fisheries often capture, injure, and kill sea turtles at various life stages. Sea turtles in the pelagic environment are exposed to U.S. Atlantic pelagic longline fisheries. Sea turtles in the benthic environment in waters off the coastal U.S. are exposed to a suite of other fisheries in federal and state waters. These fishing methods include trawls, gillnets, purse seines, hook-and-line gear (including bottom longlines and vertical lines [e.g., bandit gear, handlines, and rod-reel]), pound nets, and trap fisheries. Refer to the Environmental Baseline for more specific information regarding federal and state managed fisheries affecting sea turtles within the action area). The southeast U.S. shrimp fisheries have historically been the largest fishery threat to benthic sea turtles in the southeastern U.S., and continue to interact with and kill large numbers of sea turtles each year.

In addition to domestic fisheries, sea turtles are subject to direct as well as incidental capture in numerous foreign fisheries, further impeding the ability of sea turtles to survive and recover on a global scale. For example, pelagic stage sea turtles, especially loggerheads and leatherbacks, circumnavigating the Atlantic are susceptible to international longline fisheries including the Azorean, Spanish, and various other fleets (Aguilar, R.J., Pastor, X., 1994) (Bolten, 1994). Bottom longlines and gillnet fishing is known to occur in many foreign waters, including (but not limited to) the northwest Atlantic, western Mediterranean, South America, West Africa, Central America, and the Caribbean. Shrimp trawl fisheries are also occurring off the shores of numerous foreign countries and pose a significant threat to sea turtles similar to the impacts seen in U.S. waters. Many unreported takes or incomplete records by foreign fleets make it difficult to characterize the total impact that international fishing pressure is having on listed sea turtles. Nevertheless, international fisheries represent a continuing threat to sea turtle survival and recovery throughout their respective ranges.

Non-Fishery In-Water Activities

There are also many non-fishery impacts affecting the status of sea turtle species, both in the ocean and on land. In nearshore waters of the U.S., the construction and maintenance of federal navigation channels has been identified as a source of sea turtle mortality. Hopper dredges, which are frequently used in ocean bar channels and sometimes in harbor channels and offshore borrow areas, move relatively rapidly and can entrain and kill sea turtles (NMFS, 1997). Sea turtles entering coastal or inshore areas have also been affected by entrainment in the cooling-

water systems of electrical generating plants. Other nearshore threats include harassment and/or injury resulting from private and commercial vessel operations, military detonations and training exercises, in-water construction activities, and scientific research activities.

Coastal Development and Erosion Control

Coastal development can deter or interfere with nesting, affect nesting success, and degrade nesting habitats for sea turtles. Structural impacts to nesting habitat include the construction of buildings and pilings, beach armoring and renourishment, and sand extraction (Bouchard, 1998) (Lutcavage, 1997). These factors may decrease the amount of nesting area available to females and change the natural behaviors of both adults and hatchlings, directly or indirectly, through loss of beach habitat or changing thermal profiles and increasing erosion, respectively (Ackerman, 1997) (Witherington B. H., 2003) (Witherington D. H., 2007). In addition, coastal development is usually accompanied by artificial lighting which can alter the behavior of nesting adults (Witherington B. E., 1992) and is often fatal to emerging hatchlings that are drawn away from the water (Witherington & Bjorndal, 1991). In-water erosion control structures such as breakwaters, groins, and jetties can impact nesting females and hatchling as they approach and leave the surf zone or head out to sea by creating physical blockage, concentrating predators, creating longshore currents, and disrupting wave patterns.

Environmental Contamination

Multiple municipal, industrial, and household sources, as well as atmospheric transport, introduce various pollutants such as pesticides, hydrocarbons, organochlorides (e.g., DDT, PCBs, and PFCs), and others that may cause adverse health effects to sea turtles (Garrett 2004; Grant and Ross 2002; Hartwell 2004; Iwata et al. 1993). Acute exposure to hydrocarbons from petroleum products released into the environment via oil spills and other discharges may directly injure individuals through skin contact with oils (Geraci 1990), inhalation at the water's surface and ingesting compounds while feeding (Matkin and Saulitis 1997). Hydrocarbons also have the potential to impact prey populations, and therefore may affect listed species indirectly by reducing food availability in the action area.

The April 20, 2010, explosion of the Deepwater Horizon (DWH) oil rig affected sea turtles in the Gulf of Mexico. An assessment has been completed on the injury to Gulf of Mexico marine life, including sea turtles, resulting from the spill (DWH Trustees 2016). Following the spill, juvenile Kemp's ridley, green, and loggerhead sea turtles were found in Sargassum algae mats in the convergence zones, where currents meet and oil collected. Sea turtles found in these areas were often coated in oil and/or had ingested oil. The spill resulted in the direct mortality of many sea turtles and may have had sublethal effects or caused environmental damage that will impact other sea turtles into the future. Information on the spill impacts to leatherback sea turtles is discussed in the following section (Status of the Leatherback Sea Turtle).

Marine debris is a continuing problem for sea turtles. Sea turtles living in the pelagic environment commonly eat or become entangled in marine debris (e.g., tar balls, plastic bags/pellets, balloons, and ghost fishing gear) as they feed along oceanographic fronts where debris and their natural food items converge. This is especially problematic for sea turtles that

spend all or significant portions of their life cycle in the pelagic environment (i.e., leatherbacks, juvenile loggerheads, and juvenile green turtles).

Climate Change

There is a large and growing body of literature on past, present, and future impacts of global climate change, exacerbated and accelerated by human activities. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. NOAA's climate information portal provides basic background information on these and other measured or anticipated effects (see <http://www.climate.gov>).

Climate change impacts on sea turtles currently cannot be predicted with any degree of certainty; however, significant impacts to the hatchling sex ratios of sea turtles may result (NMFS and USFWS 2007c). In sea turtles, sex is determined by the ambient sand temperature (during the middle third of incubation) with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25-35 °C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward higher numbers of females (NMFS and USFWS 2007c).

The effects from increased temperatures may be intensified on developed nesting beaches where shoreline armoring and construction have denuded vegetation. Erosion control structures could potentially result in the permanent loss of nesting beach habitat or deter nesting females (NRC 1990). These impacts will be exacerbated by sea level rise. If females nest on the seaward side of the erosion control structures, nests may be exposed to repeated tidal overwash (NMFS and USFWS 2007d). Sea level rise from global climate change is also a potential problem for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Baker, Littnan, & Johnston, 2006) (Daniels, White, & Chapman, 1993) (Fish, Cote, Gill, & Jones, 2005). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis, Baker, Johanos, Braun, & Harting, 2006) (Baker, Littnan, & Johnston, 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., ocean acidification, salinity, oceanic currents, DO levels, nutrient distribution, etc.) could influence the distribution and abundance of lower trophic levels (e.g., phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish, etc.) which could ultimately affect the primary foraging areas of sea turtles.

Other Threats

Predation by various land predators is a threat to developing nests and emerging hatchlings. The major natural predators of sea turtle nests are mammals, including raccoons, dogs, pigs, skunks, and badgers. Emergent hatchlings are preyed upon by these mammals as well as ghost crabs, laughing gulls, and the exotic South American fire ant (*Solenopsis invicta*). In addition to natural

predation, direct harvest of eggs and adults from beaches in foreign countries continues to be a problem for various sea turtle species throughout their ranges (NMFS and USFWS, 2008). Diseases, toxic blooms from algae and other microorganisms, and cold stunning events are additional sources of mortality that can range from local and limited to wide-scale and impacting hundreds or thousands of animals.

Status of the Leatherback Sea Turtle

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

Species Description and Distribution

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

Unlike other sea turtles, leatherbacks have several unique traits that enable them to live in cold water. For example, leatherbacks have a countercurrent circulatory system (Greer et al. 1973). Countercurrent circulation is a highly efficient means of minimizing heat loss through the skin's surface because heat is recycled. For example, a countercurrent circulation system often has an artery containing warm blood from the heart surrounded by a bundle of veins containing cool blood from the body's surface. As the warm blood flows away from the heart, it passes much of its heat to the colder blood returning to the heart via the veins. This conserves heat by recirculating it back to the body's core. Additionally, leatherbacks have a thick layer of insulating fat (Davenport et al. 1990; Goff and Lien 1988), gigantothermy - a condition when an animal has relatively high volume compared to its surface area, and as a result, it loses less heat - (Paladino et al. 1990), and they can increase their body temperature through increased metabolic activity (Bostrom and Jones 2007; Southwood et al. 2005). These adaptations allow leatherbacks to be comfortable in a wide range of temperatures, which helps them to travel further than any other sea turtle species (NMFS and USFWS 1995). For example, a leatherback may swim more than 6,000 miles (10,000 km) in a single year (Benson et al. 2007a; Benson et al. 2011; Eckert 2006; Eckert et al. 2006). They search for food between latitudes 71°N and 47°S in all oceans, and travel extensively to and from their tropical nesting beaches. In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (NMFS 2001).

While leatherbacks will look for food in coastal waters, they appear to prefer the open ocean at all life stages (Heppell et al. 2003). Leatherbacks have pointed tooth-like cusps and sharp-edged jaws that are adapted for a diet of soft-bodied prey such as jellyfish and salps. A leatherback's mouth and throat also have backward-pointing spines that help retain jelly-like prey. Leatherbacks' favorite prey are jellies (e.g., medusae, siphonophores, and salps), which

commonly occur in temperate and northern or sub-arctic latitudes and likely has a strong influence on leatherback distribution in these areas (Plotkin 2003). Leatherbacks are known to be deep divers, with recorded depths in excess of a half-mile (Eckert et al. 1989), but they may also come into shallow waters to locate prey items.

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

Life History Information

The leatherback life cycle is broken into several stages: (1) egg/hatchling, (2) post-hatchling, (3) juvenile, (4) subadult, and (5) adult. Leatherbacks are a long-lived species that delay age of maturity, have low and variable survival in the egg and juvenile stages, and have relatively high and constant annual survival in the subadult and adult life stages (Chaloupka 2002; Crouse 1999; Heppell et al. 1999; Heppell et al. 2003; Spotila et al. 1996; Spotila et al. 2000). While a robust estimate of the leatherback sea turtle's life span does not exist, the current best estimate for the maximum age is 43 (Avens et al. 2009). It is still unclear when leatherbacks first become sexually mature. Using skeletochronological data, Avens et al. (2009) estimated that leatherbacks in the western North Atlantic may not reach maturity until 29 years of age, which is longer than earlier estimates of 2-3 years by Pritchard and Trebbau (1984), of 3-6 years by Rhodin (1985), of 13-14 years for females by Zug and Parham (1996), and 12-14 years for leatherbacks nesting in the U.S. Virgin Islands by Dutton et al. (2005). A more recent study that examined leatherback growth rates estimated an age at maturity of 16.1 years (Jones et al. 2011).

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

Female leatherbacks typically nest on sandy, tropical beaches at intervals of 2-4 years (Garcia M. and Sarti 2000; McDonald and Dutton 1996; Spotila et al. 2000). Unlike other sea turtle species, female leatherbacks do not always nest at the same beach year after year; some females may even nest at different beaches during the same year (Dutton et al. 2005; Eckert 1989; Keinath and Musick 1993; Steyermark et al. 1996). Individual female leatherbacks have been observed with fertility spans as long as 25 years (Hughes 1996). Females usually lay up to 10 nests during the 3-6 month nesting season (March through July in the United States), typically 8-12 days apart, with 100 eggs or more per nest (Eckert et al. 2012; Eckert 1989; Maharaj 2004; Matos 1986; Stewart and Johnson 2006; Tucker 1988). Yet, up to approximately 30% of the eggs may be infertile (Eckert 1989; Eckert et al. 1984; Maharaj 2004; Matos 1986; Stewart and Johnson 2006; Tucker 1988). The number of leatherback hatchlings that make it out of the nest on to the beach (i.e., emergent success) is approximately 50% worldwide (Eckert et al. 2012), which is lower than the greater than 80% reported for other sea turtle species (Miller 1997). In the United States, the emergent success is higher at 54-72% (Eckert and Eckert 1990; Stewart and Johnson

2006; Tucker 1988). Thus the number of hatchlings in a given year may be less than the total number of eggs produced in a season. Eggs hatch after 60-65 days, and the hatchlings have white striping along the ridges of their backs and on the edges of the flippers. Leatherback hatchlings weigh approximately 1.5-2 oz (40-50 g), and have lengths of approximately 2-3 in (51-76 mm), with fore flippers as long as their bodies. Hatchlings grow rapidly, with reported growth rates for leatherbacks from 2.5-27.6 in (6-70 cm) in length, estimated at 12.6 in (32 cm) per year (Jones et al. 2011).

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

The survival and mortality rates for leatherbacks are difficult to estimate and vary by location. For example, the annual mortality rate for leatherbacks that nested at Playa Grande, Costa Rica, was estimated to be 34.6% in 1993-1994, and 34.0% in 1994-1995 (Spotila et al. 2000). In contrast, leatherbacks nesting in French Guiana and St. Croix had estimated annual survival rates of 91% (Rivalan et al. 2005) and 89% (Dutton et al. 2005), respectively. For the St. Croix population, the average annual juvenile survival rate was estimated to be approximately 63% and the total survival rate from hatchling to first year of reproduction for a female was estimated to be between 0.4% and 2%, assuming age at first reproduction is between 9-13 years (Eguchi et al. 2006). Spotila et al. (1996) estimated first-year survival rates for leatherbacks at 6.25%.

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

Status and Population Dynamics

The status of the Atlantic leatherback population had been less clear than the Pacific population, which has shown dramatic declines at many nesting sites (Spotila et al. 2000; Santidrián Tomillo et al. 2007; Sarti Martínez et al. 2007). This uncertainty resulted from inconsistent beach and aerial surveys, cycles of erosion, and reformation of nesting beaches in the Guianas (representing the largest nesting area). Leatherbacks also show a lesser degree of nest-site fidelity than occurs with the hardshell sea turtle species. Coordinated efforts of data collection and analyses by the leatherback Turtle Expert Working Group helped to clarify the understanding of the Atlantic population status up through the early 2000's (TEWG 2007). However, additional information

for the Northwest Atlantic population has more recently shown declines in that population as well, contrary to what earlier information indicated (Northwest Atlantic Leatherback Working Group 2018). A full status review covering leatherback status and trends for all populations worldwide is being finalized (2020).

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

Researchers believe the cyclical pattern of beach erosion and then reformation has affected leatherback nesting patterns in the Guianas. For example, between 1979 and 1986, the number of leatherback nests in French Guiana had increased by about 15% annually (NMFS 2001). This increase was then followed by a nesting decline of about 15% annually. This decline corresponded with the erosion of beaches in French Guiana and increased nesting in Suriname. This pattern suggests that the declines observed since 1987 might actually be a part of a nesting cycle that coincides with cyclic beach erosion in Guiana (Schulz 1975). Researchers think that the cycle of erosion and reformation of beaches may have changed where leatherbacks nest throughout this region. The idea of shifting nesting beach locations was supported by increased nesting in Suriname (leatherback nesting in Suriname increased by more than 10,000 nests per year since 1999 with a peak of 30,000 nests in 2001), while the number of nests was declining at beaches in Guiana (Hilterman et al. 2003). This information suggested the long-term trend for the overall Suriname and French Guiana population was increasing. A more recent cycle of nesting declines from 2008-2017, as high as 31% annual decline in the Awala-Yalimapo area of French Guiana and almost 20% annual declines in Guyana, has changed the long-term nesting trends in the region negative as described above (Northwest Atlantic Leatherback Working Group 2018).

The Western Caribbean stock includes nesting beaches from Honduras to Colombia. Across the Western Caribbean, nesting is most prevalent in Costa Rica, Panama, and the Gulf of Uraba in Colombia (Duque et al. 2000). The Caribbean coastline of Costa Rica and extending through Chiriquí Beach, Panama, represents the fourth largest known leatherback rookery in the world (Troëng et al. 2004). Examination of data from index nesting beaches in Tortuguero, Gandoca, and Pacuaré in Costa Rica indicate that the nesting population likely was not growing over the 1995-2005 time series (TEWG 2007). Other modeling of the nesting data for Tortuguero

indicates a possible 67.8% decline between 1995 and 2006 (Troëng et al. 2007). Tiwari et al. (2013) report an estimated three-generation abundance change of -72%, -24%, and +6% for Tortuguero, Gandoca, and Pacuare, respectively. Further decline of almost 6% annual geometric mean from 2008-2017 reflects declines in nesting beaches throughout this stock (Northwest Atlantic Leatherback Working Group 2018).

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

The Florida nesting stock nests primarily along the east coast of Florida. This stock is of growing importance, with total nests between 800-900 per year in the 2000s following nesting totals fewer than 100 nests per year in the 1980s (Florida Fish and Wildlife Conservation Commission, unpublished data). Using data from the index nesting beach surveys, the TEWG (2007) estimated a significant annual nesting growth rate of 1.17% between 1989 and 2005. FWC Index Nesting Beach Survey Data generally indicates biennial peaks in nesting abundance beginning in 2007 (Figure 5 and Table 4). A similar pattern was also observed statewide (Table 4). This up-and-down pattern is thought to be a result of the cyclical nature of leatherback nesting, similar to the biennial cycle of green turtle nesting. Overall, the trend showed growth on Florida's east coast beaches. Tiwari et al. (2013) report an annual growth rate of 9.7% and a three-generation abundance change of +1,863%. However, in recent years nesting has declined on Florida beaches, with 2017 hitting a decade-low number, with a partial rebound in 2018. The annual geometric mean trend for Florida has been a decline of almost 7% from 2008-2017, but the long-term trend (1990-2017) remains positive with an annual geometric mean increase of over 9% (Northwest Atlantic Leatherback Working Group 2018).

Table 4. Number of Leatherback Sea Turtle Nests in Florida

Leatherback Nests Recorded- Florida		
Year	Index Nesting Beach Survey	Statewide Survey
2011	625	1,653
2012	515	1,712
2013	322	896
2014	641	1,604
2015	489	1,493
2016	319	1,054
2017	205	663
2018	316	949
2019	337	1,105
2020	467	1,652
2021	435	1,390

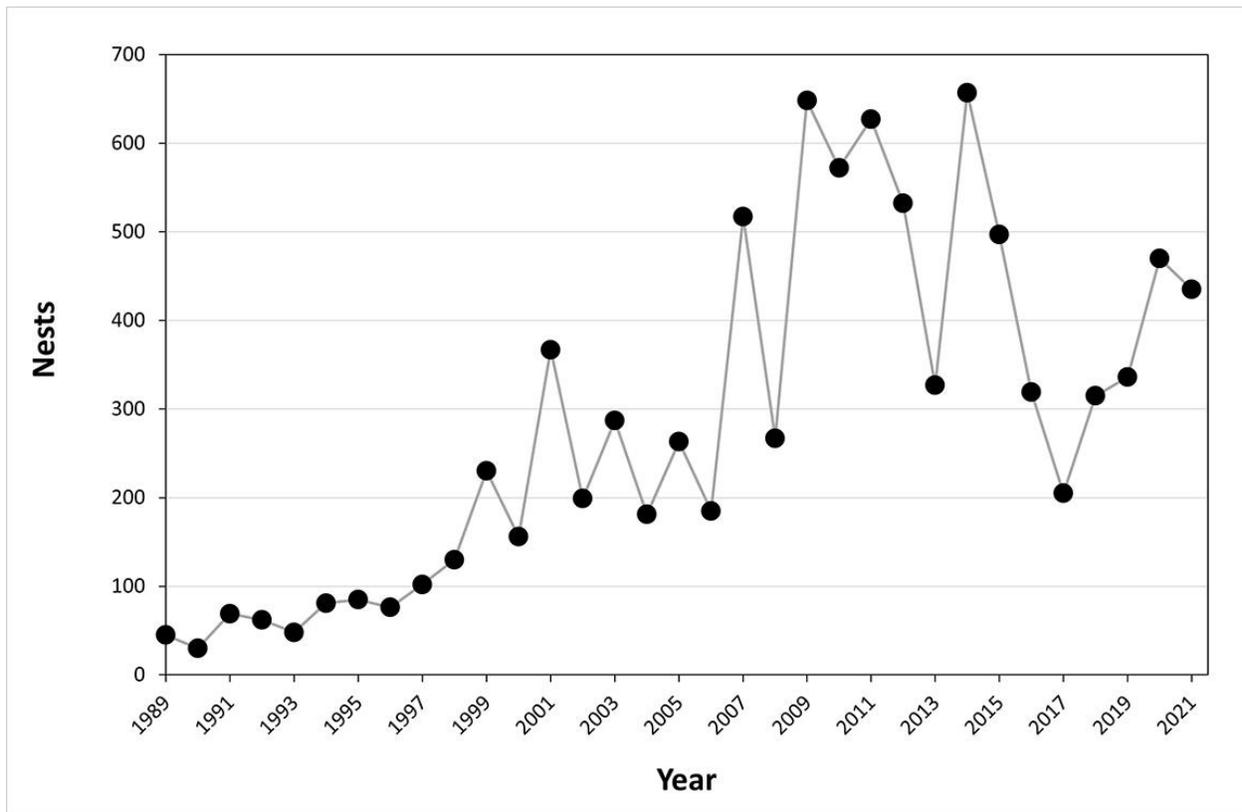


Figure 5. Leatherback sea turtle nesting at Florida index beaches since 1989.

The West African nesting stock of leatherbacks is large and important, but it is a mostly unstudied aggregation. Nesting occurs in various countries along Africa’s Atlantic coast, but much of the nesting is undocumented and the data are inconsistent. Gabon has a very large amount of leatherback nesting, with at least 30,000 nests laid along its coast in a single season (Fretey et al. 2007). Fretey et al. (2007) provide detailed information about other known nesting

beaches and survey efforts along the Atlantic African coast. Because of the lack of consistent effort and minimal available data, trend analyses were not possible for this stock (TEWG 2007).

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

Because the available nesting information is inconsistent, it is difficult to estimate the total population size for Atlantic leatherbacks. Spotila et al. (1996) characterized the entire Western Atlantic population as stable at best and estimated a population of 18,800 nesting females. Spotila et al. (1996) further estimated that the adult female leatherback population for the entire Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa, was about 27,600 (considering both nesting and interesting females), with an estimated range of 20,082-35,133. This is consistent with the estimate of 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) determined by the TEWG (2007). TEWG (2007) also determined that at the time of their publication, leatherback sea turtle populations in the Atlantic were all stable or increasing with the exception of the Western Caribbean and West Africa populations. A later review by NMFS and USFWS (2013) suggested the leatherback nesting population was stable in most nesting regions of the Atlantic Ocean. However, as described earlier, the Northwest Atlantic population has experienced declines over the near term (2008-2017), often severe enough to reverse the longer term trends to negative where increases had previously been seen (Northwest Atlantic Leatherback Working Group 2018). Given the relatively large size of the Northwest Atlantic population, it is likely that the overall Atlantic leatherback trend is no longer increasing.

Threats

Leatherbacks face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (plastics, petroleum products, petrochemicals, etc.), ecosystem alterations (nesting beach development, beach nourishment and shoreline stabilization, vegetation changes, etc.), poaching, global climate change, fisheries interactions, natural predation, and disease. A discussion on general sea turtle threats can be found in Section 3.3; the remainder of this section will expand on a few of the aforementioned threats and how they may specifically impact leatherback sea turtles.

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

has caused a sharp decline in leatherback sea turtle populations. This represents a significant threat to survival and recovery of the species worldwide.

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

As discussed in Section 3.3, global climate change can be expected to have various impacts on all sea turtles, including leatherbacks. Global climate change is likely to also influence the distribution and abundance of jellyfish, the primary prey item of leatherbacks (NMFS and USFWS 2007). Several studies have shown leatherback distribution is influenced by jellyfish abundance (Houghton et al. 2006; Witt et al. 2007; Witt et al. 2006); however, more studies need to be done to monitor how changes to prey items affect distribution and foraging success of leatherbacks so population-level effects can be determined.

While oil spill impacts are discussed generally for all species in Section 3.3, specific impacts of the DWH oil spill on leatherback sea turtles are considered here. Available information indicates leatherback sea turtles (along with hawksbill turtles) were likely directly affected by the oil spill. Leatherbacks were documented in the spill area, but the number of affected leatherbacks was not estimated due to a lack of information compared to other species. Given that the northern Gulf of Mexico is important habitat for leatherback migration and foraging (TEWG 2007), and documentation of leatherbacks in the DWH oil spill zone during the spill period, it was concluded that leatherbacks were exposed to DWH oil, and some portion of those exposed leatherbacks likely died (DWH Trustees 2016). Potential DWH-related impacts to leatherback sea turtles include direct oiling or contact with dispersants from surface and subsurface oil and dispersants, inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. No information is currently available to determine the extent of those impacts, if they occurred. Although adverse impacts likely occurred to leatherbacks, the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event may be relatively low. Thus, a population-level impact may not have occurred due to the widespread distribution and nesting location outside of the Gulf of Mexico for this species.

4 ENVIRONMENTAL BASELINE

This section describes the effects of past and ongoing human and natural factors contributing to the current status of the species, its habitat (including designated critical habitat), and ecosystem within the action area, without the additional effects of the proposed action. In the case of ongoing actions, this section includes the effects that may contribute to the projected future status of the species, its habitat, and ecosystem. The environmental baseline describes a species' and habitat's health based on information available at the time of this consultation.

By regulation, the environmental baseline for an Opinion refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

Focusing on the impacts of the activities in the action area specifically allows us to assess the prior experience and state (or condition) of the endangered individuals. This consideration is important because in some states or life history stages, or areas of their ranges, listed individuals will commonly exhibit, or be more susceptible to, adverse responses to stressors than they would be in other states, stages, or areas within their distributions. These localized stress responses or stressed baseline conditions may increase the severity of the adverse effects expected from the proposed action.

4.1 Status of Species Likely to be Adversely Affected within the Action Area

Leatherback Sea Turtles

Based on the best available species life history, and range and distribution data, leatherback sea turtles may be in the action area and adversely affected by the proposed action. Leatherback sea turtle species are migratory, traveling for reproduction purposes. The Puerto Rican waters within the action area are used by these species of sea turtle for nearshore reproductive and nesting purposes, with peak nesting seasons from April to June (Diez, 2020).

Leatherback sea turtles are highly migratory. The same individuals found in the action area may migrate into offshore waters, as well as other areas of the Gulf of Mexico, Caribbean Sea, and North Atlantic Ocean, and thus be impacted by activities occurring there; therefore, the species' statuses in the action area are considered to be the same as their range-wide statuses and supported by the species accounts in Section 3. Because these species travel widely throughout the Atlantic, Gulf of Mexico, and Caribbean Sea, individuals in the action area are impacted by activities that occur in other areas within their geographic range.

4.2 Factors Affecting Leatherback Sea Turtles within the Action Area

The following analysis examines actions that may affect the species' environment specifically within the defined action area.

Federal Actions

In recent years, NMFS has undertaken several ESA section 7 consultations to address the effects of federally-permitted fisheries and other federal actions on threatened and endangered sea turtle species, and when appropriate, has authorized the incidental taking of these species. Each of those consultations sought to develop ways of reducing the probability of adverse effects of the action on sea turtles. Similarly, NMFS has undertaken recovery actions under the ESA that are addressing the problem of take of sea turtles in the fishing and shipping industries and other activities such as USACE dredging operations.

NMFS published a Final Rule, 50 CFR Parts 223 and 224 (66 FR 67495, Publication Date December 31, 2001), detailing handling and resuscitation techniques for sea turtles that are incidentally caught during scientific research or fishing activities. Persons participating in fishing activities or scientific research are required to handle and resuscitate (as necessary) sea turtles as prescribed in the Final Rule. These measures help to prevent mortality of hardshell turtles caught in fishing or scientific research gear.

50 CFR Part 222 (70 FR 42508, Publication Date July 25, 2005) allows any agent or employee of NMFS, the USFWS, the USCG, or any other federal land or water management agency, or any agent or employee of a state agency responsible for fish and wildlife, when acting in the course of his or her official duties, to take endangered sea turtles encountered in the marine environment if such taking is necessary to aid a sick, injured, or entangled endangered sea turtle, or dispose of a dead endangered sea turtle, or salvage a dead endangered sea turtle that may be useful for scientific or educational purposes. NMFS affords the same protection to sea turtles listed as threatened under the ESA [50 CFR 223.206(b)].

In August of 2007, NMFS issued a regulation, 50 CFR Parts 222 and 223 (72 FR 43176, August 3, 2007), to require any fishing vessels subject to the jurisdiction of the U.S. to take observers upon NMFS's request. The purpose of this measure is to learn more about ESA-listed species interactions with fishing operations, to evaluate existing measures to reduce take, and to determine whether additional measures to address prohibited takes may be necessary. Fishing vessels subject to the jurisdiction of the U.S. could operate in the action area, and therefore, could be required to take a NMFS observer.

Other than the proposed action, no other federally permitted projects are known to have occurred within the action area, as per a review of the NMFS SERO PRD's completed ESA Section 7 consultation database by the consulting biologist on August 16, 2022.

Non-federal Actions

Commercial and Recreational Fishing

Commercial and recreational fishing are regulated by Puerto Rico and can affect leatherback sea turtles. The Sea Turtle Stranding and Salvage Network (STSSN) database does not contain data for Puerto Rico; however, we know that sea turtle species are prone to capture and entanglement in fishing gear. Additionally, lost fishing gear such as line cut after snagging on rocks, or discarded hooks and line, can also pose an entanglement threat to sea turtles in the area.

Marine Debris and Acoustic Impacts

A number of activities that may affect leatherback sea turtles in the action area include anthropogenic marine debris and acoustic effects. The effects from these activities are difficult to measure. Where possible, conservation actions are being implemented to monitor or study the effects to these species from these sources.

Marine Pollution and Environmental Contamination

Sources of pollutants along the coast that may affect leatherback sea turtles include polychlorinated biphenyls (PCB) loading, stormwater runoff from coastal towns and cities into rivers and canals emptying into bays and the ocean, and groundwater and other discharges (Vargo et al. 1986). In addition, marina and dock construction, dredging, aquaculture, oil and gas exploration and extraction, and boat traffic can degrade marine habitats used by these species.

Stochastic Events

Stochastic (i.e., random) events, such as hurricanes or cold snaps, occur in Puerto Rico and can affect leatherback sea turtles. These events are unpredictable and their effect on the recovery of this ESA-listed species is unknown; yet, they have the potential to directly impede recovery if animals die as a result or indirectly if important habitats are damaged. In 2017, Hurricanes Irma and Maria likely damaged important nesting grounds around Puerto Rico due to erosion.

Conservation and Recovery Actions Shaping the Environmental Baseline

The Puerto Rico Department of Natural and Environmental Resources (PRDNER) monitors beaches around Puerto Rico, including those in the Condado area. The Sea Turtle Program of Puerto Rico is a multi-agency collaboration between PRDNER, several nongovernmental organizations (NGOs), and other agencies (e.g., Sea Grant-UPR, Rio Piedras-UPR, Mayaguez-UPR, Chelonia, 7Quillas, WIDECAS, United States Fish and Wildlife Service). The main goal is to educate the public, and to investigate, recuperate, and protect the species. Nesting beach surveys are conducted on several sites along the coast of Puerto Rico and adjacent islands. These surveys monitor leatherback sea turtle nesting (April-July) and hawksbill sea turtle nesting (August-December). In addition, since 1992, in-water surveys have been conducted for hawksbill sea turtles at Mona Island and Desecheo and for green sea turtles at Culebra.

5 EFFECTS OF THE ACTION ON ESA-LISTED SPECIES

Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02).

In this section of our Opinion, we assess the effects of the action on listed species that are likely to be adversely affected. The analysis in this section forms the foundation for our jeopardy analysis in Section 7. The quantitative and qualitative analyses in this section are based upon the best available commercial and scientific data on species biology and the effects of the action. Data are limited, so we are often forced to make assumptions to overcome the limits in our knowledge. Sometimes, the best available information may include a range of values for a particular aspect under consideration, or different analytical approaches may be applied to the same data set. In those cases, the uncertainty is resolved in favor of the species. NMFS generally selects the value that would lead to conclusions of higher, rather than lower risk to endangered or threatened species. This approach provides the “benefit of the doubt” to threatened and endangered species.

We believe the proposed project has 2 routes of effects. These routes of effects will be discussed, a determination will be made whether an adverse impact is expected from that component of the project, and if an adverse impact is expected, an examination of that impact on the species in the action area will be presented. Importantly, the breakwaters themselves will be permanent; thus, any impacts to leatherback sea turtles will be in perpetuity. Additional significant project impacts may include nesting beach impacts and reduction in female nesting success. These nesting beach-related issues are under the purview of the USFWS and were analyzed under a separate consultation conducted by the USFWS (USFWS, 2018), and so will not be discussed in this Opinion.

5.1 In-water Impacts to Adult Leatherback Sea Turtles

As female sea turtles approach the beach to nest, the proposed project could potentially impact them in the short term, from construction activities. Construction activities will only take place during daylight hours, NMFS concludes that the risk of injury to nesting females from construction equipment and materials is extremely unlikely to occur because sea turtles are highly mobile, nest primarily at night when construction activities would not be occurring, and in the event that their presence coincides with construction activities, they would likely avoid the area undergoing construction at that time. In addition, the applicant will be required to follow NMFS's [*Protected Species Construction Conditions*](#) (NMFS 2021), which will further reduce the potential for interactions with sea turtles from the proposed project. NMFS has examined this potential routes of effect and has concluded that impacts to leatherbacks are extremely unlikely to occur.

The presence of the breakwaters could potentially interfere with nesting female leatherbacks attempting to access the beach. Based on the information provided by the applicant, the layout of the breakwaters includes a 30 m gap between the breakwater crests. However, the bases of the breakwaters have very little to no space in between, creating a continuous “wall” on the sea floor. Additionally, although the width of the breakwaters taper off as they reach the surface, providing a gap for adult female turtles to navigate in between, they would have to do so in a zig-zag fashion. Thus, the proposed configuration creates a potential obstacle for nesting females around which they would have to navigate to reach the nesting beach. Nevertheless, we conclude the effect of the breakwaters on nesting females is insignificant because of the ability of adult leatherback sea turtles to navigate around the breakwaters, and because of availability of additional nesting habitat on adjacent beaches to the east of the project area. Female leatherbacks that have nested at Condado beach were often also documented nesting on nearby adjacent beaches during the same nesting season (Carlos Diez, personal communication on 8/16/2022). The likelihood of the breakwaters resulting in reduced nesting numbers as a result of the impact on nesting females falls under the jurisdiction of the USFWS, and was analyzed under a separate consultation completed by the USFWS on November 16, 2018, where USFWS concluded that the breakwaters were not likely to adversely affect ESA-listed sea turtles.

5.2 Hatchling Impacts

USFWS completed their consultation that analyzed the project impact on nesting females and nest numbers. However, NMFS is responsible for analyzing the impacts to hatchlings that emerge from nests once they reach the water. Based on turtle nesting surveys conducted by 7Quillas, a local volunteer group authorized by the PRDNER to conduct sea turtle surveys and monitoring, the maximum number of nests reported from 2015 to 2022 was 9 (Table 5).

Table 5. Number of leatherback sea turtle nests documented on Condado Beach from 2015 to 2022. Data provided by Hilda Benitez, Executive Director of 7Quillas (personal communication on 8/30/2022).

Year	Number of Leatherback Nests
2015	6
2016	9
2017	7
2018	6
2019	0
2020	5
2021	6
2022	1

The potential impacts to hatchlings as a result of the proposed project are complex and extensive, including a number of routes of effects, some of which compound each other. This Opinion examines: the impacts of increased predation as a result of predator concentration at the new structures, particularly during low tide when the crest of the structures may be exposed; the barrier to exit out to the open sea which the structures may present to the hatchlings during low tide; and the compounding impact of the barrier effect increasing the severity of the predation effect. As mentioned above, although the numbers of nests are low, the 359 m (1,178 ft) stretch

of beach parallel to the proposed breakwater system has documented nesting by leatherback sea turtles. Thus, it is reasonable to expect that leatherback nesting events could occur along that stretch of beach. To err on the side of the species, we take into account the maximum number of leatherback nests reported on that beach and assume that 9 nests per year will be impacted (Hilda Benitez, personal communication on 8/30/2022). We note that this is a conservative number which overestimates the actual number of nests that can be expected in that area on an annual basis.

Predation on hatchlings can be a significant source of mortality between the time of hatching and when the hatchlings reach open waters. On the beach, hatchlings can be preyed upon by birds, stray dogs, and other animals. Once they reach the water, predation by large fish, and to a lesser extent, sea birds, begins. It has long been understood and is well documented that fish, including large predatory fish, are attracted to high-relief structures to a much greater extent than sand bottom or low-relief hardbottom. Such structures are often used as fish aggregating devices. Hatchling sea turtles are preyed upon by large predatory fishes such as jacks, tarpon, barracuda, grouper, etc. as they attempt to reach the open ocean (Stewart and Wyneken 2004, Whelan and Wyneken 2007). Studies such as Witherington and Salmon (1992) have shown that predation of hatchling sea turtles was substantially higher in the vicinity of reef structure, even patchy, low-relief reefs, than over open sand (9% vs. 0%), and other studies have also shown high fish predation near reef structures and/or shallow waters (Gyuris 1994, Wyneken and Salmon 1996, Stewart and Wyneken 2004). We also expect that the concentration of predators will increase over time at the breakwaters until the ecological carrying capacity is reached, as predatory fish recruit to the structure over subsequent seasons. Studies have shown that predation rates on hatchling sea turtles are also much higher when hatchlings are more concentrated in a particular area (Wyneken et al. 1998, Wyneken et al. 2000), as would be expected to happen as hatchlings accumulate against the breakwaters during low tide and because the hatchlings that do manage to orient towards the breakwater openings will be more concentrated in those gaps. Marine predators are known to learn to wait at locations of increased concentration for the hatchlings (Wyneken et al. 2000). These predation increases are not expected to be limited to fish predation. Increases in predation on hatchlings by avian predators are expected as, the breakwaters may also provide substrate for sea birds, shore birds, and wading birds to perch during low tide. This may facilitate or even enable in-water avian predation that would not typically occur (e.g., herons and other wading birds having access to hatchlings that approach the breakwaters).

The presence of the breakwaters will also impact sea turtle hatchlings through a combination of disorientation and acting as physical barriers. Hatchlings typically orient out to sea by swimming perpendicular to waves, but other cues may be used in the absence of wave activity. Impacts to hatchlings are likely to result from the breakwaters, such as disorientation or physical blockage delaying the hatchlings' ability to reach the open waters. Migration to the open sea incorporates frenzied activity by the hatchlings, which is known to be energetically very demanding on the hatchlings (Clusella Trullas et al. 2006). Also, the swim frenzy is based upon an internal clock that determines when the hatchlings switch from frenzy to post-frenzy swimming (Wyneken and Salmon 1992, Wyneken 2000). Prolonging the time in which hatchlings must continually attempt to reach deeper, open waters is likely to have a significant, though un-quantifiable, impact on the hatchlings, such as excess resource expenditures resulting in physiological effects reducing later

fitness. Exhausted hatchlings will be more vulnerable to the increased numbers of predators expected to accumulate at the new breakwater structures.

The combined impacts of increased vulnerability to predation, disorientation, barrier, or stranding are expected to compound the impact to hatchlings beyond each vulnerability considered separately. As discussed previously, high-relief structure off sea turtle nesting beaches is known to result in increased predator concentrations, and increased predation of hatchlings. Predation in shallow waters is in part mitigated by the swim frenzy, which typically results in the hatchlings traversing the shallows and reaching deeper, open waters quickly. The majority of predation on hatchlings appears to occur during the first 15 minutes in the water, as typically the hatchlings have passed the shallower, predator-rich waters within that time frame (Stewart and Wyneken 2004). The presence of breakwaters in the area can be expected to have a potentially significant impact on the time it takes for hatchlings to swim out to sea as they would have to scramble over, or navigate around the breakwaters while waves break over the crests during low tide when the distance between breakwater crest and sea surface is 0 m. The expected delays in reaching open water as a result of the aforementioned disorientation and physical barrier effect will result in increases in the hatchlings' exposure time to the increased predator population in the area. Delays that stretch into dawn or daylight will likely cause increased predation rates from birds and potentially exposure to additional diurnally-active fish predators. Therefore, we expect that predation rates on hatchlings would be substantially higher once the breakwaters are in place than those which currently occur off Condado Beach.

Evaluating the impact of expected hatchling mortality on sea turtle populations must take into account a number of factors. Nesting for leatherback sea turtles tends to be cyclical, with high and low years. Very few hatchlings ultimately survive to reach sexual maturity even under natural conditions. Estimates of hatchling survival vary widely in part as a result of the inability to track the survival of individuals from a population over the long life span of these animals. Actual survival rates may vary widely from beach to beach or other geographical scales depending on many factors, but most values based on back-calculating from stage-specific estimated survivorship range from one in a few hundred to less than one in one thousand (Frazer 1986, 1987, NMFS and USFWS 2008). Given the potential increase in hatchling mortality that can be expected from this project the likelihood of a hatchling from this beach reaching sexual maturity would be lower than the very low odds already facing hatchlings.

NMFS is taking the conservative approach mandated by the ESA, and resolving uncertainty regarding the level of effects by erring in favor of the species. Given the expected nesting, the obstructive effect of the breakwater on hatchlings' ability to reach the open ocean during low tide, predation increases, and the already low likelihood of hatchlings reaching maturity, the nests parallel to the footprint of the breakwater system may result in almost no hatchlings from that stretch of beach reaching sexual maturity. Given the ESA-mandated requirement of making conservative assumptions that err on the side of the species, we are treating this value as zero. Thus, the biological significance of the 359 m (1,178 ft) stretch of beach, as far as reproductive input into future adult leatherback sea turtle populations, will be lost. The impacts are expected to be permanent as a result of the permanent nature of the breakwater system.

Assuming a loss of reproductive value for the stretch of beach parallel to the project area, and using nest numbers prior to any expected reduction in nesting, the following represents the maximum impact for leatherback sea turtles to be used in the jeopardy analysis:

- Total maximum number of nests documented on Condado Beach per year: 9
- Maximum number of eggs potentially produced per nest (see Section 3.3, *Life History Information*): 100
- Total potential number of eggs at site per year= $100 \times 9 = 900$

Taking into account that approximately 70% of eggs will be fertile and of this 70%, between 54 to 72% of the hatchlings will make it out of the nest onto the beach (see Section 3.3, *Life History Information*), we can estimate that approximately between 454 ($900 \times 70\% = 630$ fertile eggs; $630 \times 72\% = 454$) to 340 ($900 \times 70\% = 630$ fertile eggs; $630 \times 54\% = 340$) hatchlings per year will successfully emerge from their nests and hence, be adversely affected.

5.3 Synthesis of Effects on Sea Turtles

As described in Sections 5.1 and 5.2 above, there are a multitude of impacts expected to sea turtles as a result of the proposed project. Nesting beach impacts fall under the purview of the USFWS. The most significant impact of the project will occur to hatchling sea turtles that emerge from the beach parallel to the project area. The project is expected to create compounding effects impeding the hatchlings' access to open waters. The construction of high-relief structures in the water is expected to result in the concentration of both piscine and avian predators of hatchlings. Likewise, the temporary emergence of the breakwaters during low tide will likely result in the hatchlings being more concentrated along the breakwater walls as they attempt to bypass the breakwater system, thus exacerbating predation. Predation will be further compounded by the barrier effect of the temporary emergent breakwaters, as hatchlings will experience increased times in the nearshore waters as they attempt to navigate their way over or around the structures, risking exhaustion, and increasing their exposure time to predators. The multiple, compounding impacts of the breakwater system are expected to be all the more significant given that the impacts will be permanent as a result of the presence of the structures.

6 CUMULATIVE EFFECTS

ESA Section 7 regulations require NMFS to consider cumulative effects in formulating its Opinions (50 CFR 402.14). 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 Opinion (50 CFR 402.02). Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

No categories of effects beyond those already described are expected in the action area, and we did not identify any new future state, tribal, or private actions reasonably certain to occur in the action area of the proposed action.

7 JEOPARDY ANALYSIS

The analyses conducted in the previous sections of this Opinion serve to provide a basis to determine whether the proposed action is likely to jeopardize the continued existence of leatherback sea turtles. In the Effects of the Action, we outlined how the proposed action would affect this species at the individual level and the extent of those effects in terms of the number of associated interactions, captures, and mortalities of the species to the extent possible based on the best available data. Now we assess the species' responses to this impact, in terms of overall population effects, and whether the effects of the proposed action, when considered in the context of the Status of the Species, the Environmental Baseline, and the Cumulative Effects, are likely to jeopardize the continued existence of the leatherback sea turtle in the wild. To "jeopardize the continued existence of" means to "engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and the recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Thus, in making this determination for leatherback sea turtles, we must look at whether the proposed action, directly or indirectly, would cause a reduction in the reproduction, numbers, or distribution of the species. Then, if there is a reduction in 1 or more of these elements, we evaluate whether it would be expected to cause an appreciable reduction in the likelihood of both the survival and the recovery of the species.

The NMFS and USFWS's ESA Section 7 Handbook (USFWS and NMFS 1998) defines survival and recovery, as they apply to the ESA's jeopardy standard. Survival means "the species' persistence . . . beyond the conditions leading to its endangerment, with sufficient resilience to allow recovery from endangerment." Survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a sufficiently large population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter. Recovery means "improvement in the status of a listed species to the point at which listing is no longer appropriate under the criteria set out in Section 4(a)(1) of the Act." Recovery is the process by which species' ecosystems are restored and/or threats to the species are removed so self-sustaining and self-regulating populations of listed species can be supported as persistent members of native biotic communities.

The status of listed species likely to be adversely affected by the proposed action is reviewed in the Status of the Species. For any species listed globally, a jeopardy determination must find that the proposed action will appreciably reduce the likelihood of survival and recovery at the global species range (i.e., in the wild). For any species listed as DPSs, a jeopardy determination must find that the proposed action will appreciably reduce the likelihood of survival and recovery of that DPS.

7.1 Effects of the Action on the Likelihood of Survival and Recovery in the Wild

Survival

Information provided by the PRDNER indicates that the maximum possible annual nesting number for leatherback turtles on the stretch of beach parallel to the proposed breakwater system is 9 nests. The PRDNER reported an average of 1,592 leatherback sea turtle nests in Puerto Rico

between 2011 to 2018 (Diez, 2020). In Section 5.2, we estimated that the area immediately parallel to the proposed breakwaters could produce 454 to 340 hatchlings annually which would be adversely affected by the action. Taking into account the parameters mentioned in Section 5.2 and that the average number of nests from 2011 to 2018 in Puerto Rico was 1,592, we can estimate that approximately an average of 60,178 to 80,237 leatherback hatchlings successfully emerged from nests all around the island ($1592 \times 100 = 159,200$ eggs; $159,200 \times 70/100 = 111,440$ fertilized eggs; $109,200 \times 54/100 = 60,178$ hatchlings successfully emerging from nests; $111,440 \times 72/100 = 80,237$ hatchlings successfully emerging from nests). This does not take into account mortality once hatchlings emerge from nests and make their way into the ocean.

Based on this, and erring on the side of the species, we will use the most conservative numbers to calculate allowed take. Hence, we shall consider the take of 340 hatchlings, which would represent 0.56% of the Puerto Rico leatherback sea turtle hatchling population ($340/60,178 \times 100$). This average loss per year will not likely have an appreciable impact on total recruitment of new sea turtles to the population. Nesting in this area is sporadic, generally below the 9 nests we use as a maximum in this analysis (average of 5 nests per year over an 8 year period). We also expect that predation won't result in 100% loss of all hatchlings and that hatchlings will be able to swim over the breakwaters at most tidal stages other than low tide. Therefore, we believe there will be no appreciable reduction in the likelihood of survival of leatherback sea turtles in the wild.

Leatherback sea turtles are highly migratory, and individuals may range throughout the Gulf of Mexico, Atlantic Ocean, and Caribbean Sea. While the potential take would result in a loss of reproductive value for the action area, given the limited leatherback nesting that occurs in the action area compared to other nesting grounds for the species, and the increasing nesting trend over the past several years in Puerto Rico, as reported by the PRDNER (Diez, 2020), as well as at the larger nesting beaches, the loss is not significant in terms of local, regional, or global distribution as a whole. Therefore, we believe the anticipated impacts will not affect the species' distribution, and the reduction in numbers and reproduction is not expected to appreciably reduce the species' likelihood of survival in the wild.

Recovery

We also consider the recovery objectives in the recovery plan prepared for the U.S. populations of leatherback sea turtles that may be affected by the predicted reduction in numbers and reproduction. The recovery plan for leatherback sea turtles (NMFS and USFWS 1992) lists the following relevant recovery objective:

(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, USVI, and along the east coast of Florida.

Status: Leatherback nesting has been increasing at these beaches. The estimated annual growth rates of the nesting female population using those beaches was 1.1 for Puerto Rico (1984-2005) and the USVI (1986-2004), and 1.17 for the east coast of Florida (1989-2005) (TEWG 2007).

The potential take described above will result in a reduction in numbers and reproduction, but will not have any detectable influence on the population and nesting trends noted above because the average loss per year will not have a measurable, discernible, or appreciable impact on total recruitment of new sea turtles to the population. Thus, the proposed action will not interfere with achieving the recovery objective above; thus, it will not result in an appreciable reduction in the likelihood of leatherback sea turtles' recovery in the wild.

8 CONCLUSION

After reviewing the Status of the Species, the Environmental Baseline, the Effects of the Action, and the Cumulative Effects using the best available data, it is NMFS's Opinion that the proposed action is likely to adversely affect, but is not likely to jeopardize the continued existence of the leatherback sea turtle.

9 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and protective regulations issued pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption.

Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. *Incidental take* is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that would otherwise be considered prohibited under Section 9 or Section 4(d), but which is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the reasonable and prudent measures and the terms and conditions of the Incidental Take Statement (ITS) of the Opinion.

9.1 Anticipated Amount or Extent of Incidental Take

The take limits prescribed in this Opinion that will trigger the requirement to reinitiate consultation are based on the amount of take that we expect to be reported from regular monitoring.

In Section 5, we developed a conservative estimate of the total number of hatchling mortality expected to be reported annually (340 hatchlings per year). This overestimates the actual numbers since we assumed regular annual nesting events at the site with the highest nest number recorded. Also, we expect hatchlings would only be affected if they emerge during low tide, when the breakwaters would be at 0 MLLW. We do not anticipate the extent of incidental take to reach 340; however, we must err on the side of the species and assume a worst-case scenario.

9.2 Effect of Take

Based on the calculations in Section 7.1, NMFS has determined that the anticipated incidental take is not likely to jeopardize the continued existence of the leatherback sea turtle.

9.3 Reasonable and Prudent Measures (RPMs)

Section 7(b)(4) of the ESA requires NMFS to issue a statement specifying the impact of any incidental take on a ESA-listed species, which results from an agency action otherwise found to comply with Section 7(a)(2) of the ESA. It also states that the RPMs necessary to minimize the impacts of take and the Terms and Conditions (T&Cs) to implement those measures must be provided and must be followed to minimize those impacts. Only incidental taking by the federal action agency or applicant that complies with the specified T&Cs is authorized.

The RPMs and T&Cs are specified as required by 50 CFR 402.14(i)(1)(ii) and (iv) to document the incidental take by the proposed action and to minimize the impact of that take ESA-listed species. These RPMs and T&C must be implemented by the federal action agency in order for the protection of Section 7(o)(2) to apply. If the USACE fails to adhere to the T&Cs of this ITS through enforceable terms, and/or fails to retain oversight to ensure compliance with these T&Cs, the protective coverage of Section 7(o)(2) may lapse. To monitor the impact of the incidental take, the applicant must report the progress of the action and its impact on leatherback sea turtles to NMFS as specified in this ITS [50 CFR 402.14(i)(3)].

NMFS has determined that the following RPMs and associated T&Cs are necessary and appropriate to minimize impacts of the incidental take on leatherback sea turtles expected as a result of the proposed action:

1. The USACE must ensure the applicant conducts regular monitoring of sea turtle nesting activities for a minimum of 5 years.
2. The USACE must ensure the applicant provides take reports to NMFS associated with any adverse impacts to ESA-listed species as a result of the breakwaters.
3. The USACE must ensure the applicant minimizes the likelihood of injury or mortality to ESA-listed species resulting from the proposed action.
4. The USACE must ensure that the applicant reduces the impacts to incidentally-captured ESA-listed species.

9.4 Terms and Conditions

The following T&Cs implement the above RPMs:

1. To implement RPM 1, regular monitoring activities during leatherback sea turtle nesting and hatching season should be conducted by the applicant in order to account for any adverse effects to leatherback sea turtle nesting and hatchling egression into the ocean as

a result of the breakwaters. Monitoring should be done for a period of at least 5 years post construction. If the applicant is unable to conduct monitoring activities, the applicant must coordinate with the local government (PRDNER) to conduct monitoring activities and provide reports.

2. To implement RPM 2, the USACE must ensure the applicant reports all known stranding and mortality due to predation of ESA-listed species and any other takes of ESA-listed species to the NMFS SERO PRD. If and when the applicant becomes aware of any stranding, predation or other take, the applicant must fill out the following form:
https://docs.google.com/forms/d/e/1FAIpQLScBib1igOHkOYnm_Pm9aty4seNTVQ3U978cgrb6MEdqLCOp6g/viewform

10 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of 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.

NMFS believes the following conservation recommendations are reasonable, necessary, and appropriate to conserve and recover leatherback sea turtles. NMFS strongly recommends that these measures be considered and adopted.

- Monitor sea turtle nesting activities.
- Monitor for any changes in the beach profile as a result of alterations caused by the breakwaters.
- Conduct pre and post construction fish surveys to determine if the breakwaters are acting as Fish Aggregation Devices and concentrating higher densities of predatory fish.

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

11 REINITIATION OF CONSULTATION

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in this Opinion; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, the Corps must immediately request reinitiation

of formal consultation and project activities may only resume if the Corps establishes that such continuation will not violate Sections 7(a)(2) and 7(d) of the ESA.

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