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

11/24/2020

F/SER31: MT
SER-2016-17913
SERO-2016-00016

Commandant (CG-MER)
U.S. Coast Guard Stop 75 16
2703 Martin Luther King Jr. Ave, SE
Washington, DC 20593-7516

Dear Sir or Madam:

The enclosed Biological Opinion ("Opinion") responds to your request for consultation with us, the National Marine Fisheries Service (NMFS), pursuant to Section 7 of the Endangered Species Act (ESA) for the following action.

Action	**Lead Federal Agency**	**NMFS Tracking Numbers**
Deepwater Horizon (DWH) Spill Response	United States Coast Guard (USCG)	SER-2016-17913 SERO-2016-00016

The Opinion considers the effects of the DWH spill response activities (action) conducted by the USCG, along with other entities (e.g., The National Guard and various State agencies) to minimize the environmental effects of the spill. The Opinion analyzes the effects of the action on the following listed species:

- Loggerhead sea turtle, Northwest Atlantic Distinct Population Segment (DPS);
- Kemp's ridley sea turtle;
- Green sea turtle, North and South Atlantic DPS;
- Leatherback sea turtle;
- Hawksbill sea turtle;
- Smalltooth sawfish, U.S. DPS;
- Sperm whale;
- Fin whale;
- Sei whale;

While the action may have affected Gulf sturgeon and Gulf sturgeon critical habitat, the United States Fish and Wildlife Service (USFWS) is responsible for the ESA consultation regarding Gulf sturgeon and its critical habitat with the USGC in this instance, because the action occurred in riverine, estuarine, and marine units, which are under both NMFS and USFWS's jurisdiction. Per the Services joint regulations, "[a]ny Federal projects that extend into the jurisdiction of both the Services will be consulted on by the FWS with internal coordination with NMFS" (50 CFR 226.214). Therefore, you must consult with the USFWS on effects to Gulf sturgeon and its critical habitat associated with the action.

NMFS concludes that the action did not adversely affect smalltooth sawfish (U.S. DPS), fin whale, or sei whale. NMFS also concludes that the action did not jeopardize the continued existence of loggerhead sea turtle (Northwest Atlantic DPS); Kemp's ridley sea turtle; green sea turtle (North and South Atlantic DPS); leatherback sea turtle; hawksbill sea turtle; or sperm whale. NMFS shares ESA consultation responsibilities with the USFWS for the species of sea turtles listed above. Federal action agencies consult with NMFS for actions that may affect sea turtles in the marine environment and with USFWS for actions that may affect sea turtles in the terrestrial environment (nesting beaches). While the action analyzed in this Opinion involved spill response activities across each of these environments, this Opinion only considers effects to sea turtles in the marine environment, and the conclusions reached on these effects may not reflect those reached by the USFWS on terrestrial/inland effects of the action.

While an Incidental Take Statement (ITS) is included in this Opinion, because the Opinion concerns completed activities taken in response to an emergency, the ITS does not authorize future take or include an exemption for the analyzed take from any ESA Section 9 take prohibitions. It also does not include reasonable and prudent measures or terms and conditions to minimize take, as all take resulting from the action has already occurred. Instead, the ITS documents what is known about the take that occurred during the emergency response actions. This Opinion also includes conservation recommendations that are designed to minimize or avoid adverse effects of future similar actions on listed species and critical habitat.

We look forward to further cooperation with you on other projects to ensure the conservation of our threatened and endangered marine species and designated critical habitat. If you have any questions on this consultation, please contact Michael Tucker, Consultation Biologist, by phone at (727) 209-5981, or by email at michael.tucker@noaa.gov.

Sincerely,

CRABTREE.ROY.E.DR.1365849559

Digitally signed by CRABTREE.ROY.E.DR.1365849559
Date: 2020.11.24 10:49:10 -05'00'

Roy E. Crabtree, Ph.D.
Regional Administrator

File: 1514-22-h

Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency:	United States Coast Guard
Activity:	Deepwater Horizon Spill Response, Gulf of Mexico
Consulting Agency:	Protected Resources Division Southeast Regional Office National Marine Fisheries Service Consultation Number SER-2016-17913; SERO-2016-00016
Approved by:	CRABTREE.ROY.E.DR.1365849559 Digitally signed by CRABTREE.ROY.E.DR.1365849559 Date: 2020.11.24 10:51:12 -05'00' Roy E. Crabtree, Ph.D., Regional Administrator NMFS, Southeast Regional Office St. Petersburg, Florida
Date Issued:	11/24/2020

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Acronyms and Abbreviations

BA	Biological Assessment
BIRNM	Buck Island Reef National Monument
BMP	Best management practice
BOEM	Bureau of Ocean Energy Management
BP	British Petroleum
BSEE	Bureau of Safety and Environmental Enforcement
CCL	Curved Carapace Length
CFR	Code of Federal Regulations
CITES	Convention on International Trade in Endangered Species
CPUE	Catch Per Unit Effort
CV	Coefficient of Variation
DoD	U.S. Department of Defense
DOSS	Dioctyl Sodium Sulfosuccinate
DPnB	Dipropylene glycol butyl ether
DPS	Distinct Population Segment
DWH	*Deepwater Horizon*
DTRU	Dry Tortugas Recovery Unit
EEZ	Exclusive Economic Zone
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FMP	Fisheries Management Plan
FOSC	Federal on Scene Coordinator
FP	Fibropapillomatosis disease
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Fish and Wildlife Research Institute
GADNR	Georgia Department of Natural Resources
GCRU	Greater Caribbean Recovery Unit
HMS	Highly Migratory Species
IAP	Incidental Action Plan
ITS	Incidental Take Statement
IWC	International Whaling Commission
MMPA	Marine Mammal Protection Act
NA	North Atlantic
NMFS	National Marine Fisheries Service
NCWRC	North Carolina Wildlife Resources Commission
NGMRU	Northern Gulf of Mexico Recovery Unit

NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Association
NRA	Natural Resource Advisor
NRC	National Research Council
NRDA	Natural Resource Damage Assessment
NRU	Northern Recovery Unit
NWA	Northwest Atlantic
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated biphenyls
PDARP	Programmatic Damage Assessment and Restoration Plan
PFRU	Peninsular Florida Recovery Unit
RAI	Request for Additional Information
SA	South Atlantic
SERO	Southeast Regional Office
SCDNR	South Carolina Department of Natural Resources
SCL	Straight Carapace Length
SEFSC	Southeast Fisheries Science Center
STSSN	Sea Turtle Stranding and Salvage Network
TED	Turtle Exclusion Device
TEWG	Turtle Expert Working Group
TSM	Take Score Model
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VIPERS	Vessels with Intrinsic Petroleum Ensnaring and Recovery Systems
VOO	Vessels of Opportunity

Units of Measurement

°C	Degrees Celsius
°F	Degrees Fahrenheit
cm	Centimeter(s)
ft	Feet
in	Inch(es)
g	Grams
kg	Kilograms
lb	Pound(s)
nmi	Nautical Mile(s)
oz	Ounce

Background

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1531 et seq.), requires each federal agency to "insure 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 on any such action. National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) share responsibilities for administering the ESA.

The action under consultation was a coordinated emergency response to the Deepwater Horizon (DWH) oil spill, which occurred during the summer of 2010 with related remediation and clean-up activities continuing through February 28, 2015. During the DWH response, the USCG engaged in emergency consultation procedures with NMFS which resulted in the development and implementation of Best Management Practices (BMPs) for avoiding and minimizing adverse effects of response activities to listed species and critical habitats. The action (the emergency response) is now concluded and all discretionary United States Coast Guard (USCG) involvement has ceased. In accordance with our joint regulations with USFWS, the USGC initiated formal consultation after the emergency was under control. 50 CFR 402.05. The USCG Biological Assessment (BA) for the action, which accompanied its request to initiate consultation, describes how the BMPs were implemented, and assesses the effects of the action on listed species and designated critical habitat.

In a biological opinion for a proposed federal action, NMFS determines whether a future action is likely to jeopardize the continued existence of listed species or destroy or adversely modify critical habitat. For this Opinion, we have determined whether the completed action has or is likely to jeopardize the continued existence of listed species or destroy or adversely modify critical habitat. This Opinion also analyzes the amount and extent of incidental take of listed species thought to have resulted from the implementation of the action. While an Incidental Take Statement (ITS) is included in this Opinion, the ITS does not authorize future take or include an exemption for the analyzed take from any ESA Section 9 take prohibitions. It also does not include reasonable and prudent measures or terms and conditions to minimize take, as all take resulting from the action has already occurred, though the species may experience chronic consequences from those interactions. Instead, the ITS documents what is known about the take that occurred during the emergency response actions. This Opinion also includes conservation recommendations that are designed to minimize or avoid adverse effects of future similar actions on listed species and critical habitat.

Biological opinions for proposed federal actions also include an analysis of anticipated effects of future non-federal actions in the action area, i.e., cumulative effects, in order to determine if these cumulative effects might compound or intensify the anticipated effects of the proposed action. The sections describing the status of the species and the environmental baseline, describe the present status of the species and the present environmental baseline. These sections reflect the effects of the oil spill, response activities, and other relevant factors that have occurred before, during, and since the action was completed. In addition, we describe future non-federal actions in the cumulative effects section. In this way, the Opinion considers actions that occurred alongside the completed actions, and evaluates actions that are a part of a cumulative effects analysis.

This document represents NMFS's opinion based on our review of impacts associated with the action. This Opinion analyzes the action's effects on threatened and endangered species and designated critical habitat, in accordance with Section 7 of the ESA. The USCG provided a detailed description and analysis of the action in its BA dated April 15, 2016, which accompanied its request for consultation. In addition, the DWH Trustees assessed the injury to natural resources caused by the entire incident, including the spill response activities. Their methods and findings are documented in the DWH *Final Programmatic Damage Assessment and Restoration Plan* (DWH PDARP; DWH Trustees 2016).

Except where otherwise cited, this Opinion relies on information provided in the BA and the DWH PDARP. We based this analysis on project information provided in these 2 documents, along with other sources of information, including the published literature cited herein.

1 CONSULTATION HISTORY

This section lists only key events and correspondence during the course of the consultation process. Appendix C of the USCG's Post-Response BA documents the consultation history in detail, which we incorporate by reference herein. That history is unusually lengthy, due to the extended duration and massive scale of the emergency response action. The events and correspondence listed below, selected from the more exhaustive USCG appendix, are the most relevant to the formulation of this Opinion. Copies of the correspondence and documents exchanged between USGC and NMFS are on file in the NMFS' Southeast Regional Office.

April 20, 2010: Transocean's mobile offshore drilling unit, the DWH, situated above the Macondo well in the Northern Gulf of Mexico, exploded and sank. This event resulted in the Macondo well flowing uncontrolled, into Gulf waters, for 87 days before it was successfully capped on July 16, 2010.

April 24, 2010: The USCG and NMFS entered into emergency Section 7 consultation under the ESA on USCG emergency response actions related to the DWH oil spill.

Early May to early September, 2010: NMFS participated in numerous correspondences with USCG and other federal and state agencies in which NMFS provided specific BMPs and conservation recommendations designed to avoid or minimize potential impacts to ESA-listed species related to several ongoing spill response techniques, such as installation and operation of boom, creation of earthen berms to block oil movement (including dredging of sediments as source material for the berms), surface skimming of oil, removal of oiled *Sargassum*, trawling to locate and remove subsurface oil mats and tar balls, and in-situ burning of surface oil.

Late May to late June, 2010: NMFS and USFWS employees deployed to assist with response activities observed that the initial conservation recommendations for listed species were not being consistently implemented. In some cases, it was found that the recommendations lacked necessary specificity and a mechanism to ensure their incorporation in applicable operations. In coordination with the USCG and other agencies, the Services refined and added to the library of BMPs for specific operational categories (air operations, on-water, on-shore, night operations, etc.). BMP checklists were developed for use with the Daily Incident Action Plans (IAPs). IAPs document the strategic goals, tactical objectives, and support requirements for incident response. The Unified Area Command adopted a checklist of BMPs related to ESA-resources for the eastern States and a separate checklist for Louisiana.

July 1, 2010: In a letter to Rear Admiral James Watson, NMFS reiterated the recommendation to implement the BMPs developed to avoid and minimize effects to ESA-listed species during USCG response actions. In addition, NMFS recommended that the USCG incorporate the BMPs into the IAPs used for daily operations. NMFS emphasized that in-situ burn operations, in particular, should incorporate dedicated observers to clear burn boom of protected species prior to ignition of the oil.

July 4, 2010: Area Unified Command approved and signed-off on the BMPs recommended by NMFS to protect sea turtles and marine mammals during in-situ burn and skimming operations.

July 15, 2010: Houma Unified Command approved and signed-off on the joint NMFS-USFWS BMPs to achieve better conservation of ESA-listed species and designated critical habitat during general onshore, nearshore, offshore, and aerial response activities, including the checklists designed to document compliance.

August 4, 2010: NMFS' Sea Turtle and Marine Mammal Liaison wrote a memorandum to the Mobile Interagency Coordinating Committee (ICC) regarding implementation of BMPs for the *Sea Turtle At-Sea Retrieval Protocol*. The memo stated that Vessels of Opportunity (VOO) and the USCG were not in compliance with the BMPs for *Sea Turtle At-Sea Retrieval Protocol*. Specifically, USCG personnel were instructing all VOOs, including designated "Wildlife" VOOs, that they were not allowed to retrieve injured, oiled, live, and dead sea turtles, which was inconsistent with the *Sea Turtle At-Sea Retrieval Protocol*.

September 23, 2010: A joint letter from NMFS and USFWS pertaining to emergency consultation under Section 7 of the ESA was issued to Rear Admiral Paul Zukunft, USCG, Unified Area Command in New Orleans. This letter stated that, due to recent success of the "static kill" of the MC 252 well and "bottom kill", transition plans, as well as long-term assessments and clean-up plans, were being prepared. Because continued response activities could result in additional impacts to ESA-listed species and their designated critical habitat, active emergency consultation would continue to facilitate the development and review of recommendations to avoid and minimize impacts to ESA-listed resources.

May 1, 2013: Emergency response actions were concluded in Mississippi and on Department of Interior lands in Florida.

June 10, 2013: Emergency response actions were concluded in Florida and Alabama.

March 27, 2014: Emergency response actions were concluded in Louisiana.

February 28, 2015: Emergency consultation continued until February 28, 2015 when Removal Actions were deemed complete as determined by the Federal On-Scene Coordinator (FOSC) in accordance with 40 CFR § 300.320(b).

April 15, 2016: The USCG provided the final draft "Deepwater Horizon Post-Response Biological Assessment; Protected Species and Critical Habitats" (BA) to NMFS and USFWS, and requested ESA Section 7 consultation.

May 26, 2016: NMFS completed review of the draft BA and submitted comments, edits and a request for additional information (RAI), including a request for a copy of the Sargassum Removal Plan, to the USCG via email.

June 6, 2016: NMFS received, via email, a copy of the Sargassum Removal Plan (dated 5/28/2010), as requested in our RAI.

June 9, 2016: NMFS participated in a teleconference with USCG and USFWS to discuss the Services' comments on the draft BA. Following this call, NMFS received all additional information necessary to analyze the effects of the action and initiated formal consultation on that day.

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on September 26, 2019 [84 FR 44976]. This consultation was pending at that time, and we are applying the updated regulations to the consultation. As the preamble to the final rule adopting the regulations noted, "[t]his final rule does not lower or raise the bar on section 7 consultations, and it does not alter what is required or analyzed during a consultation. Instead, it improves clarity and, consistency, streamlines consultations, and codifies existing practice." We have reviewed the information and analyses relied upon to complete this biological opinion in light of the updated regulations and conclude the Opinion is fully consistent with the updated regulations.

2 DESCRIPTION OF THE COMPLETED ACTION AND ACTION AREA

2.1 Completed Action

The action is comprised of all activities that the USCG authorized in response to the DWH oil spill between April 20, 2010, and February 28, 2015, when removal operations were deemed complete by the Federal On-Scene Coordinator. The overall objective of the action was to protect human health, safety, and the environment, including ESA-listed species. Response activities focused on minimizing the amount of spilled oil, protecting sensitive habitats, and removing recoverable oil. The action also includes actions taken during this period without initial USCG authorization by the National Guard and the States to mitigate the impacts of the spill. The spill itself and its effects on the environment are not part of the action, though are addressed in other sections of the opinion.

For clarity and brevity, our analysis of the action in this Opinion is limited to those activities that may have adversely affected the listed species and critical habitats under NMFS' jurisdiction, which occurred in offshore or nearshore environments. The BA also assesses the effects of many onshore activities, such as shoreline clean-up, relocation of sea turtle nests and support activities (e.g., staging equipment). To the extent those on-shore activities affect nearshore resources within our jurisdiction, they are considered in this Opinion. On-shore activities also may affect terrestrial resources within the USFWS' jurisdiction, including ESA-listed sea turtles when in the terrestrial environment. The USCG is consulting with the USFWS on all response activities that may have affected listed species and habitats under USFWS jurisdiction. Therefore, we do not further address these components of the action in this Opinion. Please refer to the BA for a more complete description of all spill response activities (USCG 2016).

Dispersants

Dispersants are chemicals that reduce the tension between oil and water, leading to the formation of oil droplets that are more readily dispersed within the water column (Waring et al. 2015). A main purpose of using dispersants is to enhance the rate at which bacteria degrade the oil in order to prevent oil slicks from fouling sensitive shoreline habitats.

In response to the DWH incident, 1.84 million gallons of 2 dispersants—Corexit 9500A and Corexit 9527A—were applied: 1.07 million gallons of the 2 dispersants were applied to surface waters, and 0.77 million gallons of Corexit 9500A were injected directly into the gushing oil at BP's Macondo wellhead on the sea floor (USCG 2011).

Response personnel coordinated aerial dispersant operations from Houma, Louisiana, for 90 days from April 21 to July 19, 2010. There were 12 dispersant aircraft utilized along with 8 spotter aircraft that flew 412 spray sorties and 816 reconnaissance and spotter sorties (Houma 2010). These aircraft applied dispersant over 305 square miles within an 18,000 square mile operating area (Houma 2010).

Nearly all aerial dispersant applications to surface oil were applied more than 3 nautical miles (nmi) offshore, with 98% of the dispersant applied more than 10 nmi offshore (Houma 2010). However, on April 29, 2010, a plane with an engine failure conducted an emergency discharge of about 1,000 gallons of dispersant near the shoreline in western Barataria Bay, Louisiana. Samples collected in the area on June 22, 2010, had no detectable dispersant constituents (Houma 2010).

In addition to aerial application, dispersant was injected directly into the oil plume at the wellhead. DWH was the first oil spill where subsea dispersant injection occurred as a response action. Prior to the DWH spill, the concept of subsea application had only been tested experimentally a few times in shallow water areas (USCG 2011).

British Petroleum (BP) requested the use of subsea applications of dispersant in late April 2010, because of greater efficiency and an ability to inject dispersants continually without daylight restrictions on surface spraying. The Coast Guard approved this request on May 15, 2010, after 2 operational tests were completed (USCG 2011). A total of 770,000 gallons of Corexit 9500A was injected subsea during response activities (USCG 2011)

Drilling Mud

Synthetic-based drilling mud was used in the original drilling of BP's Macondo well and in the failed top-kill response operation conducted May 26 to 28, 2010. These muds include petroleum-based chemicals and barium sulfate, which can smother biota on the sea floor when released in sufficient quantity. During the top-kill attempt, mud was pumped into the failed well in the attempt to stop or reduce the flow of oil and gas (USCG 2011). The mud was disgorged and subsequently found on the sea floor near the well.

In Situ Burning

Between April 28 and July 19, 2010, response personnel conducted 411 controlled, in situ burns of the oil (Mabile & Allen 2010). Aerial spotters directed fire teams to areas that potentially contained burnable quantities of surface oil, primarily within 3 to 8 miles of the wellhead (Mabile & Allen 2010). Crews contained the surface oil using fire boom and then ignited the oil. An estimated 220,000 to 310,000 barrels of oil were burned throughout this period, with the largest number of burns occurring on June 18, 2010, when 16 different burns were conducted, consuming an estimated 50,000 to 70,000 barrels of oil (Mabile and Allen 2010). The burns conducted during the DWH response were unprecedented in U.S. history, exceeding any previous in situ burns in both duration and magnitude (USCG 2011). When possible, response personnel captured and relocated sea turtles and other potentially affected wildlife before burn operations commenced (USCG 2011).

Skimming

During the response activities, mechanical surface skimmers removed oil and oil-water mixtures from surface waters in the Gulf of Mexico. Skimming operations covered a wide geographic area and were employed in offshore and nearshore waters as well as lakes, bays, and marshes (USCG 2011).

By the end of April 2010, offshore skimming operations included 26 vessels capable of working in deep water, 7 dedicated tugboats, and 3 offshore oil storage barges to support and sustain skimming operations near the well. From early June through mid-July 2010, the number of offshore skimmers increased significantly to include 593 different vessels (USCG 2011). Many of these vessels were commercial fishing vessels reconfigured to serve as skimmers. These efforts compounded what was already a tremendous increase in vessel activity throughout the spill-affected area. The overall increase in vessel traffic and the effects of these increases are further discussed below.

In the nearshore environment, smaller skimming vessels were used so they could access shallow water areas and move more quickly between oil patches. The USCG stationed surface skimmers in gaps between barrier islands in an attempt to skim oil before it entered the bays behind the islands. However, much of the emulsified oil that reached the nearshore environment was comingled with debris or was tar-like, making it difficult or impossible to skim. In beaches, bays, and marshes, a diverse array of skimming equipment was deployed in an attempt to recover different forms of oil (USCG 2011).

Freshwater Releases

With oil approaching the shoreline in April 2010, water from the Mississippi River was released as part of a series of response actions intended to reduce the movement of oil into sensitive marsh and shoreline areas. These actions were taken when efforts to control oil discharge from BP's Macondo well had been unsuccessful, the amount of oil escaping from the well had been underestimated, and accurate information about the amount was not available. In recognition of the critical importance of Louisiana's estuarine habitat over the long term to diverse floral and faunal species, salinity control structures were opened at 9 separate locations in Louisiana (Davis Pond, Caernarvon, Bayou Lamoque, West Pointe a la Hache, Violet Siphon, White Ditch, Naomi Siphon, Ostrica Lock, and Bohemia).

Unlike the sediment diversions utilized by the State of Louisiana as part of its coastal restoration efforts, the structures opened in response to the DWH oil spill have been historically used to manipulate salinity levels and to maintain salinity gradients in the estuaries. These salinity control structures are typically opened during specific times of the year, for limited durations, and with controlled flow rates intended to make targeted impacts to salinity levels in Louisiana's coastal waters. In contrast, when used as a DWH oil spill response action, these structures were opened at or near maximum capacity for extended periods of time to repel the approaching oil.

Shoreline Protection Actions

Response actions designed for shoreline protection included placement of various boom materials and construction of sediment berms. The construction of berms or "barrier island building" occurred along Scofield Island, Pelican Island, Shell Island, and the Chandeleur Islands of Louisiana in July, 2010. While 6 stretches of berm totaling approximately 38 miles in length were initially permitted, only 4 reaches totaling 16 miles of berms were actually constructed. Hopper dredges were deployed to mine the sediments used in construction of the berms. These dredges were equipped with screening on all inflows and outflows, and with draghead deflectors, intended to minimize impacts to sea turtles. Relocation trawling was also conducted ahead of the dredging operations in an attempt to remove any ESA-listed sea turtles from the areas to be dredged. NMFS-approved turtle observers were present to detect and document any take resulting from the dredging and relocation trawling operations. One hundred and ninety-four turtles (186 loggerheads and eight Kemp's ridleys) were caught during the period of July 9 through July 23, 2010 by turtle relocation trawlers operating in conjunction with dredges in the Chandeleur Islands. Three of these loggerheads were found dead in the trawler nets, and three additional loggerhead mortalities were documented aboard the dredges. All of the rest of the turtles were released alive.

Boom was placed and anchored with the intention of protecting shoreline or corralling oil on the water surface to enhance the effectiveness of skimmers or other response techniques. Boom was deployed and, in some cases, recovered using boats, airboats (in marsh areas), and by hand (on shorelines). Hard boom was used to contain, deflect, or exclude oil from shorelines. Sorbent boom was used to soak up oil and needed to be removed once saturated (NOAA 2010a).

By the end of August 2010, some 3.7 million feet (over 700 miles) of hard boom and over 9 million feet (1,700 miles) of sorbent boom had been deployed (USCG 2011). Both boom deployment and the subsequent deployment of boom removal teams greatly increased nearshore boat traffic, and many lost anchors were left behind in the bottom waters (DWH Trustees 2016).

Marsh cleanup

The methods most used for marsh cleanup were vacuuming the oil, placing sorbent boom, and placing absorbent peat (USCG 2011). In areas where oiling was light, natural recovery was typically the preferred technique to minimize disturbance to the area. Floating mechanical flushing machines were also used on a limited scale (Owens et al. 2011). For more than 6 miles of the most heavily oiled marshes in northern Barataria Bay in Louisiana, crews used intensive raking and cutting methods in 2010 and 2011, to remove oiled vegetation mats, wrack (decomposing vegetation washed up on the shore by the surf), and thick oil layers on the marsh substrate (Michel et al. 2013).

Wildlife Response Activities

Wildlife capture, transportation, rehabilitation, and relocation efforts focused primarily on marine mammals, sea turtles, and birds during the response to the spill (USCG 2011). The management of wildlife response operations was led by NMFS and USFWS; however, the magnitude of the spill and impacts to animals required the use of contract wildlife responder personnel and the development and use of site-specific protocols (USCG 2011).

As response to the spill progressed, wildlife teams were positioned across the northern Gulf of Mexico to assist with various wildlife response-related activities. Responders undertook substantial capture, transportation, rehabilitation, and relocation efforts for marine mammals, sea turtles, and birds. These activities included responding to mammal and sea turtle strandings; documenting, inventorying, and storing dead animals; serving as wildlife observers; identifying sensitive and fragile habitats; providing guidance; and taking measures to reduce impacts to wildlife from cleanup activities.

These tremendous response actions were necessitated because of the large number of animals that were directly exposed to DWH oil. Some animals were not only exposed to oil, but also handled by humans, and kept in captivity during recovery efforts, which added to the stress caused by the spill. Some animals were captured and relocated, which prevented exposure to oil but disrupted their natural behavior and activities.

Rescue teams performed active searches on more than 1,200 transects totaling over 4,200 linear kilometers and an area of nearly 200 square kilometers within potential turtle habitats to locate and capture turtles from the ocean surface. These directed capture efforts primarily targeted oceanic juvenile turtles within offshore convergence zones, which were considered to be under the greatest imminent threat from the spill. More than 900 turtles were sighted, 574 of which were captured and examined for oiling (Stacy 2012). Figure 1 shows boat-based rescue efforts, assessment of heavily oiled sea turtles, and locations of turtles captured and assessed during rescue operations. More than 90 percent of the turtles that were admitted to rehabilitation centers eventually recovered and were released (Stacy 2012).

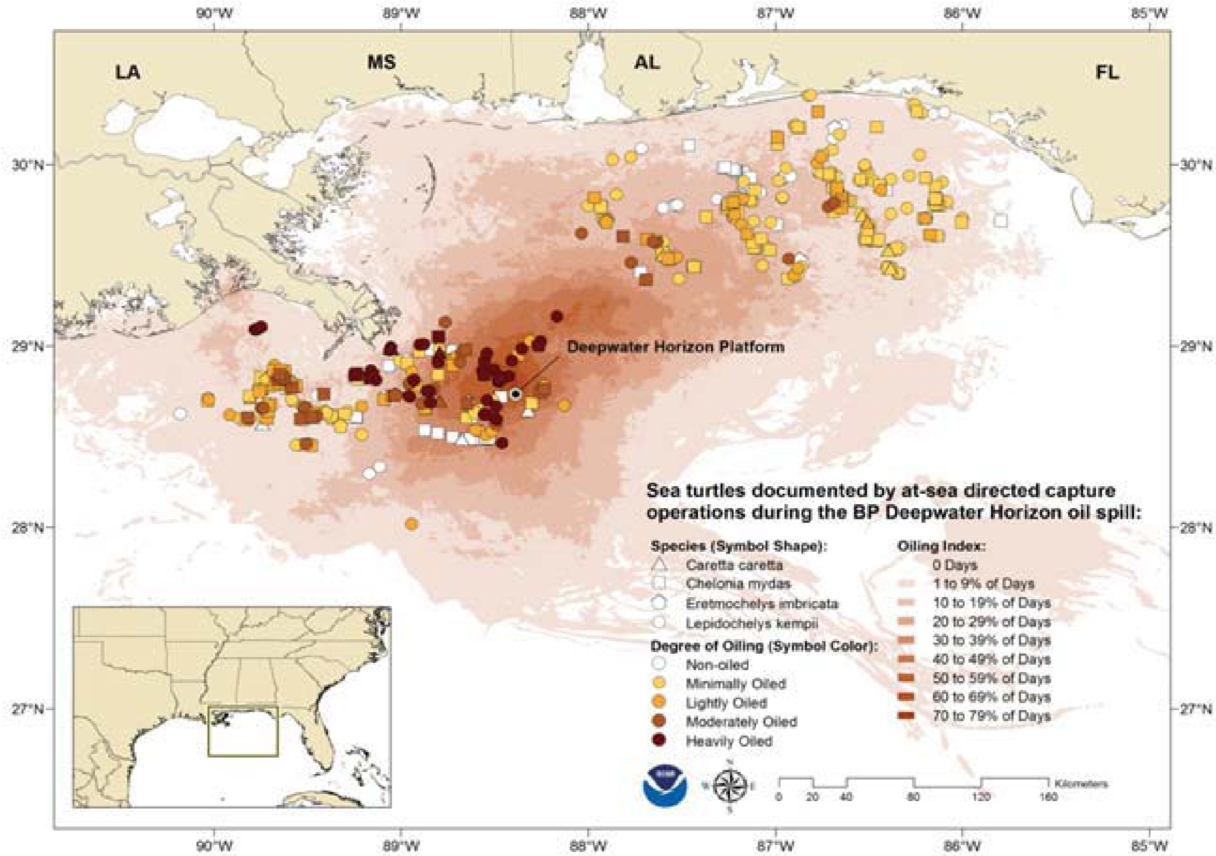

Figure 1. Locations of turtles captured and assessed during rescue operations, shown by species and degree of oiling, overlaid upon cumulative oil-days within the overall oiling footprint (Figure 4.8-7 from DWH Trustees 2016)

Vessel Traffic Activity

As mentioned previously, motorized boat activity increased dramatically in response to the spill. Hundreds of vessels responded to the spill in the open waters of the northern Gulf of Mexico, attempting to corral, disperse, and burn as much surface oil as possible. Hundreds more were deployed in nearshore environments, placing boom; assessing shoreline oiling; locating and rescuing marine wildlife; and transporting response workers as well as elected officials, agency staff, and journalists. The USCG estimated that approximately 10,000 vessels were involved in the response activities (USCG 2011).

2.2 Conservation Measures

NMFS' primary objective in the emergency ESA consultation process that was conducted during the DWH spill response was to provide specific guidelines and procedures to the action agencies that would allow them to minimize adverse effects to ESA-listed species and their designated critical habitats while completing necessary response activities. These BMPs were developed collaboratively between the Services and the action agencies, and were reviewed and updated throughout the response period. On some occasions, the Services were asked to advise on the scope of an operation, and provided draft BMPs. In all cases, the BMPs were meant to be protective strategies for both species and their habitats.

In order to ensure that these BMPs were being implemented correctly and effectively, the Mobile Unified Command, in close coordination with NMFS, developed an innovative approach, the Natural Resource Advisor (NRA) program, to oversee compliance with agency BMPs and assist operations crews in minimizing potential injury to natural resources. The NRA program involved 100 professional biologists distributed throughout the response area and imbedded within the field operations crews. For 10 months of the response, NRA Team Leaders attended daily operations planning meetings and offered suggestions to maximize cleanup efficiency while minimizing resource impacts. NRAs delineated sensitive natural resources, and directed cleanup crews and mechanized equipment away from these areas. Cleanup activities in sensitive habitats (wetlands, dunes, turtle nesting areas, etc.) were continuously monitored. The NRA program was extremely successful and achieved the primary program goal of assisting field operations personnel with BMP compliance. It provided state and federal agency personnel with a single point of accountability for natural resource issues, collected data to be used in the Section 7 consultations, and most importantly, minimized impacts to the Gulf of Mexico ecosystem throughout the response period.

Additional details on the development, dissemination, and implementation of BMPs can be found in the Consultation History (Appendix C) of the USCG BA. A full list of the BMPs that were developed and implemented during the response activities can be found in Appendix E of the USCG BA.

2.3 Action Area

The action area is defined by regulation as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402.02). The action area for this consultation includes the air space, offshore, and nearshore (lakes, bays, and sounds) areas affected by the federal actions taken in response to the spill, as shown in Figure 2. These areas include the northern Gulf of Mexico and the inshore waters of Texas, Louisiana, Mississippi, Alabama, and Florida, between Galveston County, Texas, and Apalachee Bay of the Florida Panhandle. The straight-line distance from Galveston to Apalachee Bay across the Gulf is approximately 700 miles.

Figure 2. The extent of DWH oiling, shown above, is the action area for this consultation (Figure 2.2-1 in USCG BA)

3 STATUS OF LISTED SPECIES AND CRITICAL HABITAT

Table 1 below provides a list of the ESA-listed species and critical habitat that may have been affected by the completed action. Species that were listed after the action was completed are not included in our analysis; the effects of the action were taken into account when making the listing determination, in evaluating the status of the species and stressors.

Table 1. **Effects Determination(s) for Species the Action Agency or NMFS Believes May Have Been Affected by the Completed Action**

Species	ESA Listing Status[1]	Action Agency Effect Determination	NMFS Effect Determination
Sea Turtles			
Green (North Atlantic distinct population segments [DPS])	T	LAA	LAA
Green (South Atlantic DPS)	T	LAA	LAA
Kemp's ridley	E	LAA	LAA
Leatherback	E	LAA	LAA
Loggerhead (Northwest Atlantic Ocean DPS)	T	LAA	LAA
Hawksbill	E	LAA	LAA
Marine Mammals			
Fin whale	E	NLAA	NLAA
Sei whale	E	NLAA	NLAA
Sperm whale	E	LAA	LAA
Fish			
Smalltooth sawfish (U.S. DPS)	E	NLAA	NLAA

Many of the response activities occurred in areas that are currently designated as critical habitat for loggerhead sea turtles, including Nearshore Reproductive Habitat Units LOGG-N-31 through LOGG-N-36 and *Sargassum* Habitat Unit LOGG-S-02. It is likely that some activities affected the physical or biological features and primary constituent elements that support loggerhead sea turtles in these habitats (e.g., placement of boom along nesting beaches and skimming of oiled *Sargassum* offshore). However, the final designation of these areas as critical habitat did not occur until July of 2014, long after the completion of all activities that had the potential to affect these habitats. The analysis conducted during the critical habitat designation process incorporated the effects of the DWH spill and response activities. Therefore, the completed action had no additional effects on designated critical habitat for loggerhead sea turtles beyond those analyzed in the designation process. Any effects to what would become loggerhead critical habitat would also have affected the species itself and our analysis of those effects are in section 5 of this document.

3.1 Species and Critical Habitat Not Likely to be Adversely Affected

Smalltooth Sawfish

The highest densities of smalltooth sawfish in the Gulf of Mexico occur in southwest Florida, from Charlotte Harbor southward through the Keys. The likelihood that smalltooth sawfish were present in the project areas during response activities is relatively low, as smalltooth sawfish are

[1] E = endangered; T = threatened; LAA = likely to adversely affect; NLAA = not likely to adversely affect

rare in the Florida Panhandle, and there were no reported encounters or sightings of sawfish throughout the entire response action. If smalltooth sawfish were present in proximity to response activities, effects may have included potential injury from being struck by response vessels, machinery, and materials (e.g., boom deployment and oil skimming vessels) during in-water activities. We believe that the possibility of sawfish having been injured through direct impact from response vessels, machinery or materials is extremely unlikely to have occurred, due to the rarity of sawfish occurrence in the action area, the species' mobility and natural avoidance behaviors, and the lack of any reports of sawfish sightings.

Sawfish may also have been temporarily unable to use the response activity sites for forage and shelter habitat due to avoidance of response vessels and any noise or increased turbidity that may have resulted from response activities. However, we believe any potential effects would have been insignificant considering the activities occurred in relatively unconfined areas surrounded by large expanses of similar habitats which would allow individuals avoiding the response activities to forage and shelter throughout the surrounding areas.

Dispersants applied during response activities had the potential to affect sawfish through direct toxicity or through toxic impacts to sawfish prey species. NMFS believes that the potential for dispersants to have affected sawfish or their prey species is extremely low. No dispersants were applied within 40 nmi of the Florida coastline where sawfish live. An extensive monitoring effort conducted during and after the period when dispersants were applied (between 13 May and 20 October, 2010) collected 4,850 water and 412 sediment samples in the nearshore zone (within 3 nmi of shore) throughout the Gulf Coast from the Florida Keys to Galveston, Texas (USCG 2010). These samples were analyzed for a number of dispersant-related chemicals, including, but not limited to, dipropylene glycol butyl ether (DPnB) and dioctyl sodium sulfosuccinate (DOSS). Overall, less than 1.3% of these samples contained detectable levels of dispersant-related chemicals and, in Florida's nearshore waters, less than 0.6% of samples contained detectable levels of dispersant-related chemicals. Of the 6 samples from Florida's nearshore waters that contained these chemicals, all were in the western Panhandle region (where sawfish are extremely rare), and all detections were at concentrations well below the EPA's benchmarks for impacts to aquatic life (USCG 2010).

Fin Whale and Sei Whale

Both fin and sei whales have been documented to occur in the Gulf of Mexico, though both are considered rare in this region and none have ever been documented within the spill response action area. There were no reported sightings of either fin or sei whales throughout the massive monitoring and reconnaissance activities associated with the DWH spill response. While it is possible that undetected whales may have had some exposure to the vessel and air traffic associated with the spill response activities, we believe that any effects from such exposure would have been insignificant, as the exposure would have been extremely limited (otherwise it would have been detected by monitors) and these whales regularly experience limited exposure to air and vessel traffic with no measurable effects on the foraging, migration, or reproduction of exposed individuals.

3.2 Status of Species Likely to have been Adversely Affected

This section provides a description of the present status of the listed species, their habitats, and ecosystem on which they depend. Ordinarily, this section would describe the species' status prior to the implementation of the action under consultation, and would not include the effects of the action itself. However, the emergency response action under consultation is concluded, and the effects have already been documented. We do not attempt to go back and analyze the status of the species at the time the action began in April 2010. Instead, this section summarizes best available data about the present status of the species, which reflects the effects of the oil spill, response activities, and other relevant factors that have occurred since the action was completed. We analyze the relative contribution of the completed action to the species' current status in the "Effects of the Action" section, which follows below.

Green Sea Turtle (Information Relevant to All DPSs)
The green sea turtle was originally listed as threatened under the ESA on July 28, 1978, except for the Florida and Pacific coast of Mexico breeding populations, which were listed as endangered. On April 6, 2016, the original listing was replaced with the listing of 11 distinct population segments (DPSs) (81 FR 20057 2016) (Figure 3). The Mediterranean, Central West Pacific, and Central South Pacific DPSs were listed as endangered. The North Atlantic, South Atlantic, Southwest Indian, North Indian, East Indian-West Pacific, Southwest Pacific, Central North Pacific, and East Pacific DPSs were listed as threatened. For the purposes of this consultation, only the South Atlantic DPS (SA DPS) and North Atlantic DPS (NA DPS) will be considered, as they are the only two DPSs with individuals occurring in the Atlantic and Gulf of Mexico waters of the United States.

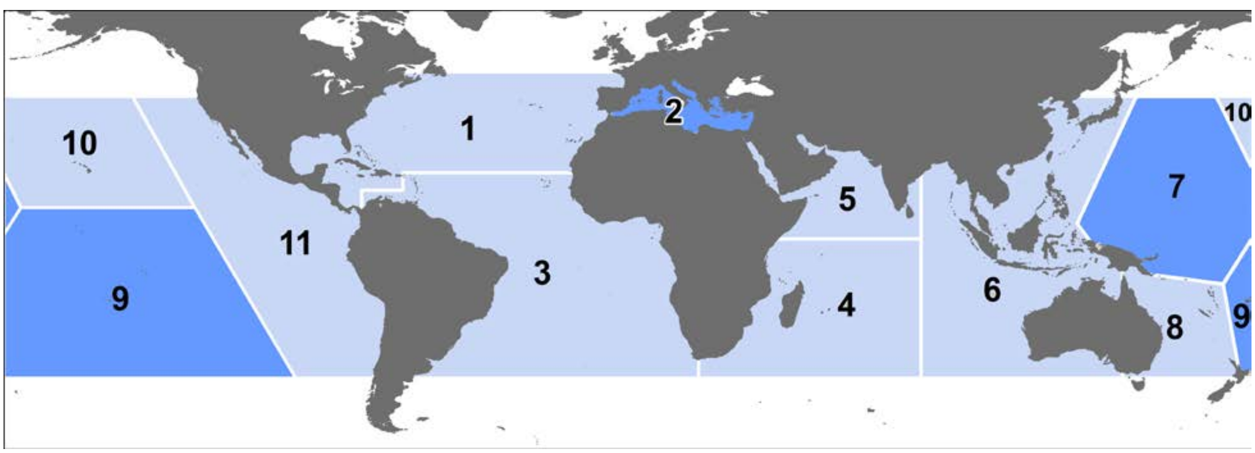

Figure 3. Threatened (light) and endangered (dark) green turtle DPSs: 1. North Atlantic, 2. Mediterranean, 3. South Atlantic, 4. Southwest Indian, 5. North Indian, 6. East Indian-West Pacific, 7. Central West Pacific, 8. Southwest Pacific, 9. Central South Pacific, 10. Central North Pacific, and 11.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

Species Description and Distribution

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

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

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

North Atlantic DPS Distribution

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

The complete nesting range of NA DPS green sea turtles within the southeastern United States includes sandy beaches between Texas and North Carolina, as well as Puerto Rico (Dow et al. 2007; NMFS and USFWS 1991). The vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Johnson and Ehrhart 1994; Meylan et al. 1995). Principal U.S. nesting areas for green sea turtles are in eastern Florida, predominantly Brevard south through Broward counties.

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

South Atlantic DPS Distribution

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

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

Life History Information

Green sea turtles reproduce sexually, and mating occurs in the waters off nesting beaches and along migratory routes. Mature females return to their natal beaches (i.e., the same beaches where they were born) to lay eggs (Balazs 1982; Frazer and Ehrhart 1985) every 2-4 years while males are known to reproduce every year (Balazs 1983). In the southeastern United States, females generally nest between June and September, and peak nesting occurs in June and July (Witherington and Ehrhart 1989b). During the nesting season, females nest at approximately 2-week intervals, laying an average of 3-4 clutches (Johnson and Ehrhart 1996). Clutch size often varies among subpopulations, but mean clutch size is approximately 110-115 eggs. In Florida, green sea turtle nests contain an average of 136 eggs (Witherington and Ehrhart 1989b). Eggs incubate for approximately 2 months before hatching. Hatchling green sea turtles are approximately 2 inches (5 cm) in length and weigh approximately 0.9 ounces (25 grams). Survivorship at any particular nesting site is greatly influenced by the level of man-made stressors, with the more pristine and less disturbed nesting sites (e.g., along the Great Barrier Reef in Australia) showing higher survivorship values than nesting sites known to be highly disturbed (e.g., Nicaragua) (Campell and Lagueux 2005; Chaloupka and Limpus 2005).

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

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

Status and Population Dynamics

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

North Atlantic DPS

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

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

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

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

Florida accounts for approximately 5% of nesting for this DPS (Seminoff et al. 2015). In Florida, index beaches were established to standardize data collection methods and effort on key nesting beaches. Since establishment of the index beaches in 1989, the pattern of green sea turtle nesting has generally shown biennial peaks in abundance with a positive trend during the 10 years of regular monitoring (Figure 4). According to data collected from Florida's index nesting beach survey from 1989-2019, green sea turtle nest counts across Florida have increased dramatically, from a low of 267 in the early 1990s to a high of 40,911 in 2019. Two consecutive years of nesting declines in 2008 and 2009 caused some concern, but this was followed by increases in 2010 and 2011, and a return to the trend of biennial peaks in abundance thereafter (Figure 4). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more resulted in an estimate of the Florida nesting stock at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9% at that time. Increases have been even more rapid in recent years.

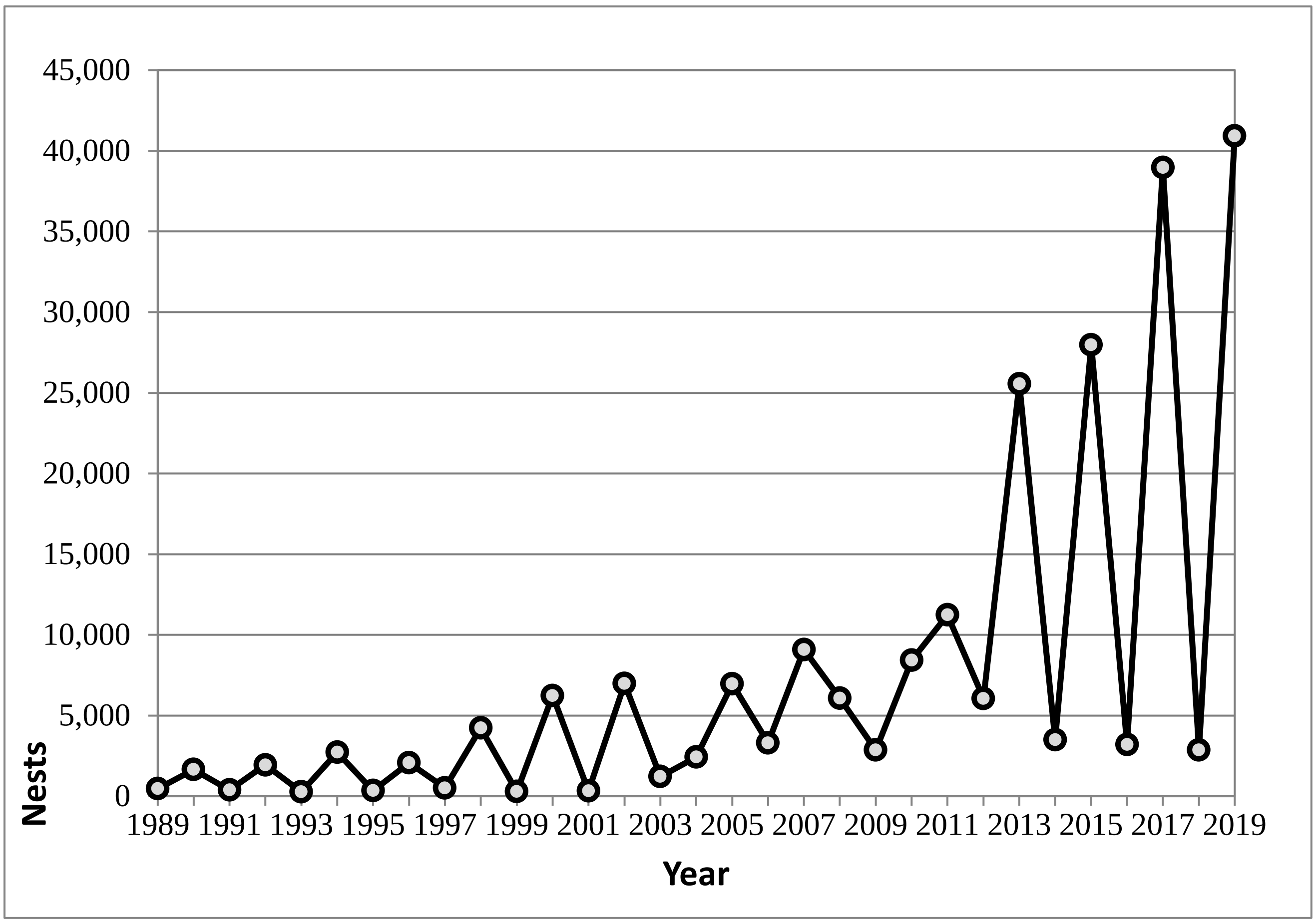

Figure 4. Green sea turtle nesting at Florida index beaches since 1989

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

South Atlantic DPS

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

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

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

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

Cold-stunning is another natural threat to green sea turtles. Although it is not considered a major source of mortality in most cases, as temperatures fall below 46.4°-50°F (8°-10°C) turtles may lose their ability to swim and dive, often floating to the surface. The rate of cooling that precipitates cold-stunning appears to be the primary threat, rather than the water temperature itself (Milton and Lutz 2003). Sea turtles that overwinter in inshore waters are most susceptible to cold-stunning because temperature changes are most rapid in shallow water (Witherington and Ehrhart 1989a). Two major cold stunning events occurred immediately prior to, and concurrent with the completed action under consultation. During January 2010, an unusually large cold-stunning event in the southeastern United States resulted in around 4,600 sea turtles, mostly greens, found cold-stunned, and hundreds found dead or dying. A large cold-stunning event occurred in the western Gulf of Mexico in February 2011, resulting in approximately 1,650 green sea turtles found cold-stunned in Texas. Of these, approximately 620 were found dead or died after stranding, while approximately 1,030 turtles were rehabilitated and released. During this same time frame, approximately 340 green sea turtles were found cold-stunned in Mexico, though approximately 300 of those were subsequently rehabilitated and released.

Impacts to green sea turtles from the DWH oil spill occurred to offshore small juveniles only. A total of 154,000 small juvenile green sea turtles (36.6% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. A large number of small juveniles were removed from the population, as 57,300 small juvenile green sea turtles are estimated to have died as a result of the exposure. A total of 4 nests (580 eggs) were also translocated during response efforts, with 455 hatchlings released (the fate of which is unknown) (DWH Trustees 2016). Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil or dispersants, and loss of foraging resources, which could lead to compromised growth and reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred.

While green turtles regularly use the northern Gulf of Mexico, they have a widespread distribution throughout the entire Gulf of Mexico, Caribbean, and Atlantic, and the proportion of the population using the northern Gulf of Mexico at any given time is relatively low. Although it is known that adverse impacts occurred and numbers of animals in the Gulf of Mexico were reduced as a result of the Deepwater Horizon oil spill of 2010, the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event, as well as the impacts being primarily to smaller juveniles (lower reproductive value than adults and large juveniles), reduces the impact to the overall population. It is unclear what impact these losses may have caused on a population level, but it is not expected to have had a large impact on the population trajectory moving forward. However, recovery of green turtle numbers equivalent to what was lost in the northern Gulf of Mexico as a result of the spill will likely take decades of sustained efforts to reduce the existing threats and enhance survivorship of multiple life stages (DWH Trustees 2016).

Kemp's Ridley Sea Turtle

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

Species Description and Distribution

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

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

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

Life History Information

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

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

Population Dynamics

Of the 7 species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Most of the population of adult females nest on the beaches of Rancho Nuevo, Mexico (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the mid-1980s, however, nesting numbers from Rancho Nuevo and adjacent Mexican beaches were below 1,000, with a low of 702 nests in 1985. Yet, nesting steadily increased through the 1990s, and then accelerated during the first decade of the twenty-first century (Figure 5), which indicates the species is recovering.

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

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

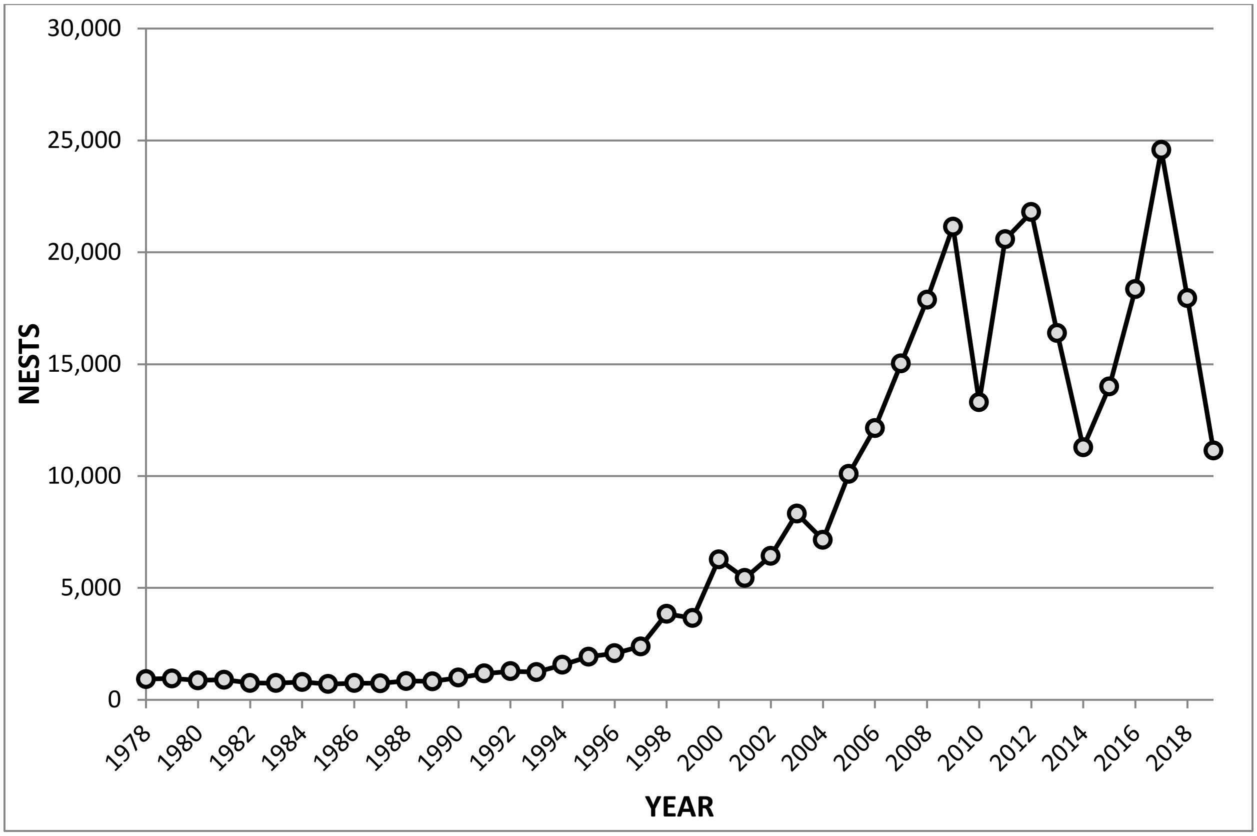

Figure 5. Kemp's ridley nest totals from Mexican beaches (Gladys Porter Zoo nesting database 2019)

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

Additionally, the significant nesting declines observed in 2010 and 2013-2014 potentially indicate a serious population-level impact, and there is cause for concern regarding the ongoing recovery trajectory.

Threats

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

As Kemp's ridley sea turtles continue to recover and nesting *arribadas*[2] are increasingly established, bacterial and fungal pathogens in nests are also likely to increase. Bacterial and fungal pathogen impacts have been well documented in the large arribadas of the olive ridley at Nancite in Costa Rica (Mo 1988). In some years, and on some sections of the beach, the hatching success can be as low as 5% (Mo 1988). As the Kemp's ridley nest density at Rancho Nuevo and adjacent beaches continues to increase, appropriate monitoring of emergence success will be necessary to determine if there are any density-dependent effects.

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

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

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

In response to these strandings, and due to speculation that fishery interactions may be the cause, fishery observer effort was shifted to evaluate the inshore skimmer trawl fisheries beginning in 2012. During May-July of that year, observers reported 24 sea turtle interactions in the skimmer trawl fisheries. All but a single sea turtle were identified as Kemp's ridleys (1 sea turtle was an unidentified hardshell turtle). Encountered sea turtles were all very small juvenile specimens, ranging from 7.6-19.0 in (19.4-48.3 cm) curved carapace length (CCL). Subsequent years of observation noted additional captures in the skimmer trawl fisheries, including some mortalities. The small average size of encountered Kemp's ridleys introduces a potential conservation issue, as over 50% of these reported sea turtles could potentially pass through the maximum 4-in bar spacing of TEDs currently required in the shrimp fisheries. Due to this issue, a proposed 2012 rule to require 4-in bar spacing TEDs in the skimmer trawl fisheries (77 FR 27411) was not implemented. Following additional gear testing, however, we proposed a new rule in 2016 (81 FR 91097) to require TEDs with 3-inch (in) bar spacing for all vessels using skimmer trawls, pusher-head trawls, or wing nets. Ultimately, we published a final rule on December 20, 2019 (84 FR 70048; correction at 85 FR 59198, September 21, 2020), that requires all skimmer trawl vessels 40 feet and greater in length to use TEDs designed to exclude small sea turtles in their nets effective April 1, 2021. A challenge to that rule resulted in a remand of the 2014 biological opinion without vacatur of the rule. A new consultation on the shrimp fishery including the new TED requirement is currently underway.

Given the nesting trends and habitat utilization of Kemp's ridley sea turtles, it is likely that fishery interactions in the Northern Gulf of Mexico may continue to be an issue of concern for the species, and one that may potentially slow the rate of recovery for Kemp's ridley sea turtles.

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

A total of 217,000 small juvenile Kemp's ridleys (51.5% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. That means approximately half of all small juvenile Kemp's ridleys from the total population estimate of 430,000 oceanic small juveniles were exposed to oil. Furthermore, a large number of small juveniles were removed from the population, as up to 90,300 small juveniles Kemp's ridleys are estimated to have died as a direct result of the exposure. Therefore, as much as 20% of the small oceanic juveniles of this species were killed during that year. Impacts to large juveniles (>3 years old) and adults were also high. An estimated 21,990 such individuals were exposed to oil (about 22% of the total estimated population for those age classes); of those, 3,110 mortalities were estimated (or 3% of the population for those age classes). The loss of near-reproductive and reproductive-stage females would have contributed to some extent to the decline in total nesting abundance observed between 2011 and 2014. The estimated number of unrealized Kemp's ridley nests is between 1,300 and 2,000, which translates to between approximately 65,000 and 95,000 unrealized hatchlings (DWH Trustees 2016). This is a minimum estimate, however, because the sublethal effects of the DWH oil spill event on turtles, their prey, and their habitats might have delayed or reduced reproduction in subsequent years, which may have contributed substantially to additional nesting deficits observed following the DWH oil spill event. These sublethal effects could have slowed growth and maturation rates, increased remigration intervals, and decreased clutch frequency (number of nests per female per nesting season). The nature of the DWH oil spill event effect on reduced Kemp's ridley nesting abundance and associated hatchling production after 2010 requires further evaluation. It is clear that the DWH oil spill event resulted in large losses to the Kemp's ridley population across various age classes, and likely had an important population-level effect on the species. Still, we do not have a clear understanding of those impacts on the population trajectory for the species into the future.

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 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),[3] a thick layer of insulating fat (Davenport et al. 1990; Goff and Lien 1988), gigantothermy (Paladino et al. 1990),[4] 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

[3] 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.

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

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,[5] while the number of nests was declining at beaches in Guiana (Hilterman et al. 2003). Though this information suggested the long-term trend for the overall Suriname and French Guiana population was increasing. A more recent cycle of nesting declines from 2008-2017, as high at 31% annual decline in the Awala-Yalimapo area of French Guiana and almost 20% annual declines in Guyana, has changed the long-term nesting trends in the region negative as described above (Northwest Atlantic Leatherback Working Group 2018).

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

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

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

The Florida nesting stock nests primarily along the east coast of Florida. This stock is of growing importance, with total nests between 800-900 per year in the 2000s following nesting totals fewer than 100 nests per year in the 1980s (Florida Fish and Wildlife Conservation Commission, unpublished data). Using data from the index nesting beach surveys, the TEWG (2007) estimated a significant annual nesting growth rate of 1.17% between 1989 and 2005. FWC Index Nesting Beach Survey Data generally indicates biennial peaks in nesting abundance beginning in 2007 (Figure 6 and Table 2). A similar pattern was also observed statewide (Table 2). This up-and-down pattern is thought to be a result of the cyclical nature of leatherback nesting, similar to the biennial cycle of green turtle nesting. Overall, the trend showed growth on Florida's east coast beaches. Tiwari et al. (2013) report an annual growth rate of 9.7% and a three-generation abundance change of +1,863%. However, in recent years nesting has declined on Florida beaches, with 2017 hitting a decade-low number, with a partial rebound in 2018. The annual geometric mean trend for Florida has been a decline of almost 7% from 2008-2017, but the long-term trend (1990-2017) remains positive with an annual geometric mean increase of over 9% (Northwest Atlantic Leatherback Working Group 2018).

Table 2. Number of Leatherback Sea Turtle Nests in Florida

Nests Recorded	2011	2012	2013	2014	2015	2016	2017	2018	2019
Index Nesting Beaches	625	515	322	641	489	319	205	316	337
Statewide	1,653	1,712	896	1,604	1,493	1,054	663	949	1,090

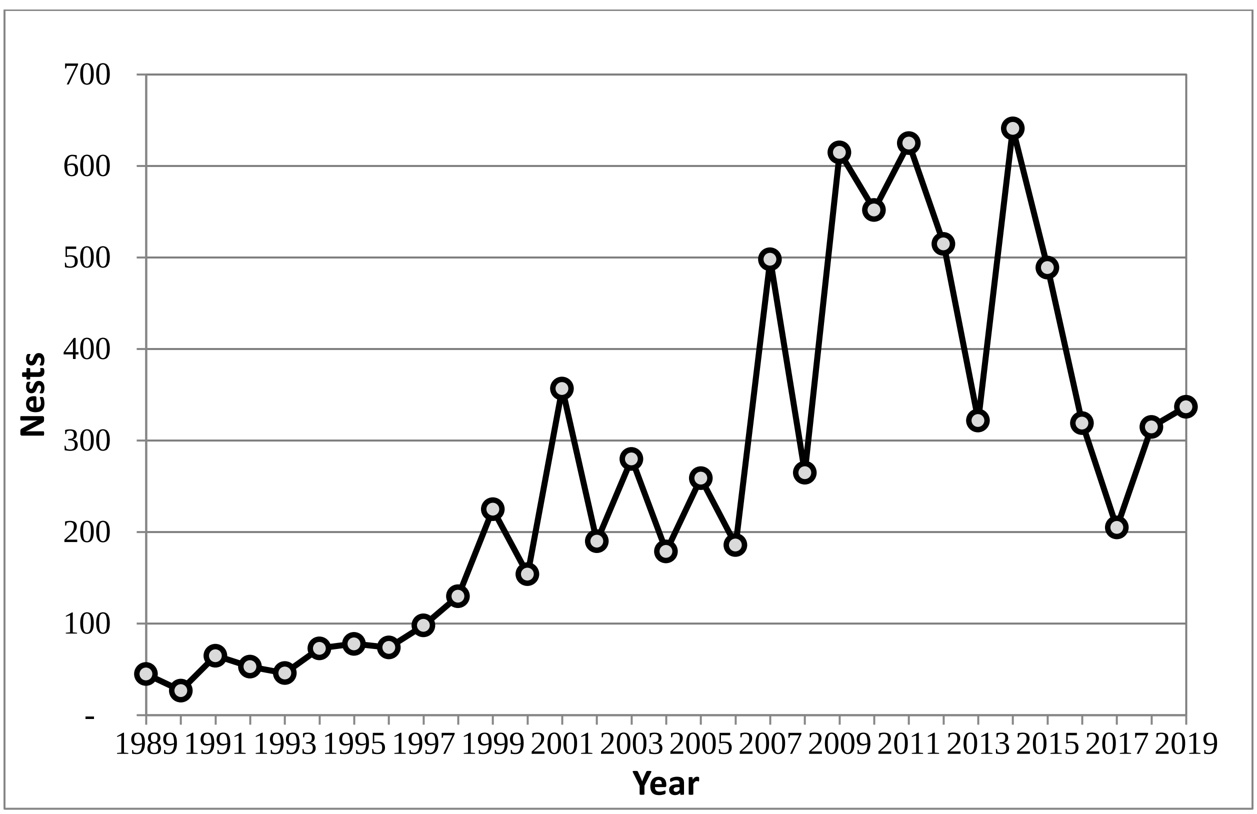

Figure 6. Leatherback sea turtle nesting at Florida index beaches since 1989

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). The 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 USFWS (2013) suggested the leatherback nesting population was stable in most nesting regions of the Atlantic Ocean. However, as described earlier, the NW 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 NW 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. 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 their attraction to the lightsticks used to attract target species in longline fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine and many other stranded individuals exhibited evidence of prior entanglement (Dwyer et al. 2003). Zug and Parham (1996) point out that a combination of the loss of long-lived adults in fishery-related mortalities and a lack of recruitment from intense egg harvesting in some areas has caused a sharp decline in leatherback sea turtle populations. This represents a significant threat to survival and recovery of the species worldwide.

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

Global climate change can be expected to have various impacts on all sea turtles, including leatherbacks. Global climate change is likely to also influence the distribution and abundance of jellyfish, the primary prey item of leatherbacks (NMFS and USFWS 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.

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

Loggerhead Sea Turtle – Northwest Atlantic DPS

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

Species Description and Distribution
Loggerheads are large sea turtles. Adults in the southeast United States average about 3 ft (92 cm) long, measured as a straight carapace length (SCL), and weigh approximately 255 lb (116 kg) (Ehrhart and Yoder 1978). Adult and subadult loggerhead sea turtles typically have a light yellow plastron and a reddish brown carapace covered by non-overlapping scutes that meet along seam lines. They typically have 11 or 12 pairs of marginal scutes, 5 pairs of costals, 5 vertebrals, and a nuchal (precentral) scute that is in contact with the first pair of costal scutes (Dodd Jr. 1988).

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

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

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

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

The recovery plan for the Northwest Atlantic population of loggerhead sea turtles concluded that there is no genetic distinction between loggerheads nesting on adjacent beaches along the Florida Peninsula. It also concluded that specific boundaries for subpopulations could not be designated based on genetic differences alone. Thus, the recovery plan uses a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to identify recovery units. The recovery units are as follows: (1) the Northern Recovery Unit (Florida/Georgia border north through southern Virginia), (2) the Peninsular Florida Recovery Unit (Florida/Georgia border through Pinellas County, Florida), (3) the Dry Tortugas Recovery Unit (islands located west of Key West, Florida), (4) the Northern Gulf of Mexico Recovery Unit (Franklin County, Florida, through Texas), and (5) the Greater Caribbean Recovery Unit (Mexico through French Guiana, the Bahamas, Lesser Antilles, and Greater Antilles) (NMFS and USFWS 2008). The recovery plan concluded that all recovery units are essential to the recovery of the species. Although the recovery plan was written prior to the listing of the NWA DPS, the recovery units for what was then termed the Northwest Atlantic population apply to the NWA DPS.

Life History Information
The Northwest Atlantic Loggerhead Recovery Team defined the following 8 life stages for the loggerhead life cycle, which include the ecosystems those stages generally use: (1) egg (terrestrial zone), (2) hatchling stage (terrestrial zone), (3) hatchling swim frenzy and transitional stage (neritic zone[6]), (4) juvenile stage (oceanic zone), (5) juvenile stage (neritic zone), (6) adult stage (oceanic zone), (7) adult stage (neritic zone), and (8) nesting female (terrestrial zone) (NMFS and USFWS 2008). Loggerheads are long-lived animals. They reach sexual maturity between 20-38 years of age, although age of maturity varies widely among populations (Frazer and Ehrhart 1985; NMFS 2001). The annual mating season occurs from late March to early June, and female turtles lay eggs throughout the summer months. Females deposit an average of

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

4.1 nests within a nesting season (Murphy and Hopkins 1984), but an individual female only nests every 3.7 years on average (Tucker 2010). Each nest contains an average of 100-126 eggs (Dodd Jr. 1988) which incubate for 42-75 days before hatching (NMFS and USFWS 2008). Loggerhead hatchlings are 1.5-2 inches long and weigh about 0.7 oz (20 g).

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

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

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

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

Status and Population Dynamics

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

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

<u>Peninsular Florida Recovery Unit</u>

The Peninsular Florida Recovery Unit (PFRU) is the largest loggerhead nesting assemblage in the Northwest Atlantic. A near-complete nest census (all beaches including index nesting beaches) undertaken from 1989 to 2007 showed an average of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females per year (NMFS and USFWS 2008). The statewide estimated total for 2017 was 96,912 nests (FWRI nesting database).

In addition to the total nest count estimates, the Florida Fish and Wildlife Research Institute (FWRI) uses an index nesting beach survey method. The index survey uses standardized data-collection criteria to measure seasonal nesting and allow accurate comparisons between beaches and between years. This provides a better tool for understanding the nesting trends (Figure 7). FWRI performed a detailed analysis of the long-term loggerhead index nesting data (1989-2017; http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trend/). Over that time period, 3 distinct trends were identified. From 1989-1998, there was a 24% increase that was followed by a sharp decline over the subsequent 9 years. A large increase in loggerhead nesting has occurred since, as indicated by the 71% increase in nesting over the 10-year period from 2007 to 2016. Nesting in 2016 also represented a new record for loggerheads on the core index beaches. FWRI examined the trend from the 1998 nesting high through 2016 and found that the decade-long post-1998 decline was replaced with a slight but nonsignificant increasing trend. Looking at the data from 1989 through 2016, FWRI concluded that there was an overall positive change in the nest counts although it was not statistically significant due to the wide variability between 2012-2016 resulting in widening confidence intervals. Nesting at the core index beaches declined in 2017 to 48,033, and rose slightly again to 48,983 in 2018 and then 53,507 in 2019, which is the 3rd highest total since 2001. However, it is important to note that with the wide confidence intervals and uncertainty around the variability in nesting parameters (changes and variability in nests/female, nesting intervals, etc.) it is unclear whether the nesting trend equates to an increase in the population or nesting females over that time frame (Ceriani, et al. 2019).

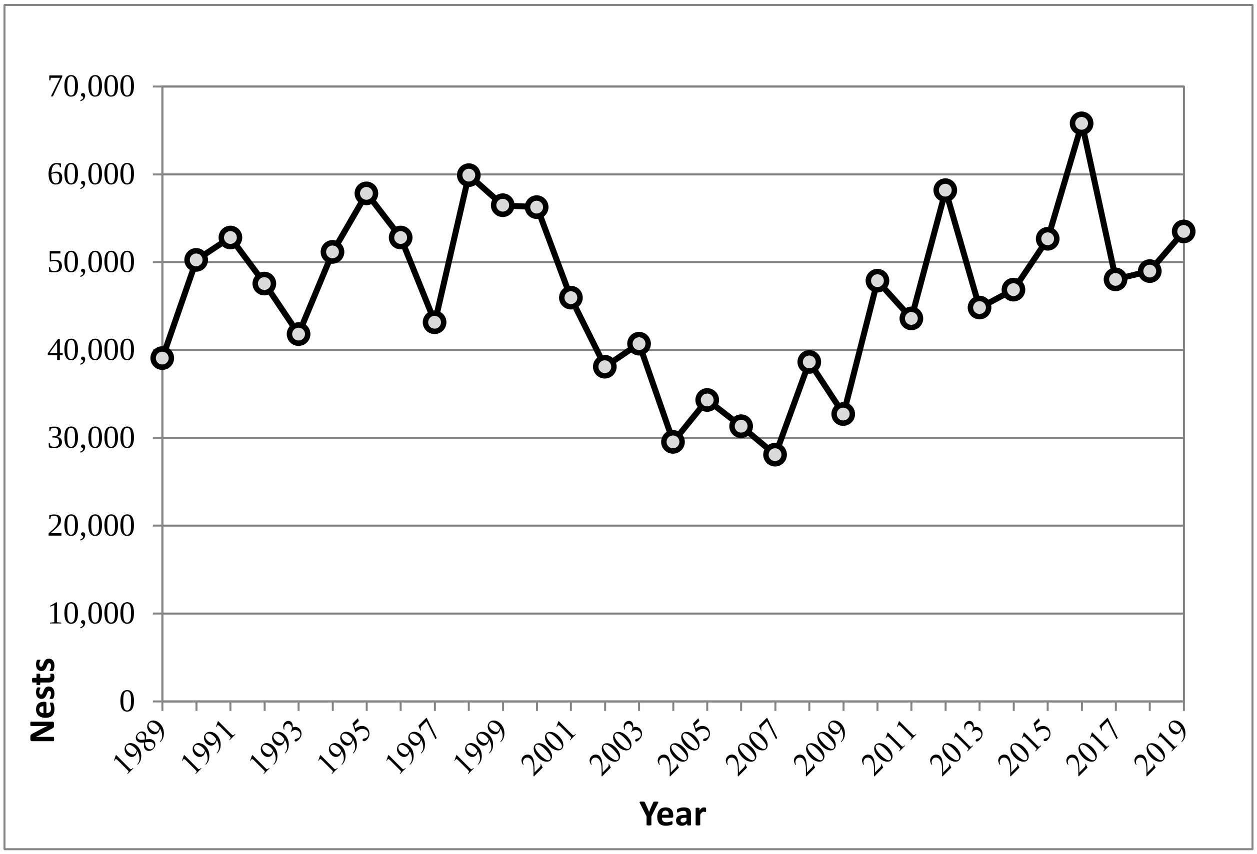

Figure 7. Loggerhead sea turtle nesting at Florida index beaches since 1989

<u>Northern Recovery Unit</u>

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

Data since that analysis (Table 3) are showing improved nesting numbers and a departure from the declining trend. Georgia nesting has rebounded to show the first statistically significant increasing trend since comprehensive nesting surveys began in 1989 (Mark Dodd, GADNR press release, http://www.georgiawildlife.com/node/3139). South Carolina and North Carolina nesting have also begun to shift away from the past declining trend. Loggerhead nesting in Georgia, South Carolina, and North Carolina all broke records in 2015 and then topped those records again in 2016. Nesting in 2017 and 2018 declined relative to 2016, back to levels seen in 2013 to 2015, but then bounced back in 2019, breaking records for each of the three states and the overall Recovery Unit.

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

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

South Carolina also conducts an index beach nesting survey similar to the one described for Florida. Although the survey only includes a subset of nesting, the standardized effort and locations allow for a better representation of the nesting trend over time. Increases in nesting were seen for the period from 2009-2013, with a subsequent steep drop in 2014. Nesting then rebounded in 2015 and 2016, setting new highs each of those years. Nesting in 2017 (the most recent year that data was reported by SCDNR) dropped back down from the 2016 high, but was still the second highest on record (Figure 8).

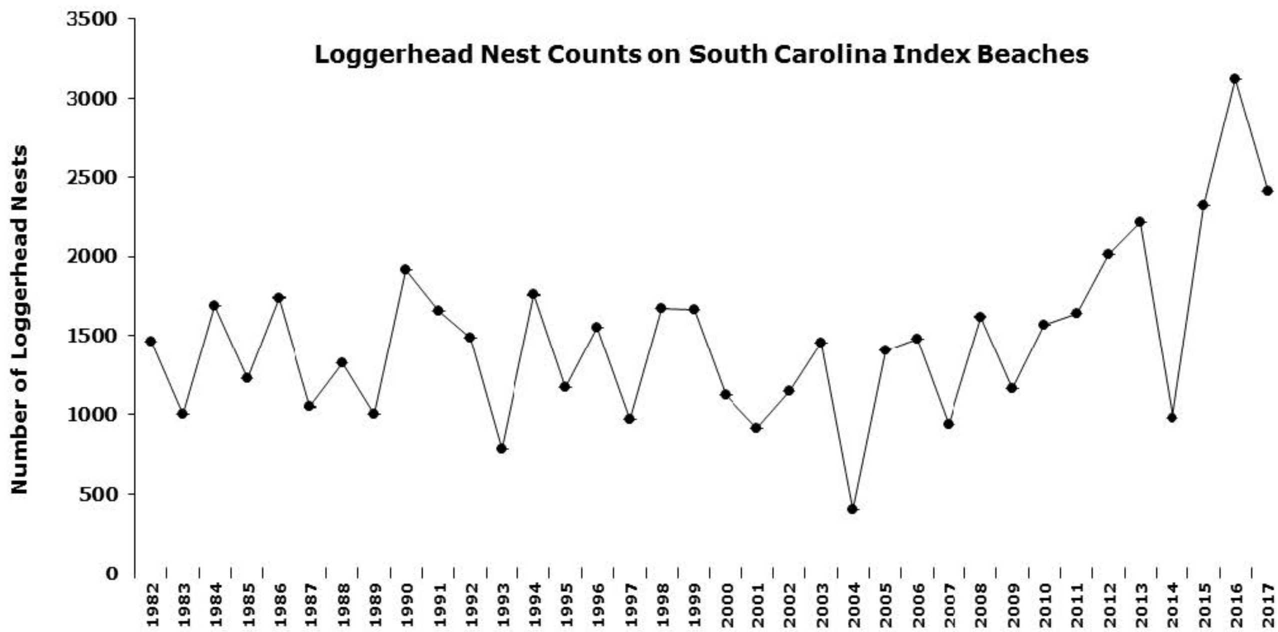

Figure 8. South Carolina index nesting beach counts for loggerhead sea turtles (from the SCDNR website: http://www.dnr.sc.gov/seaturtle/nest.htm)

<u>Other Northwest Atlantic DPS Recovery Units</u>

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

<u>In-water Trends</u>

Nesting data are the best current indicator of sea turtle population trends, but in-water data also provide some insight. In-water research suggests the abundance of neritic juvenile loggerheads is steady or increasing. Although Ehrhart et al. (2007) found no significant regression-line trend in a long-term dataset, researchers have observed notable increases in catch per unit effort (CPUE) (Arendt et al. 2009; Ehrhart et al. 2007; Epperly et al. 2007). Researchers believe that this increase in CPUE is likely linked to an increase in juvenile abundance, although it is unclear whether this increase in abundance represents a true population increase among juveniles or merely a shift in spatial occurrence. Bjorndal et al. (2005), cited in NMFS and USFWS (2008), caution about extrapolating localized in-water trends to the broader population and relating localized trends in neritic sites to population trends at nesting beaches. The apparent overall increase in the abundance of neritic loggerheads in the southeastern United States may be due to increased abundance of the largest oceanic/neritic juveniles (historically referred to as small benthic juveniles), which could indicate a relatively large number of individuals around the same age may mature in the near future (TEWG 2009). In-water studies throughout the eastern United States, however, indicate a substantial decrease in the abundance of the smallest oceanic/neritic juvenile loggerheads, a pattern corroborated by stranding data (TEWG 2009).

Population Estimate

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

Threats (Specific to Loggerhead Sea Turtles)

The impacts of fishery interactions is highly significant for this species. The joint NMFS and USFWS Loggerhead Biological Review Team determined that the greatest threats to the NWA DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant et al. 2009).

Regarding the impacts of pollution, loggerheads may be particularly affected by organochlorine contaminants; they have the highest organochlorine concentrations (Storelli et al. 2008) and metal loads (D'Ilio et al. 2011) in sampled tissues among the sea turtle species. It is thought that dietary preferences were likely to be the main differentiating factor among sea turtle species. Storelli et al. (2008) analyzed tissues from stranded loggerhead sea turtles and found that mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals, and porpoises (Law et al. 1991).

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

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

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

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

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

Hawksbill sea turtles have a circumtropical distribution and usually occur between latitudes 30°N and 30°S in the Atlantic, Pacific, and Indian Oceans. In the western Atlantic, hawksbills are widely distributed throughout the Caribbean Sea, off the coasts of Florida and Texas in the continental United States, in the Greater and Lesser Antilles, and along the mainland of Central America south to Brazil (Amos 1989; Groombridge and Luxmoore 1989; Lund 1985; Meylan and Donnelly 1999; NMFS and USFWS 1998; Plotkin and Amos 1990; Plotkin and Amos 1988). They are highly migratory and use a wide range of habitats during their lifetimes (Musick and Limpus 1997; Plotkin 2003). Adult hawksbill sea turtles are capable of migrating long distances between nesting beaches and foraging areas. For instance, a female hawksbill sea turtle tagged at Buck Island Reef National Monument (BIRNM) in St. Croix was later identified 1,160 miles (1,866 km) away in the Miskito Cays in Nicaragua (Spotila 2004).

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

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

Life History Information

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

Female hawksbills return to the beaches where they were born (natal beaches) every 2-3 years to nest (Van Dam et al. 1991; Witzell 1983) and generally lay 3-5 nests per season (Richardson et al. 1999). Compared with other sea turtles, the number of eggs per nest (clutch) for hawksbills can be quite high. The largest clutches recorded for any ESA-listed sea turtle belong to hawksbills (approximately 250 eggs per nest) ((Hirth and Latif 1980), though nests in the U.S. Caribbean and Florida more typically contain approximately 140 eggs (USFWS hawksbill fact sheet, http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/hawksbill-sea-turtle.htm). Eggs incubate for approximately 60 days before hatching (USFWS hawksbill fact sheet). Hatchling hawksbill sea turtles typically measure 1-2 in (2.5-5 cm) in length and weigh approximately 0.5 oz (15 g).

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

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

Status and Population Dynamics

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

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

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

Threats

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

Specific impacts of the DWH oil spill on hawksbill turtles have been estimated. Hawksbills made up 2.2% (8,850) of small juvenile sea turtle (of those that could be identified to species) exposures to oil in offshore areas, with an estimate of 615 to 3,090 individuals dying as a result of the direct exposure (DWH Trustees 2016). No quantification of large benthic juveniles or adults was made. Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil or dispersants, and loss of foraging resources which could lead to compromised growth and reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred. Although adverse impacts occurred to hawksbills, the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event is relatively low, and thus a population-level impact is not believed to have occurred due to the widespread distribution and nesting location outside of the Gulf of Mexico for this species.

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

The continuing demand for the hawksbills’ shells as well as other products derived from the species (e.g., leather, oil, perfume, and cosmetics) represents an ongoing threat to its recovery. The British Virgin Islands, Cayman Islands, Cuba, Haiti, and the Turks and Caicos Islands (United Kingdom) all permit some form of legal take of hawksbill sea turtles. In the northern Caribbean, hawksbills continue to be harvested for their shells, which are often carved into hair clips, combs, jewelry, and other trinkets (Márquez M. 1990; Stapleton and Stapleton 2006).

Additionally, hawksbills are harvested for their eggs and meat, while whole, stuffed sea turtles are sold as curios in the tourist trade. Hawksbill sea turtle products are openly available in the Dominican Republic and Jamaica, despite a prohibition on harvesting hawksbills and their eggs (Fleming 2001). Up to 500 hawksbills per year from 2 harvest sites within Cuba were legally captured each year until 2008 when the Cuban government placed a voluntary moratorium on the sea-turtle fishery (Carillo et al. 1999; Mortimer and Donnelly 2008). While current nesting trends are unknown, the number of nesting females is suspected to be declining in some areas (Carillo et al. 1999; Moncada et al. 1999). International trade in the shell of this species is prohibited between countries that have signed the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), but illegal trade still occurs and remains an ongoing threat to hawksbill survival and recovery throughout its range.

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

Sperm Whale

Sperm whales were first listed under the precursor to the ESA, the Endangered Species Conservation Act of 1969, and remained on the list of threatened and endangered species after the passage of the ESA in 1973 [(35 FR 18319 1970), December 2, 1970]. The primary cause of the population decline that precipitated ESA listing was commercial whaling for ambergris and spermaceti in the eighteenth, nineteenth, and twentieth centuries. Hunting of sperm whales by commercial whalers declined in the 1970s and 1980s, and virtually ceased with the implementation of a moratorium against whaling by the International Whaling Commission (IWC) in 1981, although the Japanese continued to harvest sperm whales in the North Pacific until 1988 (Reeves and Whitehead 1997). The IWC estimates that nearly 250,000 sperm whales were killed worldwide in whaling activities between 1800 and 1900. From 1910 to 1982, nearly 700,000 sperm whales were killed worldwide by whaling activities (IWC Statistics 1959-1983). A compilation of all whaling catches in the North Atlantic north of 20ºN from 1905 onward gave totals of 28,728 males and 9,507 females (NMFS 2010). Sperm whales are also protected under the Marine Mammal Protection Act (MMPA) and also listed in Appendix I of CITES, meaning that commercial trade in products of sperm whales is prohibited.

Species Description

The sperm whale (*Physeter microcephalus*, Linnaeus 1758), occurs in all oceans of the world. Sperm whales are perhaps the most widely distributed mammal on earth. It is the largest of the toothed whales, reaching a length of 60 ft (18.3 m) in males and 40 ft (12.2 m) in females (Odell 1992). Sperm whales are distributed throughout most oceanic areas, but are found in deeper waters seaward of the continental shelf. Deep water is required so they can make prolonged, deep dives to locate prey, breed, and nurse their young. In general, females and immature sperm whales appear to be restricted in range, whereas males are found over a wider range and do make occasional movements across and between ocean basins (Dufault et al. 1999). Stable, long-term associations among related and unrelated females form the core units of sperm whale societies (Christal et al. 1998). Females and juveniles form groups that are generally within tropical and temperate latitudes between 50°N and 50°S, while the solitary adult males can be found at higher latitudes between 75ºN and 75ºS (Reeves and Whitehead 1997). The home ranges of individual females seem to span distances of approximately 1,000 km (Best 1979; Dufault and Whitehead 1995). Although there is strong evidence for geographic, matrilineal structuring in sperm whales, there is no evidence these management stocks represent distinct populations of whales.

The Recovery Plan (NMFS 2010) identifies recovery criteria geographically across three ocean basins: the Atlantic Ocean/Mediterranean Sea, the Pacific Ocean, and the Indian Ocean. This geographic division by basin is due to the wide distribution of sperm whales and presumably little movement of whales between ocean basins. For management purposes under the MMPA, sperm whales inhabiting U.S. waters have been divided into 5 stocks: (1) the California-Oregon-Washington Stock, (2) the North Pacific (Alaska) Stock, (3) the Hawaii Stock, (4) the Northern Gulf of Mexico Stock, (5) and the North Atlantic Stock. In the Gulf of Mexico, sperm whales are the most common large cetacean seaward of the continental shelf (Davis et al. 1998; Jefferson and Schiro 1997; Mullin et al. 1991; Mullin and Fulling 2004; Mullin et al. 1994; Weller et al. 2000; Wursig et al. 2000). Sperm whales in the Gulf of Mexico are not evenly distributed, showing greater densities in areas associated with oceanic features that provide the best foraging opportunities (Figure 9).

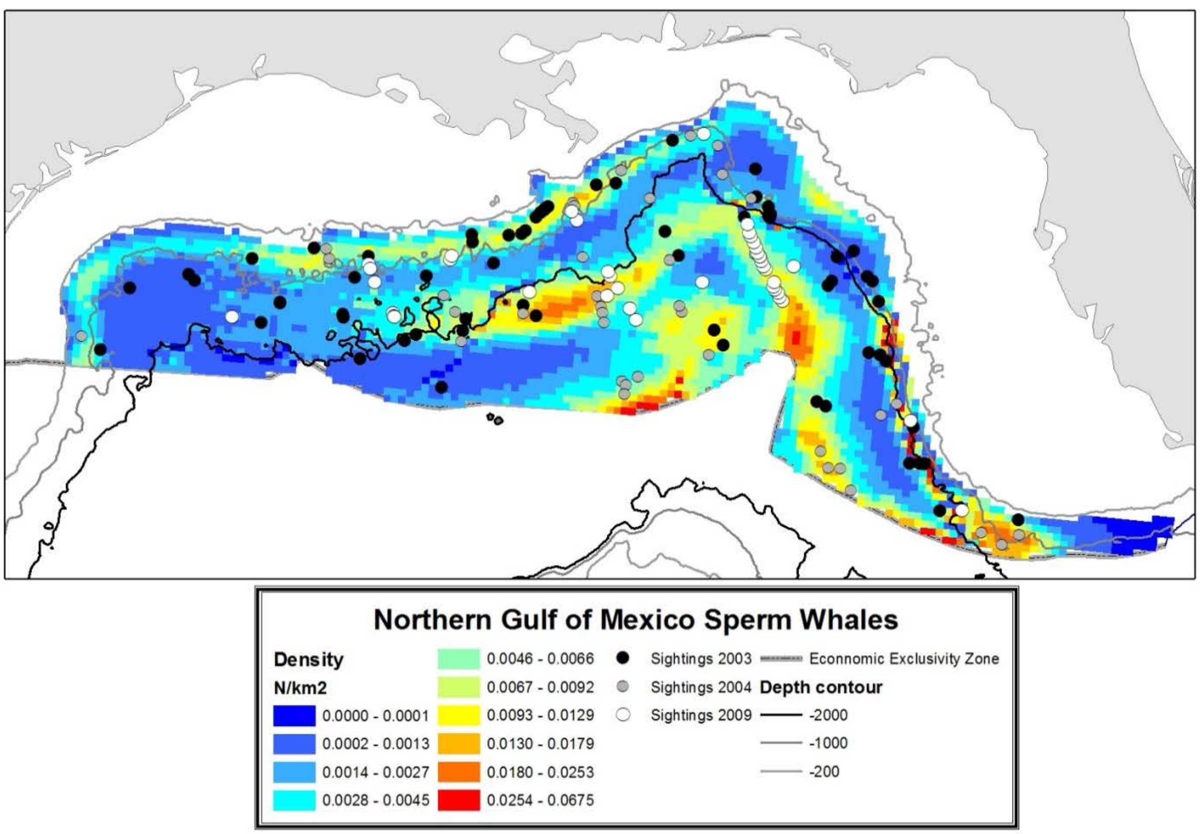

Figure 9. Sperm whale sightings and predicted densities in the Gulf of Mexico

Life History Information

The social organization of sperm whales, and with most other mammals, is characterized by females remaining in the geographic area in which they were born and males dispersing more broadly. Females group together and raise young. For female sperm whales, remaining in the region of birth can include very large oceanic ranges over which the whales need to successfully forage and nurse young whales. Male sperm whales are mostly solitary and disperse more widely and can mate with multiple female populations throughout a lifetime.

Female and immature sperm whales of both sexes are found in more temperate and tropical waters throughout the year. Maturing males will leave the female groups and form loose aggregations of bachelor schools. As the males grow older, they separate from the bachelor schools and remain solitary most of the year (Best 1979). Adult males visit female groups of whales only to breed. Large males have been sighted on occasion and are believed to enter the Gulf of Mexico for short periods to breed. Therefore, the Gulf of Mexico population is comprised of the year-round presence of females, calves, and juvenile whales. Female sperm whales attain sexual maturity at the mean age of 8 or 9 years. The mature females ovulate April through August in the Northern Hemisphere. Maturation in males usually begins in this same age interval as females, but males have a prolonged puberty and attain sexual maturity at between age 12 and 20. Males may require another 10 years to become large enough to successfully compete for breeding rights (Kasuya 1991). During this season of ovulating females, 1 or more large mature bulls temporarily join each breeding school. In the North Atlantic Ocean, the peak breeding season for sperm whales occurs during the spring (March/April to June), although some mating activity continues throughout the summer. In the South Atlantic Ocean, the peak breeding season is presumed to occur in the austral spring. During mating seasons, mature males in their late twenties and older rove among groups of females. Because females within a group often become reproductively active at the same time, the male need not remain with them for an entire season to achieve maximal breeding success (Best and Butterworth 1980) and their association with a female group can be as brief as several hours. Gestation lasts well over a year, with credible estimates of the normal duration ranging from 15 months to more than a year and a half. A single calf is born at a length of about 13 ft (4 m), after a 15-16 month gestation period. Female sperm whales rarely become pregnant after the age of 40 (Whitehead 2003). Females assist each other in the care of offspring, guarding of young at the surface while mothers dive (Whitehead 1996). Females even have been observed nursing calves other than their own (Reeves and Whitehead 1997). Calves are nursed for 2-3 years (in some cases, up to 13 years), and the calving interval is estimated to be about 4-7 years (Kasuya 1991).

The age distribution of the sperm whale population is unknown, but they are believed to live at least 60 years (Rice 1989). Potential sources of natural mortality in sperm whales include killer whale predation and the papilloma virus (Lambertsen et al. 1987). Sperm whales may also be “harassed” by pilot whales (*Globicephala spp*.) and false killer whales (*Pseudorca crassidens*), but most “attacks” by these species are probably unsuccessful (Palacios and Mate 1996; Weller et al. 1996). Very little is known about the role of disease in the natural mortality of sperm whales (Lambertsen et al. 1987). Only 2 naturally occurring diseases that are likely to be lethal have been identified in sperm whales: myocardial infarction associated with coronary atherosclerosis, and gastric ulceration associated with nematode infection (Lambertsen et al.

1987). There have been 14 individual sperm whale strandings reported in the Gulf of Mexico from 2002-2012. The rate of stranding in the Gulf of Mexico is not unusual and does not suggest mortality levels that are not sustainable to the population.

Cephalopods (i.e., squid, octopi, cuttlefishes, and nautili) are the main component of sperm whale diets. The ommastrephids, onychoteuthids, cranchids, and enoploteuthids are the cephalopod families that are numerically important in the diet of sperm whales in the Gulf of Mexico (Davis et al. 2002). Other populations, especially mature males in higher latitudes, are known to feed on significant quantities of large demersal and mesopelagic sharks, skates, and bony fishes (Clarke 1962; Clarke 1979). Sperm whales consume about 3.0-3.5% of their body weight per day (Lockyer 1981). Sperm whales undergo deep foraging dives to find prey. Descent rates are approximately 1.7 m/s and nearly vertical (Goold and Jones 1995). Dive depth may be dependent upon temporal variations in prey location in the water column.

Typical foraging dives last 40 minutes to depths of about 1,300 ft (400 m), followed by approximately 8 minutes of resting at the surface (Gordon 1987; Papastavrou et al. 1989). Nonetheless, dives of over 2 hours and deeper than 2 miles (3.3 km) have been recorded (Clarke 1976); individuals may spend extended periods of time at the surface to recover.

The disproportionately large head of the sperm whale is an adaptation to produce acoustic signals (Cranford 1992; Norris and Harvey 1972). Sperm whales locate prey by echolocation clicks while in a deep dive pattern, and also produce vocalizations while resting at the surface. The function of vocalizations is relatively well-studied (Goold and Jones 1995; Weilgart and Whitehead 1997). Long series of monotonous, regularly spaced clicks and closely spaced clicks are produced for echolocation and are associated with feeding and prey capture. Clicks produced by sperm whales (and presumably heard by them) are in the range of about 0.1-20 kHz (Goold and Jones 1995; Weilgart and Whitehead 1993; Weilgart and Whitehead 1997), up to 30 kHz, often with most of the energy in the 2-4 kHz range (Watkins 1980). Clicks have source levels estimated at 171 dB re: 1 μPa (Levenson 1974).

Sperm whales also utilize unique stereotyped click sequences called "codas" (Adler-Fenchel 1980; Mullins et al. 1988; Watkins et al. 1985a; Watkins and Schevill 1977). Codas may convey information about the age, sex, and reproductive status of the sender (Weilgart and Whitehead 1988), and may maintain social cohesion with the group (Weilgart and Whitehead 1993). Sperm whales show regional differences in coda patterns (Weilgart and Whitehead 1997). Sperm whales have been categorized as a cetacean in the mid-frequency functional hearing group in the range of 150-160 kHz and can hear wide variety of sounds in the ocean environment.

Population Size and Genetic Variability

The best estimate of the current worldwide abundance of sperm whale is estimated to be between 300,000 and 450,000 individuals (Whitehead 2002) and the abundance of sperm whales in the Atlantic Ocean is estimated at 90,000 to 134,000 individuals (NMFS 2010). The Northern Gulf of Mexico stock has a best estimate of abundance of 1,180.4 with a coefficient of variation (CV) of 0.219, based on surveys conducted in 2017 and 2018 (Garrison et al. 2020). Previous estimates include 763 resident whales in the northern Gulf of Mexico, according to the 2015 stock assessment report (NMFS 2015). The pre-spill abundance of sperm whales in the Gulf of

Mexico estimated in the DWH PDARP was 1,635 individuals (DWH Trustees 2016). The estimate of 763 individuals is based on an oceanic survey from 2009, whereas the estimate of 1,635 individuals is based upon sighting functions as well as a spatially explicit model of sperm whale density that was used for the injury quantification analysis for the Deepwater Horizon oil spill. Roberts et al. (2016) used a habitat-based distribution model and estimated 2,128 sperm whales in the Gulf of Mexico.

On a global scale, no genetic differences have been found in the nuclear DNA (nDNA) (bi-parentally inherited) between individuals sampled in different ocean basins with some differences found in mitochondrial DNA (mtDNA) (maternally-inherited) sequences (Lyrholm et al. 1999). In general, results tend to find low genetic differentiation of nDNA among sperm whales in different ocean basins and little differentiation of mtDNA within ocean basin stocks, with the exception of some semi-enclosed basins such as the Mediterranean Sea and Gulf of Mexico (Dillon et al. 1997; Lyrholm and Gyllensten 1998; Mesnick et al. 1999) {Bond, 1999}; (Engelhaupt 2004; Lyrholm et al. 1999). Based on over 2,473 tissue samples and 1,038 mtDNA sequences from a global consortium of investigators, 28 haplotypes have been identified worldwide, defined by 24 variable sites (Mesnick et al. 2005). Three common haplotypes dominated the sequencing and made up 82% of the total. This dominance by a few haplotypes indicates broad reproductive mixing of genetic material. Mitochondrial DNA evidence in the Gulf of Mexico suggests population structuring based on genetic material inherited from mothers. Regional structuring is also supported by satellite tracking data suggesting that most females establish home ranges within the Gulf of Mexico basin, and their site fidelity has resulted in maternally related groups of females and young whales in this region.

Current Threats

Since the ban on nearly all hunting of sperm whales, levels of anthropogenic mortality and injury have been comparatively low (Perry et al. 1999; Waring et al. 2002). Sperm whale numbers were drastically reduced due to whaling. Although the worldwide population has not recovered, sperm whale numbers no longer appear to be in decline. Two particular aspects of the sperm whale's reproductive biology are relevant to management and recovery of the species. First, the maximal rate of increase from reproduction is very low, perhaps no more than 1% or 2% of the population per year. Second, selective killing of large males by historical whaling could have a residual effect of reducing reproductive rates (Whitehead et al. 1997).

Current threats to sperm whales include ship strikes and entanglements in fishing gear, as well as disturbance by man-made noise, including from vessel activities and oil and gas activities, and water pollution. NMFS' Recovery Plan for Sperm Whales (NMFS 2010) identified 4 main categories of threats to the recovery of sperm whales in the Atlantic Ocean: (1) vessel interactions, (2) incidental capture in fishing gear, (3) habitat degradation, and (4) military operations.

Vessels affect sperm whales via collisions and vessel noise. Sperm whales spend periods of up to 10 minutes “rafting” at the surface between deep dives (Jaquet et al. 1998). This could make them exceptionally vulnerable to ship strikes. Studies on the behavior of sperm whales around whale watching boats suggest sperm whales change their diving and acoustic behavior in response to boats, but following frequent exposure, they become increasingly tolerant or habituated to the presence of vessels (Gordon et al. 1992){Markowitz et al. 2011}.

Incidental entrapment and entanglement in fishing gear, especially gillnets set in deep water for pelagic fish (e.g., sharks, billfish, tuna), is of potential concern. In U.S. east-coast waters, two incidents were reported between 1990 and 1995, both on Georges Bank. In 1990, one whale was found entangled and was released in “injured” condition. In 1995, another was found, also injured, and released while still carrying gear (Waring et al. 1997). Based on observer data from the drift-net fishery, mortality of sperm whales between 1989 and 1995 ranged from 0 to 4.4 (coefficient of variation [CV] 1.77) per year) (Waring et al. 1997). A single nonlethal interaction between sperm whales and the longline fishery have been recorded in the U.S. Atlantic Gulf of Mexico. Only 1 stranded sperm whale has shown signs of human interaction.

The accumulation of stable pollutants (e.g. heavy metals, polycholorobiphenyls [PCBs], chlorinated pesticides [DDT, DDE, etc.], and polycyclic aromatic hydrocarbons [PAHs]) is of concern. The potential impact of coastal pollution may be an issue for this species in portions of its habitat, though little is known regarding the effect pollutants may have on individuals. Because sperm whales feed at high trophic levels and store the chemicals in their blubber, they are susceptible to chemical pollution. Sperm whales could potentially pass these chemicals to their offspring in their milk (Whitehead 2003). A population sensitivity analysis for the Gulf of Mexico sperm whales showed that if toxins, such as those found in oil spills, reduce the survivorship rate of the mature female sperm whales by as little as 2.2% or the survivorship rate of mothers by 4.8%, the growth rate of the population would drop to a level that would result in a decline in the size of that population (Chiquet et al. 2013).

While there is little specific data on the direct impacts incurred by sperm whales from the DWH oil spill, the likely effects to sperm whales can be inferred from the well documented impacts observed in bottlenose dolphins resulting from their exposure to DWH oil (Schwacke et al. 2014). A more detailed description of these effects on bottlenose dolphins and the likely similar effects on sperm whales is included in the Environmental Baseline section below.

Applying the effects from bottle dolphins to sperm whales, NOAA (2015) conducted an assessment of the long-term reproductive effects that DWH is having on the Gulf of Mexico sperm whale population using modeling based on the mortalities associated with adverse health consequences of oil exposure and the reduced reproductive success in pregnant females due to DWH. This analysis estimated that the number of females and calves in the population has been reduced, and that DWH oil exposure has resulted in a maximum population reduction of 7% (about 115 animals)

A second NOAA analysis conducted by Farmer et al. (2018) estimated the long-term effects of exposure to the DWH oil spill would result in a 26% reduction in the Gulf of Mexico sperm whale population by 2025, as compared to an estimated baseline population (without effects from DWH). The effects of exposure to the DWH spill on sperm whales in this analysis was also based upon the Schwacke et al. (2014) analyses of the responses of bottlenose dolphin populations to the DWH oil. Farmer et al. (2018) estimated a 12% decrease in annual survival rate in Gulf of Mexico sperm whales resulting from exposure to the spill from 2011–2014, followed by a linear decrease in this reduced survivorship rate over an additional 10-year period (2015–2025).

Marine debris may be ingested by sperm whales as is the case with many marine animals. Debris entrained in the deep scattering layer where sperm whales feed could be mistaken for prey and incidentally ingested. Man-made noise and offshore energy development may also be adversely affecting habitat quality. Because of their apparent role as important predators of mesopelagic squid and fish, changing the abundance of sperm whales should affect the distribution and abundance of other marine species. Conversely, changes in the abundance of mesopelagic squid and fish from recently developed targeted fisheries could affect the distribution of sperm whales.

Sperm whales are potentially affected by military operations and oil and gas exploration and development in a number of ways. Whales can be struck by vessels and disturbed by sonar, seismic surveys and other artificial sounds. Sperm whales have been observed to frequently stop echolocating in the presence of underwater pulses made by echosounders and submarine sonar (Watkins et al. 1985b; Watkins and Schevill 1975). They also stop vocalizing for brief periods when codas are being produced by other individuals, perhaps because they can hear better when not vocalizing themselves (Goold and Jones 1995).

4 ENVIRONMENTAL BASELINE

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, within the action area. By regulation, environmental baselines for Biological Opinions include the past and present impacts of all state, federal, or private actions and other human activities in the action area. Under the regulations, we identify the anticipated impacts of all proposed federal projects in the specific action area of the consultation at issue that have already undergone formal or early Section 7 consultation as well as the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

Ordinarily, this section would describe these conditions prior to the implementation of the action under consultation, including effects of certain actions that would exist alongside the proposed action (i.e., the anticipated effects of proposed federal projects that have undergone formal or early consultation and state or private actions contemporaneous with the proposed action), and would not include the effects of the action itself. However, the emergency response action under consultation is concluded, and the effects have already been documented. We do not attempt to go back and analyze the baseline conditions present at the time the action began in April 2010. Instead, this section summarizes best available data about the present environmental baseline, which reflects the effects of the oil spill, response activities, and other relevant federal, state, or private actions or other human activities that have occurred before, during, and since the action was completed. In this way, this section provides context for the environmental baseline affecting the species as the response activities were undertaken and the cumulative effects of future state or private activities that would have been and are reasonably certain to occur within the action area. These cumulative effects also are described in section 6. This section is broader than the environmental baseline analysis would have been had the consultation been completed before the response activities began.

Focusing on the impacts of the activities in the action area specifically allows us to assess the experience and state (or condition) of the endangered and threatened individuals that were exposed to the effects of the actions under consultation. This is important because, in some phenotypic states or life history stages, 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. The same is true for localized populations of endangered and threatened species; the consequences of changes in the fitness or performance of individuals on a population's status depends on the state of the population.

4.1 Status of Species within the Action Area

Sea Turtles
Given the extremely large size of the action area, and the highly migratory behavior of the species of sea turtles affected, the statuses of the sea turtles in the action area, as well as the threats to these species, are best reflected in their range-wide statuses and species accounts described in Section 3 (Status of Species). However, of the species analyzed, only the Northwest Atlantic DPS of loggerhead sea turtles has a significant proportion of its nesting habitat within the action area. While the other species have been documented nesting in small numbers within the action area, the vast majority of these species' nesting habitat and nesting activity falls outside of the action area. Therefore, the description of the species' status and the threats related to nesting and hatchling survival are relevant primarily to loggerheads within the action area.

Sperm Whale
Sperm whale groups have been observed throughout the Gulf of Mexico from the upper continental slope near the 100-m isobath to the seaward extent of the United States Exclusive Economic Zone (EEZ) and beyond (Baumgartner et al. 2001; Burks et al. 2001; Roden and Mullin 2000). Aggregations of sperm whales are commonly found in waters over the shelf edge in the vicinity of the Mississippi River Canyon in waters that are 1,641-6,562 ft (500-2,000 m) in depth (Davis et al. 2000; Davis and Fargion 1996). They are also often concentrated along the continental slope in or near current cyclones and zones of confluence between cyclones and anticyclones (Davis et al. 2000). Sperm whales appear to be concentrated in at least 2 geographic regions of the Northern Gulf of Mexico: an area off the Dry Tortugas (outside of the action area) and offshore of the Mississippi River Delta (within the action area). Davis et al. (2000) noted the presence of a resident, breeding population of endangered sperm whales within 50 km of the Mississippi River Delta and suggested that this area may be essential habitat for sperm whales. Consistent sightings and satellite tracking results indicate that sperm whales occupy the northern Gulf of Mexico throughout all seasons (Davis et al. 2000; Davis and Fargion 1996; Jefferson and Schiro 1997; Jochens et al. 2008; Mullin et al. 1994; Sparks et al. 1995). For management purposes, sperm whales in the Gulf of Mexico are considered a separate stock from

those in the Atlantic and Caribbean (Engelhaupt et al. 2009; Gero and Whitehead 2007; Jaquet 2006; Jochens et al. 2008). The Northern Gulf of Mexico stock has a best estimate of abundance of 1,180.4 (CV =0.219) based on surveys conducted in 2017 and 2018 (Garrison et al. 2020).

The Bureau of Ocean Energy Management (BOEM)'s Sperm Whale Seismic Study provides further conclusions about sperm whales in the northern Gulf of Mexico (Jochens et al. 2008). This study concluded:

1. The data supports the conservation of sperm whales in the northern Gulf of Mexico as a discrete stock.
2. Sperm whales are present year-round in the Gulf, with females generally having significant site fidelity and males and females exhibiting significant differences in habitat use.
3. The sperm whale population off the Mississippi River Delta likely has a core size of about 140 individuals.
4. Gulf sperm whales seem to be smaller in individual size than sperm whales in some other oceans.
5. Some groups of sperm whales in the Gulf were mixed-sex groups of females/immatures and others were groups of bachelor males. The typical group size for mixed groups was 10 individuals, which is smaller than group sizes in some other oceans.
6. The typical diving and underwater behaviors of the Gulf's sperm whales are similar to those of animals in other oceans.
7. The typical feeding and foraging behaviors of the Gulf's sperm whales are similar to those of animals in other oceans, although differences in defecation rates suggest possible differences in feeding success.
8. In the otherwise oligotrophic (low productivity) Gulf of Mexico, the eddy field contributes to development of regions of locally high surface productivity that in turn may create conditions favorable for trophic cascade of surface production to the depths where Gulf sperm whales dive to forage.

While there is little specific, recent data to definitively determine the population trajectory of the northern Gulf of Mexico stock of sperm whales, the NOAA analyses of potential effects from the DWH oil spill described above in the Status of Species section indicate that the long-term effects of the spill may result in an overall reduction in this population of between 7% and 26% by 2025 (NOAA 2015; Farmer et al. 2018)

4.2 Factors Affecting Species within the Action Area

Federal Actions

NMFS has undertaken a number of Section 7 consultations to address the effects of federally permitted fisheries and other federal actions on threatened and endangered species and, when appropriate, has authorized the incidental taking of these species. Each of those consultations sought to minimize the adverse impacts of the action on sea turtles and sperm whales, as applicable. Similarly, NMFS has undertaken recovery actions under the ESA to address impacts resulting from the fishing and shipping industries and other activities such as Army Corps of

Engineers (USACE) dredging operations. The summary below of federal actions and the effects these actions have had on these ESA-listed species includes only those federal actions in the action area that have already concluded formal or early Section 7 consultation.

Fisheries

Federal fisheries in the Gulf of Mexico have interacted with sea turtles and sperm whales throughout the past. While interactions between federal fisheries and sperm whales are rare, the pelagic longline fishery for Atlantic Highly Migratory Species (HMS) has been found to adversely affect sperm whales in the Gulf of Mexico (NMFS 2020a). Sea turtles are also adversely affected by several types of fishing gear in the action area. These gears, including gillnet, hook-and-line (i.e., vertical line), and trawl gear have all been documented as interacting with sea turtles. Formal Section 7 consultations have been conducted on the following fisheries: Coastal Migratory Pelagics Fishery, Pelagic Longline Fishery for Atlantic HMS, Atlantic HMS Fisheries (Excluding Pelagic Longline), Gulf of Mexico Reef Fish, and Southeastern Shrimp Trawl Fisheries. A summary of each consultation is provided below, but more detailed information can be found in the respective Biological Opinions (NMFS 2015; NMFS 2020a; NMFS 2020b; NMFS 2011; NMFS 2012a).

Sperm whales can become entangled in fishing gears such as longlines. While this species is less susceptible to threats posed by fishing gear than other more coastal cetaceans, there have been reports of sperm whale entanglement within the Gulf of Mexico, and the Biological Opinion for the Pelagic Longline Fishery for Atlantic HMS Species anticipates take of sperm whales from that fishery.

<u>Coastal Migratory Pelagics Fishery</u>

The Coastal Migratory Pelagics (CMP) Fisheries Management Plan (FMP) was approved in 1982 and implemented by regulations effective in February of 1983. Managed species include king mackerel, Spanish mackerel, and cobia. The CMP FMP manages these species in federal waters in the Gulf of Mexico and in the Atlantic from Florida to New York. Spanish mackerel occur to depths of 75 m, cobia to depths of 125 m, and king mackerel to depths of 200 m. Consequently, fishing for CMP species typically occurs in waters less than 45 m but may occur in depths as great as 200 m. Fishing for CMP species in the Gulf of Mexico is primarily conducted by hook-and-line, cast nets, and run-around and sink gillnets. Drift gillnets targeting CMP species have been prohibited since 1990, and many additional restrictions on gillnets targeting CMP were implemented in April 2000 via Amendment 9 to the CMP FMP.

Only the gillnet component of the authorized CMP fishery is known to adversely affect sea turtles. While sea turtles are typically vulnerable to capture on hooks, the hook-and-line gear used by both commercial and recreational fishers to target CMP species is limited to trolled or, to a much lesser degree (e.g., historically ~2% by landings for king mackerel), jigged handline, bandit, and rod-and-reel gear, i.e., techniques that are extremely unlikely to affect sea turtles (NMFS 2015).

A June 18, 2015 Opinion, as amended via a November 18, 2017 memorandum and attachment, comprises the most recent completed Section 7 consultation on the operation of the CMP fishery in the Gulf of Mexico and South Atlantic. The 2015 Opinion, as amended, concluded that the proposed action is likely to adversely affect but is not likely to jeopardize the continued existence of all of the listed sea turtle species in the Gulf of Mexico (i.e., green North Atlantic and South Atlantic DPS, hawksbill, Kemp's ridley, leatherback, and loggerhead NWA DPS).

Pelagic Longline Fishery for Atlantic HMS species
On May 15, 2020 NMFS issued an Opinion on the operation of the pelagic longline fishery for Atlantic HMS fisheries as carried out under the 2006 Consolidated HMS FMP, as amended. This fishery primarily targets swordfish, yellowfin tuna, and bigeye tuna with secondary target species including dolphin, albacore tuna, and certain species of sharks. The 2020 Opinion determined that the PLL fishery in the Gulf of Mexico has in the past, and will continue in the future, to cause direct injury and mortality of sperm whales and all species of sea turtles that occur in the Gulf, through hooking and entanglement of these species in the longline fishing gear deployed in this fishery. In analyzing these expected impacts, the Opinion concluded that the continuing execution of this fishery is likely to adversely affect sperm whales and sea turtles that also were affected by this proposed action (i.e., green North Atlantic and South Atlantic DPS, hawksbill, Kemp's ridley, leatherback, and loggerhead NWA DPS), but is not likely to jeopardize the continued existence of any of these species.

Atlantic HMS Fisheries (Excluding Pelagic Longline)
On January 10, 2020, NMFS issued an Opinion on the operation of Atlantic HMS fisheries (excluding the pelagic longline fishery) as carried out under the 2006 Consolidated Atlantic HMS Fishery Management Plan (2006 Consolidated HMS FMP), as amended. The non-PLL HMS fisheries use a number of gear types that are known to interact with sea turtles, including gillnets, bottom longlines, and vertical lines. These fisheries have been in operation for an extended period of time, and have affected and are part of the environmental baseline for sea turtles in the action area for this consultation. Because of the varied nature of the non-PLL fisheries, impacts occur to a broader cross-section of sea turtle species and age classes. The 2020 Opinion concluded that the proposed action is likely to adversely affect but is not likely to jeopardize the continued existence of all of the listed sea turtle species in the Gulf of Mexico (i.e., green North Atlantic and South Atlantic DPS, hawksbill, Kemp's ridley, leatherback, and loggerhead NWA DPS).

Gulf of Mexico Reef Fish Fishery
The Gulf of Mexico reef fish fishery uses 2 basic types of gear: spear or powerhead, and hook-and-line gear. Hook-and-line gear used in the fishery includes both commercial bottom longline and commercial and recreational vertical line (e.g., handline, bandit gear, rod-and-reel).

Prior to 2008, the reef fish fishery was believed to have relatively moderate levels of sea turtle bycatch attributed to the hook-and-line component of the fishery (i.e., approximately 107 captures and 41 mortalities annually, among green, hawksbill, loggerhead, Kemp’s ridley and leatherback sea turtles combined, for the entire fishery) (NMFS 2005a). In 2008, SEFSC observer programs and subsequent analyses indicated that the overall amount of incidental take for ESA-listed sea turtles specified in the ITS of the 2005 Opinion on the reef fish fishery had been severely exceeded by the bottom longline component of the fishery: approximately 974 captures and at least 325 mortalities were estimated for the one-year period from July 2006-2007 for all of the above-listed sea turtle species combined.

In response, NMFS published an Emergency Rule essentially closing the bottom longline sector of the reef fish fishery in the eastern Gulf of Mexico for 6 months pending the implementation of a long-term management strategy. The Gulf of Mexico Fishery Management Council developed a long-term management strategy via a new amendment (Amendment 31 to the Reef Fish FMP). The amendment included: (1) a prohibition on the use of bottom longline gear in the Gulf of Mexico reef fish fishery, shoreward of a line approximating the 35-fathom contour east of Cape San Blas, Florida, from June through August and; (2) a reduction in the number of bottom longline vessels operating in the fishery via an endorsement program and a restriction on the total number of hooks that may be possessed onboard each Gulf of Mexico reef fish bottom longline vessel to 1,000, only 750 of which may be rigged for fishing.

On October 13, 2009, NMFS Southeast Regional Office (SERO) completed an Opinion that analyzed the expected effects of the continued operation of the Gulf of Mexico reef fish fishery under the changes proposed in Amendment 31 (NMFS-SEFSC 2009). The Opinion concluded that ESA-listed sea turtle takes would be substantially reduced compared to the fishery as it was previously prosecuted, and that operation of the fishery would not jeopardize the continued existence of green, hawksbill, loggerhead, Kemp's ridley or leatherback sea turtles. Amendment 31 was implemented on May 26, 2010. In August 2011, consultation was reinitiated to address the DWH oil spill event and potential changes to the environmental baseline. Reinitiation of consultation was not related to any material change in the fishery itself. The resulting September 30, 2011, Opinion concluded the operation of the Gulf of Mexico reef fish fishery is not likely to jeopardize the continued existence of green, hawksbill, Kemp's ridley, leatherback, or the Northwest Atlantic DPS of loggerhead sea turtles (NMFS 2011).

In 2018, ESA Section 7 consultation was reinitiated for this fishery to address new and updated listings for green sea turtles (listing 8 new green sea turtle DPSs as threatened and 3 new green sea turtle DPSs as endangered; the North Atlantic and South Atlantic DPSs were the only two affected by this fishery), Nassau grouper, oceanic whitetip shark, and giant manta ray. This consultation is still under way at this time.

Southeastern Shrimp Trawl Fisheries

NMFS has prepared opinions on the Gulf of Mexico shrimp trawling numerous times over the years (most recently 2014). The consultation history is closely tied to the lengthy regulatory history governing the use of TEDs and a series of regulations aimed at reducing potential for incidental mortality of ESA-listed sea turtles in commercial shrimp trawl fisheries. The level of annual mortality described by the National Research Council (NRC 1990) is believed to have continued until 1992-1994, when U.S. law required all shrimp trawlers in the Atlantic and Gulf of Mexico to use TEDs, allowing at least some sea turtles to escape nets before drowning (NMFS 2002).[7] These regulations have been refined over the years to ensure that TED effectiveness is maximized through proper placement and installation, configuration (e.g., width of bar spacing), flotation, and more widespread use.

[7] TEDs were mandatory on all shrimping vessels. However, certain shrimpers (e.g., fishers using skimmer trawls or targeting bait shrimp) could operate without TEDs if they agreed to follow specific tow-time restrictions.

Despite the apparent success of TEDs for some species of sea turtles (e.g., Kemp's ridleys), it was later discovered that TEDs were not adequately protecting all species and size classes of sea turtles. Analyses by Epperly and Teas (2002) indicated that the minimum requirements for the escape opening dimension in TEDs in use at that time were too small for some sea turtles and that as many as 47% of the loggerheads stranding annually along the Atlantic and Gulf of Mexico were too large to fit the existing openings. On December 2, 2002, NMFS completed a consultation on shrimp trawling in the southeastern United States (NMFS 2002) regarding proposed revisions to the TED regulations requiring larger escape openings (68 FR 8456 2003), February 21, 2003). This Opinion determined that the shrimp trawl fishery under the revised TED regulations would not jeopardize the continued existence of green, hawksbill, loggerhead, Kemp's ridley or leatherback sea turtles. The determination was based in part on the Opinion's analysis that shows the revised TED regulations were expected to reduce shrimp trawl related mortality by 94% for loggerheads and 97% for leatherbacks. In February 2003, NMFS implemented the revisions to the TED regulations.

On May 9, 2012, NMFS completed a Biological Opinion that analyzed the continued implementation of the sea turtle conservation regulations and the continued authorization of the Southeast U.S. shrimp fisheries in federal waters under the Magnuson-Stevens Act (NMFS 2012e). The Opinion also considered a proposed amendment to the sea turtle conservation regulations to withdraw the alternative tow-time restriction at 50 CFR 223.206(d)(2)(ii)(A)(3) for skimmer trawls, pusher-head trawls, and wing nets (butterfly trawls) and instead require all of those vessels to use TEDs. The Opinion concluded that the proposed action was not likely to jeopardize the continued existence of any ESA-listed sea turtle species. An ITS was provided that used anticipated trawl effort and fleet TED compliance (i.e., compliance resulting in overall average sea turtle catch rates in the shrimp otter trawl fleet at or below 12%) as surrogates for sea turtle takes. On November 21, 2012, NMFS determined that a Final Rule requiring TEDs in skimmer trawls, pusher-head trawls, and wing nets was not warranted and withdrew the proposal. The decision to not implement the Final Rule created a change to the proposed action analyzed in the 2012 Opinion and triggered the need to reinitiate consultation. Consequently, NMFS reinitiated consultation on November 26, 2012. Consultation was completed in April 2014; it determined the continued implementation of the sea turtle conservation regulations and the operation of the Southeast U.S. shrimp fisheries in federal waters under the Magnuson-Stevens Act was not likely jeopardize the continued existence of any ESA-listed sea turtle species. The ITS maintained the use of anticipated trawl effort and fleet TED compliance as surrogates for numerical sea turtle takes.

In 2016, ESA Section 7 consultation was reinitiated for this fishery to address new/updated listings for green sea turtles (listing 8 new green sea turtle DPSs as threatened and 3 new green sea turtle DPSs as endangered; the North Atlantic and South Atlantic DPS' were the only two affected by this fishery) and Nassau grouper. Subsequently, on December 20, 2019, NMFS published a final rule requiring all skimmer trawl vessels 40 ft and greater in length to use TEDs with 3-inch bar spacing or less, beginning on April 1, 2021 (84 FR 70048; correction at 85 FR 59198, September 21, 2020). A challenge to that rule resulted in a remand of the 2014 biological opinion without vacatur of the rule. A new consultation on the shrimp fishery including the new TED requirement is currently underway.

Federal Vessel Operations and Military Activities

Most vessels have the potential to affect sea turtles and sperm whales through collisions and the production of noise. Vessels are the greatest contributors to increases in low-frequency ambient noise in the sea (Andrew et al. 2011). It is predicted that ambient ocean noise will continue to increase at a rate of ½ dB per year (Ross 2005). Sound levels and tones produced are generally related to vessel size and speed. Larger vessels generally emit more sound than smaller vessels, and vessels underway with a full load, or those pushing or towing a load, are noisier than unladen vessels. The use of sonar aboard vessels presents another source of noise which can affect sperm whales. Vessels operating at high speeds have the potential to strike sea turtles or sperm whales with their hulls or propellers. Potential sources of adverse effects from federal vessel operations in the action area include operations of the U.S. Department of Defense (DoD), Bureau of Ocean Energy Management (BOEM), Bureau of Safety and Environmental Enforcement (BSEE), Federal Energy Regulatory Commission (FERC), USCG, NOAA, and USACE.

Military testing and training may also affect sperm whales and sea turtles. The air space over the Gulf of Mexico is used extensively by the DoD for conducting various air-to-air and air-to-surface operations. Nine military warning areas and 5 water test areas are located within the Gulf of Mexico. The central Gulf of Mexico has 5 designated military warning areas that are used for military operations. These areas total approximately 11.3 million ac. Portions of the Eglin Water Test Areas comprise an additional 0.5 million ac in the Central Planning Area. The total 11.8 million ac is about 25% of the area of the Central Planning Area.

Formal consultations on U.S. Navy activities have been completed, including U.S. Navy Atlantic Fleet Sonar Training Activities (January 20, 2011); U.S. Navy active sonar training along the Atlantic Coast and Gulf of Mexico (December 19, 2011); and activities in the Gulf of Mexico Range Complex from November 2010 to November 2015 (March 17, 2011). These Opinions concluded that although there is a potential from some U.S. Navy activities to affect green, hawksbill, Kemp's ridley, leatherback, and the Northwest Atlantic DPS of loggerhead sea turtles and sperm whales, those activities were determined to be not likely to jeopardize the continued existence of any ESA-listed species.

A consultation evaluating the impacts from U.S. Air Force search-and-rescue training operations in the Gulf of Mexico was completed in 1999 (NMFS 1999). NMFS more recently completed 5 consultations on Eglin Air Force Base testing and training activities in the Gulf of Mexico. These consultations concluded that the incidental take of ESA-listed sea turtles is likely to occur and issued incidental take for the following actions: Eglin Gulf Test and Training Range (NMFS 2004b), the Precision Strike Weapons Tests (NMFS 2005b), the Santa Rosa Island Mission Utilization Plan (NMFS 2005c), Naval Explosive Ordnance Disposal School (NMFS 2004a), and Eglin Maritime Strike Operations Tactics Development and Evaluation (NMFS 2013). These consultations determined the training operations would adversely affect green, loggerhead, Kemp's ridley and leatherback sea turtles, but would not jeopardize their continued existence. They further determined that because the activities were to be completed over shelf waters, that they were not likely to adversely affect sperm whales.

Oil and Gas Operations
Oil and gas operations involve a variety of activities that may adversely affect sea turtles and sperm whales in the action area. These activities include vessel traffic, drilling operations, seismic surveys, and oil rig removals.

Oil and Gas Vessel Operations
The most recent Biological Opinion on BOEM lease sales and operations (NMFS 2007b) determined that vessels would adversely affect ESA-listed green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles but not jeopardize their continued existence. Further, the Opinion determined that vessels were not likely to adversely affect sperm whales as the potential for direct strikes or harassment was unlikely to occur. In response to terms and conditions of previous Opinions, and in an effort to minimize the potential for vessel strikes to marine mammals and sea turtles, BOEM and BSEE issued a joint letter on February 7, 2007, titled "Vessel Strike Avoidance and Injured/Dead Protected Species Reporting" to all lessees and operators of Federal oil, gas, and sulphur leases in the Gulf of Mexico outer continental shelf region. The letter included the following list of recommendations to all industry vessel operators:

1. Vessel operators and crews should maintain a vigilant watch for marine mammals and sea turtles and slow down or stop their vessel to avoid striking protected species.
2. When whales are sighted, maintain a distance of 100 yards (91 meters) or greater from the whale. If the whale is believed to be a North Atlantic right whale, you should maintain a minimum distance of 500 yards (457 meters) from the animal (50 CFR 2224.103).
3. When sea turtles or small cetaceans are sighted, attempt to maintain a distance of 50 yards (45 meters) or greater whenever possible.
4. When cetaceans are sighted while a vessel is underway, attempt to remain parallel to the animal's course. Avoid excessive speed or abrupt changes in direction until the cetacean has left the area.
5. Reduce vessel speed to 10 knots or less when mother/calf pairs, pods, or large assemblages of cetaceans are observed near an underway vessel when safety permits. A single cetacean at the surface may indicate the presence of submerged animals in the vicinity of the vessel; therefore, precautionary measures should always be exercised.
6. Whales may surface in unpredictable locations or approach slowly moving vessels. When you sight animals in the vessel's path or in close proximity to a moving vessel, reduce speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area.

The letter also included a mandatory requirement that "Vessel crews must report sightings of any injured or dead protected species (marine mammals and sea turtles) immediately… to the NOAA Fisheries Stranding Hotline". Industry-related vessel traffic is a part of the current environmental baseline in the Gulf of Mexico and is expected to continue over the foreseeable future.

Lease Sales and Drilling Operations
The sale of leases in the Gulf of Mexico and the resulting exploration and development of these leases for oil and natural gas resources is another activity affecting the status of ESA-listed species in the action area. As technology has advanced over the past several decades, oil

exploration and development has moved further offshore into deeper waters of the Gulf. The development of wells often involves additional activities such as the installation of platforms, pipelines, and other infrastructure. Once operational, a platform will generate a variety of wastes including a variety of effluents and emissions. Additionally, although the release of oil is prohibited, accidental oil spills can occur from loss of well control and thus adversely affect sea turtles and sperm whales in the Gulf of Mexico. The most recent Biological Opinion on BOEM lease sales and operations (NMFS 2007b) considered the effects resulting from the variety of actions associated lease sales and development. This Opinion determined that some activities may adversely affect ESA-listed green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles and sperm whales, but that these adverse effects are not likely to jeopardize the continued existences of these species.

Seismic Surveys
Seismic exploration is an integral part of oil and gas discovery, development, and production in the Gulf of Mexico. Seismic surveys are routinely conducted in virtually all water depths, including the deep habitat of the sperm whales. NMFS considered the effects of seismic operations in the most recent Biological Opinion on BOEM lease sales and operations (NMFS 2020). This Opinion concluded that seismic surveys, with BOEM-required mitigation, were likely to adversely affect sperm whales through harassment of individuals or groups of whales, but were not expected to result in actual loss (mortality) of sperm whales. Required mitigations can be found in the BOEM and BSEE Joint Notice to Leases 2012-G-02 "Implementation of Seismic Survey Mitigation Measures and Protected Species Observer Program."

The Opinion considered an analysis conducted by Farmer et al. (2018), which evaluated behavioral disturbance in sperm whales resulting from exposure to noise levels associated with oil and gas seismic surveys. Bioenergetic models were used to estimate the resulting depletion of reserves in blubber, muscle, and viscera in exposed sperm whales. All simulations suggested significant reductions in relative fitness of reproductive females and estimated that up to 4.4 ± 0.3% of the stock may reach terminal starvation due to behavioral disturbance associated with future seismic surveys, leading to abortions, calf abandonment, and up to 25% greater stock declines beyond those predicted from DWH oil exposure. The authors emphasized the uncertainty in these modeled results and highlighted the need for field verification of these modeled impacts.

Oil Rig Removals
Both the USACE and BSEE permit the removal of oil rigs in the Gulf of Mexico. These removals often use explosives to sever associated pile structures, which can impact ESA-listed species in the action areas. The USACE oversees rig removals in state waters while BSEE permits those platform removals in federal waters.

The USACE consults with NMFS on a project-by-project basis for decommissioning activities that use explosives. A recent informal ESA consultation for a USACE-permitted removal activity in state waters recognized that explosives could impact ESA-listed sea turtles, but determined that the risk was "*discountable*" due to the species' mobility, harm avoidance measures, and placement of the explosives below the mudline.

In regard to rig removals in federal waters, a formal ESA Section 7 consultation was completed with BSEE in 2006, and amended in 2008, which covered their entire permitting program in Gulf federal waters. This Opinion found that the permitting of structure removals in the Gulf of Mexico would not jeopardize the continued existence of sperm whales and loggerhead, Kemp's ridley, green, hawksbill, or leatherback sea turtles. Incidental take, by injury or mortality, of 3 sea turtles per year or 18 sea turtles during the 6-year period of the Opinion was anticipated during detonations. Most of these were predicted to be loggerhead sea turtles. Incidental take, by harassment, of 2 sperm whales per year was also anticipated. The likelihood of injury of sperm whales was deemed to be low and wounding or killing was not expected. BOEM has also issued "Decommissioning Guidance for Wells and Platforms" to inform lessees about mitigation and reporting requirements.

DWH Oil Spill

The investigation conducted under the National Resource Damage Assessment regulations under the Oil Pollution Act (33 U.S.C. 2701 *et seq.*) assessed natural resource damages stemming from the DWH oil spill. Specific impacts to sperm whales; Kemp's ridley, green, loggerhead, and hawksbill sea turtles; and habitats of these species were determined (DWH Trustees 2016).

Sperm Whales and DWH

While there is little specific data on the direct impacts incurred by sperm whales from the DWH oil spill, the likely effects to sperm whales can be inferred from the well documented impacts observed in bottlenose dolphins resulting from their exposure to DWH oil. It is highly likely that many of the documented effects to bottlenose dolphins also occurred in the sperm whale population as the spill occurred in deep water sperm whale habitat, and the same routes of internal oil exposure (ingestion, inhalation, and aspiration) would have occurred in sperm whales as were documented to adversely affect coastal bottlenose dolphins. The effects to sperm whales from DWH oil exposure likely included physical and toxicological damage to organ systems and tissues, reproductive failure, and death. Sperm whales suffered from multiple routes of exposure at the same time, over intermittent timeframes and at varying rates, doses, and chemical compositions of oil.

A study of the causes of an unusual mortality event of bottlenose dolphins occurring from 2010-2014 in Louisiana, Mississippi, and Alabama found that these dolphins had a high prevalence of lung disease and were 5 times more likely to have moderate to severe lung disease compared to a population unaffected by the DWH oil spill (Schwacke et al. 2014). Dead animals had a significantly higher prevalence of adrenal gland disease (thin adrenal gland cortices) and lung disease (primary bacterial pneumonia) compared to an unaffected population (Venn-Watson et al. 2015). The rare, life-threatening, and chronic adrenal gland and lung diseases identified in the stranded animals were consistent with exposure to petroleum compounds as seen in other mammals such as mink (Mazet et al. 2001; Schwartz et al. 2004).

A large increase in the number of dead perinatal (recently born) dolphins occurred following the spill (Schwacke et al. 2014). Compared to unaffected populations, perinatal dolphins affected by DWH were significantly more likely to have died in utero or soon after birth, have fetal distress, and have pneumonia (Colgrove et al 2015). A multi-year study of animals in Barataria Bay, Louisiana showed calving success in only 2 of 10 pregnant females. This rate of calf loss is 63%

greater than the baseline for lost calves in a population unaffected by DWH oil in Sarasota Bay, Florida (Schwacke et al. 2014). The largest number of dolphin deaths occurred in Barataria Bay, Louisiana, the area with the greatest amount of oiling from DWH. The presence of increased coastal PAH levels in Barataria Bay lasted for 2 years following DWH (Allan et al. 2012), which coincided with the longest lasting cluster of dolphin strandings in Barataria Bay through the end of 2011.

Applying the effects from bottle dolphins to sperm whales, NOAA (2015) determined that 16% of the Gulf of Mexico population or about 262 whales were exposed to DWH oil. Approximately 35% of those whales (or approximately 92 whales) were likely killed. In total, 7% of the Gulf of Mexico sperm whale population is thought to have been killed. The initial exposure likely resulted in whale deaths later in time due to adrenal and lung disease as was observed in bottlenose dolphins. In addition to the sperm whale deaths, 46% of exposed females that survived are expected to have suffered reproductive failure through aborted fetuses or early calf death. An estimated 37% of all exposed whales, including pregnant females, likely suffered adverse health consequences as a result of DWH oil exposure.

In an assessment of the long-term reproductive effects that DWH is having on the Gulf of Mexico sperm whale population, NOAA (2015) completed population modeling based on the mortalities associated with adverse health consequences of oil exposure and the reduced reproductive success in pregnant females due to DWH that are discussed above. It is likely the number of females and calves in the population has been reduced. Considering these effects at the population level in the Gulf of Mexico, DWH oil exposure resulted in a maximum population reduction of 7% (about 115 animals) requiring 21 years to recovery to the pre-spill population size. The effects of the 21-year recovery period are slowing the recovery of sperm whale in the Gulf of Mexico. At a more subtle, but still crucial, level, the summed negative effects of the *DWH* oil spill on the Gulf of Mexico ecosystem across resources, up and down the food web, and among habitats, will continue to impact sperm whales due to their long life and strong dependence on a healthy ecosystem (Bossart 2011; Moore 2008; Reddy et al. 2001; Ross 2000; Wells et al. 2004).

A second recent NOAA analysis conducted by Farmer et al (2018) estimated the long-term effects of exposure to the DWH oil spill would result in a 26% reduction in the Gulf of Mexico sperm whale population by 2025, as compared to an estimated baseline population (without effects from DWH). The effects of exposure to the DWH spill on sperm whales in this analysis was also based upon the Schwacke et al. (2014) analyses of the responses of bottlenose dolphin populations to the DWH oil. Farmer et al. (2018) estimated a 12% decrease in annual survival rate in Gulf of Mexico sperm whales resulting from exposure to the spill from 2011–2014, followed by a steady decrease in this reduced survivorship rate over an additional 10-year period (2015–2025).

Sea Turtles and DWH

The DWH oil spill extensively oiled vital foraging, migratory, and breeding habitats of sea turtles throughout the northern Gulf of Mexico. *Sargassum* habitats, benthic foraging habitats, surface and water column waters, and sea turtle nesting beaches were all affected by DWH. A large portion of the impacted habitats have since been designated as critical habitat for the

Northwest Atlantic DPS of loggerhead sea turtles. Sea turtles were exposed to DWH oil in contaminated habitats; breathing oil droplets, oil vapors, and smoke; ingesting oil-contaminated water and prey; and by maternal transfer of oil compounds to developing embryos.

High numbers of sea turtles are estimated to have been exposed to oil resulting from the DWH spill due to the duration and large footprint of the spill. It was estimated that as many as 7,550 large juvenile and adult sea turtles (Kemp's ridleys, loggerheads, and unidentified hardshelled sea turtles), and up to 158,875 small juvenile sea turtles (Kemp's ridleys, green turtles, loggerheads, hawksbills, and hardshelled sea turtles not identified to species) were killed by the DWH oil spill (Tables 5 & 6). Small juveniles were affected in the greatest numbers and suffered a higher mortality rate than large sea turtles.

Table 4. Oceanic Small Juvenile Sea Turtles Exposed and Killed by the DWH Oil Spill (DWH Trustees 2016)

Species	Total Exposed	Heavily Oiled, Dead	Non-heavily Oiled, Dead	Total Dead
Kemp's ridley	206,000	35,500	51,000	86,500
Green	148,000	15,300	39,800	55,100
Loggerhead	29,800	2,070	8,310	10,380
Hawksbill	8,560	595	2,390	2,985
Unidentified	9,960	1,310	2,600	3,910
Total	402,320	54,775	104,100	158,875

Table 5. Large Juveniles and Adult Sea Turtles Exposed and Killed by the DWH Oil Spill (DWH Trustees 2016)

Species	Total Exposed	Heavily Oiled, Dead	Non-heavily Oiled, Dead	Total Dead
Kemp's ridley age 4+	21,000	1,700	950	2,650
Kemp's ridley age 3	990	380	30	410
Kemp's, all	21,990	2,080	980	3,060
Loggerhead	30,000	2,200	1,400	3,600
Unidentified	5,900	630	260	890
Total	57,890	4,910	2,640	7,550

Population Effects of DWH on Sea Turtles

Kemp's ridley sea turtles were the most affected sea turtle species, as they accounted for approximately half of all exposed turtles during DWH ([206,000+21,990]/[402,320+57,890] = 49.5%; Tables 5 & 6). Due to their limited range and small population size, Kemp's ridley sea turtles were the turtle species most impacted by the DWH event at a population level. The total population abundance of Kemp's ridleys could be calculated based on numbers of hatchlings because all individuals are reasonably expected to inhabit the northern Gulf of Mexico throughout their lives. The DWH Trustees conducted a detailed analysis in the DWH PDARP which concluded the number of unrealized Kemp's ridley nests resulting from the DWH incident was between 1,300 and 2,000, which translates to approximately 65,000 and 95,000 unrealized hatchlings (DWH Trustees 2016). However, this is a minimum estimate of the overall potential DWH effect because the sub-lethal effects of DWH oil on turtles, their prey, and their habitats likely resulted in delayed effects that would have reduced reproduction in subsequent years, contributing to additional nesting deficits observed following DWH.

Loggerheads made up 13% (59,800 animals) of the total sea turtle exposures (460,210). An estimated 14,000 loggerhead sea turtles died as a result of exposure to DWH oil (Tables 5 & 6). It is likely that impacts to the NGMRU of the NWA loggerhead DPS would be proportionally much greater than the impacts occurring to other recovery units that nest on the Atlantic coast. Impacts to nesting (as described above) and oiling effects on a large proportion of the NGMRU recovery unit, especially mating and nesting adults likely had an impact on the NGMRU. Although the long-term effects remain unknown, the DWH impacts to the NGMRU may result in some nesting declines in the future due to a large reduction of oceanic age classes during DWH. However, the NGMRU makes up only approximately 1.3% of the total nesting effort within the NWA DPS (NMFS and USFWS 2008) and the larger recovery units have generally shown increasing nesting populations since the 2010 spill (Figure 7 and Table 3). It is therefore reasonable to assume that these estimated impacts from the DWH spill on this relatively small recovery unit will not have a major impact on the overall population and recovery of the entire NWA DPS.

Green sea turtles made up at least 36.8% (148,000) of all oceanic small juvenile sea turtles exposed to DWH oil (no large juvenile or adult green sea turtles were identified, though some may have been included in the unidentified category). This includes 55,100 mortalities out of the 148,000 exposed green sea turtles (Table 5). While green turtles regularly use the northern Gulf of Mexico, they have a widespread distribution throughout the entire Gulf of Mexico, Caribbean, and Atlantic. As described in the Status of the Species Section, nesting is relatively rare on northern Gulf of Mexico beaches. Although it is known that adverse impacts occurred and numbers of animals in the Gulf of Mexico were reduced as a result of DWH, the relative proportion of the population exposed to and directly impacted by the DWH event was small, and thus a population-level impact is not likely.

The DWH PDARP analysis indicates hawksbill and leatherback sea turtles were least affected by the oil spill (DWH Trustees 2016). Hawksbills made up 2.1% (8,560) of all oceanic small juvenile sea turtle exposures (no large juvenile or adult hawksbill sea turtles were identified, though some may have been included in the unidentified category). This includes 2,985 mortalities out of the 8,560 exposed hawksbill sea turtles (Table 5). Although leatherbacks were documented in the spill area, the number of affected leatherbacks was not estimated due to a lack of information for leatherbacks compared to other species. Possible DWH-related impacts to leatherback sea turtles include direct oiling, inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil, and loss of foraging resources which could lead to compromised growth and reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred. Although adverse impacts occurred to leatherbacks and hawksbills, the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event is relatively low, and thus a population-level impact is not believed to have occurred due to the widespread distribution and nesting locations outside of the action area for both of these species.

Dredging

Coastal navigation channels are often dredged to support commercial shipping and recreational boating. Dredging activities can pose significant impacts to aquatic ecosystems by: (1) direct removal/burial of organisms; (2) turbidity/siltation effects; (3) contaminant re-suspension; (4) noise/disturbance; (5) alterations to hydrodynamic regime and physical habitat; and (6) loss of riparian habitat (Chytalo 1996; Winger et al. 2000).

Marine dredging vessels are common within U.S. coastal waters. Although the underwater noises from dredge vessels are typically continuous in duration (for periods of days or weeks at a time) and strongest at low frequencies, they are not believed to cause long-term effects on sea turtles or sperm whales (ACOE and BOEM 2017). However, the construction and maintenance of federal navigation channels and dredging in sand mining sites ("borrow areas") have been identified as sources of sea turtle mortality. Hopper dredges can lethally harm sea turtles by entraining them in dredge drag arms and impeller pumps. Hopper dredges in the dredging mode are capable of moving relatively quickly and can thus overtake, entrain, and kill sea turtles as the suction draghead(s) of the advancing dredge overtakes a resting or swimming turtles (ACOE and BOEM 2017).

To reduce take of listed sea turtle species, relocation trawling may be utilized to capture and move sea turtles. In relocation trawling, a boat equipped with nets precedes the dredge to capture sea turtles and then releases them out of the dredge pathway, thus avoiding lethal take. Relocation trawling has been successful and routinely moves sea turtles in the Gulf of Mexico (ACOE and BOEM 2017).

In 2007, NMFS updated a regional Biological Opinion on hopper dredging in the Gulf of Mexico that includes impacts to sea turtles via maintenance dredging (NMFS 2007a). NMFS determined that (1) Gulf of Mexico hopper dredging would adversely affect 4 sea turtle species (i.e., green, hawksbill, Kemp's ridley, and loggerheads) but would not jeopardize their continued existence, and (2) dredging in the Gulf of Mexico would not adversely affect leatherback sea turtles or ESA-listed large whales.

Numerous other consultations have been completed that analyzed hopper dredging projects that did not fall under the scope of actions contemplated by the regional Opinion. Each of these "free-standing" Opinions had its own ITS and determined that hopper dredging would not jeopardize the continued existence of any ESA-listed species or adversely modify critical habitat of any listed species.

Construction and Operation of Public Fishing Piers

Since the active hurricane seasons of 2004, 2005 and 2017, a number of fishing piers have either been built or rebuilt along the Gulf coast. The USACE permits the building of these structures and in some cases the Federal Emergency Management Administration provides funding. Additionally, the DWH NRDA Trustees have funded the construction/rehabilitation of 10 fishing piers in Florida and Alabama since 2014 to compensate for lost recreational opportunities resulting from the DWH oil spill. Consultations on these actions have found that the fishing activities at these piers is likely to adversely affect certain species of sea turtles, but is not likely to jeopardize their continued existence. Hook and line capture of sea turtles can result in severe injuries which may lead to death.

State and Private Actions

Vessel Traffic

Commercial and recreational vessels can have an adverse effect on marine mammals and sea turtles by direct physical impacts from vessel strikes, or by harassment from engine noise.

State Fisheries

Several coastal state fisheries are known to incidentally take ESA-listed sea turtles, but information on these fisheries is sparse (NMFS 2001a). Various fishing methods used in these commercial and recreational fisheries, including trawling, pot fisheries, gillnets, and vertical line are known to incidentally take sea turtles (NMFS 2001a). The past and current effects of state fisheries on listed species are currently unknown, as most state data are based on extremely low observer coverage or sea turtles were not part of data collection.

In addition to commercial state fisheries, protected sea turtles can also be incidentally captured by hook and line recreational fishers. Sea Turtle Stranding Network data along with scientific observations of state recreational fisheries have shown that sea turtles are known to bite baited hooks or become entangled in active or abandoned fishing gear. Hooked turtles have been reported by the public fishing from boats, piers, beaches, banks, and jetties. A detailed summary of the known impacts of hook-and-line incidental captures to loggerhead sea turtles can be found in the TEWG reports (1998; 2000).

State fisheries are limited to areas from 3 to 9 miles from shore in the Gulf of Mexico and are generally in waters of less than 100 ft deep. Sperm whales do not inhabit these near-shore waters and are therefore not thought to be affected by state fisheries activities.

Oil and Gas Activities

State oil and gas exploration, production, and development are expected to result in similar effects to hawksbill, Kemp’s ridley, leatherback, North Atlantic and South Atlantic DPSs of green, and the Northwest Atlantic DPS of loggerhead sea turtles as described in the analysis of federal activities for oil and gas lease sale provided above, including impacts associated with the construction and removal of offshore structures, seismic exploration, marine debris, oil spills, and vessel operation. As previously noted, sperm whales do not inhabit these near-shore waters and are therefore not likely to be affected by impacts associated with the construction and removal of oil and gas infrastructure or seismic exploration in state waters. However, sperm whales could be affected by marine debris or oil spills originating in state waters if those effects were to spread out to the deep-water habitats inhabited by sperm whales.

4.3 Other Potential Sources of Impacts to the Environmental Baseline

Marine Debris and Pollution

The discharge of debris into the marine environment is a continuing threat to ESA-listed species in the action area, regardless of whether the debris is discharged intentionally or accidentally. A 1991 report (GESAMP, 1991 #9275) indicates that up to 80% of marine debris is land-based in origin with plastic making up the majority of this debris (Derraik 2002). Many of the plastics discharged to the sea can withstand years of saltwater exposure without disintegrating or dissolving. Further, floating materials have been shown to concentrate in ocean gyres and convergence zones where *Sargassum* and consequently juvenile sea turtles are known to occur (Carr 1987).

Marine debris has the potential to impact hawksbill, Kemp's ridley, leatherback, North Atlantic and South Atlantic DPSs of green, and the Northwest Atlantic DPS of loggerhead sea turtles, as well as sperm whales through ingestion or entanglement (Gregory 2009). Both of these effects can result in reduced feeding, reduced reproductive success, and potential injury, infection, or death. Sperm whale ingestion of marine debris is a concern, particularly because their suspected feeding behavior includes cruising along the bottom with their mouths open (Walker and Coe 1990). All sea turtles are susceptible to ingesting marine debris, though leatherbacks show a marked tendency to ingest plastic which they misidentify as jellyfish, a primary food source (Balazs 1985). Ingested debris may block the digestive tract or remain in the stomach for extended periods, thereby reducing the feeding drive, causing ulcerations and injury to the stomach lining, or perhaps even providing a source of toxic chemicals (Laist 1987; Laist 1997). Weakened animals are then more susceptible to predators and disease and are also less fit to migrate, breed, or, in the case of turtles, nest successfully (McCauley and Bjorndal 1999) (Katsanevakis 2008).

Pollution from a variety of sources including atmospheric loading of pollutants such as PCBs, stormwater from coastal or river communities, and discharges from ships and industries may affect sea turtles and sperm whales in the action area. Sources of marine pollution are often difficult to attribute to specific federal, state, local, or private actions.

There are studies on organic contaminants and trace metal accumulation in green, leatherback, and loggerhead sea turtles (Aguirre et al. 1994; Caurant et al. 1999; Corsolini et al. 2000). McKenzie et al. (1999) measured concentrations of chlorobiphenyls and organochlorine pesticides in sea turtles tissues collected from the Mediterranean (Cyprus, Greece) and European Atlantic waters (Scotland) between 1994 and 1996. Omnivorous loggerhead turtles had the highest organochlorine contaminant concentrations in all the tissues sampled, including those from green and leatherback turtles (Storelli et al. 2008). It is thought that dietary preferences were likely to be the main differentiating factor among species. Decreasing lipid contaminant burdens with sea turtle size were observed in green turtles, most likely attributable to a change in diet with age. Sakai et al. (1995) documented the presence of metal residues occurring in loggerhead sea turtle organs and eggs. Storelli et al. (1998) analyzed tissues from 12 loggerhead sea turtles stranded along the Adriatic Sea (Italy) and found that characteristically, mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals, and porpoises (Law et al. 1991). No information on detrimental threshold concentrations is available and little is known about the consequences of exposure of organochlorine compounds to sea turtles. Research is needed on the short- and long-term health and fecundity effects of chlorobiphenyl, organochlorine, and heavy metal accumulation in sea turtles.

Like sea turtles, sperm whales may be adversely affected by marine pollution originating from federal, state, or private activities, though little is known regarding the specific pollutants or the effects pollutants may have on individuals. It is possible that high levels of heavy metals, PCBs, and organochlorines found in prey species accumulate with age and are transferred through nursing. Nevertheless, the accumulation of stable pollutants such as heavy metals, PCBs, chlorinated pesticides [DDT, DDE, etc.], and PAHs) is of concern.

The development of marinas and docks in inshore waters can negatively impact nearshore habitats. Fueling facilities at marinas can discharge oil, gas, and sewage into sensitive estuarine and coastal habitats. Although these contaminant concentrations do not likely affect the more pelagic waters of the action area, the species of turtles analyzed in this biological opinion travel between nearshore and offshore habitats and may be exposed to and accumulate these contaminants during their life cycles.

Acoustic Impacts

Ambient noise in the Gulf of Mexico is approximately 40 dB re 1 μPa above estimated baseline levels prior to industrialization, and it is expected to increase. Contributions to ambient noise levels include vessel engines, sonar, geophysical exploration, and the construction, operation, and decommissioning of structures. Effects on sea turtles and sperm whales from noise exposure may include lethal or nonlethal injury, temporary hearing impairment, and behavioral responses. NOAA is working cooperatively with the ship-building industry to find technologically-based solutions to reduce the amount of noise produced by commercial vessels. Through ESA consultation with NMFS (NMFS 2013), BOEM has implemented Gulf of Mexico-wide measures to reduce the risk of harassment to sperm whales from noise produced by geological and geophysical surveying activities and the explosive removal of offshore structures.

Nutrient Loading and Hypoxia

Nutrient loading from land-based sources, such as coastal communities and agricultural operations stimulate plankton blooms which can result in depleted oxygen levels in the action area. An example is the large area of the Louisiana continental shelf with seasonally depleted oxygen levels (< 2 mg/liter) caused by eutrophication from both point and non-point sources of polution. The oxygen depletion, referred to as hypoxia, generally begins in late spring, reaches a maximum in mid-summer, and dissipates in the fall. Since 1993, the average extent of mid-summer, bottom-water hypoxia in the northern Gulf of Mexico has been approximately 16,000 km^2, approximately twice the average size measured between 1985 and 1992. The hypoxic zone attained a maximum measured extent in 2002, when it was about 22,000 km^2. In 2010, during the DWH spill response activities, the maximum area covered by the hypoxic zone was approximately 20,000 km^2, though much of this zone occurred off of the western Louisiana and Texas coasts, outside of the action area. The hypoxic zone negatively impacts sea turtles and prey availability which in turn can affect survival and reproductive fitness.

4.4 Conservation and Recovery Actions Shaping the Environmental Baseline

NMFS has implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles from commercial fisheries in the action area. These include sea turtle release gear requirements for the Atlantic HMS, South Atlantic snapper-grouper, and Gulf of Mexico reef fish fisheries, and TED requirements for the Southeast shrimp trawl fishery. In addition to regulations, outreach programs have been established and data on sea turtle interactions with recreational fisheries has been collected through the Marine Recreational Fishery Statistical Survey/Marine Recreational Information Program.

NMFS currently has cooperative research and conservation agreements with all 5 states along the Gulf of Mexico. These agreements have helped to establish an extensive network of sea turtle rescue and rehabilitation facilities along the Gulf of Mexico that not only collect data on dead sea turtles, but also rescue and rehabilitate any live stranded sea turtles. These programs have recently been enhanced through funding provided under the BP DWH settlement which will improve the infrastructure and response capabilities of the Sea Turtle Stranding and Salvage Network (STSSN) by funding new personnel, mobile sea turtle rescue units, and other essential equipment. In addition to the STSSN efforts, there are many local organizations such as "Share the Beach" in Alabama that count and monitor sea turtle nests, and protect them from natural predators and human impacts, thereby increasing the survival of hatchlings reaching the ocean.

NMFS published a Final Rule (66 FR 67495), 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 sea turtles caught in fishing or scientific research gear.

5 EFFECTS OF THE ACTION ON 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" (40 CFR 402.02).

Given the massive adverse effects of the oil spill, which overlapped spatially and temporally with the effects of the response activities analyzed in this consultation, it is very difficult to separate out the effects caused directly by the response activities from the larger effects of the oil spill. There is very little available data on the specific effects of the response activities that would allow quantification of the amount and extent of harm that may have been experienced by ESA-listed species resulting from the response activities alone. In order to overcome these issues, the USCG developed a "Take Score Model" (TSM) for their Biological Assessment. This TSM combined available data regarding location, timing and extent of response activities conducted as part of the action, the types of stressors on ESA-listed species expected to result from these response activities, the level of exposure that listed species likely had to these stressors, and the types of responses that listed species most likely experienced as a result of that exposure. While the TSM does not provide quantitative output that could be used to directly measure the amount and extent of take resulting from the completed action, it does provide a qualitative analysis of the relative levels of effects that each species likely experienced from the various response activities.

In the TSM, the marine portion of the action area is divided into 4 different environmental categories: Open Water, oligotrophic; Open Water, Sargassum; Coastal; and Lakes, Bays, and Sounds. Oligotrophic waters are the offshore open waters with low surface productivity. Sargassum areas are offshore areas where converging currents and eddies are likely to congregate floating materials such as Sargassum (vegetative floating mats) as well as neritic juvenile sea turtles which rely on these materials for food and shelter. Coastal waters are seaward of the barrier islands, but within state waters, while Lakes, Bays, and Sounds are further inland and characterized by fluctuating salinities. Each of these areas is then subdivided into latitude/longitude ½ degree blocks (approximately 1,190 sq. miles).

The TSM used data for these area blocks which covered:

- listed species that were likely to be present in the area;
- habitat type of the area and its sensitivity to spill-response activities;
- spill-response activities that occurred in the area;
- timing and duration of the activities; and
- applicable BMPs, and whether deviations from BMPs occurred.

For the listed species present in an area, the TSM applied species-specific factors, including:

- the probability of the species' exposure to the activities implemented in the area;
- the species' relative tolerance to action-caused stressors; and
- impacts to the species' prey in the area, if applicable.

Combining these data for each area where listed species were likely present, the TSM generated a score indicating the severity of individual's responses to the action. For each listed species, the USGC delineated the range of scores that corresponded to:

- behavioral responses (e.g., startle, alarm, avoidance, abandonment, displacement);
- sub-lethal responses (e.g., increased respiration, reduced feeding success, reduced growth rates, delayed age at sexual maturity, depressed autoimmune responses, reduced fecundity); and
- lethal (e.g., reproductive failure or death of any life stage).

While the TSM does not provide actual estimates of the numbers of individuals that may have experienced these different response levels, it does provide a general indication of the severity of effects for each species from each response activity type. For further details about the TSM, please refer to section 6.1 of the USCG BA.

The DWH Natural Resource Damage Assessment Trustees provided a comprehensive analysis of the effects of the DWH oil spill within the DWH PDARP (DWH Trustees 2016). This analysis included an assessment of impacts to ESA-listed species and their habitats caused by response activities, such as increased boat traffic, oil skimming and burning operations, dredging and relocation trawling. However, due to the data limitations and logistical constraints described above, the Trustees were also unable to quantify the amount or extent of impacts resulting directly from these response activities.

In this section, we estimate the likely effects of the response activities identified in Section 2. Unless otherwise cited, we rely upon the USCG BA and on the DWH PDARP as our data sources. We also document NMFS's recommendations to the USCG for minimizing the effects of the emergency response activities on ESA-listed species and the results of the implementation of those recommendations on ESA-listed species.

5.1 NWA DPS of Loggerhead Sea Turtles

The response activities that overlapped the areas where loggerhead sea turtles were present during the activities include:

- Vessel traffic
- Aerial traffic
- Skimming
- Booming
- Dispersants
- In-situ burning
- Berm Construction
- Trawling

Due to the proximity of the DWH spill to the primary nesting areas for loggerhead sea turtles in the northern Gulf of Mexico, it is reasonable to infer that a large percentage of 2010 nesting females in the northern Gulf were exposed to oil and the associated spill response activities. However, among the 1,146 sea turtles found stranded or captured (both dead and alive) during wildlife search and rescue operations from April 26 – October 20, 2010, loggerhead sea turtles accounted only for about 4% of all live turtles recovered, and about 11% of all dead turtles recovered (NMFS 2014). Relative to other sea turtle species in the Gulf, loggerhead populations are much larger, yet recoveries during the DWH oil spill response were much lower.

NMFS wildlife operations conducted sea turtle overflights between April 28 and August 25, 2010, and NOAA sea turtle observations were made from surface vessels between April 26 and October 18, 2010 (ERMA 2015). In total 134 loggerhead sea turtles were observed alive in the water: 25 from the NMFS overflights (17 of which were observed in oil) and 109 from surface vessels (of which, 8 were captured and released, and 10 others were taken to rehab facilities). There were also 48 loggerheads observed dead on the shoreline.

In addition, a total of 249 live and 48 dead unidentified sea turtles were also observed from the overflights and surface vessels. Table 7 shows the total number of each species of turtle that were observed both alive and dead, and the percent of the total numbers observed that each species made up. Assuming the same ratio of identified turtle types for the unidentified turtles, another 24 live and 5 dead loggerhead may have been observed (9.5% of identified live and 10.4% of identified dead sea turtles were loggerheads; 9.5% of 249 = 24 and 10.4% of 48 = 5).

Table 6. Numbers and Percentages of Each Species of Sea Turtle Observed During Wildlife Monitoring Efforts (DWH Trustees 2016)

Sea Turtle	Observed Alive	Percent Of Total Observed Alive	Observed Dead	Percent Of Total Observed Dead
Loggerhead	134	9.5%	48	10.4%
Green	459	32.7%	21	4.6%
Kemp's Ridley	759	54.1%	390	84.8%
Hawksbill	29	2.1%	1	0.2%
Leatherback	23	1.6%	0	0%
Total	**1,404**	**100%**	**460**	**100%**

The USCG BA did not estimate specific numbers of loggerheads affected by the spill response activities corresponding to the TSM results. The TSM results indicate that the vast majority of effects on loggerheads were in the behavioral range (startle, disturbance, displacement, etc.), and that the effects of these behavioral responses were insignificant for most individuals. However, due to the high intensity, extended duration, and large spatial extent of several of the response activities, it is likely that for some individuals, these behavioral responses eventually reached a level that caused adverse effects by significantly impairing their essential behavioral patterns, such as breeding, feeding, or resting. The TSM results also indicate that some activities (e.g. vessel traffic, burning and trawling) were likely to have resulted in direct injury (non-lethal) and lethal take of loggerhead sea turtles. A more detailed analysis of the likely effects of each category of response activity is provided below. Through that analysis we determined that vessel traffic, skimming, burning, berm construction, and trawling were likely to have adversely affected loggerhead sea turtles.

Vessel Traffic
Heavy vessel traffic over the course of the response action accounts for the vast majority of response activities that were likely to overlap with loggerhead sea turtle presence. The USCG BA concludes that stressors related to vessel traffic resulted in extensive behavioral responses from loggerheads, such as startle, alarm, and avoidance of heavy traffic areas. We also believe that for some individuals, these behavioral responses caused adverse effects by significantly impairing their essential behavioral patterns, namely breeding, feeding, and resting. Due to the extremely large area of high vessel activity (Figure 2) and the large number of vessels involved with the response (approximately 10,000 vessels) some turtles would have been unable to escape the high-traffic effects, resulting in frequent, repeated avoidance behaviors (fast swimming and diving) leading to exhaustion and abandonment of the essential behaviors listed above. Additionally, it was estimated that hundreds of turtles (species unspecified) were killed by

collisions with response vessels based on those that were found stranded with clear evidence of vessel collision injuries during the response activities (Stacy 2015). We therefore conclude that loggerhead sea turtles experienced a broad spectrum of effects from the extensive vessel traffic related to response activities. These effects ranged from insignificant behavioral responses such as short-term startling, to more extensive behavioral responses resulting in adverse effects through impairment of essential behavioral patterns, to direct mortality from vessel strikes.

Aerial Traffic

Aerial traffic may also have affected loggerhead sea turtles at the surface by eliciting a startle response due to noise and the physical presence of the aircraft overhead (NMFS 2010). There was a significant increase in the amount of air traffic over the Gulf of Mexico during the DWH response. Much of this traffic was maintained at altitudes above 3,000 feet, (FAA 2010) which is 4 to 6 times higher than the altitude of flights that have been found to have insignificant effects on sea turtles (NMFS 2010). However, flights associated with dispersant applications and wildlife observations frequently dropped to altitudes of 1500 feet or lower, with the lowest flights at 50-75 feet (FAA 2010; Gass et. al. 2011). Responses to low flying aircraft likely included alarm or short-term avoidance behaviors, such as diving or rapid changes in swimming speed or direction. The greatest such responses likely occurred when aircraft were hovering or circling an area (NMFS 2010). Loggerhead sea turtles may have temporarily avoided some of these high-traffic, low-altitude activity areas and been temporarily unable to use these areas for forage and shelter habitat. However, we believe any potential effects would have been insignificant because the activities occurred for short periods of time (less than 3 hours) over discrete areas of open-water surrounded by large expanses of similar habitats that would allow affected individuals to continue breeding, foraging and resting throughout the surrounding area.

Skimming

Skimming took place in regions where there was thick oil coverage from the end of April until the beginning of August, 2010, in open water locations surrounding the well site, at the entrances to Breton Sound and Mississippi Sound, and to the west of the mouth of the Mississippi River, including regions containing *Sargassum.* These are all regions where loggerhead sea turtles were likely to be present during that time period. Conservation measures implemented to help reduce impacts on sea turtles included the placement of marine observers on oil skimming vessels and requiring the use of TEDs and limited tow-times on trawl nets used to skim oil. The “Big Gulp” skimmer in particular was identified by NMFS as having the potential to cause lethal take of sea turtles, especially with the in-take of *Sargassum* mats. Following this determination, the use of this vessel was limited to oil skimming only (no skimming of *Sargassum*).

There were no documented incidents of turtle mortalities resulting from skimming activities and no estimates of potential mortalities were included in either the DWH PDARP or the USCG BA. The TSM provides qualitative results indicating that the primary responses to skimming from loggerheads were likely insignificant behavioral responses (e.g. startle and avoidance behaviors) that did not impair essential behavioral patterns, such as breeding, feeding, or resting. These behavioral effects were insignificant due to the limited areas affected and limited time periods that any specific areas was skimmed. This allowed turtles to vacate affected areas to pursue their essential behaviors in similar surrounding habitats, and return to the skimmed areas after the activities ceased. However, NMFS believes that skimming operations caused adverse effects to loggerhead sea turtles, as mortalities of juvenile loggerheads likely occurred during the early stages of the response action when the “Big Gulp” skimmer was used in skimming of oiled *Sargassum* mats where juvenile loggerhead sea turtles are known to congregate. It is also probable that any turtles that may have been taken in the skimming operations would have died anyway from exposure to the thick oil deposits that were being skimmed.

Booming

Millions of feet of boom were deployed as part of the spill response. The use of boom to contain spilled oil can pose a risk to turtles depending on the timing and location of their deployment (Shigenaka et al. 2003). While protecting sensitive areas from the oil, boom may have impeded sea turtles from entering and exiting foraging and nesting sites. Given the floating design of most boom types used in nearshore habitats, sea turtles were likely able to pass underneath boom without significant impedance. As an added precaution, boom used onshore was required to be removed each night to avoid becoming a potential barrier for nesting/hatchling sea turtles. Furthermore, BMPs were in place to ensure that booms were checked frequently and if a sea turtle was observed trapped or entangled in a boom, that the boom would be opened to allow the animal to leave on its own. There were no documented observations of sea turtles in the marine environment impacted by blockage or entanglement in boom during the response activities. We believe any effects of boom placement on loggerhead sea turtles would have been insignificant, as boom was placed in a manner that would not have impeded essential behavioral patterns, such as breeding, feeding, or resting. Individuals may have temporarily avoided work areas while boom was being placed or removed, but could have continued their essential behaviors in the surrounding areas with similar habitat features, and could have returned and moved freely throughout the boomed areas as soon as the placement or removal activities were completed.

Dispersants

There is limited data available regarding the impact of dispersants or dispersed oil on sea turtles. The application of dispersants to an oil slick is intended to benefit surface oriented species such as sea turtles by reducing the amount of oil on the surface that could stick to them or irritate sensitive membranes such as their eyes, reducing the likelihood of oil being ingested by turtles, and reducing oil fumes that may be inhaled by them. Recent information generated for the Natural Resource Damage Assessment (NRDA) process for the DWH oil spill clearly shows oiled turtles absorbed PAHs from oil via ingestion and inhalation based on gastrointestinal and lung data (Ylitalo *et al.*, 2017). Ylitano *et al.* (2017) examined 492 sea turtles during and following the DWH spill response, but found limited evidence of exposure to, or absorption of, dispersants. Dioctyl sodium sulfosuccinate (DOSS; a persistent component of the dispersants used during the DWH response) levels in these turtles were below quantification except in the oil found in the esophagus of one heavily oiled Kemp’s ridley sea turtle. This indicates that dispersants were either not used in the vicinity of these oiled turtles before they died, or that the dispersant or dispersed oil was not bioavailable or bioaccumulated by the turtles. This latter hypothesis is in agreement with the research of Wolfe *et al.* (2001, 1999, 1998) which found negligible trophic transfer of petroleum hydrocarbons from invertebrates to vertebrates and that absorption of petroleum hydrocarbons from both vertebrates and invertebrates decreased when dispersant was used. This is likely due to the dispersed oil molecules being fully encapsulated within the dispersant molecules and not bioavailable.

Dispersants do not reduce the amount of oil in a spill, but reduce the mass of oil at the surface of the water by forcing the oil into smaller droplets that can be suspended in the water column. Monitoring during the DWH response showed a maximum total petroleum hydrocarbon concentration of 2 ppm at 1m depth approximately 30 minutes after chemical dispersion of a weathered oil slick at the surface (Bejarano *et. al.*, 2013) and BenKinney *et. al.* (2011) noted that dispersed oil concentrations at 10m depth were consistent with background concentrations throughout monitoring of aerial dispersant applications during the DWH response.

The National Research Council (NRC 1989) concluded that the acute lethality of dispersed oil is primarily associated with the dissolved oil constituents, and very little with the dispersant itself. The NRC (2005) presented data from many studies to further illustrate that COREXIT 9500 and 9527 are significantly less toxic to multiple species compared to oil and dispersed oil. The Environmental Protection Agency (EPA 2010a, Hemmer *et. al.*, 2011) tested several dispersant formulations during the DWH oil spill response due to the concerns of the public about the volume of COREXIT dispersants being applied. The EPA reconfirmed that COREXIT 9500 alone was much less toxic than the test oil (Louisiana sweet crude) and the dispersed oil.

The NRC (2005) further concluded that there was no compelling evidence that chemically dispersed oil is any more toxic than physically dispersed oil. Some studies indicate that the encapsulation of hydrocarbon molecules in a dispersant micelle reduces the toxicity of the oil by making the hydrocarbon generally incapable of diffusing across cell membranes, greatly reducing its bioavailability (Tjeerdema *et. al.*, 2010, Fuller *et. al.* 2004, Lin *et. al.,* 2009).

Dispersants significantly mitigate the toxic effects of oil exposure to water column resources by reducing the duration and concentration of exposure through increased, rapid dilution (NMFS 2015, NRC 2005, 2003, 1998, USCG and EPA 2015, 2014, Bejarano *et al.,* 2014b). When dispersants are applied to surface oil the concentrations of toxins to which an organism may be exposed in the water column rapidly dilutes within minutes to hours (≤ 4 hours) to low (≤ 1 ppm) or background levels (Bejarano *et. al.*, 2014b, NRC 2005, 1998, BenKinney *et. al.*, 2011). Clark *et. al.*, (2001) found that spiked, short-term exposure conditions (as would be experienced by organisms swimming through areas where surface oil has been dispersed) were up to 36 times less toxic than constant exposure conditions for COREXIT 9500 and 9527 when tested with 3 types of oil on 5 different species.

Another important benefit of dispersant use is to prevent movement of the oil into nearshore and shoreline areas where removal is more difficult and impacts to nesting/hatchling sea turtles is potentially severe. Dispersion of oil at sea can reduce the chronic impacts of oil on sensitive inshore habitats, and habitat conditions recover faster if the oil is dispersed before it reaches shore (NRC 1989; Boyd, et al. 2001). Given that dispersant applications occurred during the loggerhead nesting season, the concentration of loggerheads would have been heavier in the shallower nearshore areas, creating, on balance, a larger benefit to the loggerhead population of reduced oil exposure to the shoreline and coastal regions.

Wildlife monitors were required to survey for sea turtles prior to any dispersant application and these monitors coordinated with the aerial dispersants teams to advise them on exclusion zones when sea turtles were observed near the point of planned dispersant applications (Houma 2010).

Though this conservation measure was implemented, it would not have prevented animals from entering an area once dispersants had been applied and it is possible that some turtles could have been missed by the monitors.

While the turtle observation and monitoring data shows that many loggerhead sea turtles were present in areas where they were likely to have been exposed to dispersants and dispersed oil, we do not believe that this exposure resulted in measurable effects to these turtles. Both direct monitoring of sea turtles and water chemistry during DWH dispersant applications, as well as many laboratory experiments conducted before and since the spill, have found that these turtles did not absorb harmful levels of dispersants and did not display any adverse effects from their exposure to the dispersants. On the other hand, many studies have shown the benefits of dispersant application in preventing toxic impacts of oil exposure to surface breathing species, especially in nearshore and shoreline (nesting) habitats. Therefore, we believe the effect was insignificant.

In Situ Burning of Surface Oil

In situ burning, whereby floating oil was corralled and ignited to reduce the amount of oil that could impact resources and strand on shorelines, was widely used in response to the DWH oil spill. Approximately 250,000 barrels of floating DWH oil reportedly were consumed during 411 separate burn events (Mabile & Allen 2010). The burning produced significant atmospheric emissions (Perring et al. 2011; Ryerson et al. 2011) and between 11,600 and 16,300 barrels of "stiff, taffy-like" burn residue, some of which was collected by skimmer trawlers, and some of which sank. Samples of burn residue collected from the sea surface and sea floor were found to be enriched in high molecular weight PAHs compared to unburned oil (Stout & Payne 2015). In addition, PAH-rich particles were collected in deep-sea sediment trap samples from late August 2010, which was 4 to 5 weeks after the last in situ burn (Stout & Passow 2015). Detection of burn-related PAH in these sediment trap samples suggests that atmospheric particles (soot) settled out of the smoke and onto the Gulf surface and subsequently sank. Thus, both residues of the burned surface oil and soot particles generated during in situ burning passed through the water column and sunk to the sea floor.

Bioassays with water-accommodated fractions prepared from laboratory and field-generated burn residues of crude oil showed very little or no acute toxicity to marine life (echinoderm, bivalve, inland silverside, three-spine stickleback, white sea urchin) for either weathered oil or burn residue (Daykin et al. 1994 and Blenkinsopp et al. 1997). This research was validated with studies on a marine amphipod, which showed very low to low toxicity in lethal and sub-lethal tests when exposed to water-accommodated fractions or physical suspensions of burn residue in sea water (Gulec and Holdway 1999).

Turtles rely on oxygen inhaled at the water's surface, and thus were likely exposed to inhalation or aspiration of smoke from burning oil if they surfaced to breathe in areas immediately downwind of active burns. Inhalation exposure could decrease respiratory and cardiovascular function, and thus hinder turtles' abilities to dive efficiently to forage, escape predators, find mates, migrate, etc.

In order to maintain control of the burn, the area in which it was actually conducted was kept relatively small and the burns were conducted for relatively short durations, typically less than 2 hours. During in-situ burns, each burn team member was trained to identify and protect sensitive resources (Allen et al. 2011). Near the end of burn operations (the last 10%), NMFS-trained wildlife observers joined the burn teams to ensure that listed species were not present during burning operations (Allen et al. 2011; Mabile and Allen 2010). Throughout all burn operations, no turtles were spotted in or near the fire boom prior to or during operational periods. The closest sighting of a turtle to a burn was over 2.5 nmi from the burn site, on July 14, 2010 (USCG BA). Even with careful monitoring, the possibility of a turtle surfacing in or near a burn site is unavoidable. The difficulties of adequately accounting for sea turtles that are submerged for extended periods of time has been documented (Thomson et al. 2013), and the consequences of a sea-turtle surfacing in a burn area are likely severe injury or mortality.

Due to data limitations, the DWH PDARP was unable to quantify effects due to response activities such as burning operations. However, the Trustees did conclude that turtles were likely killed during response activities such as oil skimming and burning operations (and assumed that these mortalities were accounted for in their "offshore injury quantification"). In addition, the USCG TSM results indicate that the cumulative effects of all burn operations likely resulted in an unspecified level of lethal take of loggerhead sea turtles.

Given the potential long-term effects to loggerhead sea turtles from inhalation or ingestion of post-burning residues, potential impacts to benthic forage species from sunken residues and soot, and the possibility that turtles could have surfaced within a burn area, we conclude that loggerhead sea turtles were adversely affected by in situ burning activities. These adverse effects manifested through direct mortality of turtles in the immediate burn areas, as well as long-term chronic injuries to turtles and their prey base from exposure to (inhalation or ingestion of) airborne and waterborne burn byproducts (smoke, soot and residue). However, these adverse effects were likely reduced by pre-burn turtle monitoring efforts, relatively short burn times and collection/removal of post-burn residues.

Barrier Berm Construction – Dredging and Relocation Trawling

As discussed in Section 2.1, construction of the Louisiana "barrier berms" began in mid-June 2010, with a total of approximately 16 miles of barriers constructed by the time efforts were ceased in mid-July. The berms were created from sediments mined via hopper dredges, and dredging was preceded by relocation trawling to move ESA-listed sea turtles from the area to be dredged. Although the hopper dredges used during construction were equipped with intake screening and draghead deflectors, wildlife observers documented 6 loggerhead sea turtles killed by dredging and relocation trawling operations associated with berm construction (3 died in the trawler nets and 3 others were killed by the dredges). An additional 183 loggerheads were captured in the trawler nets, relocated out of the dredging zone, and released unharmed. While the barrier islands where the construction occurred are not known to support loggerhead sea turtle nesting, it is clear that a significant number of loggerheads were in the area, and it is likely that additional individuals that were not detected in the trawling and monitoring efforts were also likely impacted through behavioral disturbance and avoidance of the construction activities. It is also possible that sea turtles had their movements restricted by the placement of the barriers themselves. These types of behavioral effects were likely insignificant, as loggerhead sea turtles would have had the ability to avoid construction areas and continue normal behaviors outside of the disturbed areas. However, the dredging and trawling activities associated with barrier berm construction clearly resulted in adverse effects through the capture and release of 183 loggerheads, and the direct mortality of at least 6 others.

Trawling

Trawling and snare drag trawling was conducted in Louisiana's Barataria Bay and Chandeleur Sound in an attempt to remove floating and suspended oil from these sensitive areas. Vessels with Intrinsic Petroleum Ensnaring and Recovery Systems (VIPER) conducted trawling in the nearshore region along the Florida Panhandle coast. While loggerhead sea turtles are known to occur in both areas, the Florida Panhandle has significant nesting habitat and higher densities of loggerheads than Louisiana. BMPs were implemented during trawling operations that included the use of TEDs and limited tow times to a maximum of 30 minutes to minimize the potential for injury to sea turtles. NMFS trained observers were also deployed on the trawlers to monitor for the presence of listed species. The relocation of most turtle nests along the panhandle beaches is likely to have reduced the number hatchlings emerging (and potentially being netted) during the trawling. There were no documented captures or observations of sea turtles during these operations.

There was no mention of trawling effects in the DWH PDARP analysis of spill response activities and the USCG TSM results indicated that most effects were in the behavioral range, with some potential sublethal to lethal effects. Given the BMPs that were implemented for trawling activities, the limited areas and duration of those activities, the low likelihood of emerging hatchlings in trawling areas, and the lack of incident specific evidence of loggerhead sea turtles being captured or injured by trawling actions during the response, it is likely that most individuals that were exposed to trawling activities would have experienced only insignificant effects. However, we also believe that some individuals likely experienced adverse effects in the form of non-lethal take, by being captured in a trawl net but immediately escaping through the TED (thereby avoiding detection by observers).

NMFS's Recommendations

During the emergency response, the USCG coordinated with NMFS to obtain recommendations for avoiding and minimizing adverse effects of response activities to ESA-listed species and critical habitats. The agencies formalized these recommendations as a set of 52 Best Management Practices (BMPs). A full list of these BMPs can be found in Appendix E of the USCG BA. The 19 BMPs that are most relevant to ESA-listed species and habitats under NMFS' purview are listed below in section 10 (Conservation Recommendations).

Many of these BMPs were not developed or implemented until well into the spill response process. We do however believe that these BMPs had a beneficial effect on loggerhead sea turtles. In particular, those BMPs that required monitoring and avoidance of certain activities (burning, spraying dispersants, etc.) in areas where ESA-listed species were detected are thought to have prevented adverse effects to numerous individuals. In addition, development and implementation of guidelines for safe capture, handling and rehabilitation of distressed sea turtles was documented to have saved at least 18 loggerhead sea turtles.

5.2 Green Sea Turtles (North Atlantic and South Atlantic DPSs)

The response activity stressors that overlapped the areas where green sea turtles were present during the activities include:

- Vessel traffic
- Aerial traffic
- Skimming
- Booming
- Dispersants
- In-situ burning
- Berm Construction
- Trawling

NMFS wildlife operations conducted sea turtle overflights between April 28 and August 25, 2010 and NOAA sea turtle observations were made from surface vessels between April 26 and October 18, 2010 (ERMA 2015). A total of 459 green sea turtles were observed alive in water, all from surface vessels. Of those observed, 198 were captured and released and 99 were taken to rehab facilities. An additional 21 green sea turtles were observed dead on the shoreline. In addition, a total of 249 live and 48 dead unidentified sea turtles were also observed from the overflights and surface vessels. Assuming the same ratio of identified turtle types for the unidentified turtles (Table 7), another 81 live and 2 dead green sea turtles may have been seen (32.7% of identified live and 4.6% of identified dead sea turtles were green sea turtles; 32.7% of 249 = 81 and 4.6% of 48 = 2).

The USCG BA did not estimate specific numbers of green sea turtles affected by the spill response activities corresponding to the TSM results. The model results indicate that the vast majority of effects on green sea turtles were in the behavioral range (startle, disturbance, displacement, etc.), and that the effects of these behavioral responses were insignificant for most individuals. However, due to the high intensity, extended duration, and large spatial extent of several of the response activities, it is likely that for some individuals, these behavioral responses eventually reached a level that caused adverse effects by significantly impairing their essential behavioral patterns, such as breeding, feeding, or resting. The TSM results also indicate that some activities (e.g. vessel traffic, burning and trawling) were likely to have resulted in direct injury and lethal take of green sea turtles. A more detailed analysis of the likely effects of each category of response activity is provided below. Through that analysis we determined that vessel traffic, skimming, burning, and trawling were likely to have adversely affected green sea turtles.

Vessel Traffic

Heavy vessel traffic over the course of the response action accounts for the vast majority of response activities that were likely to overlap with green sea turtle presence. The effects of this vessel traffic on green sea turtles were likely similar to those described above for loggerhead sea turtles, with the majority of interactions resulting in insignificant behavioral responses, including startle, alarm, and temporary avoidance of heavy traffic areas. However, for some individuals, these behavioral responses likely reached a level that resulted in adverse effects by significantly impairing the individual’s essential behavioral patterns, namely feeding and resting. Due to the extremely large area of high vessel activity (Figure 2) and the large number of vessels involved with the response (approximately 10,000 vessels) some turtles would have been unable to escape the high-traffic effects, resulting in frequent, repeated avoidance behaviors (fast swimming and diving) leading to exhaustion and abandonment of the essential behaviors listed above. Green sea turtles also likely experienced some level of direct injury, including mortality, from collisions with response vessels.

Unlike loggerheads, green sea turtles do not commonly nest within the action area. The nesting season for green sea turtles is June – September, which encompasses the time period (in 2010) when the majority of the spill response activities occurred (by the end of August, 2010, all offshore response activities had been completed and only nearshore and shoreline clean-up continued beyond August, 2010). It is therefore reasonable to assume that a significant proportion of the mature adults from both the NA and SA DPSs would have been in or near their primary nesting habitats, outside of the action area, during the time period when these activities were occurring, and therefore would not have been exposed to the effects of the action. This assumption is supported by the DWH PDARP, which concluded that "Impacts of the DWH spill on green sea turtles occurred to offshore small juveniles only" (DWH Trustees 2016). We also know that at least 4 green sea turtle nests were found (and translocated) along the northern Gulf coast during the summer of 2010 (DWH Trustees 2016), indicating that at least some mature adults were present in the area during the high-traffic phase of the response efforts. We therefore conclude that response-related vessel traffic did cause adverse effects on both the NA and SA DPS of green sea turtles, and that the great majority of these effects were on small juveniles. Our jeopardy analysis, below, contains additional analysis of the age of potentially affected individuals.

Aerial Traffic
Aerial traffic may have affected green sea turtles at the surface by eliciting a startle response similar to the effects described above for loggerhead sea turtles. Green sea turtles may have temporarily avoided some low-altitude aerial traffic areas and been temporarily unable to use these areas for forage and shelter habitat. However, we believe any potential effects would have been insignificant because the activities occurred for short periods of time (less than 3 hours) over discrete areas of open-water surrounded by large expanses of similar habitats that would allow affected individuals to continue foraging and resting throughout the surrounding area.

Skimming
Skimming took place from the end of April until the beginning of August, 2010, in areas where small juvenile green sea turtles were likely to be present during that time period. The effects of oil skimming on green sea turtles were likely similar to those described above for loggerhead sea turtles, with the majority of effects resulting in insignificant behavioral responses along with some adverse effects including direct injuries and mortalities of small juvenile green sea turtles during the early stages of the response action when the "Big Gulp" skimmer was used in skimming of oiled *Sargassum* mats where juvenile green sea turtles are known to congregate.

Booming
Millions of feet of boom were deployed as part of the spill response, with the potential to entangle or impede sea turtles entering and exiting boomed areas. The effects of booming on green sea turtles were likely similar to those described above for loggerhead sea turtles, with the exception of effects to nesting adults and hatchlings (as the primary nesting grounds for green sea turtles are not within the action area). There were no documented observations of sea turtles impacted by blockage or entanglement in boom during the response activities. We believe any effects of boom placement on green sea turtles would have been insignificant, as boom was placed in a manner that would not have impeded essential behavioral patterns, such as feeding or resting. Individuals may have temporarily avoided work areas while boom was being placed or removed, but could have continued their essential behaviors in the surrounding areas with similar habitat features, and then returned and moved freely throughout the boomed areas as soon as the placement or removal activities were completed.

Dispersants
A detailed description of the potential effects of dispersant use on sea turtles is provided above in the section describing effects on loggerheads. The effects of dispersants on green sea turtles were likely similar to those described for loggerheads, with the exception of effects to nesting adults and hatchlings (as the primary nesting grounds for green sea turtles are not within the action area).

While the turtle observation and monitoring data shows that many small juvenile green sea turtles were present in areas where they were likely to have been exposed to dispersants and dispersed oil, we do not believe that this exposure resulted in measurable effects on these turtles. Direct monitoring of both sea turtles and water chemistry during DWH dispersant applications, as well as many laboratory experiments conducted before and since the spill, indicate that these turtles were not likely to have been adversely effected by dispersants, as they did not absorb harmful levels of dispersants and did not display any adverse effects from their exposure to the dispersants. Therefore, we believe the effect was insignificant.

In Situ Burning of Surface Oil
In situ burning, whereby floating oil was corralled and ignited to reduce the amount of oil that could impact resources and strand on shorelines, was widely used in response to the DWH oil spill. A detailed description of the potential effects of in situ burning on sea turtles is provided above in the section describing effects on loggerheads. The effects of burning on green sea turtles were likely similar to those described for loggerheads.

Given the potential long-term effects to green sea turtles from inhalation or ingestion of post-burning residues and the possibility that turtles could have surfaced within a burn area, we conclude that small juvenile green sea turtles were adversely affected by in situ burning activities. These adverse effects manifested through direct mortality of turtles in the immediate burn areas, as well as long-term chronic injuries to turtles from exposure to (inhalation or ingestion of) airborne and waterborne burn byproducts (smoke, soot and residue). However, these adverse effects were likely reduced by pre-burn turtle monitoring efforts, relatively short burn times and collection/removal of post-burn residues.

Barrier Berm Construction – Dredging and Relocation Trawling
Construction of the Louisiana "barrier berms" using hopper dredges and relocation trawling lasted approximately 1 month, from mid-June to mid-July, 2010 (see detailed description in loggerhead section). While there were no green sea turtles detected and no mortalities reported during berm construction, it is possible that juvenile green sea turtles were in the area, and were therefore potentially impacted through temporary disturbance of their foraging and resting behaviors through avoidance of the construction activities. It is also possible that juvenile green sea turtles had their movements restricted by the placement of the barriers themselves. These types of behavioral effects were likely insignificant, as these turtles would have had the ability to avoid construction areas and continue normal behaviors outside of the disturbed areas.

Trawling
Trawling and snare drag trawling was conducted in Louisiana's Barataria Bay and Chandeleur Sound in an attempt to remove floating and suspended oil from these sensitive areas. VIPER trawling was conducted in the nearshore region along the Florida Panhandle coast. The effects of trawling on green sea turtles were likely similar to those described for loggerheads, with the exception of potential effects to hatchlings (as the primary nesting grounds for green sea turtles are not within the action area). There were no documented captures or observations of green sea turtles during these operations, but it is possible that trawling resulted in low levels of adverse effects in the form of non-lethal take (e.g., juvenile turtles being captured in a trawl net but immediately escaping through the TED).

NMFS's Recommendations
During the emergency response, the USCG coordinated with NMFS to obtain recommendations for avoiding and minimizing adverse effects of response activities to ESA-listed species and critical habitats. The agencies formalized these recommendations as a set of 52 Best Management Practices (BMPs). A full list of these BMPs can be found in Appendix E of the USCG BA. The 19 BMPs that are most relevant to ESA-listed species and habitats under NMFS' purview are listed below in section 10 (Conservation Recommendations).

Many of these BMPs were not developed or implemented until well into the spill response process. We do however believe that these BMPs had a beneficial effect on green sea turtles. In particular, those BMPs that required monitoring and avoidance of certain activities (burning, spraying dispersants, etc.) in areas where ESA-listed species were detected are thought to have prevented adverse effects to numerous individuals. In addition, development and implementation of guidelines for safe capture, handling and rehabilitation of distressed sea turtles was documented to have saved at least 297 green sea turtles.

5.3 Kemp's Ridley Sea Turtles

The response activity stressors that overlapped the areas where Kemp's ridley sea turtles were present during the activities include:

- Vessel traffic
- Aerial traffic
- Skimming
- Booming
- Dispersants
- In-situ burning
- Berm Construction
- Trawling

A total of 759 Kemp's ridley sea turtles were observed alive in the water; 13 during NMFS overflights, with 4 observed in oil; and 430 from surface vessels, with 100 captured and released and 110 others taken to rehab facilities (the other 316 observations were reported by non-NMFS personnel). Roughly 390 Kemp's ridleys were observed dead on the shoreline.

In addition, a total of 249 live and 48 dead unidentified sea turtles were also observed in the water from the overflights and surface vessels. Assuming the same ratio of identified turtle types for the unidentified turtles (Table 7), another 135 live and 41 dead Kemp's ridley may have been seen (54.1% of identified live and 84.8% of identified dead sea turtles were Kemps ridley; 54.1% of 249 = 135 and 84.8% of 48 = 41).

The USCG BA did not estimate specific numbers of Kemp's ridley sea turtles affected by the spill response activities corresponding to the TSM results. The model results indicate that the vast majority of effects on Kemp's ridley were in the behavioral range (startle, disturbance, displacement, etc.), and that the effects of these behavioral responses were insignificant for most individuals. However, due to the high intensity, extended duration, and large spatial extent of several of the response activities, it is likely that for some individuals, these behavioral responses eventually reached a level that caused adverse effects by significantly impairing their essential behavioral patterns, such as breeding, feeding, and resting. The TSM results also indicate that some activities (e.g. vessel traffic, burning, trawling, and dredging) were likely to have resulted in direct injury and lethal take of Kemps ridley sea turtles. A more detailed analysis of the likely effects of each category of response activity is provided below. Through that analysis we determined that vessel traffic, skimming, burning, berm construction, and trawling were likely to have adversely affected Kemp's ridley sea turtles.

Vessel Traffic

Heavy vessel traffic over the course of the response action accounts for the vast majority of response activities that were likely to overlap with Kemp's ridley sea turtle presence. TSM results indicate that the effects of this vessel traffic on Kemp's ridley sea turtles were similar to those described above for loggerhead sea turtles, with the majority of interactions resulting in insignificant behavioral responses, including startle, alarm, and temporary avoidance of heavy traffic areas. However, for some individuals, these behavioral responses reached a level that caused adverse effects by significantly impairing their essential behavioral patterns, namely breeding, feeding, and resting. Due to the extremely large area of high vessel activity (Figure 2) and the large number of vessels involved with the response (approximately 10,000 vessels) some turtles would have been unable to escape the high-traffic effects, resulting in frequent, repeated avoidance behaviors (fast swimming and diving) leading to exhaustion and abandonment of the essential behaviors listed above. Kemp's ridley sea turtles also likely experienced some level of direct injury, including mortality, from collisions with response vessels.

Aerial Traffic
Aerial traffic may have affected Kemp's ridley sea turtles at the surface by eliciting a startle response similar to the effects described above for loggerhead sea turtles. Kemp's ridley sea turtles may have temporarily avoided some low-altitude aerial traffic areas and been temporarily unable to use these areas for forage and resting habitat. However, we believe any potential effects would have been insignificant because the activities occurred for short periods of time (less than 3 hours) over discrete areas of open-water surrounded by large expanses of similar habitats that would allow affected individuals to continue foraging and resting throughout the surrounding area.

Skimming
Skimming took place from the end of May until the beginning of August, 2010, in areas where juvenile and adult life stages of Kemp's ridley sea turtles were likely to be present during that time period. The effects of oil skimming on Kemp's ridley sea turtles were likely similar to those described above for loggerhead sea turtles, with the majority of effects resulting in insignificant behavioral responses along with some adverse effects including direct injuries and mortalities of Kemp's ridley sea turtles likely occurring during the early stages of the response action when the "Big Gulp" skimmer was used in skimming of oiled *Sargassum* mats where juvenile Kemp's ridley sea turtles are known to congregate.

Booming
Millions of feet of boom were deployed as part of the spill response, with the potential to entangle or impede sea turtles entering and exiting boomed areas. The effects of booming on Kemp's ridley sea turtles were likely similar to those described above for loggerhead sea turtles, with the exception of effects to nesting adults and hatchlings (as the primary nesting grounds for Kemp's ridley sea turtles are not within the action area). There were no documented observations of sea turtles directly or indirectly impacted by blockage or entanglement in boom during the response activities. We believe any effects of boom placement on Kemp's ridley sea turtles would have been insignificant, as boom was placed in a manner that would not have impeded essential behavioral patterns, such as feeding, or resting. Individuals may have temporarily avoided work areas while boom was being placed or removed, but could have continued their essential behaviors in the surrounding areas with similar habitat features, and could have returned and moved freely throughout the boomed areas as soon as the placement or removal activities were completed (generally less than one day each for placement and removal).

Dispersants
A detailed description of the potential effects of dispersant use on sea turtles is provided above in the section describing effects on loggerheads. The effects of dispersants on Kemp's ridley sea turtles were likely similar to those described for loggerheads, with the exception of effects to nesting adults and hatchlings (as the primary nesting grounds for Kemp's ridley sea turtles are not within the action area).

While the turtle observation and monitoring data shows that many juvenile and adult Kemp's ridley sea turtles were present in areas where they were likely to have been exposed to dispersants and dispersed oil, we do not believe that this exposure resulted in measurable effects on these turtles. DOSS, a persistent component of the dispersants used during the DWH response, was detected in the oil found in the esophagus of a single heavily oiled Kemp's ridley sea turtle, but all tissue samples taken from that turtle showed no quantifiable levels of DOSS had been absorbed by that turtle. Direct monitoring of both sea turtles and water chemistry during DWH dispersant applications, as well as many laboratory experiments conducted before and since the spill, indicate that these turtles were not likely to have been adversely effected by dispersants, as they did not absorb harmful levels of dispersants and did not display any adverse effects from their exposure to the dispersants. Therefore, we believe the effect of the dispersants was insignificant.

In Situ Burning of Surface Oil
In situ burning was widely used in response to the DWH oil spill. A detailed description of the potential effects of in situ burning on sea turtles is provided above in the section describing effects on loggerheads. The effects of burning on Kemp's ridley sea turtles were likely similar to those described for loggerheads.

Given the potential long-term effects to Kemp's ridley sea turtles from inhalation or ingestion of post-burning residues, potential impacts to benthic forage species from sunken residues and soot, and the possibility that turtles could have surfaced within a burn area, we conclude that Kemp's ridley sea turtles were adversely affected by in situ burning activities. These adverse effects manifested through direct mortality of turtles in the immediate burn areas, as well as long-term chronic injuries to turtles and their prey base from exposure to (inhalation or ingestion of) airborne and waterborne burn byproducts (smoke, soot and residue). However, these adverse effects were likely reduced by pre-burn turtle monitoring efforts, relatively short burn times and skimming (removal) of post-burn residues.

Barrier Berm Construction – Dredging and Relocation Trawling
Construction of the Louisiana "barrier berms" using hopper dredges and relocation trawling lasted approximately 1 month, from mid-June to mid-July, 2010 (see detailed description in loggerhead section). There were 8 Kemp's ridleys captured in the relocation-trawlers, which were subsequently released unharmed outside of the dredging area, and three additional Kemp's ridleys were found dead in the vicinity of the southern Louisiana berms on August 19, 2010 (GCIMT 2015). While there was no definitive evidence that these deaths were attributable to the dredging operations, the possibility cannot be discounted since they were found shortly after the dredging operations were completed and hopper dredging has been documented to kill Kemp's ridley sea turtles. Regardless of the cause of these mortalities, their discovery, along with the

capture and release of 8 others, establishes that Kemp's ridleys were in the area, and were therefore potentially impacted through harassment and avoidance of the construction activities. It is also possible that Kemp's ridley sea turtles had their movements restricted or migration routes blocked by the placement of the barriers themselves. These types of behavioral effects were likely insignificant, as Kemp's ridley sea turtles would have had the ability to avoid construction areas and continue normal behaviors outside of the disturbed areas. However, the capture and release of 8 Kemp's ridleys in the trawls is proof of non-lethal adverse effects from these activities, and the discovery of the dead Kemp's ridleys near the dredging and trawling activities is a strong indication that these activities also resulted in direct mortality of at least 3 Kemp's ridley sea turtles.

Trawling

Trawling and snare drag trawling was conducted in Louisiana's Barataria Bay and Chandeleur Sound in an attempt to remove floating and suspended oil from these sensitive areas. VIPER trawling was conducted in the nearshore region along the Florida Panhandle coast. The effects of trawling on Kemp's ridley sea turtles were likely similar to those described for loggerheads, with the exception of potential effects described for loggerhead hatchlings (as effects to Kemp's ridley hatchlings are not likely since the primary nesting grounds for Kemp's ridley sea turtles are not within the action area). There were no documented captures or observations of Kemp's ridley sea turtles during these operations, but it is possible that trawling resulted in low levels of adverse effects in the form of non-lethal take (e.g. turtles being captured in a trawl net but immediately escaping through the TED).

NMFS's Recommendations

During the emergency response, the USCG coordinated with NMFS to obtain recommendations for avoiding and minimizing adverse effects of response activities to ESA-listed species and critical habitats. The agencies formalized these recommendations as a set of 52 Best Management Practices (BMPs). A full list of these BMPs can be found in Appendix E of the USCG BA. The 19 BMPs that are most relevant to ESA-listed species and habitats under NMFS' purview are listed below in section 10 (Conservation Recommendations).

Many of these BMPs were not developed or implemented until well into the spill response process. We do however believe that these BMPs had a beneficial effect on Kemp's ridley sea turtles. In particular, those BMPs that required monitoring and avoidance of certain activities (burning, spraying dispersants, etc.) in areas where ESA-listed species were detected are thought to have prevented adverse effects to numerous individuals. In addition, development and implementation of guidelines for safe capture, handling and rehabilitation of distressed sea turtles was documented to have saved at least 210 Kemp's ridley sea turtles.

5.4 Hawksbill Sea Turtles

Hawksbill sea turtles do not nest in the northern Gulf of Mexico and the closest nesting sites to the action area are in the Caribbean (Hart, et al. 2012). While hawksbills are known to occur within the action area, they are generally found in offshore waters of this area, and in relatively low densities.

The response activity stressors that overlapped the areas where hawksbills were present during the activities include:

- Vessel traffic
- Aerial traffic
- Skimming
- Booming
- Dispersants
- In-situ burning
- Trawling

A total of 29 juvenile hawksbill sea turtles were observed alive in water, all from surface vessels. Of those observed, 11 were captured and released and 4 were taken to rehab facilities. 1 juvenile hawksbill was observed dead on the shoreline near the Louisiana-Texas border.

In addition, a total of 249 live and 48 dead unidentified sea turtles were also observed from the overflights and surface vessels. Assuming the same ratio of identified turtle types for the unidentified turtles (Table 7), another 5 live and up to 1 dead hawksbills may have been seen (2.1% of identified live and 0.2% of identified dead sea turtles were hawksbills; 2.1% of 249 = 5 and 0.2% of 48 = 0.1).

The USCG BA did not estimate specific numbers of hawksbill sea turtles affected by the spill response activities corresponding to the TSM results. The model results indicate that the vast majority of effects on hawksbills were in the behavioral range (startle, disturbance, displacement, etc.), and that the effects of these behavioral responses were insignificant for most individuals. However, due to the high intensity, extended duration, and large spatial extent of several of the response activities, it is likely that for some individuals, these behavioral responses eventually reached a level that caused adverse effects by significantly impairing their essential behavioral patterns, such as feeding or resting. The TSM results also indicate that some activities (e.g., vessel traffic and burning) were likely to have resulted in direct injury and lethal take of hawksbill sea turtles. A more detailed analysis of the likely effects of each category of response activity is provided below. Through that analysis we determined that vessel traffic, skimming, and burning were likely to have adversely affected juvenile hawksbill sea turtles.

Vessel Traffic
Heavy vessel traffic over the course of the response action accounts for the vast majority of response activities that were likely to overlap with hawksbill sea turtle presence. The effects of this vessel traffic on hawksbill sea turtles were likely similar to those described above for loggerhead sea turtles, with the majority of interactions resulting in insignificant behavioral responses, including startle, alarm, and avoidance of heavy traffic areas. However, for some individuals, these behavioral responses likely reached a level that resulted in adverse effects by significantly impairing the individual's essential behavioral patterns, namely feeding and resting. Due to the extremely large area of high vessel activity (Figure 2) and the large number of vessels involved with the response (approximately 10,000 vessels) some turtles would have been unable to escape the high-traffic effects, resulting in frequent, repeated avoidance behaviors (fast

swimming and diving) leading to exhaustion and abandonment of the essential behaviors listed above. Hawksbill sea turtles also likely experienced some level of direct injury, including potential mortality, from collisions with response vessels.

Unlike loggerheads, hawksbill sea turtles do not nest within the action area. The nesting season for hawksbill sea turtles is April - October, which encompasses the time period (in 2010) when the majority of the spill response activities occurred (by the end of August, 2010, all offshore response activities had been completed and only nearshore and shoreline clean-up continued beyond August, 2010). It is therefore reasonable to assume that a significant proportion of the mature adults would have been in or near their primary nesting habitats, outside of the action area, during the time period when these activities were occurring, and therefore would not have been exposed to the effects of the action during that time period. This assumption is supported by the fact that no adult or large juvenile hawksbills were documented in the action area throughout all response/monitoring efforts (DWH Trustees 2016). We therefore conclude that response-related vessel traffic did cause adverse effects to hawksbill sea turtles, and that it is extremely unlikely that mature individuals were adversely affected.

Aerial Traffic

Aerial traffic may have affected juvenile hawksbill sea turtles at the surface by eliciting a startle response similar to the effects described above for loggerhead sea turtles. Juvenile hawksbill sea turtles may have temporarily avoided some low-altitude aerial traffic areas and been temporarily unable to use these areas for forage and shelter habitat. However, we believe any potential effects would have been insignificant because the activities occurred for short periods of time (less than 3 hours) over discrete areas of open-water surrounded by large expanses of similar habitats that would allow affected individuals to continue foraging and resting throughout the surrounding area.

Skimming

Skimming took place from the end of May until the beginning of August, 2010, in areas where small juvenile hawksbill sea turtles were likely to be present during that time period. The effects of oil skimming on hawksbill sea turtles were likely similar to those described above for loggerhead sea turtles, with the majority of effects resulting in insignificant behavioral responses along with some adverse effects including direct injuries and mortalities of small juvenile hawksbills likely occurring during the early stages of the response action when the “Big Gulp” skimmer was used in skimming of oiled *Sargassum* mats where juvenile hawksbill sea turtles are known to congregate.

Booming

Millions of feet of boom were deployed as part of the spill response, with the potential to entangle or impede sea turtles entering and exiting boomed areas. However, most of this boom was located in nearshore and inshore areas where hawksbill sea turtles were extremely unlikely to occur (hawksbills are generally found in the offshore waters of the action area), and there were no documented observations of sea turtles impacted by blockage or entanglement in boom during the response activities. Even if booming did take place in the vicinity of a hawksbill, any effects would have been insignificant, as those individuals could have temporarily avoided the work areas and continued their essential behaviors in the surrounding areas with similar habitat features. These individuals could have then returned and moved freely throughout the boomed areas as soon as the placement or removal activities were completed.

Dispersants
A detailed description of the potential effects of dispersant use on sea turtles is provided above in the section describing effects on loggerheads. The effects of dispersants on hawksbill sea turtles were likely similar to those described for loggerheads, with the exception of effects to nesting adults and hatchlings (as the primary nesting grounds for hawksbill sea turtles are not within the action area). In addition, mature individuals were extremely unlikely to have been in the action area during the time when the majority of response activities occurred.

While the turtle observation and monitoring data shows that a relatively small number of hawksbill sea turtles were present in areas where they were likely to have been exposed to dispersants and dispersed oil, we do not believe that this exposure resulted in measurable effects on these turtles. Direct monitoring of both sea turtles and water chemistry during DWH dispersant applications, as well as many laboratory experiments conducted before and since the spill, indicate that these turtles were not likely to have been adversely effected by dispersants, as they did not absorb harmful levels of dispersants and did not display any adverse effects from their exposure to the dispersants. Thus, we believe any effect would be insignificant.

In Situ Burning of Surface Oil
In situ burning was widely used in response to the DWH oil spill. A detailed description of the potential effects of in situ burning on sea turtles is provided above in the section describing effects on loggerheads. The effects of burning on hawksbill sea turtles were likely similar to those described for loggerheads, though at a much smaller scale (hawksbills made up approximately 2% of all live sea turtles observed during response/monitoring activities).

Given the potential long-term effects to juvenile hawksbill sea turtles from inhalation or ingestion of post-burning residues, potential impacts to benthic forage species from sunken residues and soot, and the possibility that turtles could have surfaced within a burn area, we conclude that juvenile hawksbill sea turtles were adversely affected by in situ burning activities. These adverse effects manifested through direct mortality of turtles in the immediate burn areas, as well as long-term chronic injuries to turtles and their prey base from exposure to (inhalation or ingestion of) airborne and waterborne burn byproducts (smoke, soot and residue). However, these effects were likely reduced by turtle monitoring efforts, relatively short burn times and skimming (removal) of post-burn residues.

Trawling
Trawling and snare drag trawling was conducted in Louisiana's Barataria Bay and Chandeleur Sound in an attempt to remove floating and suspended oil from these sensitive areas. VIPER trawling was conducted in the nearshore region along the Florida Panhandle coast. Hawksbill sea turtles are generally found in the offshore waters of the action area, and are extremely unlikely to have been present in the nearshore areas where trawling was conducted and therefore,

extremely unlikely to have been affected by the operations. There were no documented captures or observations of hawksbill sea turtles during these operations, and we therefore conclude that trawling was not likely to have adversely affected hawksbill sea turtles.

NMFS's Recommendations
During the emergency response, the USCG coordinated with NMFS to obtain recommendations for avoiding and minimizing adverse effects of response activities to ESA-listed species and critical habitats. The agencies formalized these recommendations as a set of 52 Best Management Practices (BMPs). A full list of these BMPs can be found in Appendix E of the USCG BA. The 19 BMPs that are most relevant to ESA-listed species and habitats under NMFS' purview are listed below in section 10 (Conservation Recommendations).

Many of these BMPs were not developed or implemented until well into the spill response process. We do however believe that these BMPs had a beneficial effect on hawksbill sea turtles. In particular, those BMPs that required monitoring and avoidance of certain activities (burning, spraying dispersants, etc.) in areas where ESA-listed species were detected are thought to have prevented adverse effects to numerous individuals. In addition, development and implementation of guidelines for safe capture, handling and rehabilitation of distressed sea turtles was documented to have saved at least 15 hawksbill sea turtles.

5.5 Leatherback Sea Turtles

Leatherback sea turtles rarely nest in the northern Gulf of Mexico. No leatherback nests were detected in the action area in 2010 (when the majority of response activities occurred), but 1 nest was documented in 2012 in the Florida Panhandle (GCIMT 2015). While leatherbacks are known to occur throughout the action area, they are generally found in offshore waters of this area, and in relatively low densities.

The response activity stressors that overlapped the areas where leatherbacks were present during the activities include:

- Vessel traffic
- Aerial traffic
- Skimming
- Booming
- Dispersants
- In-situ burning
- Trawling

A total of 21 leatherback sea turtles were observed alive in water from surface vessels and 2 others were observed alive from the air, 1 of which was in oil. No leatherbacks were captured or taken to rehab facilities, and none were observed dead throughout the response period.

In addition, a total of 249 live and 48 dead unidentified sea turtles were also observed from the overflights and surface vessels. Assuming the same ratio of identified turtle types for the unidentified turtles (Table 7), 4 other live leatherbacks may have been seen (1.6% of identified live sea turtles were leatherbacks; 1.6% of 249 = 4).

The USCG BA did not estimate specific numbers of leatherback sea turtles affected by the spill response activities corresponding to the TSM results. The model results indicate that the vast majority of effects on leatherbacks were in the behavioral range (startle, disturbance, displacement, etc.), and that the effects of these behavioral responses were insignificant for most individuals. However, due to the high intensity, extended duration, and large spatial extent of several of the response activities, it is likely that for some individuals, these behavioral responses eventually reached a level that caused adverse effects by significantly impairing their essential behavioral patterns, such as feeding or resting. The TSM results also indicate that some activities (e.g. vessel traffic and burning) were likely to have resulted in direct injury and lethal take of leatherback sea turtles. A more detailed analysis of the likely effects of each category of response activity is provided below. Through that analysis we determined that vessel traffic, skimming and burning were likely to have adversely affected juvenile leatherback sea turtles.

Vessel Traffic

Heavy vessel traffic over the course of the response action accounts for the vast majority of response activities that were likely to overlap with leatherback sea turtle presence. The effects of this vessel traffic on leatherback sea turtles were likely similar to those described above for loggerhead sea turtles, with the majority of interactions resulting in insignificant behavioral responses, including startle, alarm, and avoidance of heavy traffic areas. However, for some individuals, these behavioral responses likely reached a level that resulted in adverse effects by significantly impairing the individual's essential behavioral patterns, namely feeding and resting. Due to the extremely large area of high vessel activity (Figure 2) and the large number of vessels involved with the response (approximately 10,000 vessels) some turtles would have been unable to escape the high-traffic effects, resulting in frequent, repeated avoidance behaviors (fast swimming and diving) leading to exhaustion and abandonment of the essential behaviors listed above. Leatherback sea turtles also likely experienced some level of direct injury, including potential mortality, from collisions with response vessels.

Unlike loggerheads, leatherback sea turtles do not commonly nest within the action area. The nesting season for leatherback sea turtles is March - July, which encompasses a significant portion of the time period (in 2010) when offshore spill response activities occurred (offshore response activities occurred from April through August, 2010). It is therefore reasonable to assume that a significant proportion of the mature adults would have been in or near their primary nesting habitats, outside of the action area, for more than half of the time period when these activities were occurring, and therefore would have a reduced likelihood of being exposed to the effects of the action during that time period. Although leatherbacks (age-class unspecified) were documented in the spill area, the number of affected leatherbacks was not estimated in the DWH PDARP due to the extremely low numbers of leatherbacks observed, compared to other species (DWH Trustees 2016). We therefore conclude that response-related vessel traffic is likely to have caused adverse effects to juvenile leatherback sea turtles, but the proportion of the overall population that was affected was extremely low due to the widespread distribution and nesting locations outside of the action area for this species.

Aerial traffic
Aerial traffic may have affected juvenile leatherback sea turtles at the surface by eliciting a startle response similar to the effects described above for loggerhead sea turtles. Juvenile leatherback sea turtles may have temporarily avoided some low-altitude aerial traffic areas and been temporarily unable to use these areas for forage and shelter habitat. However, we believe any potential effects would have been insignificant because the activities occurred for short periods of time (less than 3 hours) over discrete areas of open-water surrounded by large expanses of similar habitats that would allow affected individuals to continue foraging and resting throughout the surrounding area.

Skimming
Skimming took place from the end of May until the beginning of August, 2010, in areas where juvenile leatherback sea turtles were likely to be present during that time period. The effects of oil skimming on juvenile leatherback sea turtles were likely similar to those described above for loggerhead sea turtles, with the majority of effects resulting in insignificant behavioral responses (startle, disturbance, displacement, etc.) along with some adverse effects including direct injuries and mortalities of juvenile leatherback sea turtles occurring during the early stages of the response action when the “Big Gulp” skimmer was used in skimming of oiled *Sargassum* mats where juvenile leatherback sea turtles are known to congregate.

Booming
Millions of feet of boom were deployed as part of the spill response, with the potential to entangle or impede sea turtles entering and exiting boomed areas. However, most of this boom was located in nearshore and inshore areas where leatherback sea turtles were extremely unlikely to occur (leatherbacks are generally found in the offshore waters of the action area), and there were no documented observations of sea turtles impacted by blockage or entanglement in boom during the response activities. Even if booming did take place in the vicinity of a leatherback, any effects would have been insignificant, as those individuals could have temporarily avoided the work areas and continued their essential behaviors in the surrounding areas with similar habitat features. These individuals could have then returned and moved freely throughout the boomed areas as soon as the placement or removal activities were completed.

Dispersants
A detailed description of the potential effects of dispersant use on sea turtles is provided above in the section describing effects on loggerheads. The effects of dispersants on leatherback sea turtles were likely similar to those described for loggerheads, with the exception of effects to hatchlings (as the primary nesting grounds for leatherback sea turtles are not within the action area). In addition, mature individuals were extremely unlikely to have been in the action area during the time when the majority of response activities occurred.

While the turtle observation and monitoring data shows that a relatively small number of juvenile leatherback sea turtles were present in areas where they were likely to have been exposed to dispersants and dispersed oil, we do not believe that this exposure resulted in measurable effects on these turtles. Direct monitoring of both sea turtles and water chemistry during DWH dispersant applications, as well as many laboratory experiments conducted before and since the spill, indicate that these turtles were not likely to have been adversely effected by dispersants, as they did not absorb harmful levels of dispersants and did not display any adverse effects from their exposure to the dispersants.   Therefore, we believe the effect is insignificant.

In Situ Burning of Surface Oil

In situ burning was widely used in response to the DWH oil spill. A detailed description of the potential effects of in situ burning on sea turtles is provided above in the section describing effects on loggerheads. The effects of burning on leatherback sea turtles were likely similar to those described for loggerheads, though at a much smaller scale (leatherbacks made up approximately 1.5% of all live sea turtles observed throughout the response/monitoring activities).

Given the potential long-term effects to juvenile leatherback sea turtles from inhalation or ingestion of post-burning residues, potential impacts to benthic forage species from sunken residues and soot, and the possibility that turtles could have surfaced within a burn area, we conclude that juvenile leatherback sea turtles were adversely affected by in situ burning activities. These adverse effects manifested through direct mortality of turtles in the immediate burn areas, as well as long-term chronic injuries to turtles and their prey base from exposure to (inhalation or ingestion of) airborne and waterborne burn byproducts (smoke, soot and residue). However, these effects were likely reduced by turtle monitoring efforts, relatively short burn times and skimming (removal) of post-burn residues.

Trawling

Trawling and snare drag trawling was conducted in Louisiana's Barataria Bay and Chandeleur Sound in an attempt to remove floating and suspended oil from these sensitive areas. VIPER trawling was conducted in the nearshore region along the Florida Panhandle coast. Leatherback sea turtles are generally found in the offshore waters of the action area, and are extremely unlikely to have been present in the nearshore areas where trawling was conducted and therefore, extremely unlikely to have been affected by the operations. There were no documented captures or observations of leatherback sea turtles during these operations, and we therefore conclude that trawling operations were not likely to have adversely affected leatherback sea turtles.

NMFS's Recommendations

During the emergency response, the USCG coordinated with NMFS to obtain recommendations for avoiding and minimizing adverse effects of response activities to ESA-listed species and critical habitats. The agencies formalized these recommendations as a set of 52 Best Management Practices (BMPs). A full list of these BMPs can be found in Appendix E of the USCG BA. The 19 BMPs that are most relevant to ESA-listed species and habitats under NMFS' purview are listed below in section 10 (Conservation Recommendations).

Many of these BMPs were not developed or implemented until well into the spill response process. We do however believe that these BMPs had a beneficial effect on leatherback sea turtles. In particular, those BMPs that required monitoring and avoidance of certain activities (burning, spraying dispersants, etc.) in areas where ESA-listed species were detected are thought to have prevented adverse effects to numerous individuals.

5.6 Sperm Whales

Sperm whales are present year-round in the Gulf of Mexico and their core habitat, where they are most densely populated, overlaps with the Mississippi Canyon and the DWH wellhead (Jochens, et al. 2008; Figure 10)

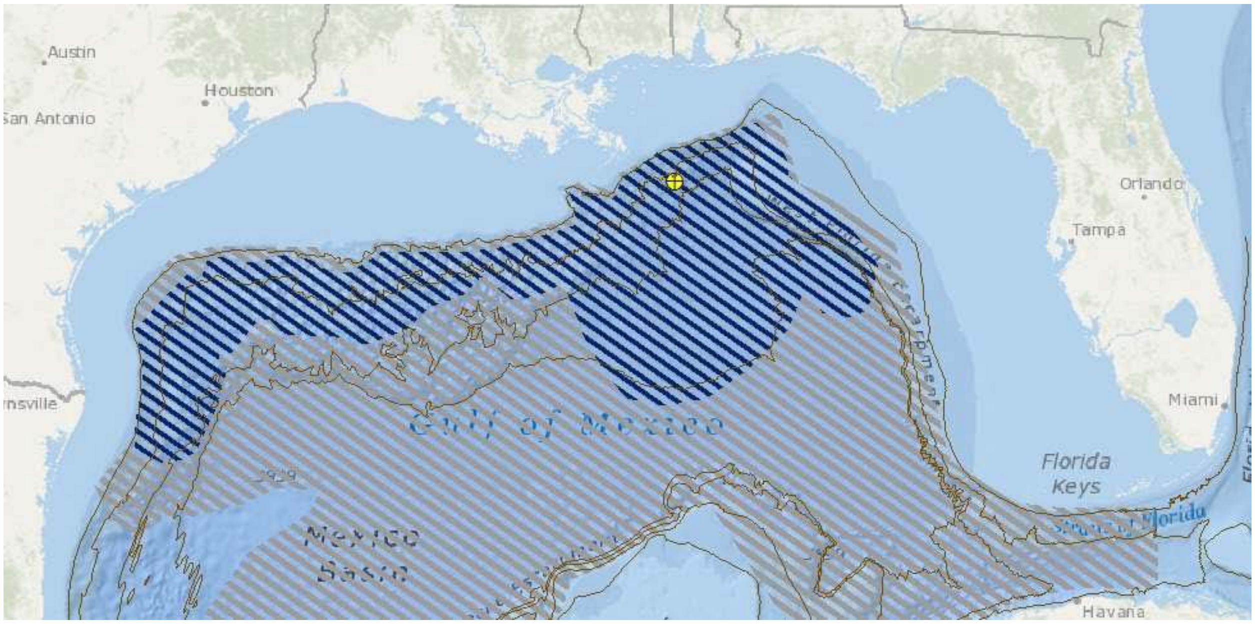

Figure 10. Gulf of Mexico sperm whale range. The dark hatched area reflects the sperm whale's core range with the highest probability of exposure; while the lighter hatched area reflects the sperm whale's overall range with a lower probability of exposure (Figure 6.6-1 in USCG BA).

NMFS wildlife operations conducted marine mammal aerial surveys between April 28 and August 25, 2010 (ERMA 2015), as shown in Figure 11. There were 30 live sperm whales observed during these aerial surveys. Coast Guard photo logs recorded an additional sperm whale sighting on May 11th and the USFWS National Wildlife Call Log received whale sighting reports (likely sperm whales) on June 13, June 15, and July 18, 2010. In addition, a total of 34 sperm whales were sighted by wildlife monitors during skimming and in-situ burn operations (ERMA 2015).

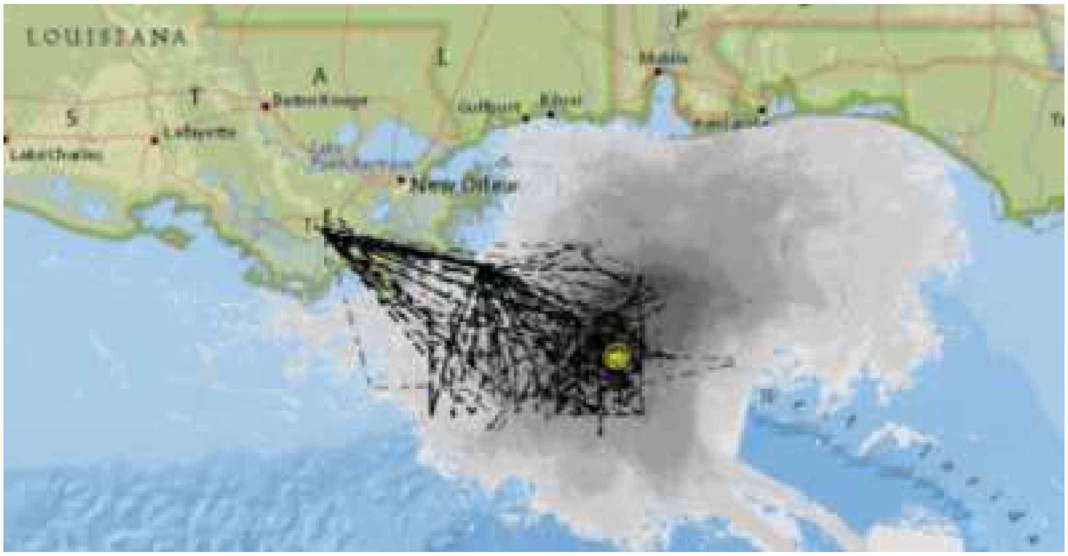

Figure 11. NMFS' marine mammal and turtle aerial survey tracks. (Figure 6.6-7 in USCG BA)

The response activity stressors that overlapped the sperm whale home range include:

- Vessel traffic
- Aerial traffic
- Dispersants
- In-situ burns
- Skimming

The USCG BA did not estimate specific numbers of sperm whales affected by the spill response activities corresponding to the TSM results. The TSM results indicate that the vast majority of effects on sperm whales were insignificant behavioral effects (startle, disturbance, displacement, etc.). However, due to the high intensity, extended duration, and large spatial extent of several of the response activities, it is likely that for some individuals, these behavioral responses eventually reached a level that caused adverse effects by significantly impairing their essential behavioral patterns, such as breeding, feeding, or resting. The TSM results also indicate that some activities (e.g. burning) were likely to have resulted in direct injury and possibly lethal take of sperm whales. A more detailed analysis of the likely effects of each category of response activity is provided below. Through that analysis we determined that vessel traffic and burning were likely to have adversely affected sperm whales.

Vessel Traffic

The heavy ship traffic over the course of the response accounts for the highest volume of response activities likely to have affected sperm whales. The USCG BA concludes that stressors related to vessel traffic most likely resulted in behavioral responses from sperm whales, such as startle, alarm, and avoidance of heavy traffic areas. An acoustic study of DWH sperm whale response by Ackleh et al. (2012) indicates that some sperm whales moved away from the area of highest response activities around the wellhead. Their findings demonstrated a decrease in abundance of sperm whales within 9 miles of the incident site. This decrease corresponded with an increase in abundance at a site 25 miles away from the wellhead, suggesting that sperm whales left the high-activity area and relocated farther away from the incident site.

The TSM results and the findings noted above indicate that the effects from these behavioral responses were primarily insignificant, as the species were able to relocate to other areas of similar habitat. However, for some individuals, it is likely that these behavioral responses eventually reached a level that caused adverse effects by significantly impairing their essential behavioral patterns, namely breeding, feeding, or resting. Due to the extremely large area of high vessel activity (Figure 2) and the large number of vessels involved with the response (approximately 10,000 vessels) some whales may have been unable to escape the high-traffic effects, resulting in frequent, repeated avoidance behaviors (fast swimming and diving) leading to exhaustion and abandonment of the essential behaviors listed above.

Despite the increased level of vessel traffic associated with the spill response, no whale strikes were reported and no whales with vessel-related injuries were observed. We therefore conclude that the increased vessel traffic adversely affected sperm whales by significantly impairing their essential behavioral patterns, but did not result in direct injury or mortality of sperm whales from vessel strikes.

Aerial Traffic

Aerial traffic may also have affected sperm whales by eliciting a startle response due to increased noise or the physical presence of the aircraft overhead. Air traffic within 12 nmi of the coastline was required to maintain altitudes above 3,000 feet (FAA 2010), which is well above the altitude that has been found to elicit responses from sperm whales (Smultea, et al. 2008). Airspace altitudes of 1500 feet or lower were dedicated to dispersant applications and wildlife observations with the lowest flights at 50 - 75 feet (FAA 2010; Gass et al. 2011). Sperm whale responses to low-flying aircraft include alarm or avoidance behaviors, such as diving or rapid changes in swimming speed or direction (Smultea, et al. 2008). Sperm whales may have temporarily avoided these low-altitude aerial traffic areas and been temporarily unable to use these areas for foraging habitat. However, we believe any potential effects would have been insignificant because the activities occurred for short periods of time (less than 3 hours) over discrete areas of open-water surrounded by large expanses of similar habitats that would allow affected individuals to continue their essential behavioral patterns throughout the surrounding areas. We therefore conclude that the increased aerial traffic is not likely to have adversely affected sperm whales, as any effects would have been insignificant.

Dispersants

A detailed description of the toxicity and other properties of dispersants is provided above in the section describing effects on loggerhead sea turtles.

Wildlife operations officials coordinated with the aerial dispersants teams to advise them on exclusion zones when whales, dolphins, or sea turtles were observed near the point of planned dispersant drops (Houma 2010). Though this conservation measure was implemented, it would not have prevented whales from entering an area once dispersant had been applied and it is possible that submerged whales could have been missed.

Sperm whale sightings that occurred in the vicinity (spatially and temporally) of dispersant drops occurred on April 28th, May 12th (1 whale each) and June 13th (3 whales). All of these sightings were more than 2 nmi from the dispersant drop zones, and there were no reports or other evidence to indicate that any whales entered the dispersant drop zones. However, sperm whales swim on the order of 5 miles/hour with sprint speeds of up to 15 miles/hour (Brown 1997). Therefore, on any of the days sighted, an observed whale could have swum into the dispersant drop zones.

The sub-sea dispersant application took place over the course of 72 days from April 30th until July 17th. Because it was impossible to use spotters for whale protection during the application of subsurface dispersants, it is possible that whales contacted elevated concentrations of dispersants if they were to dive in the vicinity of the wellhead. There are no reports or other evidence to indicate that this may have happened, or that whales were even present in the area of the wellhead during the sub-sea dispersant application period, however, it is possible that they could have been in the area and could have been affected. Subsurface dispersant application may also have had negative impacts on deep-sea prey resources for sperm whales, and may have led to incidental ingestion of dispersants.

Limited data is available regarding the impact of dispersants or dispersed oil on sperm whales. The application of dispersants to the spilled oil is likely to have provided beneficial effects to surface oriented species such as whales by reducing the amount of oil on the surface that could stick to them or irritate sensitive membranes such as their eyes; reducing the likelihood of oil being ingested by whales; and reducing oil fumes that may be inhaled by whales. Wolfe *et al.* (2001, 1999, and 1998) found that absorption of petroleum hydrocarbons from both vertebrates and invertebrates decreased when dispersant was used. This is likely due to the dispersed oil molecules being fully encapsulated within the dispersant molecules and not bioavailable.

While direct effects to the skin, lungs, or gastrointestinal tracts of sperm whales by exposure to the dispersants themselves during the DWH response remains a possibility, based on the above, we believe any such effects were insignificant. The available data does not establish effects from the dispersants and, given the available toxicity analyses, we believe any effects would be insignificant.

In Situ Burning of Surface Oil
Approximately 250,000 barrels of floating DWH oil were reportedly consumed during 411 separate burn events (Mabile & Allen 2010). The burning produced significant atmospheric emissions (Perring et al. 2011; Ryerson et al. 2011) and between 11,600 and 16,300 barrels of "stiff, taffy-like" burn residue, some of which was collected by skimmer trawlers, and some of which sank. Samples of burn residue collected from the sea surface and sea floor were found to be enriched in high molecular weight PAHs compared to unburned oil (Stout & Payne 2015). In addition, PAH-rich particles were collected in deep-sea sediment trap samples from late August 2010, which was 4 to 5 weeks after the last in situ burn (Stout & Passow 2015). Detection of

burn-related PAH in these sediment trap samples suggests that atmospheric particles (soot) re-deposited to the Gulf surface and subsequently sank. Thus, both residues of the burned surface oil and soot particles generated during in situ burning passed through the water column and sunk to the sea floor.

Bioassays with water-accommodated fractions prepared from laboratory- and field-generated burn residues of crude oil showed very little or no acute toxicity to marine life (echinoderm, bivalve, inland silverside, three-spine stickleback, white sea urchin) for either weathered oil or burn residue (Daykin et al. 1994 and Blenkinsopp et al. 1997). This research was validated with studies on a marine amphipod, which showed very low or low toxicity in lethal and sub-lethal tests when exposed to water-accommodated fractions or physical suspensions of burn residue in sea water (Gulec and Holdway 1999).

Sperm whales rely on oxygen inhaled at the water's surface, and thus were potentially exposed to inhalation or aspiration of smoke from burning oil if they surfaced to breathe in areas immediately downwind of active burns. Inhalation exposure could decrease respiratory and cardiovascular function, and thus hinder whales' abilities to dive efficiently to forage, find mates, migrate, etc.

In order to maintain control of a burn, the area in which it was conducted was kept relatively small and the burns were conducted for relatively short durations, typically less than 2 hours. Each burn team member was trained to identify and protect sensitive resources (Allen et al. 2011). Near the end of burn operations (the last 10%), NMFS-trained wildlife observers joined the burn teams to ensure that listed species were not present during burning operations (Allen et al. 2011; Mabile and Allen 2010).

Due to data limitations, the DWH PDARP was unable to quantify impacts due to response activities such as burning operations. However, the Trustees did determine that throughout all burn operations, no whales were reported in the vicinity of any burn areas prior to or during operational periods.

Given the large scale of the in situ burns, and the potential short-term and long-term or chronic affects to sperm whales from inhalation or ingestion of post-burning residues, along with the potential impacts to deep-water forage species (large squids and demersal fish) from sunken residues and soot, there is a high probability that some sperm whales were adversely affected by in situ burning activities. These adverse effects were likely reduced (but not eliminated) by monitoring efforts, relatively short burn times and skimming of post-burn residues.

Skimming
The TSM results indicate that effects from skimming on sperm whales were likely insignificant behavioral effects such as temporary disturbance or avoidance of the immediate area of the skimming activities. While a large amount of the skimming activities occurred within the areas where sperm whales were potentially present, there were no reports of sperm whales being physically injured by skimming activities or otherwise affected beyond having their normal behavior temporarily disrupted by the increased vessel and equipment activity. These

disruptions were temporary and we expect the animals to relocate to other areas of similar habitat. We therefore conclude that the effects of skimming on sperm whales was insignificant and that sperm whales were not adversely affected by skimming activities.

NMFS's Recommendations
During the emergency response, the USCG coordinated with NMFS to obtain recommendations for avoiding and minimizing adverse effects of response activities to ESA-listed species and critical habitats. The agencies formalized these recommendations as a set of 52 Best Management Practices (BMPs). A full list of these BMPs can be found in Appendix E of the USCG BA. The 19 BMPs that are most relevant to ESA-listed species and habitats under NMFS' purview are listed below in section 10 (Conservation Recommendations).

Many of these BMPs were not developed or implemented until well into the spill response process. We do however believe that these BMPs had a beneficial effect on sperm whales. In particular, those BMPs that required monitoring and avoidance of certain activities (burning, spraying dispersants, etc.) in areas where ESA-listed species were detected are thought to have prevented adverse effects to numerous individuals.

6 CUMULATIVE EFFECTS

Cumulative effects are those effects of future state or private actions that are reasonably certain to occur within the action area of the federal action subject to consultation (50 CFR 402.02). We analyze these cumulative effects in order to determine if they might compound or intensify the anticipated effects of a proposed action. As was discussed in the Background section of this Opinion, the action under consideration has already concluded. In this Opinion, we are analyzing whether the completed action has already or is likely to jeopardize the continued existence of ESA-listed species or destroyed/adversely modified ESA-designated critical habitat. The effect of state or private actions that occurred at the same time as the completed response activities and that we expect to continue into the future, such as vessel traffic, fisheries, oil and gas activities, marine debris and pollution, acoustic noise, and nutrient loading are considered and analyzed in the section describing the environmental baseline (Section 4). In addition, the section on the status of the species (Section 3) describes the present status of the species, taking into account events to date that have affected the species, including the effects of the oil spill and the response activities and subsequent actions. At this time, we are not aware of any non-federal actions, beyond those discussed in the Environmental Baseline section, which would have ongoing effects to ESA-listed species that might compound or intensify any chronic consequences to species from the completed action. Within the action area, major future changes are not anticipated in the ongoing human activities described in the Environmental Baseline. The present, major human uses of the action area are expected to continue at or near the present levels of intensity in the foreseeable future.

7 INTEGRATION AND SYNTHESIS

Jeopardy Analysis

The analyses conducted in the previous sections of this Opinion serve to provide a basis to determine whether the effects of the completed actions jeopardized or is likely to jeopardize the continued existence of loggerhead sea turtle, Kemp's ridley sea turtle, green sea turtle, leatherback sea turtle, hawksbill sea turtle, or sperm whale. In Section 5.0, we outlined how the completed actions affected these species at the individual level and the extent of those effects to the extent possible based on the best available information. Now we turn to an assessment of the species response to these impacts, in terms of overall population effects, and whether the effects of the completed action, when considered in the context of the current status of the species (Section 3.0) and the current environmental baseline (Section 4.0), jeopardized or is likely to jeopardize the continued existence of the affected species. As noted above, unlike in other opinions, in this after-the-fact consultation, the environmental baseline in this opinion considers the actions currently affecting the species in the action area, including actions that occurred concurrently with the response activities and future actions. In this way, as described in Section 6, the cumulative effects analysis, the environmental baseline section of this opinion captures activities that would have been described in both the environmental baseline and the cumulative effects sections had the consultation occurred before the activities were completed.

To *jeopardize the continued existence of* is defined as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). The best available information on the effects of the completed action, detailed above, cannot provide a specific, quantitative estimate of the number of individuals of each species that were affected by the action. However, the primary purpose for estimating the specific numbers of take for a jeopardy analysis is to allow us to evaluate how that level of take might affect the survival and recovery of the species as a whole. Because we are conducting this analysis years after the action was completed, we have a good understanding of the current status of the species following the action at issue here, including how the action affected the species' survival and recovery. Thus, even though we do not have specific take numbers, we are still able to evaluate the action's effects on the survival and recovery of the species.

Another purpose of conducting an after-the-fact effects analysis on emergency actions, and providing take estimates, where possible, is to use those effects and the level of take that resulted from those effects to inform the environmental baseline in future opinions. Because we are unable to determine the specific amount of take that resulted from the response activities, we are not able to provide that information for future use. However, our environmental baseline sections in current opinions, including in this opinion, do include a detailed description of the effects of the spill and the response, based on best available information.

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. To determine the impacts of the action on the affected species' likelihood of recovery, we evaluate whether the action appreciably interfered with achieving recovery objectives.

7.1 NWA DPS of Loggerhead Sea Turtles

The analyses provided in Section 5 found that the vast majority of the effects on loggerhead sea turtles from the USCG response activities were insignificant behavioral effects (startle, displacement, etc.), which we determined were not likely to adversely affect the species. However, due to the high volume and extended duration of response-related vessel traffic, we determined that for some individuals, vessel-related behavioral responses likely reached a level that caused adverse effects by significantly impairing their essential behavioral patterns, such as breeding, feeding, or resting, resulting in non-lethal take of those individuals. Vessel traffic was also determined to have resulted in lethal take of loggerhead sea turtles due to vessel strikes. Hopper dredging and relocation trawling associated with berm construction in Louisiana were also documented to have resulted in both non-lethal and lethal take of loggerhead sea turtles. Skimming and burning of surface oil were determined to have resulted in lethal take of loggerhead sea turtles (the latter of which also resulted in some sub-lethal effects), and trawling (to capture sub-surface oil) was determined to have resulted in non-lethal take, as loggerheads were potentially captured by the nets, but able to immediately escape through the TEDs, unharmed. The fact that these activities overlapped both temporally and spatially with one of the worst ecological disasters in American history makes it very difficult to discern the effects of the response activities from the overwhelming effects of the oil spill. We did, however, determine that the response activities themselves resulted in some level of mortalities of loggerhead sea turtles. It is also very likely that the adverse effects from the oil spill would have been significantly worse, and would have resulted in significantly higher loggerhead mortalities, if the response activities had not been implemented.

In determining whether the effects of the USCG's spill response actions resulted or are likely to result in an appreciable reduction in the likelihood of survival and recovery of the NWA DPS of loggerhead sea turtles, we begin our analysis by looking at how the action may have affected the numbers, reproduction, or distribution of the DPS, and the effect of any reduction in numbers, reproduction, or distribution on the likelihood of survival and recovery of the species, addressing survival below first.

Survival

With regard to numbers, we know that some response activities did result in lethal take, and that lethal take resulted in a reduction in numbers of loggerhead sea turtles. For example, there were 6 loggerheads documented as killed by the dredging and relocation trawling during berm construction in Louisiana, and the DWH PDARP estimated that "hundreds of turtles" were killed by collisions with response vessels. While the species of the turtles killed by vessel strikes were not specified, given the distribution and density of loggerheads in the high-traffic zone, it is likely that some were loggerheads. We also believe that skimming and burning operations resulted in lethal takes that reduced the numbers of loggerhead sea turtles.

We have also determined that some response activities resulted in non-lethal take of loggerhead sea turtles (e.g., trawling to capture subsurface oil, relocation trawling associated with berm construction, and harassment from response vessels). While the majority of individuals experiencing non-lethal take are expected to have fully recovered, it is likely that some of the non-lethal take eventually resulted in mortalities of the affected individuals (e.g. delayed mortality from chronic effects of ingestion of burn material), indicating additional reductions in numbers of loggerhead sea turtles.

While we can conclude that some level of mortality occurred, we are unable to calculate the exact number of mortalities of loggerhead sea turtles based on the best available information. The findings in the DWH PDARP (Tables 5 & 6) indicate that all life stages of loggerhead sea turtles were affected by the oil spill, and we expect similar exposure to the response activities. The estimated numbers of small oceanic juveniles exposed to the effects of the spill are similar to the numbers for large juveniles and adults. However, the estimated numbers of small juveniles actually killed by the spill are nearly 3 times higher than the estimate for large juveniles/adults. The ratio of mortalities resulting from response activities is likely similar to that from the overall effects of the spill as small juveniles would be more vulnerable to activities such as skimming of oiled Sargassum and in situ burning. Therefore, we expect that the spill reduced the number of mature and juvenile loggerheads, with a greater reduction in the number of small juveniles.

We also know that loggerhead sea turtle reproduction was significantly impacted in 2010, partially due to spill response activities. All sea turtle nests identified within the spill impact zone were excavated and 14,216 loggerhead hatchlings from those nests were transported to the east coast of Florida and released into the Atlantic Ocean. While this effect occurred in the terrestrial environment, and would therefore fall under the jurisdiction of the USFWS, it is highly likely that response activities in the marine environment resulted in lethal take of mature females that would have nested that year, or in subsequent years (e.g., vessel strikes, burning, berm construction, and skimming), and that some response activities resulted in non-lethal take (behavioral impacts) at a level that deterred turtles from breeding or nesting that year (e.g. harassment from vessel traffic and other in-water activities). Whatever the reasons, loggerhead sea turtle nest counts in the Florida Panhandle (their primary nesting area in the northern Gulf of Mexico) in 2010 were the lowest ever recorded from 1996-2017 (Figure 12). It should also be noted that lethal take of juvenile and sub-adult female sea turtles also had the potential to result in a reduction in future reproduction, assuming the individual would otherwise have survived to reproduce in the future (which only a small proportion of juveniles do). Based on the above analysis, we conclude that the lethal and non-lethal take of loggerhead sea turtles resulting from the spill response activities caused a reduction in the species' reproduction.

It is unlikely that the lethal and non-lethal take of loggerhead sea turtles caused by the spill response activities had any measurable impact on the overall distribution of the NWA DPS of loggerhead sea turtles. Aerial surveys conducted both before and after the spill suggest that NWA DPS loggerheads are distributed throughout U.S. waters as follows: 54% off the southeast U.S. coast, 29% off the northeast U.S. coast, 5% in the western Gulf of Mexico (outside of the action area) and only 12% in the eastern Gulf of Mexico, where they could have been affected by the spill response activities (TEWG 1998). There is no indication that these distributions have changed significantly since the spill response activities were concluded (Dennis Klemm, NMFS Southeast Regional Sea Turtle Recovery Coordinator, pers. comm., August 4, 2020). In addition, the data shows that all of the nesting areas for the NWA DPS continue to be used by loggerheads, suggesting neither the in-water distribution nor the nesting distribution has changed as a result of the completed response activities.

Whether the reductions in loggerhead sea turtle numbers and reproduction appreciably reduced or are likely to appreciably reduce the likelihood of survival for the NWA DPS of loggerhead sea turtles depends on what effect these reductions in numbers and reproduction had on overall population sizes and trends. In making this determination, we would generally view these reductions in the context of the status of the species, the environmental baseline, and the expected cumulative effects. In this case, we have already provided the current status of the species and the current baseline, which account for the effects of the completed action and any additional actions that have been undertaken and have affected the species to date, as well as actions that are reasonably certain to occur. We can therefore look directly to the current status and trajectory of the DPS in determining if the effects of the completed action may have or are likely to appreciably reduce the likelihood of survival of the DPS.

Surveys conducted prior to the spill and response provide estimates of the adult female population size for the NWA DPS between 20,000-40,000 individuals (median 30,050) (in the 2004-2008 timeframe; NMFS-SEFSC 2009b), and estimates of the entire in-water loggerhead population along the Eastern Seaboard in the summer of 2010 at 588,439 individuals (estimate ranged from 381,941 to 817,023; NMFS-NEFSC (2011), indicating a strong population going into the period of spill response activities.

In looking at the more recent population trends, following the spill response activities, we start by examining the recovery unit most likely to have been affected by the response activities. Of the 5 recovery units delineated for the NWA DPS, the Northern Gulf of Mexico Recovery Unit (NGMRU; which nests on beaches from Franklin County, Florida, through Texas) is the unit most likely to have been affected by the response activities. The population of this recovery unit is relatively small compared to the Peninsular Florida Recovery Unit and the Northern Recovery Unit of the NWA DPS, and slightly larger than the other 2 recovery units. It is possible that some individuals from the other recovery units were present in the northern Gulf, and potentially affected by the response activities, but the great majority of impacts are thought to have occurred to turtles from the NGMRU, because these are the only turtles that nest in area affected by the response activities.

The Florida Fish and Wildlife Conservation Commission have been monitoring loggerhead nesting on Florida Panhandle beaches (where a large majority of NGMRU loggerheads nest) for over 20 years. These data show a strong increase in nest numbers since 2010 (when the majority of response activities affecting turtles in the marine environment were completed) with 2016 providing the highest nest counts since the surveys began in 1996 (Figure 12). Similar trends were documented for the larger Northern and Peninsular Florida Recovery units over the same time period (Figures 7 & 8). In fact, all previously documented NWA DPS nesting areas have continued to be utilized by loggerhead sea turtles since the completion of the spill response activities and most have seen increases in nest numbers in recent years. Since female loggerheads nest every 3.7 years on average (Tucker 2010), we know that all nesting cohorts would have returned to nest (and be counted in these surveys) at least once, and many twice, since the action was completed. Based on these nesting survey results, we conclude that the previously described impacts on the numbers and reproduction of loggerhead sea turtles did not result in and are not likely to result in a measurable reduction in the survival of the nesting female segment of the DPS (by far the most important segment for the survival and recovery of the DPS).

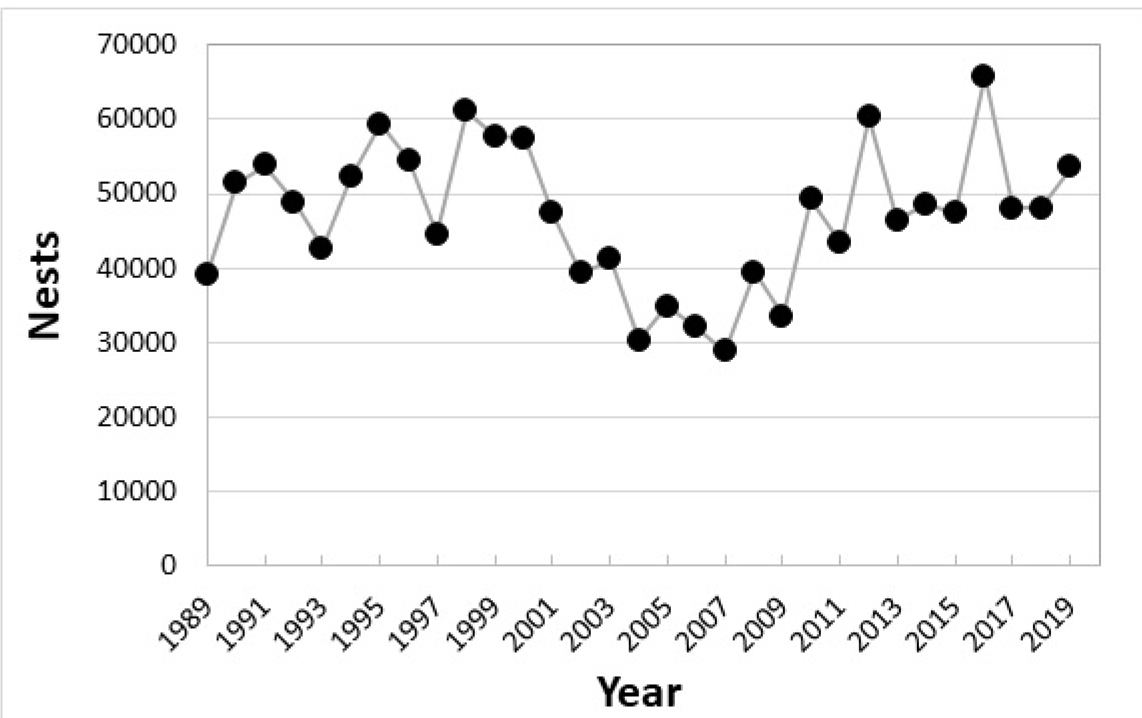

Figure 12. Annual loggerhead sea turtle nest counts on Florida Panhandle index beaches. (http://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/)

The effects of the completed action on the juvenile segment of the population, and the attendant potential effect to the survival of the DPS, is more difficult to determine. Because loggerheads do not reach sexual maturity until 20-38 years of age, the full effects of the completed action on juvenile life stages are not likely to be reflected in nesting surveys for many years to come. However, the available data indicates that a very small proportion of the juvenile population of the DPS was harmed by the completed action. Even if we attribute the entire mortality estimate of "non-heavily oiled" juvenile loggerhead sea turtles (8,310 juveniles; Table 5) to the effects of the response activities (which would certainly be an overestimate), this would equal approximately 0.15% of a single year's juvenile production, based on the information detailed in Section 3 above (and using egg and hatchling survival rates described in Crouse et al. (1987)).

105,500[8] nests * 100[9] eggs/nest = 10,550,000 eggs
10,550,000 eggs * 0.675 survival rate to hatch = 7,121,250 hatchlings
7,121,250 hatchlings * 0.786 survival to 1 year = 5,597,303 juveniles produced
8,310 juveniles killed/5,597,303 juveniles produced = 0.15%

Based on the robust population estimates and strong upward trends in nesting observed since the spill response activities were completed, and the minor effects on the overall juvenile population described above, we do not believe the completed action has caused a detectable impact on population numbers or the increasing trends that has affected the survival of the species. After analyzing the effects of the completed action, in combination with the past, present, and future expected impacts to the DPS discussed in this Opinion, we believe the completed action did not cause and is not likely to cause an appreciable reduction in the likelihood of survival of the loggerhead sea turtle NWA DPS in the wild.

Recovery

The loggerhead recovery plan defines the recovery goal as "…ensur[ing] that each recovery unit meets its Recovery Criteria alleviating threats to the species so that protection under the ESA is no longer necessary" (NMFS and USFWS 2008b). The Services' recovery plan for the NWA population of the loggerhead sea turtle (NMFS and USFWS 2008), which is the same population that was later identified as the NWA DPS of loggerhead sea turtle, anticipates that, with implementation of the plan, the NWA population (DPS) will recover within 50-150 years, but notes that reaching recovery in only 50 years would require a rapid reversal of the then declining trends of the Northern, Peninsular Florida, and Northern Gulf of Mexico Recovery Units. The higher end (150 years) assumes that additional time will be needed for recovery actions to bring about population growth.

The recovery objectives most pertinent to the impacts caused by the completed action are Numbers 1 through 4, and 8 (listed below):

1. Ensure that the number of nests in each recovery unit are increasing and that this increase corresponds to an increase in the number of nesting females.

[8] Based on 2017 estimate of total nests for Florida and the East Coast combined.
[9] Based on the lower end of the estimate of 100-126 eggs per nest from Dodd Jr. (1988).

2. Ensure the in-water abundance of juveniles in both neritic and oceanic habitats is increasing and is increasing at a greater rate than strandings of similar age classes.

3. Manage sufficient nesting beach habitat to ensure successful nesting.

4. Manage sufficient feeding, migratory, and internesting marine habitats to ensure successful growth and reproduction.

8. Recognize and respond to mass/unusual mortality or disease events appropriately.

Recovery Objectives 1 & 2, are the plan's overarching objectives and have associated demographic criteria. Currently, none of the specific criteria are being met, but the plan acknowledges that it will take 50-150 years to achieve recovery. Recent status information provided in Section 3.2, above, indicates the current population consists of several hundred thousand individuals and is showing encouraging signs of stabilizing and possibly increasing. These nesting surveys and in-water surveys indicate that the DPS is represented by a broad range of age classes, supports genetic heterogeneity, and a large number of sexually mature individuals producing viable offspring (NMFS-NEFSC 2011; Figures 7, 8 & 12). Given these improvements in both nesting numbers and in-water abundance that has been observed since the completion of the action under consultation, we believe the impacts associated with the completed action have not prevented or impeded and are not likely to impede the progress towards these recovery objectives.

With regard to Recovery Objectives 3, 4 & 8, the spill response activities were specifically designed and implemented to help achieve these objectives by reducing and reversing the massive impacts to the turtles and their habitats caused by the spill. Without the concentrated efforts of the spill response activities, NWA DPS loggerhead sea turtle nesting, feeding and migratory habitats would have sustained immense, long-term damage and the mortality rates of sea turtles would have been significantly higher. Therefore, we believe the completed action not only did not impede the recovery of NWA DPS of loggerhead sea turtles, but it actually contributed to the ongoing recovery that has been observed since the action was completed.

<u>Conclusion</u>

In determining the overall effects of the completed action, we must also factor in the significant beneficial effects, including the removal of oil from sea turtle habitat and rescuing and rehabilitating sea turtles affected by the spill. Based on the full analysis provided above, we believe that the incidental take, both lethal and non-lethal, of loggerhead sea turtles associated with the completed action have not caused and are not likely to cause an appreciable reduction in the likelihood of survival and recovery of the NWA DPS of loggerhead sea turtles. The above analyses indicate that the effects of the completed action did not cause this robust and widespread DPS of hundreds of thousands of individuals to lose genetic heterogeneity, broad demographic representation, or long-term successful reproduction, or interfere with recovery objectives. Given this information, we can conclude that likely lethal and non-lethal take of the NWA DPS of loggerhead sea turtles associated with the spill response activities undertaken and overseen by the USCG did not appreciably reduce the likelihood of either the survival or recovery of the NWA DPS of loggerhead sea turtles, and did not and are not likely to jeopardize the continued existence of the species.

7.2 Green Sea Turtles (North Atlantic and South Atlantic DPSs)

In order to determine the relative level of effects that each DPS experienced, we must first determine the likely origin of the individuals that were exposed to those effects in the northern Gulf of Mexico. While there are currently no in-depth studies available to determine the percent of NA and SA DPS individuals in any given location, an analysis of cold-stunned green sea turtles in St. Joseph Bay, Florida (northern Gulf of Mexico) found approximately 4% of individuals came from nesting stocks in the SA DPS and that the remainder were from the NA DPS (Foley et al. 2007). On the Atlantic coast of Florida, a study on the foraging grounds off Hutchinson Island found that approximately 5% of the turtles sampled came from the SA DPS (Bass and Witzell 2000). All of the individuals in both studies were benthic juveniles.

Taken together, this information suggests that the vast majority of the green sea turtles affected by the completed action in the Gulf of Mexico were members of the NA DPS. However, it is possible that a small number of animals from the SA DPS could also have been affected by the completed action. Since the cold-stun study (Foley et al. 2007) was conducted in the northern Gulf of Mexico, we will assume those results represent the best available data for estimating the NA and SA DPS distribution for green sea turtle in the action area (also the northern Gulf of Mexico), we therefore assume that 96% of green sea turtles affected by the completed action were from the NA DPS, and the remaining 4% were from the SA DPS, per the breakdown in the study.

The analyses provided in Section 5 found that the vast majority of the effects on green sea turtles from the USCG response activities were insignificant behavioral effects (startle, displacement, etc.), which we determined were not likely to adversely affect the species. However, for some activities (e.g., vessel traffic), the resulting behavioral responses likely reached a level that caused non-lethal adverse effects to some individuals by significantly impairing their essential behavioral patterns, such as breeding, feeding, or resting. Other activities (e.g., vessel strike, burning, and skimming) are thought to have resulted in direct injury and lethal take of green sea turtles, resulting in a reduction in their numbers. The fact that these activities overlapped both temporally and spatially with one of the worst ecological disasters in American history makes it very difficult to discern the effects of the response activities from the overwhelming effects of the oil spill. We did, however, determine that the response activities themselves resulted in some level of mortalities of green sea turtles. It is also very likely that the adverse effects from the oil spill would have been significantly worse, and would have resulted in significantly higher green sea turtle mortalities, if the response activities had not been implemented.

It is also important to note that green sea turtles do not generally nest within the action area. The nesting season for green sea turtles is June through September, which encompasses the time period (in 2010) when the majority of the spill response activities occurred (by the end of August, 2010, all offshore response activities had been completed and only nearshore and shoreline clean-up continued beyond August, 2010). It is therefore reasonable to assume that a large proportion of the mature adults from both the NA and SA DPSs would have been in or near their primary nesting habitats, outside of the action area, during the time period when these activities were occurring, and therefore would not have been exposed to the effects of the action. This assumption is supported by the DWH PDARP, which concluded that "Impacts of the DWH spill on green sea turtles occurred to offshore small juveniles only" (DWH Trustees 2016). We also know that at least 4 green sea turtle nests were found (and translocated) along the northern Gulf coast during the summer of 2010 (DWH Trustees 2016), indicating that at least some mature adults were present in the area during the high-traffic phase of the response efforts. We therefore conclude that response activities did cause adverse effects on both the NA and SA DPS of green sea turtles, and that the great majority (but not all) of these effects were on small juveniles. For the purpose of evaluating whether the action jeopardized the species, we will assume there were some impacts to mature individuals from the NA DPS, as is explained below.

SA DPS

In determining whether the effects of the USCG's spill response actions resulted in or are likely to result in an appreciable reduction in the likelihood of survival and recovery of the SA DPS of green sea turtles, we begin our analysis by looking at how the action may have affected the numbers, reproduction, or distribution of the DPS, and the effect of any reduction in numbers, reproduction, or distribution on the likelihood of survival and recovery of the species, addressing survival first below.

<u>Survival</u>

With regard to numbers, we determined that some response activities did result in lethal take, and that lethal take resulted in a reduction in numbers of green sea turtles. The DWH PDARP estimated that "hundreds of turtles" were killed by collisions with response vessels. While the species of these turtles were not specified, given the distribution and density of green sea turtles in the high-traffic zone, it is likely that some of those killed were green sea turtles. Some green sea turtles also likely were killed during skimming and burning operations (though none were specifically documented). It is also possible that some of the non-lethal take described above eventually resulted in mortalities of the affected individuals (e.g., delayed mortality from chronic effects of ingestion of burn material), indicating additional reductions in numbers of green sea turtles. Despite this anecdotal information, we are unable to determine the total number of mortalities based on the best available information. The DWH PDARP (Tables 5 & 6) determined that the great majority of the green sea turtles that were affected by response activities were small juveniles, though some level of effects on mature adults cannot be ruled out. We also estimate that of the green sea turtles affected by response activities, it is likely that only 4% were members of the SA DPS. Based on the PDARP determination that very few (if any) mature adult green sea turtles were affected by the spill and response, and the fact that only 4% of the green sea turtles encountered likely come from the SA DPS, it is extremely unlikely that any mature adult green sea turtles encountered and affected by the completed action were from the SA DPS. We will therefore assume that only juvenile SA DPS green sea turtles were affected by the completed action.

Based on the determination that mature adult SA DPS green sea turtles were not likely to have suffered mortality from the response activities, it is unlikely that SA DPS green sea turtle reproduction was impacted by response activities. It is possible that the estimated lethal effects (from vessel traffic, skimming, and burning) and nonlethal effects to small juveniles (e.g., from burning or vessel disturbances) could eventually manifest in a slight reduction in reproductive success in the distant future (small juvenile green sea turtles affected by the action would not reach sexual maturity until 25-40 years of age). However, even without the effects of the spill and response activities, these small juveniles would have less than 1% chance of survival to maturity (Crouse et al. 1987). Therefore, it is unlikely that the completed action had or will have any measurable effect on reproduction for this DPS.

It is also unlikely that the lethal and non-lethal effects of the spill response activities on small juveniles had or will have any measurable impact on the overall distribution of the SA DPS of green sea turtles. The in-water range of this DPS is extremely widespread, including significant nesting and feeding grounds along the West Coast of Africa (e.g. Guinea, Congo and Angola), as well as the Caribbean and the East Coast of South America (e.g. Venezuela, Suriname and Brazil), and while no nesting occurs as far south as Uruguay and Argentina, both have important foraging grounds for the SA DPS. All of these widespread nesting and foraging areas have continued to support SA DPS green sea turtles following completion of the spill response activities. Given this extremely broad distribution and the robust nesting populations throughout this range (conservatively estimated at over 63,000 nesters; Seminoff et al. 2015), it is unlikely that the completed action had or will have any measurable effect on the distribution of this DPS.

In determining whether the estimated reductions to the numbers of juveniles from the SA DPS green sea turtles may have appreciably reduced the likelihood of survival of the DPS, we would generally view the reductions in the context of the status of the species, the environmental baseline, and the expected cumulative effects. In this case, we have already provided the current status of the species and the current baseline, which account for the effects of the completed action and any additional actions that have been undertaken and have affected the species to date, as well as actions that are reasonably certain to occur. We can therefore look directly to the current status and trajectory of the DPS in determining if the completed action may have impacted the likelihood of survival of the DPS. In making this determination we can look at the type and extent of impacts that SA DPS individuals were exposed to, the number of SA DPS individuals that were likely exposed to those impacts, and the population trajectory of the DPS following that exposure. We see from the effects analysis above that the majority of effects were insignificant behavioral effects, and that minimal mortality is thought to have occurred. We also know that a very low percentage (4%) of the green sea turtles exposed to these effects were likely to have been from the SA DPS, and that most of the reproductive age adults (the most valuable age class for the survival of any long-lived species) were likely far away in the southern nesting grounds of the DPS. We also know from Section 3 (Status of Species) that this DPS has a large number of nesting females (over 63,000) spread out over 51 identified nesting sites, and that the nesting sites with monitoring data sufficient to allow an estimate number of nesters or trends appear to be stable or growing since the action under consultation was completed.

Because green sea turtles do not reach sexual maturity until 25-40 years of age, the effects to juvenile life stages, the majority of which occurred in 2010, are not likely to be reflected in nesting surveys for many years to come. However, the available data indicates that a very small proportion of the juvenile population of the SA DPS was harmed by the completed action. Even if we attribute the entire mortality estimate of “non-heavily oiled” juvenile green sea turtles

(39,800*0.04 = 1,592 juveniles; Table 5) to the effects of the response activities (which would certainly be an overestimate), this would equal approximately 0.04% of a single year's juvenile production, based on the information detailed in Section 3 above (and using egg and hatchling survival rates described in Crouse et al. (1987)). The one-time loss of 0.04% of a single year's juvenile production is not expected to have any measurable effect on the survival of the SA DPS of green sea turtles.

63,000 nests[10] * 110[11] eggs/nest = 6,930,000 eggs
6,930,000 eggs * 0.675 survival rate to hatch = 4,677,750 hatchlings
4,677,750 hatchlings * 0.786 survival to 1 year = 3,676,712 juveniles produced
1,592 juveniles killed/3,676,712 juveniles produced = 0.04%

Based on the robust population estimates (at least 63,000 nesters spread across 51 nesting sites) and stable or increasing trends in nesting observed since the spill response activities were completed, and the minor effects on the juvenile population described above, we do not believe the completed action has caused or is likely to cause a detectable impact on population numbers or trends. After analyzing the effects of the completed action, in combination with the past, present, and future expected impacts to the DPS discussed in this Opinion, we believe the completed action did not and is not likely to cause an appreciable reduction in the likelihood of survival of the SA DPS of green sea turtles in the wild.

Recovery

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

Objective: The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years.

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

There is no nesting of the SA DPS in Florida, but given the estimated nesting abundance of over 63,000 adult females in the South Atlantic, and the fact that all major nesting populations for which we have consistent monitoring data are experiencing long-term stability or increases in abundance (Seminoff et al. 2015), the effects of the lethal and nonlethal take on a small number of juveniles caused by the completed action do not appear to have caused any detectable reduction in the average annual nesting levels. We have no data on the total number of individuals in the SA DPS foraging grounds, but the documented stability and potential increases

[10] Nesting females average approximately 3 nests per season, and mature females return to nest approximately once every 3 years, so an average of 1 nest per mature female in a population is a reasonable annual estimate.
[11] From Johnson and Ehrhart (1996)

in adult females within the DPS is a good indication that the other sectors of the population are also stable or growing. Therefore, the completed action does not appear to be impeding achieving the basic recovery objectives and has not and is not expected to result in an appreciable reduction in the likelihood of the SA DPS of green sea turtles' recovery in the wild.

<u>Conclusion</u>
In determining whether the effects of the completed action (including all lethal and nonlethal take) have or are likely to jeopardize the continued existence of the species, we must also factor in the significant beneficial effects, including the removal of oil from sea turtle habitat and rescuing and rehabilitating sea turtles affected by the spill. Based on the full analysis provided above, we believe that the lethal and nonlethal take of green sea turtles from the SA DPS associated with the completed action have not caused and are not likely to cause an appreciable reduction in the likelihood of survival and recovery of the SA DPS of green sea turtles. Surveys show the current population is comparatively large (i.e., over 63,000 nesting females) and is showing encouraging signs of stabilizing and possibly increasing. Nesting surveys indicate that the DPS is represented by a large number of sexually mature individuals producing viable offspring (Section 3). These data indicate that the effects of the completed action did not cause this robust and widespread DPS to lose genetic heterogeneity, broad demographic representation, or long-term successful reproduction, or interfere with recovery objectives. Given this information, we can conclude that the spill response activities undertaken and overseen by the USCG did not appreciably reduce the likelihood of either the survival or recovery of the SA DPS of green sea turtles, and did not jeopardize and are not likely to jeopardize the continued existence of the species.

NA DPS
In determining whether the effects of the USCG's spill response actions resulted in an appreciable reduction in the likelihood of survival and recovery of the NA DPS of green sea turtles, we begin our analysis by looking at how the action may have affected the numbers, reproduction, or distribution of the NA DPS, and the effect of any reduction in numbers, reproduction, or distribution on the likelihood of survival and recovery of the species, addressing survival first below.

<u>Survival</u>
With regard to numbers, we determined that some response activities did result in lethal take, and that lethal take resulted in a reduction in numbers of green sea turtles. The DWH PDARP estimated that "hundreds of turtles" were killed by collisions with response vessels. While the species of these turtles were not specified, given the distribution and density of green sea turtles in the high-traffic zone, it is likely that some of those killed were green sea turtles. Some green sea turtles also likely were killed during skimming, and burning operations (though none were specifically documented). It is also possible that some of the non-lethal take described above eventually resulted in mortalities of the affected individuals (e.g. delayed mortality from chronic effects of ingestion of burn material), indicating additional reductions in numbers of green sea turtles. Despite this anecdotal information, we are unable to determine the total number of mortalities based on the best available information. Based on findings in the DWH PDARP (Tables 5 & 6) it is likely that the great majority (if not all) of the green sea turtles that were affected by response activities were small juveniles, though some level of effects on mature

adults cannot be ruled out. We also estimate that, of the green sea turtles killed by response activities, it is likely that approximately 96% were members of the NA DPS. Because we assume most (96%) of the green sea turtles affected by the completed action come from the NA DPS, we will assume any mortalities of mature individuals were to individuals from the NA DPS.

Based on the low expected mortalities to mature adult green sea turtles from the NA DPS in the marine environment, it is unlikely that NA DPS green sea turtle reproduction was significantly impacted by spill response activities. It is possible the expected effects to small juveniles could eventually manifest in a slight reduction in reproductive success in the distant future (small juvenile green sea turtles affected by the action would not reach sexual maturity until 25-40 years of age). However, even without the effects of the spill and response activities, these small juveniles would have less than 1% chance of survival to maturity (Crouse et al. 1987). Given the low level of effects on adults, the naturally low survival rates for small juveniles, and the relatively small percentage of small juveniles estimated to have been adversely affected by the response activities (see calculation below), it is unlikely that the completed action caused or will cause any measurable reduction in reproduction for this DPS.

It is also unlikely that the effects of the spill response activities had any measurable impact on the overall distribution of the NA DPS of green sea turtles. The NA DPS is the largest of the 11 designated DPSs and their geographic distribution is very broad, including large nesting populations (<1000 nesters) located in Costa Rica, Cuba, Mexico, and the East Coast of Florida. Nesting also occurs in the Bahamas, Belize, Cayman Islands, Dominican Republic, Haiti, Honduras, Jamaica, Nicaragua, Panama, Puerto Rico, Turks and Caicos Islands, and North Carolina, South Carolina, Georgia, and Texas, U.S.A. In the eastern Atlantic, nesting has been reported in Mauritania, North Africa (Fretey 2001). All of these widespread nesting areas have continued to support NA DPS green sea turtles following completion of the spill response activities. Given this broad distribution, the robust nesting populations throughout this range (estimated at 167,000 nesting females; Seminoff et al. 2015), and the continued growth of these populations since the completion of the action, it is unlikely that the completed action had or will have any measurable effect on the distribution of this DPS.

In determining whether the effects to the NA DPS green sea turtles described above may have reduced the likelihood of survival of the DPS, we would generally view the reductions in the context of the status of the species, the environmental baseline, and the cumulative effects. In this case, we have already provided the current status of the species and the current baseline, which account for the effects of the completed action and any additional actions that have been undertaken and have affected the species to date, as well as actions that are reasonably certain to occur. We can therefore look directly to the current status and trajectory of the DPS in determining if the completed action impacted (or will) the likelihood of survival of the DPS. In making this determination we can look at the type and extent of impacts that NA DPS individuals were exposed to, the number of NA DPS individuals that were likely exposed to those impacts, and the population trajectory and viability of the DPS following that exposure. We see from the effects analysis above that the majority of effects were insignificant behavioral effects, and that minimal mortality is thought to have occurred. We also know that a large percentage of the reproductive age adults (the most valuable age class for the survival of any long-lived species) were likely far away from the action area, in the nesting grounds of the NA DPS, during the majority of the response operations and that the DWH PDARP found that only small juvenile green sea turtles were affected by the spill and response activities, though we assume some potential impacts to mature individuals of this DPS. We also know from Section 3 (Status of Species) that this DPS is the largest of all the green sea turtle DPSs, with over 167,000 adult females from 73 nesting sites, and that all of the populations that have been monitored over the past decade have shown significant and consistent increases in nest counts since the action under consultation was completed.

Because green sea turtles do not reach sexual maturity until 25-40 years of age, the effects to juvenile life stages, the majority of which occurred in 2010, are not likely to be reflected in nesting surveys for many years to come. However, the available data indicates that a very small proportion of the juvenile population of the NA DPS was harmed by the completed action. Even if we attribute the entire mortality estimate of "non-heavily oiled" juvenile green sea turtles (39,800*0.96 = 38,208 juveniles; Table 5) to the effects of the response activities (which would certainly be an overestimate), this would equal approximately 0.4% of a single year's juvenile production, based on the information detailed in Section 3 above (and using egg and hatchling survival rates described in Crouse et al. (1987)). The one-time loss of 0.4% of a single year's juvenile production is not expected to have any measurable effect on the survival of the NA DPS of green sea turtles.

167,000 nests[12] * 110[13] eggs/nest = 18,370,000 eggs
18,370,000 eggs * 0.675 survival rate to hatch = 12,399,750 hatchlings
12,399,750 hatchlings * 0.786 survival to 1 year = 9,746,204 juveniles produced
38,208 juveniles killed/9,746,204 juveniles produced = 0.4%

Based on the robust population estimates (at least 167,000 nesting females spread across 15 countries and 5 states) and stable or increasing trends in nesting observed since the spill response activities were completed, and the minor effects on juveniles (and possibly some adults) described above, we do not believe the completed action has caused or is likely to cause a detectable impact on population numbers or trends. After analyzing the effects of the completed action, in combination with the past, present, and future expected impacts to the DPS discussed in this Opinion, we believe the completed action did not cause and is not likely to cause an appreciable reduction in the likelihood of survival of the NA DPS of green sea turtles in the wild.

Recovery

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

[12] Nesting females average approximately 3 nests per season, and mature females return to nest approximately once every 3 years, so an average of 1 nest per mature female in a population is a reasonable annual estimate.
[13] From Johnson and Ehrhart (1996)

Objective: The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years.

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

Given the estimated nesting abundance of over 167,000 adult females from 73 nesting sites, and the fact that all major nesting populations are experiencing long-term increases in abundance (Seminoff et al. 2015), the non-lethal take caused by the completed action along with the lethal take do not appear to have resulted in any detectable reduction in the average annual nesting levels. We have no data on the total number of individuals in the NA DPS foraging grounds, but the documented increases in adult females within the DPS is a good indication that the other sectors of the population are also stable or growing. Therefore, the completed action does not appear to be impeding achieving the recovery objectives above and has not resulted in and is not likely to result in an appreciable reduction in the likelihood of the NA DPS of green sea turtles' recovery in the wild.

Conclusion

In determining the overall effects of the completed action, we must also factor in the significant beneficial effects, including the removal of oil from sea turtle habitat and rescuing and rehabilitating sea turtles affected by the spill. Based on the full analysis provided above, we believe that the lethal and non-lethal incidental take of green sea turtles from the NA DPS associated with the completed action have not caused and are not likely to cause an appreciable reduction in the likelihood of survival and recovery of the NA DPS of green sea turtles. Surveys show the current population includes approximately 167,000 nesting females, and is showing encouraging signs of stabilizing and possibly increasing. Nesting surveys indicate that the DPS is represented by a large number of sexually mature individuals producing viable offspring (Section 3). These data indicate that the effects of the completed action did not cause this robust and wide spread DPS to lose genetic heterogeneity, broad demographic representation, or long-term successful reproduction, or interfere with recovery objectives. Given this information, we can conclude that the spill response activities undertaken or overseen by the USCG did not appreciably reduce the likelihood of either the survival or recovery of the NA DPS of green sea turtles, and did not jeopardize and are not likely to jeopardize the continued existence of the species.

7.3 Kemp's Ridley Sea Turtles

The analyses provided in Section 5 found that the vast majority of the effects on Kemp's ridley sea turtles from the USCG response activities were insignificant behavioral effects (startle, displacement, etc.), which we determined were not likely to adversely affect the species. However, for some activities (e.g., vessel traffic), the resulting behavioral responses likely reached a level that caused adverse effects to some individuals by significantly impairing their essential behavioral patterns, such as breeding, feeding, or resting, resulting in non-lethal take of those individuals. Vessel traffic was also determined to have resulted in lethal take of Kemp's ridley sea turtles due to vessel strikes. Other activities are thought to have resulted in direct injury (non-lethal take) (e.g., burning, trawling for subsurface oil, relocation trawling associated with berm construction) and mortality (lethal take) (e.g., burning, berm construction, and skimming) of Kemp's ridley sea turtles. The fact that these activities overlapped both temporally and spatially with one of the worst ecological disasters in American history makes it very difficult to discern the effects of the response activities from the overwhelming effects of the oil spill. Kemp's ridleys were thought to be the turtle species most severely impacted by the DWH oil spill. The DWH PDARP estimates that approximately half of all small juvenile Kemp's ridleys were exposed to oil, with up to 86,500 small juveniles (approximately 20% of the population for that age class) killed as a direct result of the exposure during 2010. Impacts to large juveniles (3 years and older) and adults were also high. An estimated 21,990 such individuals were exposed to oil, with 3,060 mortalities estimated (or 3% of the population for those age classes; DWH Trustees 2016). It is also very likely that the adverse effects from the oil spill would have been significantly worse, and would have resulted in significantly higher Kemp's ridley sea turtle mortalities, if the response activities had not been implemented.

A very small percentage of Kemp's ridley sea turtles nest within the action area (<1%). The nesting season for Kemp's ridley sea turtles is April through June, which encompasses a significant proportion the time period (in 2010) when the offshore spill response activities occurred (by the end of August, 2010, all offshore response activities had been completed and only nearshore and shoreline clean-up continued beyond August, 2010). It is therefore reasonable to assume that many mature adults would have been outside of the action area, near their primary nesting habitats during the first few months of response activities, and would have had a reduced likelihood of exposure to the effects of the action. However, we know that some large juveniles and sexually mature adults were affected by the spill and the response activities as the DWH PDARP estimated that 21,000 Kemp's ridleys over age 3 were exposed, and 2,650 of those were killed (Table 6).

In determining whether the effects of the USCG's spill response actions resulted in or are likely to result in an appreciable reduction in the likelihood of survival of Kemp's ridley sea turtles, we begin our analysis by looking at how the action may have affected the numbers, reproduction, or distribution of the species, and the effect of any reduction in numbers, reproduction, or distribution on the likelihood of survival and recovery of the species, addressing survival first.

Survival

With regard to numbers, we know that some response activities did result in lethal take and a reduction in numbers of Kemp's ridley sea turtles. There were 3 Kemp's ridleys found dead in the vicinity of the dredging activities during berm construction in Louisiana, and the DWH PDARP estimated that "hundreds of turtles" were killed by collisions with response vessels. While the species of those turtles were not specified, given the distribution and density of Kemp's ridleys in the high-traffic zone, it is likely that some were Kemp's ridleys. Some Kemp's ridleys also likely were killed during skimming and burning operations (though none were specifically documented). In addition, it is possible that the estimated nonlethal take of Kemp's ridleys (such as from vessel traffic and burning) could eventually manifest in a slight reduction in numbers if stressed or injured turtles eventually died as a result of the non-lethal take. Despite this anecdotal information, we are unable to estimate the total number of mortalities based on the best available information. The DWH PDARP (Tables 5 & 6) determined that all life stages of Kemp's ridley sea turtles were affected by the spill, which is a strong indication that those same age classes were also affected by the spill response activities.

It is also difficult to determine the extent to which reproduction of Kemp's ridley sea turtles was impacted by the completed action. While it is likely that the majority of mature adults avoided the majority of effects of the spill response activities (due the timing and location of their primary nesting activities), we believe that some mature adults, and many sub-adults, that may have eventually contributed to reproduction of the species were adversely affected through both lethal and non-lethal take as a result of the completed action. Any mature females that were killed or deterred from nesting by dredging, vessel strikes, skimming, and burning would have resulted in a direct and immediate reduction in reproduction, and lethal take of sub-adults from these activities may have reduced potential future reproduction by removing future nesters from the population.

It is unlikely that the lethal and non-lethal take of juvenile and adult Kemp's ridley sea turtles that resulted from the spill response activities had any measurable impact on the overall distribution of the species. The primary range of Kemp's ridley sea turtles is within the Gulf of Mexico basin, though they have also been documented in coastal and offshore waters of the U.S. Atlantic Ocean. Currently, over 90% of nesting occurs within a 76-mile stretch of beaches along the southwestern Gulf coast of Mexico (Gladys Porter Zoo 2017). However, the species nesting distribution appears to be expanding in recent years with nesting recorded from beaches in Texas, Florida, Georgia, and the Carolinas. Nesting in these new areas has continued to increase in the years since the response activities were completed (with oscillations mirroring those seen at the primary nesting beaches in Mexico), and in 2012, the first Kemp's ridley sea turtle nest was recorded in Virginia. We therefore conclude that the spill response activities did not reduce the overall distribution of Kemp's ridley sea turtles.

In determining whether the estimated reductions to the numbers and reproduction of Kemp's ridley sea turtles may have appreciably reduced the likelihood of survival of the species, or are likely to, we would generally view these reductions in the context of the status of the species, the environmental baseline, and the expected cumulative effects. In this case, we have already provided the current status of the species and the current baseline, which account for the effects of the completed action and any additional actions that have been undertaken and have affected the species to date, as well as actions that are reasonably certain to occur. We can therefore look directly to the current status and trajectory of the species in determining if the completed action may have impacted the likelihood of survival of the species. In making this determination we must look at the type and extent of impacts that individuals were exposed to, the number of individuals that were likely exposed to those impacts, and the population trajectory of the species following that exposure. We see from the effects analysis above that the majority of effects were insignificant behavioral effects, and that a small amount of documented mortality can be directly linked to the response activities (an unspecified number of both adult and juvenile Kemp's ridleys are thought to have been killed by dredging, vessel strikes, skimming, and burning). We also know that many reproductive age adults (the most valuable age class for the survival of any long-lived species) were likely far away from the action area, in their primary nesting grounds in Mexico and southwest Texas during the first few months of the response actions.

In Section 3 (Status of Species) we documented the population dynamics and recent trajectory of the species. Monitoring of the primary nesting sites in Mexico shows exponential growth from 1999 through 2009, followed by large fluctuations in nesting over the past decade (Figure 6). A small nesting population has also emerged in the United States, primarily in Texas, rising from 6 nests in 1996 to 42 in 2004, to a record high of 353 nests in 2017 (National Park Service data). Nesting in Texas has paralleled the trends observed in primary nesting sites in Mexico, characterized by a significant decline in 2010, followed by a second decline in 2013-2014, and a strong rebound from 2015 - 2017, and then a drop back down to 190 nests in 2019 (National Park Service data).

With significant inter-annual variation in nesting data, sea turtle population trends necessarily are measured over decades and the long-term trend line better reflects the population trajectory in Kemp's ridleys. Given the significant oscillations in nesting numbers over the past decade, it is impossible to predict how future trends may be affected. Nonetheless, data from 1990 to present continue to support that Kemp's ridley sea turtle are showing a generally increasing nesting trend. We believe this long-term increasing trend in nesting is evidence of an increasing population, as well as a population that is maintaining (and potentially increasing) its genetic diversity. We believe these nesting trends are indicative of a species with a high number of sexually mature individuals.

Based on the long-term increasing trends in nesting, and no indication of sustained decreases observed since the spill response activities were completed, we do not believe the completed action has caused or is likely to cause a detectable impact on population numbers or trends. After analyzing the effects of the completed action, in combination with the past, present, and future expected impacts to the species discussed in this Opinion, we believe the completed action did not cause and is not likely to cause an appreciable reduction in the likelihood of survival of Kemp's ridley sea turtles in the wild.

Recovery

The recovery plan for the Kemp's ridley sea turtle (NMFS et al. 2011b) lists the following relevant recovery objective:

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

The recovery plan states the average number of nests per female is 2.5; it sets a recovery goal of 10,000 nesting females associated with 25,000 nests. The 2012 nesting season recorded approximately 22,000 nests and the numbers from 2017 were very close to 25,000, indicating that the goal of 10,000 nesting females may have been reached (for 1 year only). The fact that these high nesting periods occurred after most or all of the spill response activities had been completed, along with the overall increasing long-term trend for the species, indicates that the lethal and nonlethal take of adult and juvenile Kemps ridley sea turtles resulting from the completed action has not resulted in appreciable reductions in the species' ability to recover.

The increase in Kemp's ridley sea turtle nesting is believed to be due to a combination of management measures including elimination of direct harvest, nest protection, the use of TEDs, reduced trawling effort in Mexico and the U.S., and possibly other changes in vital rates (TEWG 1998a; TEWG 2000). The estimated reductions in numbers and reproduction caused by the completed action do not appear to have influenced the nesting population trends noted above. Thus, we believe the completed action did not have an appreciable effect on the recovery objective above, and did not cause and are not likely to result in an appreciable reduction in the likelihood of Kemp's ridley sea turtles' recovery in the wild.

<u>Conclusion</u>

Based on the full analysis provided above, we believe that the lethal and nonlethal take of Kemp's ridley sea turtles associated with the completed action have not caused and are not likely to cause an appreciable reduction in the likelihood of survival and recovery of the species. Surveys show the current population is comparatively large (i.e., 5,000 to 10,000 nesting females) and is expanding its nesting range outside of Mexico. These data indicate that the effects of the completed action did not cause this species to lose genetic heterogeneity, broad demographic representation, or long-term successful reproduction, or interfere with survival or recovery. Given this information, we can conclude that the spill response activities undertaken or overseen by the USCG did not and are not likely to appreciably reduce the likelihood of either the survival or recovery of Kemp's ridley sea turtles, and did not and are not likely to jeopardize the continued existence of the species.

7.4 Hawksbill Sea Turtles

There were relatively few hawksbill sea turtles thought to be impacted by the DWH oil spill and related response efforts. Only 29 hawksbills were observed throughout the response period, with 4 treated and released, and only a single documented mortality. The analyses provided in Section 5 found that the vast majority of the effects from the USCG response activities were insignificant behavioral effects (startle, displacement, etc.), which we determined were not likely to adversely affect the species. However, for some activities (e.g., vessel traffic), the resulting behavioral responses likely reached a level that caused adverse effects to some individuals by significantly impairing their essential behavioral patterns, such as feeding or resting, resulting in nonlethal take of these individuals. Vessel traffic also was determined to have resulted in lethal take of hawksbill sea turtles due to vessel strikes. Some other activities (e.g., skimming, and burning) are thought to have resulted in direct injury (nonlethal take) and even mortality (lethal take) of hawksbill sea turtles. The fact that these activities overlapped both temporally and spatially with one of the worst ecological disasters in American history makes it very difficult to discern the effects of the response activities from the overwhelming effects of the oil spill. We did however, determine that the response activities themselves resulted in some level of mortalities of hawksbill sea turtles. It is also very likely that the adverse effects from the oil spill would have been significantly worse, and would have resulted in significantly higher hawksbill mortalities, if the response activities had not been implemented.

Hawksbill sea turtles do not nest within the action area. The nesting season for hawksbill sea turtles is April through October, which encompasses the time period (in 2010) when the majority of the spill response activities occurred (by the end of August, 2010, all offshore response activities had been completed and only nearshore and shoreline clean-up continued beyond August, 2010). It is therefore reasonable to assume that mature adults would have been outside of the action area, near their primary nesting habitats during most of the response activities, and therefore would not have been exposed to the effects of the action. This assumption is supported by the DWH PDARP, which concluded that "Impacts of the DWH spill on hawksbill sea turtles occurred to offshore small juveniles only" (DWH Trustees 2016). Given the very low numbers of hawksbill sea turtles observed within the action area (much lower than the other sea turtle species), the fact that breeding adults are likely to have been far from the action area in their nesting grounds, and the DWH PDARP conclusion that only small juveniles were affected by the spill and response, we conclude that it is extremely unlikely that mature individuals were adversely affected, and that only small juveniles were adversely affected.

In determining whether the effects of the USCG's spill response actions resulted in an appreciable reduction in the likelihood of survival and recovery of hawksbill sea turtles, we begin our analysis by looking at how the action may have affected the numbers, reproduction, or distribution of the species, and the effect of any reduction in numbers, reproduction, or distribution on the likelihood of survival and recovery of the species. We address survival first, below.

<u>Survival</u>

With regard to numbers, we determined that some response activities did result in lethal take (and a corresponding reduction in numbers) of hawksbill sea turtles. For example, the DWH PDARP estimated that "hundreds of turtles" were killed by collisions with response vessels. While the species of these turtles were not specified, given the distribution of hawksbill sea turtles in the high-traffic zone, some of those killed were likely hawksbills. Despite this anecdotal information, we are unable to determine the total number of mortalities based on the best available information. Based on the analysis above and the findings in the DWH PDARP (Tables 5 & 6), we assume that all of the hawksbill sea turtles that were adversely affected by response activities were small juveniles.

We conclude that because it is extremely unlikely that mature adult hawksbill sea turtles were adversely affected by the completed action, it is unlikely that their reproduction was impacted by spill response activities. No nesting beaches or other reproductive habitat occur within the affected area, and any adults that may have been nesting or mating in 2010 would have been far away in their nesting areas when the primary effects of the action were occurring. It is possible that the lethal and nonlethal effects to small juveniles could eventually manifest in a slight reduction in reproductive success in the distant future (small juvenile hawksbill sea turtles killed by the action would not have reached sexual maturity until 20-40 years of age). However, even without the effects of the spill and response activities, these small juveniles would have less than 1% chance of survival to maturity (Crouse et al. 1987). Given the lack of effects on adults, the naturally low survival rates for small juveniles, and the relatively small number of small juveniles estimated to have been adversely affected by the response activities (0.15% of a single year's production; see calculation below), it is unlikely that the completed action had or will have any measurable effect on reproduction for this species.

It is also unlikely that the lethal and nonlethal take of a relatively small number of juvenile hawksbill sea turtles caused by the spill response activities had any measurable impact on the overall distribution of the species. Hawksbills are broadly distributed throughout tropical and subtropical regions around the world, with a 2007 estimate of 21,212 to 28,138 adult females nesting at 83 different sites throughout 10 ocean regions. In the western Atlantic, hawksbills are distributed throughout the Caribbean Sea, off the coasts of Florida and Texas in the continental United States, in the Greater and Lesser Antilles, and along the mainland of Central America south to Brazil. Genetic research has shown that hawksbills of multiple nesting origins commonly mix in foraging areas (Bowen and Witzell 1996). There is limited information on hawksbill population trends, but the most recent analysis, conducted after all effects of the completed action had been realized, indicates that several nesting populations in the Caribbean and Mexico are stable or increasing (NMFS and USFWS 2013b). Given this extremely broad, circumtropical distribution, and the relatively small number of small juveniles estimated to have been adversely affected by the response activities (see calculation below), it is unlikely that the completed action had or will have any measurable effect on the overall distribution of hawksbill sea turtles.

With no measurable effects on reproduction or distribution of the species, we need to determine whether the estimated reductions to the numbers of hawksbill turtles may have reduced the likelihood of survival of the species. In a normal pre-project consultation, we would need to view the reductions in the context of the status of the species, the environmental baseline, and the cumulative effects. In this case, we have already provided the current status of the species and the current baseline, which account for the effects of the completed action and any additional actions that have been undertaken and have affected the species to date, as well as actions that are reasonably certain to occur. We can therefore look directly to the current status and trajectory of the species in determining if the completed action may have impacted the likelihood of survival of the species. In making this determination we can look at the type and extent of impacts that individuals were exposed to, the number of individuals that were likely exposed to those impacts, and the population trajectory of the species following that exposure.

In Section 3 (Status of Species), we provided information on the population dynamics of the species. Hawksbills are broadly distributed throughout tropical and subtropical regions around the world, with a 2007 estimate of 21,212 to 28,138 adult females nesting at 83 different sites throughout 10 ocean regions. Hawksbills nest in low densities on scattered small beaches throughout the Caribbean, with the majority of nesting occurring in Mexico and Cuba. In Mexico, about 2,800 adult females were estimated to nest in Campeche, Yucatán, and Quintana Roo in 2003 (Spotila 2004), and Lutz et al. (2003) estimated the total number of adult hawksbills living in the Caribbean to be 27,000. The most recent data on population trends is from 2012, which shows nesting populations throughout the Caribbean and mainland Central America continued to grow following the DWH spill (NMFS and USFWS 2013b).

While there were no mortalities of hawksbill sea turtles detected, we believe that a small proportion of the juvenile population present in the action area was killed by the effects of the completed action. Even if we attribute the entire mortality estimate of "non-heavily oiled" juvenile hawksbill sea turtles (2,390 juveniles; Table 5) to the effects of the response activities (which would certainly be an overestimate), this would equal approximately 0.15% of a single year's juvenile production, based on the information detailed in Section 3 above (and using egg and hatchling survival rates described in Crouse et al. (1987)).

21,212 nests[14] * 140[15] eggs/nest = 2,969,680 eggs
2,969,680 eggs * 0.675 survival rate to hatch = 2,004,534 hatchlings
2,004,534 hatchlings * 0.786 survival to 1 year = 1,575,564 juveniles produced
2,390 juveniles killed/1,575,564 juveniles produced = 0.15%

Based on the robust population estimates (21,212 to 28,138 adult females nesting at 83 different sites throughout 10 ocean regions in 2007) and stable or increasing trends in nesting observed throughout the Caribbean and mainland Central America since the spill response activities were completed, and the relatively minor estimated lethal take of small juveniles described above (with no measurable effects to the reproduction or distribution of the species), we believe the completed action did not and is not likely to cause an appreciable reduction in the likelihood of survival of hawksbill sea turtles in the wild.

Recovery

The Services' recovery plan for hawksbill sea turtles (NMFS and USFWS 1993) provides a detailed explanation of the goals and vision for recovery for this species. The recovery objectives most pertinent to the impacts caused by the completed action are Numbers 1 and 3 (listed below):

(1) The adult female population is increasing, as evidenced by a statistically significant trend in the annual number of nests on at least five index beaches, including Mona Island and Buck Island Reef National Monument.

(3) Numbers of adults, subadults, and juveniles are increasing, as evidenced by a statistically significant trend on at least five key foraging areas within Puerto Rico, USVI, and Florida.

The latest status review of hawksbill sea turtles (NMFS 2013b) did find statistically significant increases in nesting on at least 7 index beaches in the Caribbean and mainland Central America, including Mona Island and Buck Island Reef National Monument. There has not been sufficient monitoring of in-water foraging areas to determine whether numbers of adults, subadults, and juveniles are increasing in these areas. However, given the extremely low densities of hawksbills observed in the action area during response activities, the small number of juvenile hawksbills estimated to have been impacted by the completed action, and the evidence of recent increases in nesting trends in the area, we believe that the estimated lethal and nonlethal take that resulted from the completed action has not had and is not likely to have an appreciable effect on the recovery objectives above, and has not and is not likely to result in an appreciable reduction in the likelihood of hawksbill sea turtles' recovery in the wild.

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[14] Based on the 2007 lower estimate of 21,212 nesting females, assuming each female lays 3 nests once every 3 years.
[15] From USFWS hawksbill fact sheet (http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/hawksbill-sea-turtle.htm).

Conclusion
In determining whether the effects of the completed action (including all lethal and nonlethal take) jeopardized or is likely to jeopardize the continued existence of the species, we must also factor in the significant beneficial effects, including the removal of oil from sea turtle habitat and rescuing and rehabilitating sea turtles affected by the spill. Based on the full analysis provided above, we believe that the lethal and nonlethal take of hawksbill sea turtles associated with the completed action have not caused and are not likely to cause an appreciable reduction in the likelihood of survival and recovery of the species. Surveys show the nesting population included approximately 21,000-28,000 nesting females in 2007, and more recent information is showing encouraging signs of stabilizing and possibly increasing. There is currently no indication that the effects of the completed action caused this widely distributed species to lose genetic heterogeneity, broad demographic representation, or long-term successful reproduction, or interfered with recovery objectives for the species. Given this information, we can conclude that the spill response activities undertaken or overseen by the USCG did not and are not likely to appreciably reduce the likelihood of either the survival or recovery of hawksbill sea turtles, and did not and are not likely to jeopardize the continued existence of the species.

7.5 Leatherback Sea Turtles

There were relatively few leatherback sea turtles thought to be impacted by the DWH oil spill and related response efforts. Only 21 leatherback sea turtles were observed alive in water from surface vessels and 2 others were observed from the air. No leatherbacks were captured or taken to rehab facilities, and none were observed dead throughout the response period. The analyses provided in Section 5 found that the vast majority of the effects from the USCG response activities were insignificant behavioral effects (startle, displacement, etc.), which we determined were not likely to adversely affect the species. However, for some activities (e.g., vessel traffic), the resulting behavioral responses likely reached a level that caused adverse effects to some individuals by significantly impairing their essential behavioral patterns, such as feeding or resting, resulting in nonlethal take of these individuals. Vessel traffic also was determined to have resulted in lethal take of leatherback sea turtles due to vessel strikes. Some other activities (e.g., skimming and burning) are thought to have resulted in direct injury (nonlethal take) and even mortality (lethal take) of leatherback sea turtles. The fact that these activities overlapped both temporally and spatially with one of the worst ecological disasters in American history makes it very difficult to discern the effects of the response activities from the overwhelming effects of the oil spill. We did however, determine that the response activities themselves resulted in some level of mortalities of leatherback sea turtles. It is also very likely that the adverse effects from the oil spill would have been significantly worse, and would have resulted in significantly higher leatherback mortalities, if the response activities had not been implemented.

Leatherback sea turtles do not nest within the action area. The nesting season for leatherback sea turtles is March through July, which encompasses the time period (in 2010) when the majority of the spill response activities occurred (by the end of August, 2010, all offshore response activities had been completed and only nearshore and shoreline clean-up continued beyond August, 2010). It is therefore reasonable to assume that mature adults would have been outside of the action area, near their primary nesting habitats during the first few months of the response activities, and therefore would have had a reduced likelihood of exposure to the effects of the action. Due to data limitations and logistical constraints, the DWH PDARP was not able to quantify the amount or type of injuries incurred by leatherbacks. There were too few leatherbacks detected during surveys for the DWH PDARP to estimate abundance or age class of leatherbacks exposed to the effects of the spill.

Very low numbers of leatherback sea turtles were observed within the action area, similar to the number of hawksbills observed, and much lower than the other sea turtle species discussed above: Table 7. Breeding adults are likely to have been far from the action area in their nesting grounds, and the DWH PDARP conclusion that there were too few leatherbacks present to estimate any type of effects to the species that may have been caused by the response activities (Tables 5&6). Therefore, we conclude that response activities may have caused adverse effects to a small number of leatherback sea turtles, that it is extremely unlikely that mature individuals were adversely affected, and that only small juveniles were affected.

In determining whether the effects of the USCG's spill response actions resulted in an appreciable reduction in the likelihood of survival and recovery of leatherback sea turtles, we begin our analysis by looking at how the action may have affected the numbers, reproduction, or distribution of the species, and the effect of any reduction in numbers, reproduction, or distribution on the likelihood of survival and recovery of the species. We address survival first.

<u>Survival</u>
With regard to numbers, we determined that some response activities did result in lethal take (and a corresponding reduction in numbers) of leatherback sea turtles. The DWH PDARP estimated that "hundreds of turtles" were killed by collisions with response vessels. While the species of these turtles were not specified, given the distribution of leatherback sea turtles in the high-traffic zone, it is possible that some of those killed were leatherbacks. Despite this anecdotal information, we are unable to determine the total number of mortalities based on the best available information. Based on the analysis above and the findings in the DWH PDARP (Tables 5 & 6), we assume that all of the leatherback sea turtles that were adversely affected by response activities were small juveniles.

Because we conclude that mature adult leatherback sea turtles were not likely to have been adversely affected by the completed action, it is unlikely that their reproduction was impacted by spill response activities. No nesting beaches or other reproductive habitat occur within the affected area, and any adults that may have been nesting/mating in 2010 would have been far away in their nesting areas when the primary effects of the action were occurring. It is possible that the lethal and nonlethal effects to small juveniles could eventually manifest in a slight reduction in reproductive success in the distant future (small juvenile leatherback sea turtles killed by the action would not have reached sexual maturity until 30-40 years of age). However, even without the effects of the spill and response activities, these small juveniles would have less than 1% chance of survival to maturity (Crouse et al. 1987). Given the lack of effects on adults, the extremely low densities of leatherbacks within the action area (too low to even estimate), and the extremely broad distribution of nesting sites throughout the globe (documented nesting in over 30 countries, detailed below), it is unlikely that the completed action had or will have any measurable effect on reproduction of leatherback sea turtles.

It is also unlikely that the lethal and nonlethal take of a relatively small number of juvenile leatherback sea turtles caused by the spill response activities had or will have any measurable impact on the overall distribution of the species. Leatherbacks nesting is very broadly distributed throughout the tropics and sub-tropics and they forage throughout an even broader range, into higher-latitude sub-polar regions. Important nesting areas in the western Atlantic Ocean occur in Florida, United States; St. Croix, U.S. Virgin Islands; Puerto Rico; Costa Rica; Panama; Colombia; Trinidad and Tobago; Guyana; Suriname; French Guiana; and southern Brazil. In the eastern Atlantic Ocean, a globally significant nesting population is concentrated in Gabon on the west coast of Africa, with additional widely dispersed but fairly regular nesting between Mauritania in the north and Angola in the south. In the Indian Ocean, major nesting beaches occur in South Africa, Sri Lanka, Andaman and Nicobar islands, with smaller populations in Mozambique, Java, and Malaysia. In the western Pacific Ocean, the main nesting beaches occur in the Solomon Islands, Papua Barat Indonesia, and Papua New Guinea, with additional nesting occurring in Vanuatu, Fiji, and southeastern Australia. In the eastern Pacific Ocean, important nesting beaches occur in Mexico and Costa Rica with scattered nesting along the Central American coast. Given this extremely broad, circumtropical distribution, and the relatively small number of small individuals estimated to have been adversely affected by the response activities, it is unlikely that the completed action had (or will have) any measurable effect on the overall distribution of leatherback sea turtles.

With no measurable effects on reproduction or distribution of the species, we need to determine whether the estimated reductions to the numbers of leatherback sea turtles may have reduced the likelihood of survival of the species. In a normal pre-project consultation, we would need to view the reductions in the context of the status of the species, the environmental baseline, and the cumulative effects. In this case, we have already provided the current status of the species and the current baseline, which account for the effects of the completed action and any additional actions that have been undertaken and have affected the species to date, as well as actions that are reasonably certain to occur. We can therefore look directly to the current status and trajectory of the species in determining if the completed action may have impacted the likelihood of survival of the species. In making this determination, we can look at the type and extent of impacts that individuals were exposed to, the number of individuals that were likely exposed to those impacts, and the population trajectory of the species following that exposure.

In Section 3 (Status of Species) we provided information on the population dynamics of the species. Leatherbacks are widespread throughout tropical, subtropical and temporate regions around the world. Spotila et al. (1996) estimated that the adult female leatherback population for just the Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa, was about 27,600 (considering both nesting and internesting females), with an estimated range of 20,082-35,133. This estimate is consistent with the 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) estimated more recently by the Turtle Expert Working Group (TEWG; 2007). The TEWG (2007) also documented positive growth within major nesting areas of the western Atlantic, including 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).

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, nesting between 1978 and 2005 ranged between 469-882 nests, and the population had 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 nesting beaches, 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 was 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 increased 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). More recently, the overall Northern Caribbean nesting trend has reversed course, 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).

In Florida, the TEWG (2007) estimated a significant annual nesting growth rate of 1.17% between 1989 and 2005 and Tiwari et al. (2013) reported 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, followed by 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).

With extremely low numbers of leatherback sea turtles detected in the action area, and the DWH PDARP conclusion that there were too few leatherbacks present to estimate any type of effects to the species, along with the fact that mature adults were likely to be far from the action area in their breeding/nesting grounds, we determined that only a small number of juveniles were likely to have been adversely affected by the completed action (none were documented, but we assume a small reduction in numbers).

Based on the robust population estimates (34,000-95,000 total adults) and despite the recent declines in nesting at the closest nesting beaches (in Florida and the Northern Caribbean), we believe that the small amount of estimated lethal take of small juveniles described above (with no measurable effects to the reproduction or distribution of the species), caused by the completed action, did not and is not likely to cause an appreciable reduction in the likelihood of survival of leatherback sea turtles in the wild.

Recovery
The Services' recovery plan for leatherback sea turtles in the U.S. Caribbean, Atlantic and Gulf of Mexico (NMFS and USFWS 1992) provides a detailed explanation of the goals and vision for recovery for this species. The recovery objective most pertinent to the impacts caused by the completed action is Number 1:

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.

We believe the completed action did not, and is not likely in the future, to impede the recovery objective above and will not result in an appreciable reduction in the likelihood of leatherback sea turtles' recovery in the wild. As discussed above, the most recent analysis from 2018 has shown a reverse in trends, as the Culebra, St. Croix, and Florida nesting populations have decreased in recent years, although the long-term trend in Florida remains positive. It is unclear whether these declines represent a shift in nesting locations, changes in reproductive output, actual declines in the adult female population, or some combination of those factors. Since we concluded that the small amount of estimated lethal take of small juveniles described above is not likely to have any detectable effect on the overall nesting trends in the Northwest Atlantic, we do not believe the completed action has impeded the progress toward achieving this recovery objective. Thus, we believe the completed action has not, and will not in the future, result in an appreciable reduction in the likelihood of leatherback sea turtles' recovery in the wild.

Conclusion
In determining whether the effects of the completed action (including all lethal and nonlethal take) jeopardized the continued existence of the species, we must also factor in the significant beneficial effects, including the dispersal and removal of oil from leatherback sea turtle habitat. Based on the full analysis provided above, we believe that the lethal and nonlethal take of leatherback sea turtles associated with the completed action have not caused and are not likely to cause an appreciable reduction in the likelihood of survival and recovery of the species. There is currently no indication that the effects of the completed action caused this widely distributed species to lose genetic heterogeneity, broad demographic representation, or long-term successful reproduction, or interfered with recovery objectives for the species. Given this information, we can conclude that the spill response activities undertaken or overseen by the USCG did not appreciably reduce and are not likely to appreciably reduce the likelihood of either the survival or recovery of leatherback sea turtles, and did not and are not likely to jeopardize the continued existence of the species.

7.6 Sperm Whales

Sperm whales are present year-round in the Gulf of Mexico, and their core habitat, where they are most densely populated, overlaps with the Mississippi Canyon and the DWH wellhead. A total of 34 sperm whales were sighted during standardized aerial surveys and an additional 30 were sighted by wildlife monitors during skimming and in-situ burn operations (ERMA 2015). There were also 4 additional sperm whale sightings reported by other response vessels during the summer of 2010. None of these whales showed indications of injuries due to response activities (though one was spotted in heavy oil and thought to be in distress), and none were rescued, rehabbed, or contacted in any way by response personnel.

The analyses provided in Section 5 found that the vast majority of effects from the USCG response activities were likely insignificant behavioral effects (startle, disturbance, displacement, etc.), though 2 activities (burning and vessel traffic) may potentially have resulted in sub-lethal adverse effects (impairing essential behavioral patterns such as breeding, feeding or resting), and possibly direct (non-lethal) injury to sperm whales (though none were documented). The fact that the response activities overlapped both temporally and spatially with one of the worst ecological disasters in American history makes it very difficult to discern the effects of these activities from the overwhelming effects of the oil spill. While we have determined that the response activities themselves resulted in some level of adverse effects on sperm whales, it is also very likely that the adverse effects from the oil spill would have been significantly worse, and would have resulted in significantly greater impacts on sperm whales if the response activities had not been implemented.

In determining whether the effects of the USCG's spill response actions resulted in or are likely to result in an appreciable reduction in the likelihood of survival and recovery of sperm whales, we begin our analysis by looking at how the action may have affected the numbers, reproduction, or distribution of the species, and the effect of any reduction in numbers, reproduction, or distribution on the likelihood of survival and recovery of the species. We address survival first.

Survival

With regard to numbers, there is no evidence to indicate that the response activities resulted in a reduction in numbers of sperm whales. We believe that some individuals were adversely affected by vessel traffic and burning activities, and possibly even physically injured, but we have not found that these adverse effects resulted in the mortality of any individual sperm whales.

The adverse effects from vessel traffic and burning described above may have resulted in a reduction in reproductive success of sperm whales in the northern Gulf of Mexico. The impairment of essential behaviors such as feeding and breeding, as well as the potential physical injuries caused by vessel traffic and burning may have prevented successful mating or reduced the fitness of pregnant females to the point of preventing successful gestation and healthy birth of their calves. We are unable to quantify the actual reduction in reproductive success that may have resulted from the adverse effects of the completed action, but we conclude that some level of reduction in reproduction likely occurred.

It is also unlikely that the effects of the completed action had any measurable impact on the distribution of sperm whales. While there is evidence that the response activities (or possibly the oil itself) may have caused the temporary displacement of some resident sperm whales away from the immediate area of the DWH wellhead, these animals are known to naturally roam broadly throughout large (> 600 miles across) home ranges within the Gulf, and the whales appear to have re-distributed back into the primary impact zone the following year (Ackleh et al 2012). Given the extremely broad, worldwide distribution of the species (sperm whales are considered to be one of the most broadly distributed mammals on the planet), and the relatively minor and short term displacement, it is unlikely that the completed action had or will have any measurable effect on the overall distribution of sperm whales.

In determining whether the estimated effects on reproduction of sperm whales may have reduced the likelihood of survival of the species, we would generally view the reduction in the context of the status of the species, the environmental baseline, and the cumulative effects. In this case, we have already provided the current status of the species and the current baseline, which account for the effects of the completed action and any additional actions that have been undertaken and have affected the species to date, as well as actions that are reasonably certain to occur. We can therefore look directly to the current status and trajectory of the species in determining if the completed action may have impacted the likelihood of survival of the species. In making this determination we can look at the type and extent of impacts that individuals were exposed to and the number of individuals that were likely exposed to those impacts (minor reduction in reproduction as a result of interactions with a few individuals; no mortality thought to have occurred; no change to distribution), and the population trajectory of the species following that exposure.

In Section 3 (Status of Species) we provided information on the population dynamics of the species. The best estimate for the worldwide abundance of sperm whale is estimated between 300,000-450,000 individuals (Whitehead 2002). The best available estimate of abundance for the Northern Gulf of Mexico stock is 1,180.4 (CV =0.219) based on surveys conducted in 2017 and 2018 (Garrison et al. 2020). Previous estimates include 763 resident whales based on an oceanic survey from 2009 (NMFS 2015). The DWH PDARP included a pre-spill abundance estimate of sperm whales in the Gulf of Mexico of 1,635 individuals (DWH Trustees 2016). This estimate of 1,635 individuals was based upon sighting functions as well as a spatially explicit model of sperm whale density that was used for the injury quantification analysis for the spill. Roberts et al. (2016) used a habitat-based distribution model and estimated 2,128 sperm whales in the Gulf of Mexico. Based on these robust population estimates derived both before and after the spill response activities were completed, and the relatively minor effects on reproduction described above (with no measurable effects to the numbers or distribution of the species), we believe the completed action did not and is not likely to cause an appreciable reduction in the likelihood of survival of sperm whales in the wild.

Recovery

The recovery plan for sperm whales (NMFS 2010) lists the following recovery objectives:

Objective 1: Achieve sufficient and viable populations in all ocean basins

Criterion: Given current and projected threats and environmental conditions, the sperm whale population in each ocean basin in which it occurs (Atlantic Ocean/Mediterranean Sea, Pacific Ocean, and Indian Ocean) satisfies the risk analysis standard for unlisted status (has less than a 10% probability of becoming endangered, and has no more than a 1% chance of extinction in the next 100 years). Any factors or circumstances that are thought to substantially contribute to a real risk of extinction that cannot be incorporated into a Population Viability Analysis will be carefully considered before delisting takes place.

Objective 2: Ensure significant threats are addressed

Criteria: Factors that may limit population growth (those that are identified in the threats analysis as high or medium or unknown) have been identified and are being or have been addressed to the extent that they allow for continued growth of populations.

Regarding Objective 1, the relatively minor adverse effects on reproduction resulting from the completed action described above are not expected to have any measurable effect on the size or viability of the Atlantic Ocean population of sperm whales, which is estimated at 90,000-134,000 individuals based on the most recent available information. No mortalities are thought to have resulted from the completed action, and any reductions in reproduction from the one-time incident would have effected a small proportion of the total population (approximately 30-60 individuals were detected throughout the entire response) for a single breeding season. This level and duration of effects would not be expected to produce a measurable impact to a population of this size and broad distribution.

Regarding Objective 2, there are no limiting factors identified as high or medium level threats in the Recovery Plan, but there are several identified as “unknown.” Anthropogenic Noise, Loss of Prey Base Due to Climate Change, and Contaminants and Pollutants are listed as unknowns throughout the species’ range. Of these three factors, the only one that is directly relevant to this analysis is Contaminants and Pollutants. One of the criteria listed as necessary to bring the threat level for this factor down to “low” is:

> Effects of oil spills and contaminants are determined to not affect the potential for continued growth or maintenance of the sperm whale population and actions taken or having been taken to minimize potential effects have been proven effective.

The massive interagency coordination effort and subsequent development of preemptive spill response plans associated with the completed action produced significant advances in addressing the threats posed by future oil spills to sperm whales in the Gulf of Mexico (and elsewhere). Relatively minor effects to reproduction were estimated to have occurred to sperm whales in the Gulf of Mexico, with no effects to numbers or distribution. The completed action provided significant benefits during the spill and for effective, coordinated responses to future spills. We believe the completed action has not interfered with the recovery objectives above, and did not nor is it likely to result in an appreciable reduction in the likelihood of sperm whales’ recovery in the wild.

Based on the full analysis provided above, we believe that the effects of the completed action, including the non-lethal take related to reproduction in sperm whales, have not and are not likely to cause an appreciable reduction in the likelihood of survival and recovery of the species, and did not and are not likely to result in jeopardy to the species.

8 CONCLUSION

After reviewing the current status of the ESA-listed species affected by the completed action, the environmental baseline, cumulative effects, and the effects of the completed action, it is NMFS's Opinion that the completed action did not and is not likely to jeopardize the continued existence the NWA DPS of loggerhead sea turtles, the NA DPS or the SA DPS of green sea turtles, Kemp's ridley sea turtles, hawksbill sea turtles, leatherback sea turtles, or sperm whales.

9 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulations issued pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively.

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. Section 7(b)(4) and Section 7(o)(2) provide that take that is incidental to an otherwise lawful agency action is not considered to be prohibited take under the ESA if that action is performed in compliance with the reasonable and prudent measures and the terms and conditions of an Incidental Take Statement.

An emergency response action that may affect listed species and designated critical habitat is the sole circumstance under which Federal agencies may initiate ESA consultation *after* implementing the action. However, the Services have no authority to exempt the taking of listed species from the ESA take prohibitions after the fact. Therefore, the ITS of an emergency consultation Opinion does not include reasonable and prudent measures or terms and conditions to minimize take, unless the agency has an ongoing action related to the emergency. Rather, an emergency consultation incidental take statement documents the recommendations given to minimize take during informal consultation, the success of the agency in carrying out these recommendations, and the ultimate effects on the species of concern through take. Appendix E of the USCG BA provides a detailed list of the recommendations provided by NMFS to the USCG for avoiding and minimizing adverse effects of response activities to ESA-listed species and critical habitats. Appendix C of the USCG BA provides a detailed account of how the USCG received and implemented these recommendations throughout the response period. All activities related to the action evaluated in this Opinion have concluded.

9.1 Amount and Extent of Take

There was very little documented lethal take of ESA-listed species that could be specifically attributed to the spill response activities. During the berm construction activities in Louisiana, there were 6 loggerhead sea turtles that were documented as killed by the dredging and associated relocation trolling. An additional 3 Kemp's ridley sea turtles were found dead on nearby shorelines during the dredging activities, indicating that these turtles may also have been killed by the dredging/trawling activities.

The Take Score Model presented in the USCG BA did not provide any quantification of the amount or extent of take that resulted from the completed action, though the model results did indicate that some level of take, ranging from non-lethal harassment to mortality, was likely inflicted on each of the ESA-listed species analyzed in this Opinion. The DWH PDARP was likewise unable to quantify the amount or extent of take that may have resulted from the completed action, though it did estimate that "hundreds of turtles" (species unspecified) were killed by collisions with response vessels based on those that were found stranded with clear evidence of vessel collision injuries during the response activities.

Based on our analysis of the best available information on the effects of the completed action, we determined that for loggerhead sea turtles, vessel traffic, berm construction (dredging), skimming and burning resulted in lethal take, and vessel traffic, burning, skimming, trawling (for sub-surface oil) and berm construction (relocation trawling), resulted in non-lethal take of the NWA DPS. For green sea turtles (both the NA and SA DPSs), vessel traffic, burning and skimming resulted in lethal take, and vessel traffic, burning, skimming and trawling, resulted in non-lethal take of these DPSs. For Kemp's ridley sea turtles, vessel traffic, burning, berm construction (dredging), and skimming resulted in lethal take, and vessel traffic, berm construction (relocation trawling), burning, skimming, and trawling (for sub-surface oil) resulted in non-lethal take of this species. For hawksbill sea turtles, vessel traffic, burning and skimming resulted in lethal take, and vessel traffic, burning and skimming, resulted in non-lethal take of this species. For leatherback sea turtles, vessel traffic, burning and skimming resulted in lethal take, and vessel traffic, burning and skimming, resulted in non-lethal take of this species. For sperm whales; none of the activities are believed to have resulted in lethal take, and vessel traffic and burning resulted in non-lethal take.

9.2 Effect(s) of the Take

NMFS has determined the incidental take described in Sections 5 and 7 of this Opinion did not and are not likely to jeopardize the continued existence the NWA DPS of loggerhead sea turtles, the NA DPS or the SA DPS of green sea turtles, Kemp's ridley sea turtles, hawksbill sea turtles, leatherback sea turtles, or sperm whales.

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 designed to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

During the DWH emergency response, the USCG coordinated with NMFS to obtain recommendations for avoiding and minimizing adverse effects of response activities to ESA-listed species and critical habitats. The agencies formalized these recommendations as a set of 52 Best Management Practices (BMPs) (Appendix E of the USCG BA) applicable to particular response activities, species, and their habitats. Many of these BMPs were not developed or implemented until well into the DWH response process. In order to ensure that any impacts to ESA-listed species from future response actions are avoided or minimized, NMFS strongly recommends that the following BMPs be implemented by the USCG throughout all future large-scale contaminant spill response actions in the Gulf of Mexico (the following BMPs are specific to actions that may affect ESA-listed species in the marine environment):

BMP 1: All vessel crew members must be instructed to watch for and avoid collisions with wildlife. Report all turtle sightings and all distressed or dead birds, sharks, rays, and marine mammals to the appropriate state hotline.

BMP 2: Retrieve all injured/dead/oiled sea turtles using the turtle At-Sea Retrieval Protocol (http://sero.nmfs.noaa.gov/sustainable_fisheries/gulf_sa/turtle_sawfish_release/documents/pdfs/turtle_release_protocols.pdf).

BMP 14: If skimming, avoid skimming *Sargassum* that is not oiled or is only very lightly oiled.

BMP 15: If a sea turtle is observed trapped or entangled in boom, open the boom carefully until the animal leaves on its own.

BMP 16: Install, monitor, and remove underwater equipment/boom to prevent fish/wildlife entrapment.

BMP 17: Do not block major egress points in channels, rivers, passes, and bays.

BMP 18: All deployed boom must include: (1) gaps between boom or sufficient space under boom to allow sea turtles to go around or under them, (2) boom should be monitored daily for sea turtle presence.

BMP 19: When conducting in situ burning, sea turtle observers must be present on the ignition vessel to spot and retrieve any sea turtles prior to the burn.

BMP 20: An additional survey should be conducted in the burn area after the burn is complete.

BMP 21: Avoid burning unoiled/lightly oiled *Sargassum*.

BMP 23: Arial surveys of all dispersant application areas must be conducted prior to application, and no dispersant application shall occur within 2 nmi of sighted marine mammals/sea turtles.

BMP 24: Turtle excluder devices (TEDs) should be installed on all trawl nets.

BMP 32: For net recovery of tar balls, a maximum allowable tow time of 30 minutes. After 30 minutes, check the net for any live or dead sea turtles.

BMP 33: All vessels must be equipped with the necessary equipment (dip nets, holding containers, towels, etc.) to capture and hold sea turtles aboard the vessel.

BMP 34: Resuscitate any live, unresponsive sea turtles according to the official sea turtle resuscitation guidelines (https://www.greateratlantic.fisheries.noaa.gov/protected/stranding/disentanglements/turtle/seaturtlehandlingresuscitationv1.pdf).

BMP 35: Safely release uninjured and unoiled sea turtles over the stern of the boat, when gear is not in use, the engine is in neutral, and in areas where they are unlikely to be recaptured or injured by vessels.

BMP 40: All vessels shall operate at "no wake/idle" speed at all times while in water where the draft of the vessel provides less than a 4-foot clearance from the bottom. All vessels shall follow deep-water routes whenever possible.

BMP 42: Avoid scouring and prop-scarring submerged aquatic vegetation (e.g., seagrass).

BMP 43: Natural Resource Advisors (NRAs), or agency biologists should accompany all cleanup crews (both daytime and nighttime operations) in appropriate numbers to ensure BMPs are implemented properly. Contact the section 7 Coordinator/Liaison for recommendations on appropriate numbers.

11 REINITIATION OF CONSULTATION

This concludes NMFS's formal consultation on the completed action. As provided in 50 CFR 402.16, reinitiation of consultation is required under certain circumstances if the action agency retains discretionary involvement or control over the action. However, the action is concluded. Therefore, reinitiating this consultation will not be necessary.

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