NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7
BIOLOGICAL OPINION

Title:	Biological Opinion on Issuance of Permit #21293 to Gulf Specimen Marine Laboratories, Inc.
Consultation Conducted By:	Endangered Species Act Interagency Cooperation Division, Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce
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1 INTRODUCTION

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

ESA §7(b)(3) requires that at the conclusion of consultation NMFS provide an opinion stating whether the Federal agency's action is likely to jeopardize ESA-listed species or destroy or adversely modify designated critical habitat. If NMFS determines that the action is likely to jeopardize ESA-listed species or destroy or adversely modify critical habitat, NMFS provides a reasonable and prudent alternative that allows the action to proceed in compliance with ESA §7(a)(2). If an incidental take is expected, ESA §7(b)(4) requires NMFS to provide an incidental take statement that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts and terms and conditions to implement the reasonable and prudent measures.

The action agency for this consultation is the NMFS, Office of Protected Resources, Endangered Species Division (hereinafter referred to as "the Species Division"). The Species Division proposes to issue an Incidental Take Permit (ITP; Permit #21293) pursuant to ESA §10(a)(1)(B) to Jack Rudloe of Gulf Specimen Marine Laboratories, Inc (GSML). The permit would authorize takes of ESA-listed species during collection of marine organisms using a trawl without a turtle excluder device (TED).

NMFS Office of Protected Resources Endangered Species Act Interagency Cooperation Division (hereafter referred to as "we") conducted this consultation in accordance with ESA §7(a)(2) (16 USC 1536 (a)(2)), associated implementing regulations (50 CFR §401-16), and agency policy and guidance.We prepared this biological opinion (opinion) and incidental take statement in accordance with section 7(b) of the ESA and implementing regulations at 50 CFR §402.

This document represents the opinion of the NMFS, Office of Protected Resources, ESA Interagency Cooperation Division regarding the effects of the proposed action on North Atlantic Distinct Population Segment (DPS) of green turtle (*Chelonia mydas*), Kemp's ridley turtle (*Lepidochelys kempii*), leatherback turtle (*Dermochelys coriacea*), Northwest Atlantic Ocean DPS of loggerhead turtle (*Caretta caretta*), Gulf sturgeon (*Acipenser oxyrinchus desotoi*), designated critical habitat for the Northwest Atlantic Ocean DPS of loggerhead turtle, and designated critical habitat for Gulf sturgeon. Information about the project and permit issuance in this biological opinion is from the permit application, draft permit, *Federal Register* notice of receipt of the application (82 FR 17638), draft environmental assessment, 2003 biological opinion on the previously issued ITP (Permit #1417; NMFS 2003), and communications with the Species Division unless otherwise cited. A complete record of this consultation is on file at the NMFS Office of Protected Resources in Silver Spring, Maryland.

1.1 Background

GSML has been trawling for marine organisms without using TEDs since 1965 in the Apalachee Bay region of Florida waters. GSML has never taken a turtle during specimen collection activity using their <500-sqft trawl. The organisms are used to feed their captive turtles and to sell marine life to over 1300 schools, research laboratories, biomedial institutions, and public aquariums.

Since 1970, GSML has received state permits from Florida to trawl without using a TED. After such permitting authority was transferred to NMFS, in December 2002 GSML applied for and was denied an exemption to using a TED. Despite NMFS's suggestion that GSML apply for an ESA §10(a)(1)(B) ITP, GSML applied for an ESA §10(a)(1)(A) research permit in early January 2003, and NMFS again suggested that GSML apply instead for an ITP. In late January 2003, GSML did apply for an ITP, and NMFS issued permit #1417 on May 13, 2003 to Anne Rudloe of GSML to authorize incidental takes of green turtle, Kemp's ridley turtle, leatherback turtle, loggerhead turtle, and Gulf sturgeon through May 1, 2012. The Species Division conducted ESA §7(a)(2) consultations with NMFS and with the U.S. Fish and Wildlife Service, and NMFS issued a biological opinion that concluded the permit (ITP #1417) issuance was not likely to jeopardize the continued existence of the green turtle, Kemp's ridley turtle, leatherback turtle, loggerhead turtle, or Gulf sturgeon and was not likely to destroy or adversely modify the Gulf sturgeon designated critical habitat (NMFS 2003). GSML has not had an ITP since May 2, 2012, and they have not reported any takes.

1.2 Consultation History

Communication with the Species Division throughout this consultation is summarized as follows:

- March 29, 2017: Received the ITP application and the draft *Federal Register* notice of receipt. Also received were the 2003 permit #1417 and associated biological opinion.
- April 24, 2017: Received a rough draft of an environmental assessment based on the 2003 permit.
- April 27, 2017: Submitted a request for additional information. Received a draft permit.

- May 5, 2017: Received the published *Federal Register* notice and responses to request for additional information.
- May 9, 2017: Submitted follow-up request for additional information, and received response.
- May 10, 2017: Transmitted consultation initiation memorandum to Species Division.

2 Approach to the Assessment

ESA §7(a)(2) requires Federal agencies, in consultation with NMFS, to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. NMFS uses a step-wise approach for §7 analyses. The first step identifies the spatiotemporal extent of the *action area* and aspects of proposed actions that are likely to have direct and indirect physical, chemical, and biotic effects on listed species, designated critical habitat, or the physical, chemical, and biotic environment of an action area. The second step identifies the ESA-listed resources that are likely to be affected by the proposed action (i.e., *exposure analyses*). Next, NMFS examines the scientific and commercial data available to determine whether and how those listed resources are likely to respond given their exposure (i.e., *response analyses*). The final step is to evaluate the risks those responses pose to listed resources individually (i.e., *risk analyses*). When data are absent or uncertainty exists, decisions are conservative. Jeopardy determinations must be based on an action's effects on the continued existence of threatened or endangered species, and destruction or adverse modification determinations must be based on an action's effect on designated critical habitat features that are essential for recovery of the ESA-listed species.

"To jeopardize the continued existence of a listed species" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02). The jeopardy analysis considers both survival and recovery of the species.

"Destruction or adverse modification" means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species (50 CFR § 402.02). The adverse modification analysis considers the impacts on the conservation value of designated critical habitat including, but not limited to, alterations of the quality and quantity of essential physical or biological features.

3 Description of the Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies. The proposed action is the Species Division's issuance of ITP #21293 to Jack Rudloe of GSML. The activities authorized by the ITP and the action area are described in the following subsections.

3.1 Proposed Activities

The primary activity affiliated with ITP #21293 and its associated conservation plan is fishing for marine organisms using a trawl without a TED. GSML's trawl is under 500 sqft and has 2-ft-long doors, and each tow would be for a maximum of 30 minutes. Vessel operation in the action area is inherently part of the fishing activity. Collection trips are based on need. Trips are made Monday through Friday throughout the year, and each trip could last about seven hours (usually 10am to 5pm). During field and fishing operations, GSML would record observations of sea turtles as part of its sea turtle research program.

Although the applicant does not anticipate capturing a sea turtle or Gulf sturgeon, the ITP authorizes one turtle take and one Gulf sturgeon take every three years for the life of the permit (18 years). If GSML captures a turtle or Gulf sturgeon, GSML is authorized to conduct the following additional activities:

- If GSML encounters a live turtle or Gulf sturgeon that is entangled in fishing gear, GSML would attempt to disentangle the animal and/or transport it to a rehabilitation facility.
- Comotose sea turtles would be resuscitated per permit conditions.
- Captured sea turtles that are healthy would be handled and released according to permit conditions. Any captured Gulf sturgeon would be released per permit conditions.

3.2 Action Area

Action area means all areas affected directly or indirectly by the Federal action, and not just the immediate area involved in the action (50 CFR § 402.02). For ITP issuance to GSML, indirect effects beyond the action area are not anticipated.

The action area consists of Florida waters in Gulf, Franklin, and Wakulla Counties, which all border the Gulf of Mexico (Figure 1). Most of the activity would occur in Apalachee Bay, St. George Sound, and St. Joseph Bay in waters typically no deeper than 15 m.

Figure 1. Action area (outlined in red) for ITP #21293.

3.3 Interrelated and Interdependent Activities

Interrelated activities are those that are part of a larger action and depend on the larger action for their justification. Interdependent activities are those that have no independent utility apart from the action under consideration. Interrelated activities associated with GSML fishing include tagging, recording morphometrics of, and handling sea turtles, including any that are incidentally caught under ITP #21293, as permitted via the Sea Turtle Stranding and Salvage Network (STSSN). GSML is permitted through the STSSN, which has undergone previous consultation (NMFS 2016a), and, thus, will not be considered further in the effects analysis. Otherwise, no interrelated or interdependent activities exist for the action of ITP issuance to GSML.

4 Status of Listed Resources

The issuance of ITP #21293 is likely to affect four species of sea turtles, Gulf sturgeon, loggerhead turtle Northwest Atlantic Ocean DPS critical habitat, and Gulf sturgeon critical habitat (Table 1).

Other ESA-listed species, including the hawksbill turtle (*Eretmochelys imbricata*) and smalltooth sawfish (*Pristis pectinata*), may occur in the action area, but their occurrences are so rare that they are not likely to be affected by the proposed action. The Species Division determined that issuance of ITP #21293 would have no effect on ESA-listed species other than the four turtle species or designated critical habitats other than that of Gulf sturgeon, and such species and critical habitats are not subject to this consultation, with the exception of loggerhead critical habitat. The nearshore reproductive designated critical habitat for the Northwest Atlantic Ocean DPS of loggerhead turtle has two components (LOGG-N-31 and LOGG-N-32) that are within the action area. Although the Species Division determined the proposed action would have no effect on critical habitat of Northwest Atlantic Ocean DPS loggerheads, we determined that critical habitat may be affected if a loggerhead is incidentally caught in GMSL's trawl, which is discussed in more detail in Section 6.3.4.

Table 1. ESA-listed species and critical habitat that may be affected by issuance of ITP #21293.

Species	ESA Status	Critical Habitat
Sea Turtles		
Green Turtle (*Chelonia mydas*) – North Atlantic Distinct Population Segment (DPS)	T – 81 FR 20057	63 FR 46693*
Kemp's Ridley Turtle (*Lepidochelys kempii*)	E – 35 FR 18319	-- --
Leatherback Turtle (*Dermochelys coriacea*)	E – 35 FR 8491	44 FR 17710* 77 FR 4170*
Loggerhead Turtle (*Caretta caretta*) – Northwest Atlantic Ocean DPS	T – 76 FR 58868	79 FR 39855
Fish		
Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)	T – 56 FR 49653	68 FR 13370

E=endangered; T=threatened.
* Critical habitat is designated but would not be affected by the proposed action.

During the consultation, NMFS examined the status of each species that would be affected by the proposed action. The status is determined by the level of risk that each listed species faces, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. The species status section helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR §402.02. More detailed information on the status and trends of these listed resources and their biology and ecology can be found in the listing regulations and critical habitat designations published in the *Federal Register*, status reviews, and recovery plans and also on the NMFS website.

We examined the condition of designated critical habitat throughout the designated area, evaluated the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and considered the current function of the essential physical and biological features that help form that conservation value. The only designated critical habitats that occur in the vicinity of the action area are for Northwest Atlantic Ocean DPS of loggerhead sea turtles and for the Gulf sturgeon.

4.1 North Atlantic DPS Green Turtle

The green sea turtle is globally distributed and commonly inhabits nearshore and inshore waters. The North Atlantic DPS green turtle is found in the northern Atlantic Ocean and Gulf of Mexico (Figure 2).

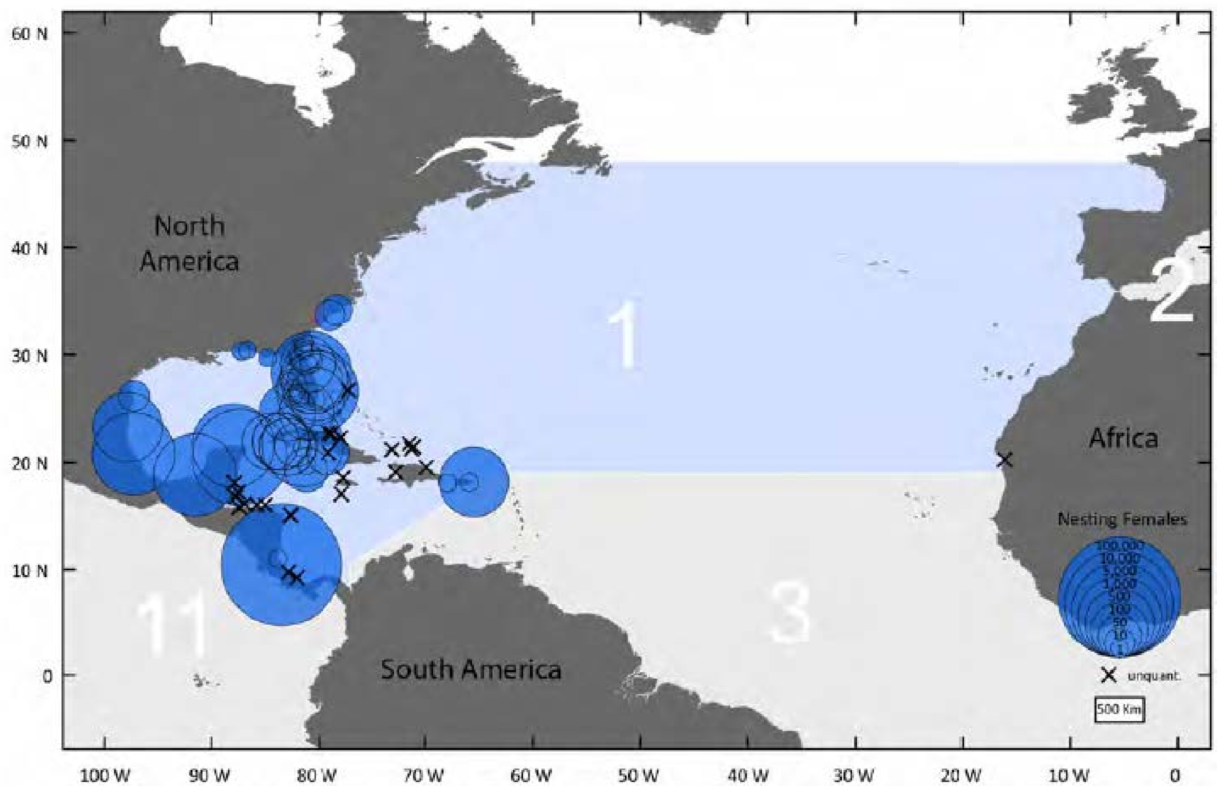

Figure 2. Geographic range of the North Atlantic distinct population segment green turtle with location and abundance of nesting females. From Seminoff et al. 2015.

The green sea turtle is the largest of the hardshell marine turtles; it reaches a weight of 350 pounds (159 kilograms) and has a straight carapace length of greater than 3.3 feet (1 meter) (Figure 3). The species was listed under the ESA on July 28, 1978 (43 FR 32800). The species was separated into two listing designations: endangered for breeding populations in Florida and the Pacific coast of Mexico and threatened in all other areas throughout its range. On April 6, 2016, NMFS listed 11 DPSs of green sea turtles as threatened or endangered under the ESA (Table 2). The North Atlantic DPS is listed as threatened.

Figure 3. Green sea turtle. Photo: Mark Sullivan, NOAA.

Table 2. North Atlantic DPS green sea turtle information bar.

Species	Common Name	Distinct Population Segment	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Chelonia mydas	Green sea turtle	North Atlantic (4 sub-populations)	Threatened	2015	81 FR 20057	1991	63 FR 46693

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

4.1.1 Life history

Age at first reproduction for females is 20-40 years. Green sea turtles lay an average of three nests per season with an average of 100 eggs per nest. The remigration interval (the time between visits to nesting beaches) is two to five years. Nesting occurs primarily on beaches with intact dune structure, native vegetation, and appropriate incubation temperatures during summer months. After emerging from the nest, hatchlings swim to offshore areas where they likely live for several years during a post-hatchling pelagic stage. During this life stage, green sea turtles feed close to the surface on a variety of marine algae and other life associated with drift lines and debris. Adult turtles exhibit site fidelity and migrate hundreds to thousands of kilometers from nesting beaches to foraging areas. Green sea turtles spend the majority of their lives in coastal foraging grounds, which include open coastlines and protected bays and lagoons. Adult green turtles feed primarily on seagrasses and algae, and they also eat jellyfish, sponges, and other invertebrates.

4.1.2 Population dynamics

The green turtle has a circumglobal distribution, occurring throughout nearshore tropical, subtropical, and, to a lesser extent, temperate waters. Green turtles from the North Atlantic DPS range from the boundary of South and Central America (7.5°N, 77°W) in the south, throughout the Caribbean, the Gulf of Mexico, and the U.S. Atlantic coast to New Brunswick, Canada (48°N, 77°W) in the north. The range of the DPS then extends due east along latitudes 48°N and 19°N to the western coasts of Europe and Africa.

Worldwide, nesting data at 464 sites indicate that 563,826 to 564,464 females nest each year (Seminoff et al. 2015). Nesting for the North Atlantic DPS occurs primarily in Costa Rica, Mexico, Florida, and Cuba. Compared to other DPSs, the North Atlantic DPS exhibits the highest nester abundance, with approximately 167,424 females at 73 nesting sites, and available data indicate an increasing trend in nesting. The largest nesting site in the North Atlantic DPS is in Tortuguero, Costa Rica, which hosts 79 percent of nesting females for the DPS (Seminoff et al. 2015).

There are no reliable estimates of population growth rate for the DPS as a whole, but estimates have been developed at local levels. The Florida nesting stock at the Archie Carr National Wildlife Refuge grows at an annual rate of 13.9 percent, and the Tortuguero, Costa Rica, population grows at 4.9 percent (Chaloupka et al. 2008).

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

4.1.3 Status

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

Four regions support nesting concentrations of particular interest in the North Atlantic DPS: Costa Rica (Tortuguero), Mexico (Campeche, Yucatan, and Quintana Roo); United States (Florida), and Cuba. Seminoff et al. (2015) identified 73 nesting sites within the North Atlantic DPS, although some represent numerous individual beaches. Tortuguero, Costa Rica is the most important nesting concentration for green turtles in the North Atlantic DPS. In 2010, the estimated number of nesters was 30,052 to 64,396 (Seminoff et al. 2015). In the United States, green turtles nest primarily along the central and southeastern coasts of Florida where an estimated 8,426 females nest annually.

4.1.4 Critical Habitat

On September 2, 1998, NMFS designated critical habitat for green sea turtles, which includes coastal waters surrounding Culebra Island, Puerto Rico. Seagrass beds surrounding Culebra provide important foraging resources for juvenile, subadult, and adult green sea turtles. Additionally, coral reefs surrounding the island provide resting shelter and protection from predators and is important developmental habitat for the species. Activities that may affect the critical habitat include beach renourishment, dredge and fill activities, coastal construction, and freshwater discharge. The critical habitat is accessible to individuals of the North Atlantic DPS. However, the designated critical habitat is not near the action area and, thus, would not be affected by the proposed action.

4.1.5 Recovery Goals

Broadly, recovery plan goals emphasize the need to protect and manage nesting and marine habitat, protect and manage populations on nesting beaches and in the marine environment, reduce fisheries bycatch, increase research and monitoring, increase public education, and promote international cooperation on sea turtle conservation topics (NMFS et al. 2011).

4.2 Kemp’s Ridley Turtle

The Kemp’s ridley turtle is considered to be the most endangered sea turtle internationally (Groombridge 1982; Zwinenberg 1977). Its range extends from the Gulf of Mexico to the Atlantic coast, with nesting beaches limited to a few sites in Mexico and Texas (Figure 4).

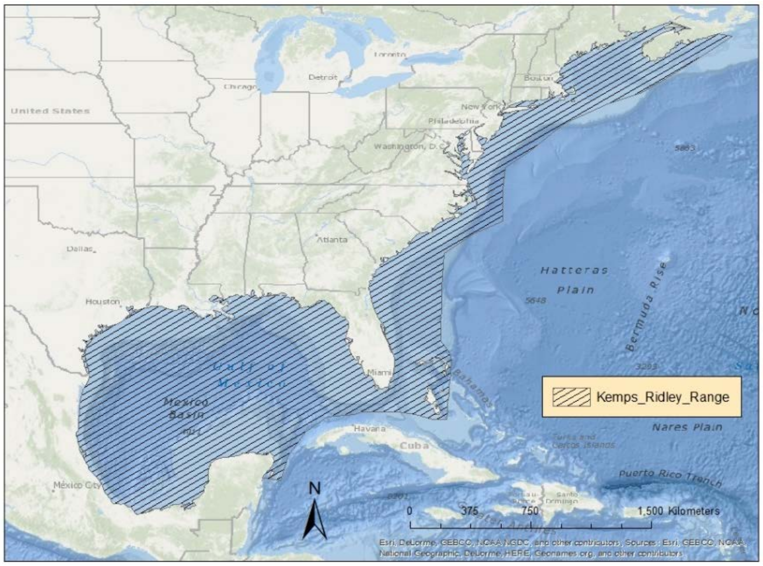

Figure 4. Map identifying the range of the endangered Kemp's ridley sea turtle.

Kemp's ridley sea turtles are the smallest sea turtle species, and they have a nearly circular top shell and a pale yellowish bottom shell (Figure 5). The species was first listed under the Endangered Species Conservation Act and later listed as endangered under the ESA in 1973 (Table 3).

Figure 5. Kemp's ridley turtle. Photo: NOAA

Table 3. Kemp's ridley turtle information bar.

Species	Common Name	Distinct Population Segment	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Lepidochelys kempii	Kemp's ridley sea turtle	None designated	Endangered range wide	2015	35 FR 18319	75 FR 12496 U.S. Caribbean, Atlantic, and Gulf of Mexico (draft)	None

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

4.2.1 Life History

Females mature at 12 years of age. The average remigration is two years. Nesting occurs from April to July in large arribadas, primarily at Rancho Nuevo, Mexico. Females lay an average of 2.5 clutches per season. The annual average clutch size is 97-100 eggs per nest. The nesting location may be particularly important because hatchlings can more easily migrate to foraging grounds in deeper oceanic waters, where they remain for approximately two years before returning to nearshore coastal habitats. Juvenile Kemp's ridley sea turtles use these nearshore coastal habitats from April through November but move toward more suitable overwintering habitat in deeper offshore waters (or more southern waters along the Atlantic coast) as water temperature drops. Adult habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 ft (37 m) deep although they can also be found in deeper offshore waters. As adults, Kemp's ridleys forage on swimming crabs, fish, jellyfish, mollusks, and tunicates (NMFS 2011).

4.2.2 Population Dynamics

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

Of the sea turtles species in the world, the Kemp's ridley has declined to the lowest population level. Nesting aggregations at a single location (Rancho Nuevo, Mexico) were estimated at

40,000 females in 1947. By the mid 1980s, the population had declined to an estimated 300 nesting females. In 2014, there were an estimated 10,987 nests and 519,000 hatchlings released from three primary nesting beaches in Mexico (NMFS 2015). The number of nests on Padre Island, Texas has increased over the past two decades, with 1 nest observed in 1985, 4 in 1995, 50 in 2005, 197 in 2009, and 119 in 2014 (NMFS 2015).

From 1980 to 2003, the number of nests at three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) increased 15 percent annually (Heppell et al. 2005); however, due to recent declines in nest counts, decreased survival at other life stages, and updated population modeling, this rate is not expected to continue (NMFS 2015).

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

4.2.3 Status

The Kemp's ridley was listed as endangered in response to a severe population decline, which was primarily the result of egg collection. In 1973, legal ordinances prohibited the harvest of sea turtles from May to August, and in 1990, the harvest of all sea turtles was prohibited by presidential decree. In 2002, Rancho Nuevo was declared a sanctuary. A successful head-start program has resulted in the reestablishment of nesting at Texan beaches. While fisheries bycatch remains a threat, the use of TEDs mitigates take. Fishery interactions and strandings, possibly due to forced submergence, appear to be the main threats to the species. The population appears to be increasing; however, the species's limited range and low global abundance make it vulnerable to new sources of mortality. Therefore, the species's resilience to future perturbation is low.

During the mid-20th century, the Kemp's ridley was abundant in the Gulf of Mexico. Historic information indicates that tens of thousands of Kemp's ridleys nested near Rancho Nuevo, Mexico, during the late 1940s (Hildebrand 1963). From 1978 through the 1980s, arribadas were 200 turtles or less, and by 1985, the total number of nests at Rancho Nuevo had dropped to approximately 740 for the entire nesting season, which was a projection of roughly 234 turtles (TEWG 2000; USFWS and NMFS 1992). Beginning in the 1990s, an increasing number of beaches in Mexico were being monitored for nesting, and the total number of nests on all beaches in Tamaulipas and Veracruz in 2002 was over 6,000; the rate of increase from 1985 ranged from 14 to 16 percent (Heppell et al. 2005; TEWG 2000; USFWS 2002). In 2006, approximately 7,866 nests were laid at Rancho Nuevo with the total number of nests for all the beaches in Mexico estimated at about 12,000 nests, which amounted to about 4,000 nesting females based on three nests per female per season (Rostal 2007; Rostal et al. 1997; USFWS 2006). Considering remigration rates, the population included approximately 7,000 to 8,000 adult female turtles at that time (Márquez et al. 1989; Rostal 2007; TEWG 2000). The 2007 nesting season included an arribada of over 4,000 turtles over a three-day period at Rancho

Nuevo (NMFS and USFWS 2007b). The increased recruitment of new adults is illustrated in the proportion of first time nesters, which has increased from 6 percent in 1981 to 41 percent in 1994. Drops in the number of nests in Texas and Mexico occurred in 2010, 2013, and 2014, and the highest number of nests recorded since 1947 was in 2012 (NMFS 2015).

4.2.4 Critical Habitat

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

4.2.5 Recovery Goals

The following items are priorities for recovery of Kemp's ridely sea turtles (NMFS et al. 2011):

1. Protect and manage nesting and marine habitats.
2. Protect and manage populations on the nesting beaches and in the marine environment.
3. Maintain a stranding network.
4. Manage captive stocks.
5. Sustain education and partnership programs.
6. Maintain, promote awareness of, and expand U.S. and Mexican laws.
7. Implement international agreements.
8. Enforce laws.

4.3 Leatherback Turtle

The leatherback sea turtle is unique among sea turtles for its large size, wide distribution (due to thermoregulatory systems and behavior), and lack of a hard, bony carapace. Leatherback sea turtles are distributed in oceans, from nearshore habitats to oceanic environments and from tropical to subpolar latitudes, worldwide (Figure 6; Shoop and Kenney 1992). Movements are largely dependent upon reproductive and feeding cycles and the oceanographic features, such as frontal systems, eddy features, current boundaries, and coastal retention areas, that concentrate prey (Benson et al. 2011).

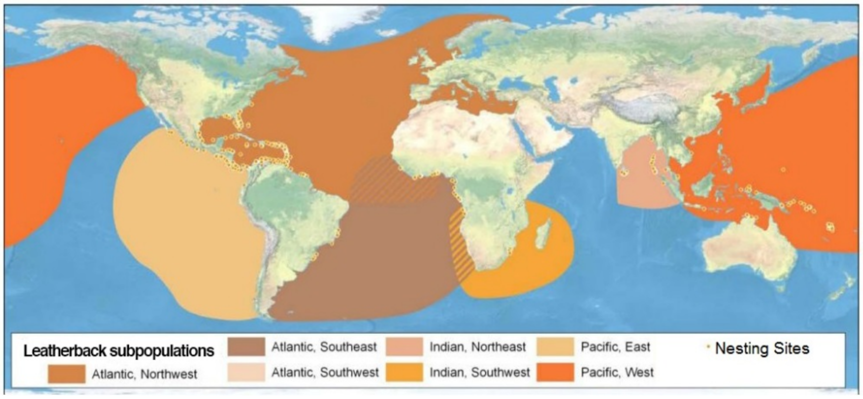

Figure 6. Map identifying the range of the endangered leatherback sea turtle. Adapted from Wallace et al. 2013.

Leatherbacks are the largest living sea turtle, reaching lengths of six feet long and weighing up to one ton. Leatherback sea turtles have a distinct black leathery skin covering their carapace with pinkish white skin on their belly (Figure 7). The species was first listed under the Endangered Species Conservation Act and was later listed as endangered under the ESA in 1973 (Table 4).

Table 4. Leatherback turtle information bar.

Species	Common Name	Distinct Population Segment	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Dermochelys coriacea	Leatherback sea turtle	None designated	Endangered range wide	2013	35 FR 8491	63 FR 28359 Pacific U.S. Caribbean, Atlantic and Gulf of Mexico	44 FR 17710 and 77 FR 4170

We used information available in the five-year review (NMFS 2013a) and the critical habitat designation (77 FR 61573) to summarize the life history, population dynamics, and status of the species, as follows.

4.3.1 Life History

Age at maturity has been difficult to ascertain, with estimates ranging from 5-29 years (Avens et al. 2009; Spotila et al. 1996). Females lay up to seven clutches per season, with more than 65 eggs per clutch and eggs weighing greater than 80 grams (Reina et al. 2002; Wallace et al. 2007). The number of leatherback hatchlings that make it out of the nest on to the beach (i.e., emergent success) is approximately 50 percent worldwide (Eckert et al. 2012). Females nest every one to seven years. Natal homing, at least within an ocean basin, results in reproductive isolation among five broad geographic regions: eastern and western Pacific, eastern and western Atlantic, and Indian Ocean. Leatherback sea turtles migrate long, transoceanic distances between their tropical nesting beaches and the highly productive temperate waters where they forage primarily on jellyfish and tunicates. These gelatinous prey are relatively nutrient-poor, such that leatherbacks must consume large quantities to support their body weight. Leatherbacks weigh about 33 percent more on their foraging grounds than on nesting grounds, which indicates that they probably use fat reserves to fuel migration and subsequent reproduction (James et al. 2005; Wallace et al. 2006). Sea turtles must meet an energy threshold before returning to nesting beaches. Therefore, their remigration intervals are dependent upon foraging success and duration (Hays 2000; Price et al. 2004).

4.3.2 Population Dynamics

Leatherbacks are globally distributed with nesting beaches in the Pacific, Atlantic, and Indian Oceans. Detailed population structure is unknown but is likely dependent upon nesting beach location. Based on estimates calculated from nest count data, there are between 34,000 and 94,000 adult leatherbacks in the North Atlantic (TEWG 2007). In contrast, leatherback populations in the Pacific are much lower. Overall, Pacific populations have declined from an estimated 81,000 individuals to less than 3,000 total adults and subadults (Spotila et al. 2000). Population abundance in the Indian Ocean is difficult to assess due to lack of data and inconsistent reporting. Available data from southern Mozambique show that approximately ten females nested per year from 1994 to 2004, and about 296 nests per year were counted in South Africa (NMFS 2013a).

Population growth rates for leatherback sea turtles vary by ocean basin. Counts of leatherbacks at nesting beaches in the western Pacific indicate that the subpopulation has been declining at a rate of almost six percent per year since 1984 (Tapilatu et al. 2013). Leatherback subpopulations in the Atlantic Ocean, however, are showing signs of improvement. Nesting females in South Africa are increasing at an annual rate of 4-5.6 percent, and they are increasing by 9-13 percent in Florida and the U.S. Virgin Islands (TEWG 2007).

Analyses of mitochondrial DNA from leatherback sea turtles indicates a low level of genetic diversity, which indicates possible difficulties in the future if current population declines continue (Dutton et al. 1999). Further analysis of samples taken from individuals from rookeries in the Atlantic and Indian Oceans suggest that each rookery represents demographically independent populations (NMFS 2013a).

4.3.3 Status

The leatherback sea turtle is an endangered species whose nesting populations have experienced steep declines in recent decades. The primary threats to leatherback sea turtles include fisheries bycatch, harvest of nesting females, and egg harvesting. Because of these threats, once-large rookeries are now functionally extinct, and there have been range-wide reductions in population abundance. Other threats include loss of nesting habitat due to development, tourism, and sand extraction. Lights on or adjacent to nesting beaches alter nesting adult behavior and are often fatal to emerging hatchlings as they are drawn to light sources and away from the sea. Plastic ingestion is common in leatherbacks and can block gastrointestinal tracts leading to death. Climate change may alter sex ratios (as temperature determines hatchling sex), range (through expansion of foraging habitat), and habitat (through the loss of nesting beaches, because of sea-level rise). The species's resilience to additional perturbations is low.

North Atlantic leatherbacks likely number 34,000 to 94,000 individuals, with females numbering 18,800 and the eastern Atlantic segment numbering 4,700 (TEWG 2007). Trends and numbers include only nesting females and are not a complete demographic or geographic cross-section. In 1996, the entire western Atlantic population was characterized as stable at best, with roughly 18,800 nesting females (Spotila et al. 1996). A subsequent analysis indicated that by 2000, the western Atlantic nesting population had decreased to about 15,000 nesting females (NMFS 2005). Other estimates are similar: 34,000 to 95,000 total adults (20,000 to 56,000 adult females; 10,000 to 21,000 nesting females) (TEWG 2007).

In the Caribbean, Atlantic, and Gulf of Mexico, leatherback populations are generally increasing. In the United States, the Atlantic coast of Florida is one of the main nesting areas. Data from this area reveal a general upward trend with some fluctuation. Florida index nesting beach data from 1989 to 2014 indicate that the number of nests at core index nesting beaches ranged from 27 to

641 in 2014. In the U.S. Caribbean, nesting in Puerto Rico and St. Croix continues to increase as well, with some shift in the nesting between these two islands.

4.3.4 Critical Habitat

On March 23, 1979, leatherback critical habitat was designated adjacent to Sandy Point, St. Croix in the U.S. Virgin Islands from the 183-m isobath to mean high tide level between 17° 42’12” N and 65°50’00” W (Figure 8). This habitat is essential for nesting, which has been increasingly threatened since 1979, when tourism increased significantly bringing nesting habitat and people into close and frequent proximity. The designated critical habitat is within the Sandy Point National Wildlife Refuge. Leatherback nesting increased at an annual rate of 13 percent from 1994 to 2001; this rate has slowed according to nesting data from 2001 to 2010 (NMFS 2013a).

On January 20, 2012, NMFS issued a final rule to designate additional critical habitat for the leatherback sea turtle. This designation includes two areas: approximately 43,798 square kilometers stretching along the California coast from Point Arena to Point Arguello east of the 3000-m depth contour and 64,760 square kilometers stretching from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 meters depth contour (Figure 9). The designated areas comprise approximately 108,558 sq km of marine habitat and include waters from the ocean surface down to a maximum depth of 80 m. They were designated specifically because of the occurrence of prey, primarily scyphomedusae of the order Semaeostomeae (i.e., jellyfish), of sufficient condition, distribution, diversity, abundance, and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

Neither designated critical habitat in the U.S. Virgin Islands nor on the U.S. Pacific Coast are near the action area. Therefore, the proposed action would not affect designated critical habitat of the leatherback sea turtle.

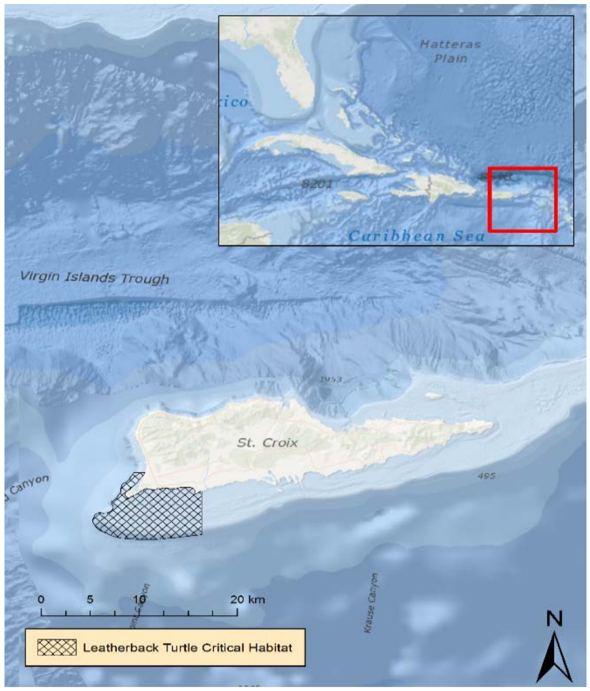

Figure 8. Map depicting leatherback sea turtle designated critical habitat in the U.S. Virgin Islands.

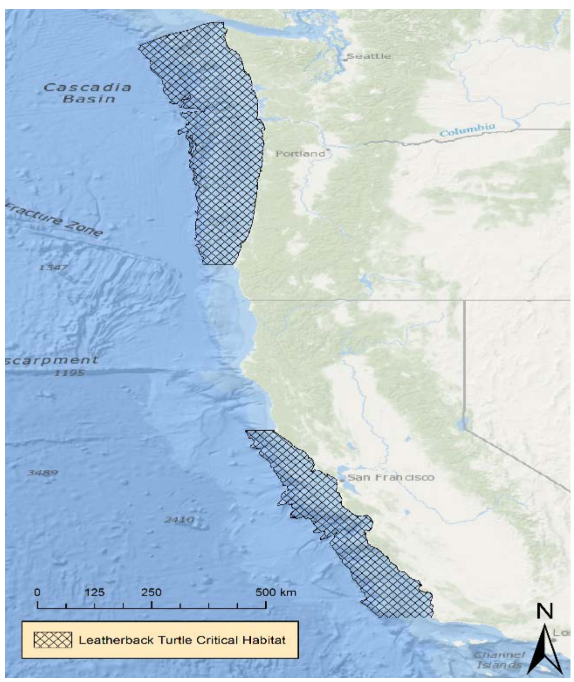

Figure 9. Map depicting leatherback sea turtle designated critical habitat along the U.S. Pacific Coast.

4.3.5 Recovery Goals

The following items are the top five recovery actions identified to support in the Leatherback Five-Year Action Plan (NMFS and USFWS 1992; NMFS and USFWS 1998):

1. Reduce fisheries interactions.
2. Improve nesting beach protection and increase reproductive output.
3. International cooperation.
4. Monitoring and research.
5. Public engagement.

4.4 Northwest Atlantic Ocean DPS Loggerhead Turtle

Loggerhead sea turtles are circumglobal and are found in the temperate and tropical regions of the Indian, Pacific, and Atlantic Oceans. Northwest Atlantic Ocean DPS loggerheads are found along eastern North America, Central America, and northern South America (Figure 10).

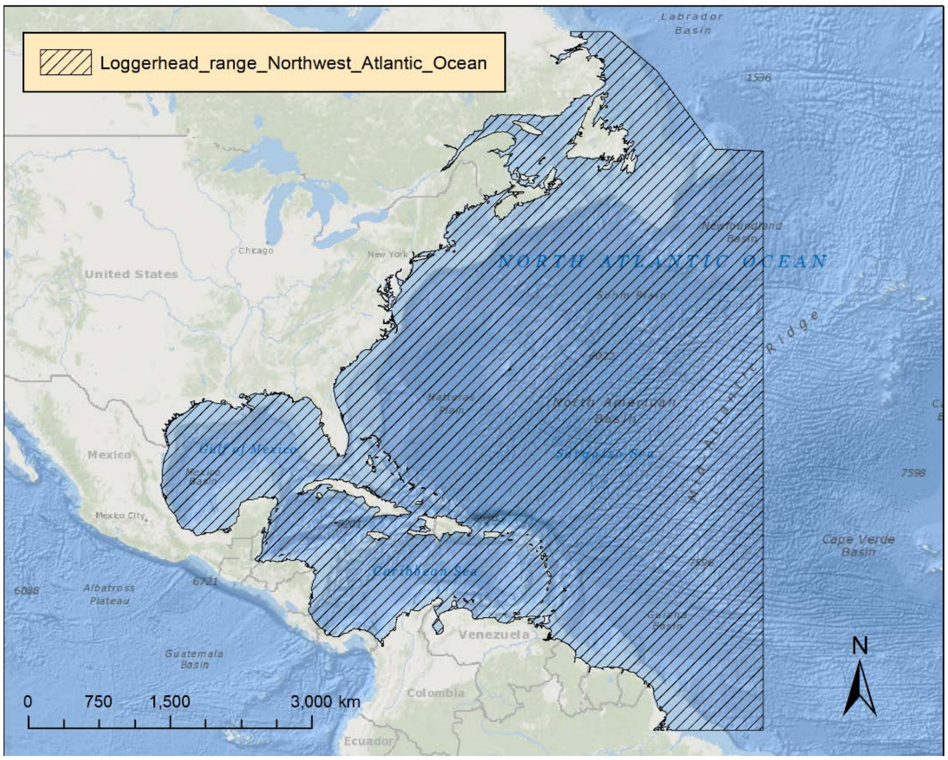

Figure 10. Map identifying the range of the Northwest Atlantic Ocean DPS loggerhead sea turtle.

The loggerhead sea turtle is distinguished from other turtles by its reddish-brown carapace, large head, and powerful jaws (Figure 11). The species was first listed as threatened under the Endangered Species Act in 1978 (43 FR 32800). On September 22, 2011, the NMFS designated nine DPSs of loggerhead sea turtles, with the Northwest Atlantic Ocean DPS listed as threatened (Table 5).

Table 5. Northwest Atlantic Ocean DPS loggerhead turtle information bar.

Species	Common Name	Distinct Population Segment	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Caretta caretta	Loggerhead sea turtle	Northwest Atlantic Ocean	Threatened	2009	76 FR 58868	2009	79 FR 39855

We used information available in the 2009 Status Review (Conant et al. 2009) and the final listing rule (76 FR 58868) to summarize the life history, population dynamics, and status of the species as follows.

4.4.1 Life History

Mean age at first reproduction for female loggerhead sea turtles is 30 years. Females lay an average of three clutches per season. The annual average clutch size is 112 eggs per nest. The average remigration interval is 2.7 years. Nesting occurs on beaches, where warm, humid sand temperatures incubate the eggs. Temperature determines the sex of the turtle during the middle of the incubation period. Turtles spend the post-hatchling stage in pelagic waters. The juvenile stage is spent first in the oceanic zone and later in the neritic zone (i.e., coastal waters). Coastal waters provide important foraging habitat, inter-nesting habitat, and migratory habitat for adult loggerheads.

4.4.2 Population Dynamics

The number of nesting females provides a useful index of the species's population size and stability at this life stage, even though reliability of an estimate of overall population size is not strong. Adult nesting females often account for less than one percent of total population numbers (Bjorndal et al. 2005).

Using a stage/age demographic model, the adult female population size of the DPS is estimated at 20,000 to 40,000 females with an estimated 53,000 to 92,000 nests annually (NMFS-SEFSC 2009). Based on genetic information, the Northwest Atlantic Ocean DPS is further categorized into five recovery units corresponding to nesting beaches—Northern Recovery Unit, Peninsular Florida Recovery Unit, Dry Tortugas Recovery Unit, Northern Gulf of Mexico Recovery Unit, and the Greater Caribbean Recovery Unit.

The Northern Recovery Unit, from North Carolina to northeastern Florida, is the second largest nesting aggregation in the DPS with an average of 5,215 nests from 1989 to 2008 and approximately 1,272 nesting females (NMFS and USFWS 2008). Nest counts at loggerhead nesting beaches in North Carolina, South Carolina, and Georgia declined at 1.9 percent annually from 1983 to 2005 (NMFS and USFWS 2007a).

The Peninsular Florida Recovery Unit hosts more than 10,000 females nesting annually, which constitutes 87 percent of all nesting effort in the DPS (Ehrhart et al. 2003). Nest counts taken at index beaches in Peninsular Florida show a significant decline in loggerhead nesting from 1989 to 2006, most likely attributed to mortality of oceanic-stage loggerheads caused by fisheries bycatch (Witherington et al. 2009). Loggerhead nesting on the Archie Carr National Wildlife Refuge (representing individuals of the Peninsular Florida subpopulation) has fluctuated over the past few decades. There was an average of 9,300 nests throughout the 1980s, with the number of nests increasing into the 1990s until it reached an all-time high of 17,629 nests in 1998. The number of loggerhead nests at the Refuge has since declined steeply to a low of 6,405 in 2007 and then increased again to 15,539, still a lower number of nests than in 1998 (Bagley et al. 2013).

The Dry Tortugas Recovery Unit includes all islands west of Key West, Florida in the northeastern Gulf of Mexico. The only available data for the nesting subpopulation on Key West come from a census conducted from 1995 to 2004 (excluding 2002), which provided a mean of 246 nests per year, or about 60 nesting females (NMFS and USFWS 2007a).

The Northern Gulf of Mexico Recovery Unit has 100-999 nesting females annually and a mean of 910 nests per year. The nesting subpopulation in the Florida panhandle has exhibited a significant declining trend from 1995 to 2005 (Conant et al. 2009; NMFS and USFWS 2007a). Recent model estimates predict an overall population decline of 17 percent for the St. Joseph Peninsula, Florida subpopulation of the Northern Gulf of Mexico recovery unit (Lamont et al. 2014). St. Joseph Peninsula is in the action area.

The Greater Caribbean Recovery Unit encompasses nesting subpopulations in Mexico to French Guiana, the Bahamas, and the Lesser and Greater Antilles. The majority of nesting for this recovery unit occurs on the Yucatán peninsula, in Quintana Roo, Mexico, with 903 to 2,331 nests annually (Zurita et al. 2003). Other significant nesting sites are found throughout the Caribbean with approximately 250 to 300 nests annually (Ehrhart et al. 2003), and over 100 nests occur annually in Cay Sal in the Bahamas (NMFS and USFWS 2008).

An analysis using expanded mitochondrial DNA sequences revealed that rookeries from the Gulf and Atlantic coasts of Florida are genetically distinct and that rookeries from Mexico's Caribbean coast express high haplotype diversity (Shamblin et al. 2014). Furthermore, the results suggest that the Northwest Atlantic Ocean DPS should be considered as ten management units: (1) South Carolina and Georgia, (2) central eastern Florida, (3) southeastern Florida, (4) Cay Sal, Bahamas, (5) Dry Tortugas, Florida, (6) southwestern Cuba, (7) Quintana Roo, Mexico, (8) southwestern Florida, (9) central western Florida, and (10) northwestern Florida (Shamblin et al. 2012).

Loggerhead hatchlings from the western Atlantic disperse widely, most likely using the Gulf Stream to drift throughout the Atlantic Ocean. Mitochondrial DNA evidence demonstrates that juvenile loggerheads from southern Florida nesting beaches comprise the vast majority (71-88 percent) of individuals found in foraging grounds throughout the western and eastern Atlantic: Nicaragua, Panama, Azores and Madiera, Canary Islands and Adalusia, Gulf of Mexico, and Brazil (Masuda 2010).

4.4.3 Status

Due to declines in nest counts at index beaches in the United States and Mexico and continued mortality of juveniles and adults from fishery bycatch, the Northwest Atlantic Ocean DPS is at risk and likely to decline in the foreseeable future (Conant et al. 2009). However, the trend in Florida appears to vary. A near-complete statewide nest census in Florida (all beaches including index nesting beaches) undertaken from 1989 to 2007 showed a mean of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females annually (NMFS and USFWS 2008). The Florida statewide estimated total for 2010 was 73,702, which was the largest index nesting number since 2000 (FWC 2016).

Loggerhead nesting likely consists of only 60 nesting females in the Caribbean and Gulf of Mexico. The action area is in the Northern Gulf of Mexico Recovery Unit, and its population trend (based on data prior to 2010) appears to be declining (Conant et al. 2009). The nesting subpopulation in the Florida panhandle has exhibited a significant declining trend from 1995 to 2005 (Conant et al. 2009; NMFS and USFWS 2007a). Recent model estimates predict an overall population decline of 17 percent for the St. Joseph Peninsula, Florida subpopulation of the Northern Gulf of Mexico recovery unit (Lamont et al. 2014). However, in Franklin and Gulf Counties, nesting survey results show a significant increase in 2016 compared to the previous four years (FWC 2017).

4.4.4 Critical Habitat

On July 10, 2014, NMFS and the U.S. Fish and Wildlife Service designated critical habitat for the Northwest Atlantic Ocean DPS loggerhead sea turtles along the U.S. Atlantic and Gulf of Mexico coasts from North Carolina to Mississippi (Figure 12). These areas contain one or a combination of nearshore reproductive habitat, winter area, breeding areas, and migratory corridors. The critical habitat is categorized into 38 occupied marine areas and 685 miles of nesting beaches. The physical or biological features and primary constituent elements identified for the different habitat types include waters adjacent to high-density nesting beaches, waters with minimal obstructions and manmade structures, high densities of reproductive males and females, appropriate passage conditions for migration, conditions that support sargassum habitat, available prey, and sufficient water depth and proximity to currents to ensure offshore transport of post-hatchlings.

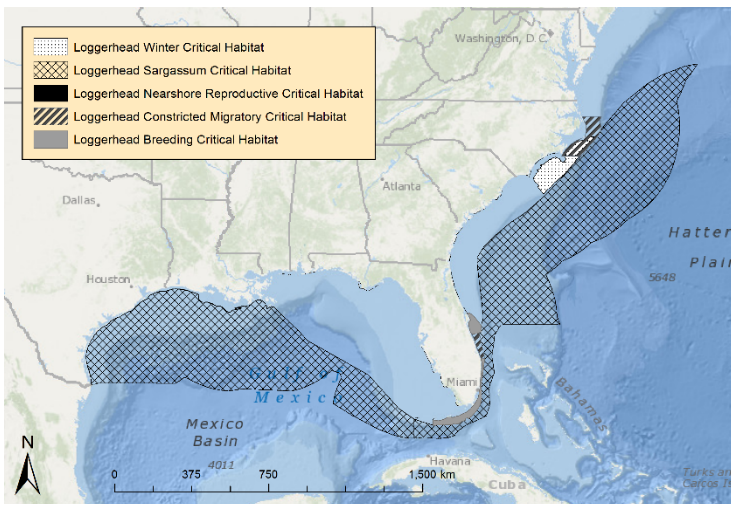

Figure 12. Map identifying designated critical habitat for the Northwest Atlantic Ocean DPS loggerhead sea turtle.

Of the areas of designated critical habitat for the Northwest Atlantic Ocean DPS of loggerheads, only two units (LOGG-N-31 and LOGG-N-32) of the nearshore reproductive critical habitat in the Florida panhandle are within the action area (Figure 13). The critical habitat is designated from mean high water to 1.6 km offshore of high-density nesting beaches and adjacent beaches. Essential physical or biological features include the portions of nearshore waters adjacent to nesting beaches that hatchlings use to egress to open water and that nesting females use to transit between beach and open water during nesting season. The primary constituent elements to support the habitat includes nearshore waters off nesting and adjacent beaches to 1.6 km offshore; waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone to open water; and waters with minimal manmade structures that could promote predators, disrupt wave patterns necessary for orientation, and/or create excessive longshore currents. Unit LOGG-N-31 occurs in Gulf and Franklin Counties from St. Joseph Bay to St.

George Sound, and Unit LOGG-N-32 is in Bay and Gulf Counties from the eastern boundary of Tyndall Air Force Base to Gulf County Canal in St. Joseph Bay.

Primary impacts to the critical habitat are from activities that cause loss of habitat conditions that allow for hatchlings to swim to open water and for nesting females to move between open water and the nesting beach. Examples include offshore structures, disorienting lights, oil spill and response activities, offshore energy development, fishing or aquaculture gear, and dredging and disposal activities.

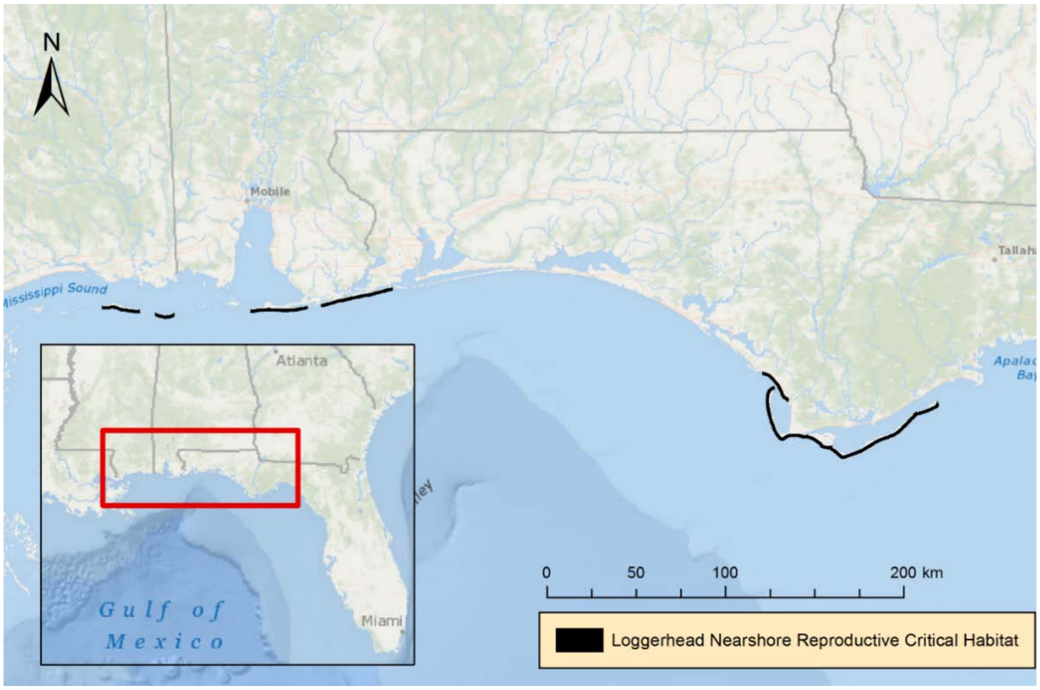

Figure 13. Map depicting parts of designated loggerhead nearshore reproductive critical habitat in the Florida panhandle, Alabama, and Mississippi. The two segments farthest to the east are within the action area.

4.4.5 Recovery Goals

The Final Recovery Plan for the Northwest Atlantic Population of Loggerheads (NMFS and USFWS 2008) lists the following recovery objectives:

1. Ensure that the number of nests in each recovery unit is increasing and that this increase corresponds to an increase in the number of nesting females.
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.
5. Eliminate legal harvest.

6. Implement scientifically-based nest management plans.
7. Minimize nest predation.
8. Recognize and respond to mass/unusual mortality or disease events appropriately.
9. Develop and implement local, state, Federal, and international legislation to ensure long-term protection of loggerheads and their terrestrial and marine habitats.
10. Minimize bycatch in domestic and international commercial and artisanal fisheries.
11. Minimize trophic changes from fishery harvest and habitat alteration.
12. Minimize marine debris ingestion and entanglement.
13. Minimize vessel strike mortality.

4.5 Gulf Sturgeon

The current range of the Gulf sturgeon extends from Lake Pontchartrain in Louisiana east to the Suwannee River system in Florida. Within that range, seven major rivers are known to support reproducing populations: Pearl, Pascagoula, Escambia, Yellow, Choctawhatchee, Apalachicola, and Suwannee (USFWS and NMFS 2009; Figure 14). Within the action area, only the Apalachicola River subpopulation, which is in the eastern portion of the Gulf sturgeon's range, would likely occur.

Gulf sturgeon are benthic fusiform fish with an extended snout, vertical mouth, five rows of scutes (bony plates surrounding the body), four barbels (slender, whisker-like feelers anterior to the mouth used for touch and taste), and a heterocercal (upper lobe is longer than lower) caudal fin (Figure 14). Adults range from 6-8 feet in length and weigh up to 200 pounds; females grow larger than males (USFWS and NMFS 2009). The Gulf sturgeon was listed as threatened on September 30, 1991 (Table 6).

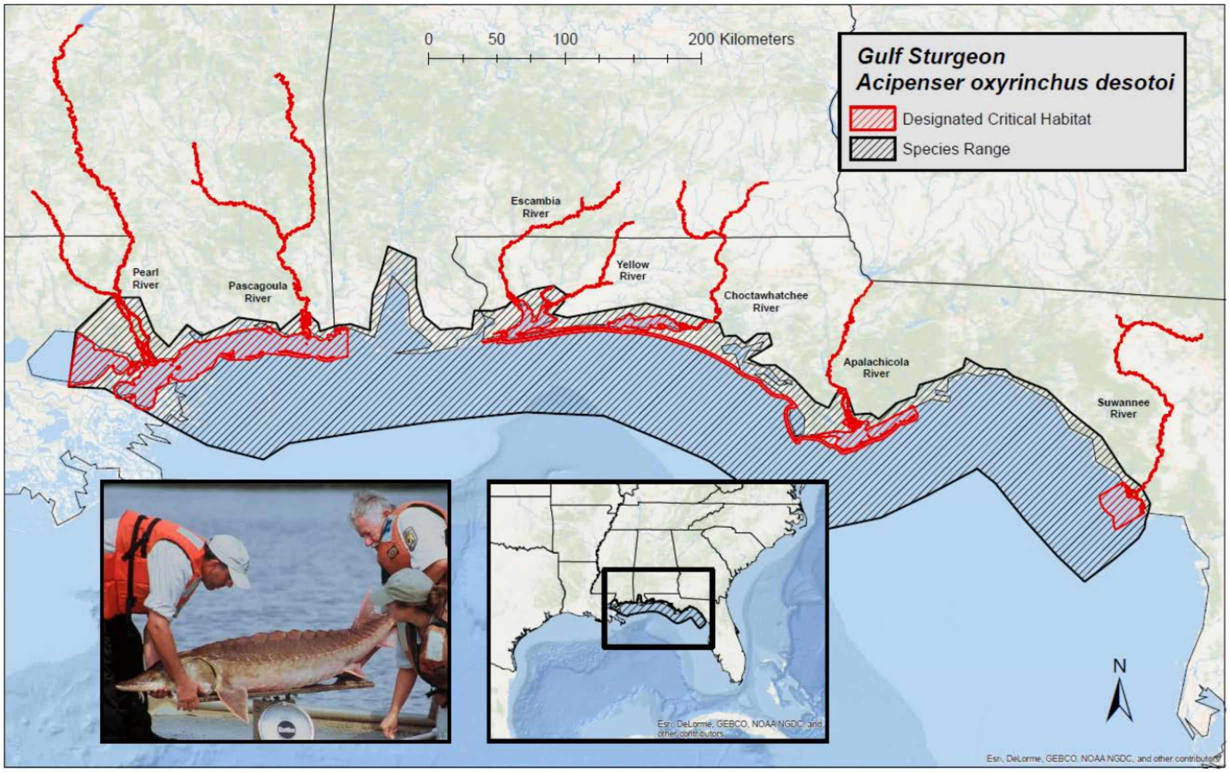

Figure 14. Geographic range and designated critical habitat of the Gulf sturgeon.

Table 6. Gulf sturgeon information bar.

Species	Common Name	Distinct Population Segment	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Acipenser oxyrinchus desotoi	Gulf sturgeon	None designated	Threatened	2009	1991 56 FR 49653	1995	2003 68 FR 13370

4.5.1 Life history

Gulf sturgeon are long-lived, with some individuals reaching at least 42 years of age. Surveys in the Suwannee River suggest that a more common maximum age may be around 25 years (Sulak and Clugston 1999). Age at sexual maturity for females ranges from 8 to 17 years, and for males from 7 to 21 years (Huff 1975). In general, Gulf sturgeon spawn upriver in spring, spend winter months in nearshore marine environments, and utilize pre- and post-spawn staging and nursery areas in the lower rivers and estuaries (Heise et al. 2005; Heise et al. 2004). There is some evidence of autumn spawning in the Suwannee River; however, there is uncertainty as to whether this spawning is due to environmental conditions or represents a genetically distinct population (Randall and Sulak 2012). Gulf sturgeon spawn at intervals ranging from 3 to 5 years for females and 1 to 5 years for males (Fox et al. 2000; Smith 1985). The spring migration to up-river spawning sites begins in mid February and continues through May. Fertilization is external;

females deposit their eggs in the upper reaches of the river and show preference for hard, clean substrate (e.g. bedrock covered in gravel and small cobble).

Upon hatching, Gulf sturgeon larvae spend their first few days sheltered in interstitial spaces at the spawning site (Kynard and Parker 2004). At the onset of feeding, age-0 Gulf sturgeon disperse and are often found on shallow sandbars and rippled sand shoals (<4 meters depth) (Sulak and Clugston 1998). Young-of-the-year spend 6-10 months slowing moving downstream while feeding on aquatic insects (e.g., mayflies and caddisflies), worms (oligochaetes), and bivalve molluscs. The fish arrive in estuaries and river mouths by mid winter (Sulak and Clugston 1999) where they spend their next six years developing. After spawning, adult Gulf sturgeon migrate downstream to summer resting and holding areas in the mid to lower reaches of the rivers where they may hold until November (Wooley and Crateau 1985). While in freshwater, adults lose a substantial amount of their weight but regain it upon entering the estuaries. Subadult and non-spawning adults also spend late spring through fall in these holding areas (Foster and Clugston 1997). By early December, all adult and subadult Gulf sturgeon return to the marine environment to forage on benthic invertebrates along the shallow nearshore waters (2-4 meter depth), barrier island passes, and in unknown off-shore locations in the Gulf of Mexico (Carr et al. 1996; Fox et al. 2002; Huff 1975; Ross et al. 2009). Juvenile Gulf sturgeon overwinter in estuaries, river mouths, and bays; juveniles do not enter the nearshore/offshore marine environments until around age 6 (Sulak and Clugston 1999). Gulf sturgeon show a high degree of river-specific fidelity (Rudd et al. 2014). Adult and subadult Gulf sturgeon fast while in freshwater environments and are almost entirely dependent on the estuarine/marine environment for food (Gu et al. 2001; Wooley and Crateau 1985). Some juveniles (ages 1-6) also fast in the freshwater summer holding areas, but the majority feed year round in the estuaries, river mouths, and bays (Sulak et al. 2009).

4.5.2 Population dynamics

The following is a discussion of the species's population and its variance over time. This section includes abundance, population growth rate, genetic diversity, and spatial distribution as it relates to Gulf sturgeon. As mentioned above, seven rivers currently are known to support reproducing populations of Gulf sturgeon. Gulf sturgeon abundance trends are typically assessed on a riverine basis (Table 7). In general, Gulf sturgeon populations in the eastern portion of the range appear to be stable or slightly increasing, and populations in the western portion are associated with lower abundances and higher uncertainty (USFWS and NMFS 2009). Pine and Martell (2009) reported that, due to low recapture rates and sparse data, the population viability of Gulf sturgeon is currently uncertain.

Table 7. Gulf sturgeon abundance estimates by river and year, with confidence intervals (CI) for the seven major rivers with reproducing populations. Table modified from USFWS and NMFS 2009.

River	Year of Data Collection	Abundance Estimate[a]	Lower/Upper 95% CI[b]	Source
Pearl	2001	430	323/605	(Rogillio et al. 2001)
Pascagoula	2000	216	124/429	(Ross et al. 2001)
Escambia	2006	451	338/656	(USFWS 2007)
Yellow	2003 fall	911	550/1550	(Berg et al. 2007)
Choctawhatchee	2008	3314	not reported	(USFWS 2009)
Apalachicola	2004	350	221/648	(USFWS 2004)
Suwannee	2007	14,000	not reported	(USFWS and NMFS 2009)

[a] *Estimates refer to numbers of individuals greater than a certain size, which varies between studies depending on sampling gear, and in some cases, numbers of individuals that use a particular portion of the river. Refer to original publication for details.*

[b] *Large confidence intervals (CI) around the mean estimates reflect the low number of captures in mark-recapture survey.*

When grouped by genetic relatedness, five regional or river-specific stocks emerge: (1) Lake Pontchartrain and Pearl River; (2) Pascagoula River; (3) Escambia, Blackwater, and Yellow Rivers; (4) Choctawhatchee River; and (5) Apalachicola, Ochlocknee, and Suwanee Rivers (Rudd et al. 2014; Stabile et al. 1996). Gene flow is low in Gulf sturgeon stocks, with each stock exchanging less than one mature female per generation (Waldman and Wirgin 1998).

4.5.3 Status

The decline in the abundance of Gulf sturgeon has been attributed to targeted fisheries in the late 19th and early 20th centuries; habitat loss associated with dams and sills; habitat degradation associated with dredging, de-snagging, and contamination by pesticides, heavy metals, and other industrial contaminants; and certain life history characteristics (e.g., slow growth and late maturation) (56 FR 49653). Effects of climate change (warmer water, sea-level rise, and higher salinity levels) could accelerate changes in habitats utilized by Gulf sturgeon. The rate that climate change and corollary impacts are occurring may outpace the ability of the Gulf sturgeon to adapt given its limited geographic distribution and low dispersal rate.

4.5.4 Critical Habitat

Critical habitat for Gulf sturgeon was designated in 2003 and consists of 14 geographic units encompassing 2,783 river kilometers as well as 6,042 square kilometers of estuarine and marine habitat (Figure 14). Essential elements for the conservation of Gulf sturgeon are abundant food items; riverine spawning sites with substrates suitable for egg deposition and development; riverine aggregation areas; a flow regime necessary for normal behavior, growth, and survival; water and sediment quality necessary for normal behavior, growth, and viability of all life stages;

and safe and unobstructed migratory pathways. The action area contains only 2 of the 14 critical habitat units for the Gulf sturgeon—Unit 11 (Florida nearshore Gulf of Mexico, including Gulf County) and Unit 13 (Apalachicola Bay in Gulf and Franklin Counties, Florida). Both units provide winter feeding and migration habitat for the Apalachicola River subpopulation. Unit 11 includes nearshore waters out to 1 nm between Pensacola and Apalcahicola. Unit 13 includes Apalachicola Bay and its adjacent sounds and bays, such as St. George Sound, and nearshore waters out to 1 nm from the barrier islands.

4.5.5 Recovery Goals

The 1995 Recovery Plan outlined three recovery objectives: (1) to prevent further reduction of existing wild populations of Gulf sturgeon within the range of the subspecies; (2) to establish population levels that would allow delisting of the Gulf sturgeon by management units (management units could be delisted by 2023 if required criteria are met); (3) to establish, following delisting, a self-sustaining population that could withstand directed fishing pressure within management units (USFWS 1995). The most recent Gulf sturgeon 5-year review recommended that criteria be developed in a revised recovery plan (USFWS and NMFS 2009).

5 ENVIRONMENTAL BASELINE

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR §402.02).

5.1 Climate Change

The direct effects of climate change will result in increases in atmospheric and sea surface temperatures, changes in patterns of precipitation, and rising sea level. The globally-averaged combined land and ocean surface temperature data, as calculated by a linear trend, show a warming of approximately 0.85 degrees Celsius over the period 1880 to 2012 (IPCC 2014). Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850 (IPCC 2014). Burning fossil fuels has increased atmospheric carbon dioxide concentrations by 35 percent with respect to pre-industrial levels, with consequent climatic disruptions that include a higher rate of global warming than occurred at the last global-scale state shift (the last glacial-interglacial transition, approximately 12,000 years ago) (Barnosky et al. 2012). Ocean warming dominates the increase in energy stored in the climate system, accounting for more than 90 percent of the energy accumulated between 1971 and 2010 (IPCC 2014). The upper ocean (0 to 700 m depth range) warmed from 1971 to 2010, and it likely also warmed between the 1870s and 1971 (IPCC 2014). On a global scale, ocean warming is greatest near the surface, and the upper 75 m warmed by 0.11 degrees Celsius per decade over the period 1971 to 2010 (IPCC 2014). Observed changes in marine systems are associated with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels, and circulation.

Higher carbon dioxide concentrations have also caused the ocean to become rapidly more acidic, which is evident as a decrease in pH by 0.05 in the past two decades (Doney 2010).

This climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine ecosystems in the near future. The most pronounced effects would most likely occur on species whose populations are already in tenuous positions (Isaac 2009). As such, we expect the extinction risk of ESA-listed species to rise with climate change. Primary effects of climate change on individual species include habitat loss or alteration, distribution changes, altered and/or reduced distribution and abundance of prey, changes in the abundance of competitors and/or predators, shifts in the timing of seasonal activities of species, and geographic isolation or extirpation of populations that are unable to adapt. Secondary effects include increased stress, disease susceptibility, and predation.

For sea turtles, temperature regimes generally lead toward female-biased nests, and such altered sex ratios occur in sea turtle populations worldwide (Fuentes et al. 2010; Hill et al. 2015; Mazaris et al. 2008; Reina et al. 2009; Robinson et al. 2009). Increasing temperatures in sea turtle nests also reduces incubation times (producing smaller hatchlings) and nesting success due to exceeded thermal tolerances (Fuentes et al. 2010; Fuentes et al. 2011; Fuentes et al. 2009). This does not appear to have yet affected population viabilities through reduced reproductive success, although nesting and emergence dates of days to weeks in some locations have changed over the past several decades (Poloczanska et al. 2009).

Changes in global climatic patterns will likely have profound effects on the coastlines of every continent by increasing sea levels and the intensity and frequency of hurricanes and tropical storms (Wilkinson and Souter 2008). Based on computer models, these phenomena would inundate nesting beaches of sea turtles, change patterns of coastal erosion and sand accretion that are necessary to maintain those beaches, and increase the number of turtle nests destroyed by tropical storms and hurricanes (Wilkinson and Souter 2008). Inundation itself reduces hatchling success by creating hypoxic conditions within inundated eggs (Pike et al. 2015). In addition, flatter beaches preferred by smaller sea turtle species would be inundated sooner than would steeper beaches preferred by larger species (Hawkes et al. 2014). The loss of nesting beaches would have catastrophic effects on sea turtle populations globally if they are unable to colonize new beaches that form or if the beaches do not provide the habitat attributes (sand depth, temperature regimes, refuge) necessary for egg survival. In some areas, increases in sea level alone may be sufficient to inundate sea turtle nests and reduce hatching success (Caut et al. 2009). Storms may also cause direct harm to sea turtles, causing “mass” strandings and mortality (Poloczanska et al. 2009).

Gulf sturgeon are within a region that is predicted to experience overall climatic drying (IPCC 2008). Higher water temperatures and changes in extremes in this region, including floods and droughts, affect water quality and exacerbate many forms of water pollution— from sediments, nutrients, dissolved organic carbon, pathogens, pesticides, and salt, as well as thermal pollution—with possible negative impacts on ecosystems (IPCC 2008). In addition, sea-level rise is projected to extend areas of salinization of groundwater and estuaries, resulting in a decrease of freshwater availability for humans and ecosystems in coastal areas, which could lead to more dams and dredging (see Section 5.7). Dams, dredging, and poor water quality have already modified and restricted the extent of suitable habitat for Gulf sturgeon spawning and nursery habitat. Abnormally low stream flows can restrict access by sturgeon to habitat areas and exacerbate water quality issues such as water temperature, reduced DO, nutrient levels, and contaminants. Effects could be especially harmful since these populations have already been reduced to low numbers, potentially limiting their capacity for adaptation to changing environmental conditions (Belovsky 1987; Salwasser et al. 1984; Soulé 1987; Thomas 1990).

5.2 Fishery Interactions

Globally, 6.4 million tons of fishing gear is lost in the oceans every year (Wilcox et al. 2015). Fishery interaction remains a major factor in sea turtle recovery. An estimated 62,000 loggerhead sea turtles have been killed as a result of incidental capture and drowning in shrimp trawl gear in 2001 (Epperly et al. 2002). Although TEDs and other bycatch reduction devices have significantly reduced bycatch of sea turtles and other marine species, mortality still occurs in Gulf of Mexico waters.

In addition to commercial bycatch, recreational hook-and-line interaction also occurs. From 1993 to 1995, at least 170 Kemp’s ridley sea turtles were hooked or tangled by recreational hook-and-line gear in the northern Gulf of Mexico (Cannon and Flanagan 1996). Of these, 18 were dead stranded turtles, 51 were rehabilitated turtles, 5 died during rehabilitation, and 96 were reported as released by fishermen. From 2003 to 2016, data from STSSN and anecdotal calls or reports to NMFS show that 241 sea turtles were caught by hook-and-line in Florida. Of those, 48 turtles (46 Kemp’s ridleys, one loggerhead, and one green) were caught in the action area. From 2000 to 2012, reported hook-and-line captures specifically from piers totaled 123 turtles for all of Florida; 47 (all Kemp’s ridleys) of those occurred in the action area. Most of the caught turtles were released (often after tagging) or taken to GSML; only two died (both Kemp’s ridleys). These data are likely a large underestimate of the number of turtle takes from recreational fishing because of the voluntary nature of reporting such takes.

Overfishing of Atlantic sturgeon, including the Gulf subspecies, caused initial severe declines in the southeastern U.S., and they have never rebounded. Further, bycatch in commercial fisheries is an ongoing impact to Gulf sturgeon subpopulations. All sturgeon species are more sensitive to bycatch mortality because they are a long-lived species, have an older age at maturity, have lower maximum reproductive rates, and produce a large percentage of eggs late in life. Based on these life history traits, Atlantic sturgeon can only withstand the annual loss to bycatch mortality of up to five percent of the population without suffering population declines (Boreman 1997). Bycatch mortality rates of Atlantic sturgeon in various types of fishing gear range from 0 to 51 percent, with the greatest mortality occurring in sturgeon caught by sink gillnets. In addition, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (e.g., exposure to toxins and low dissolved oxygen). This may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality.

GSML has been harvesting organisms using the same technique (i.e., trawling without a TED) since 1965. To date, no turtles, Gulf sturgeon, or any other ESA-listed species have been reported to be collected or otherwise taken from the GSML collection activities. However, as part of a NMFS survey in 1985, three Kemp's ridley turtles were caught in GSML's 1100-sqft net. All three turtles had pre-existing entanglement issues, and they were disentangled, tagged, and released.

5.3 Vessel Traffic

Commercial and recreational vessel traffic can have an adverse effect on sea turtles through vessel strikes. Vessel strikes are a poorly-studied threat but have the potential to be an important source of mortality to sea turtle populations (Work et al. 2010). All sea turtles must surface to breathe, and several species are known to bask at the surface for long periods. Although sea turtles can move rapidly, they are not able to avoid vessels moving at more than four kilometers per hour; most vessels move faster than this in open water (Hazel et al. 2007; Work et al. 2010). Given the high level of vessel traffic in the Gulf of Mexico, frequent injury and mortality could affect sea turtles in the region. Hazel et al. (2007) suggested that green turtles may use auditory cues to react to approaching vessels rather than visual cues, making them more susceptible to strike as vessel speed increases.

Because Gulf sturgeon are demersal, vessel strikes are unlikely. However, vessel strikes are a documented threat to Atlantic sturgeon, and injuries consistent with vessel interactions have been documented in Gulf sturgeon (ASSRT 2007; USFWS and NMFS 2009).

5.4 In-water Research Projects

In Florida, in-water sea turtle research has increased in recent years, but no coordinated trend-monitoring program exists for in-water populations. Most in-water projects are, or were, located on the southeastern coast of Florida. Scientific research has and will continue to affect ESA-listed sea turtle and fishes within the action area. Authorized research on ESA-listed sea turtles includes capture and handling; satellite, internal, and external tagging; blood and tissue collection; ultrasound; laparoscopy; and imaging. Currently, there are nine active permits (Permit Nos. 16598, 16733, 17183, 17304, 17381, 19496, 19627, 19716, and 20339) involving ESA-listed turtles within the action area. Only one permit (Permit No. 20339) authorizes unintentional mortalities: two North Atlantic DPS green turtles, two Kemp's ridley turtles, three Northwest Atlantic Ocean DPS loggerhead turtles, one leatherback turtle, one hawksbill turtle, and one olive ridley turtle. Otherwise, these permits are not expected to affect the fitness of individual turtles.

In addition to dedicated in-water studies, other projects and activities that involve the collection of sea turtle data, often secondary to the primary purpose, help identify target areas for future in-depth studies. Other data come from incidental capture in fisheries research projects or from the fisheries themselves. Pre-dredge trawling, sea turtle aerial surveys, stranding networks, and satellite tracking of sea turtles also provide important distributional data.

There are currently no active research permits for Gulf sturgeon under NMFS jurisdiction.

5.5 Military Activities

The Gulf test and training range of the Eglin Air Force Base is near the waters of Gulf, Franklin, and Wakulla Counties. Therefore, test and training activities conducted by the U.S. Air Force could affect the same sea turtles or Gulf sturgeon that could be affected by ITP #21293. Such activities include firing weapons (bombs, missiles, rockets, gunnery rounds) from aircraft to targets in the water and from land or vessels to targets flying over the water. Resulting impacts to sea turtles include behavioral disturbance from acoustic stressors, temporary and permanent hearing threshold shifts, ingestion of marine debris, serious injury, and mortality (NMFS 2017a; NMFS 2017b). Eglin Air Force Base activities are not likely to adversely affect Gulf sturgeon.

Military activites that occur beyond the action area, such as dredging at the Tyndall Air Force Base (USAF 2015), likely affect the same sea turtle populations, and some military activities beyond the action area could also affect Gulf sturgeon in the region. The U.S. Navy conducts testing and training activities in the northern Atlantic Ocean, and the activities could adversely affect sea turtles and possibly Gulf sturgeon as a result of vessel strikes, munition detonations, and sonar use, among others (NMFS 2013b). Resulting impacts include harassment, temporary and permanent hearing threshold shifts, sub-lethal injury, and mortality. Although military activities result in marine debris being deposited in designated critical habitats for the North Atlantic Ocean DPS of loggerhead and for the Gulf sturgeon, the amount of debris is unlikely enough to be considered an obstruction to migratory or transitory pathways or to alter flow regimes within the critical habitats in the action area.

5.6 Pollutants

Pollutants, including anthropogenic marine debris and sound, may affect ESA-listed species in the action area. Such impacts are difficult to measure, and conservation actions focus on monitoring and studying impacts from these sources (NMFS 2016b). Sources of pollutants along the Gulf coastal regions include polychlorinated biphenyl compounds (PCBs), metals, stormwater runoff from coastal towns and cities, marina and dock construction, oil spills, and other discharges. Poor water quality limits available habitat for Gulf sturgeon. Nutrient loading from land-based sources such as coastal community discharges is known to stimulate algal blooms in closed or semi-closed estuarine systems and to cause hypoxia (reduced oxygen availability). Although pathological effects of oil spills have been documented in laboratory studies of marine mammals and sea turtles (Vargo et al. 1986), the impacts of many other anthropogenic toxins have not been investigated. Similarly, not all specific effects of sound on turtles and fish are known, but high levels of anthropogenic sound may injure or kill turtles and fishes. Also, continuous sounds or sounds at sub-injurious levels may alter behavior and/or mask biologically relevant sounds in the surrounding environment.

5.7 Dredging and Dams

Dredging is common within U.S. coastal waters. Construction and maintenance of federal navigation channels and dredging in sand mining sites have been identified as sources of sea turtle mortality. Hopper dredges are capable of moving relatively quickly compared to sea turtle swimming speed and can overtake, entrain, and kill sea turtles. Relocation trawling frequently occurs in association with dredging projects to reduce the potential for dredging to injure or kill sea turtles (Dickerson et al. 2007). Dredging has been documented to capture or kill 168 sea turtles from 1995 to 2009 in the Gulf of Mexico, including 97 loggerheads, 35 Kemp's ridleys, 32 greens, and 3 unidentified sea turtles (USACE 2010).

Dredging also threatens Gulf sturgeon. Riverine, nearshore, and offshore areas are often dredged to support commercial shipping and recreational boating, construction of infrastructure, and marine mining. Environmental impacts of dredging include the direct removal/burial of organisms, turbidity/siltation effects, contaminant resuspension, noise/disturbance, alterations to hydrodynamic regime and physical habitat, and actual loss of riparian habitat (Chytalo 1996; Winger et al. 2000). Maintenance dredging occurs regularly in numerous parts of all seven river drainages that are used by Gulf sturgeon and results in reduced dissolved oxygen and upriver movement of the salt wedge, which restricts spawning habitat (USFWS and NMFS 2009).

Dams for hydropower generation, flood control, and navigation adversely affect Gulf sturgeon habitat by impeding access to spawning, developmental, and foraging habitat; modifying freeflowing rivers to reservoirs; physically damaging fish on upstream and downstream migrations; and altering water quality in the remaining downstream portions of spawning and nursery habitat. Fish passage has not proven very successful in minimizing the impacts of dams on Gulf sturgeon because they do not regularly use existing fish passage devices. All of the dams identified in the original listing of Gulf sturgeon continue to block Gulf sturgeon movement to historic spawning grounds, and in the most recent status review an additional six proposed dams were identified that may negatively affect Gulf sturgeon movement (USFWS and NMFS 2009).

5.8 Disease and Non-native Species Introductions

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

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

5.9 Conservation and Recovery Actions Shaping the Environmental Baseline

NMFS and cooperating states have established the STSSN, of which GSML is a member, along the Atlantic and Gulf of Mexico coasts that collect data on dead sea turtles and rescue and rehabilitate live stranded sea turtles. Some STSSN activities and other research activities are conducted on rescued turtles, and those activities are permitted by the state, USFWS, and/or NMFS. Data are used to monitor stranding levels, compare them with fishing pressure, and determine whether additional fishing restrictions are warranted. The data also contribute to scientific research regarding disease, toxicology and effects of contaminants, genetic analyses, and population dynamics.

The Fish and Wildlife Research Institute is responsible for collecting a wide variety of estuarine and marine fisheries data (e.g., stock assessments, life history, fisheries-dependent monitoring, and fisheries-independent monitoring) for the State of Florida. Also, in 1989 the Florida Fish and Wildlife Conservation Commission (FWC) initiated the Fisheries-Independent Monitoring Program, which is an ongoing, long-term sampling program that monitors the relative abundance of fishery resources in Florida’s major estuarine, coastal, and reef systems. The FWC’s Fisheries-Dependent Monitoring Program, in cooperation with NMFS, collects and compiles data on recreational landings, commercial landings, and processed fishery products in Florida. The fisheries sampling conducted statewide has the potential to provide a significant amount of data on sea turtles and some data on Gulf sturgeon.

6 Effects of the Action

Section 7 regulations define “effects of the action” as the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR §402.02). Indirect effects are those that are caused by the proposed action and are later in time, but are reasonably certain to occur. This effects analyses section is organized following the stressor, exposure, response, and risk assessment framework.

The jeopardy analysis relies upon the regulatory definition of “to jeopardize the continued existence of a listed species,” which is “to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species” (50 CFR §402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

The destruction and adverse modification analysis considers whether the action produces “a direct or indirect alteration that appreciably diminished the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features” (50 CFR §402.02).

This section assesses the types of effects that are expected from trawling without a TED as specified in ITP #21293 and the overall impact of those effects on sea turtle and Gulf sturgeon populations and their designated critical habitats within the action area.

6.1 Stressors Associated with the Proposed Action

A stressor is any physical, chemical, or biological stimulus that may induce an adverse response in an ESA-listed species or alter designated critical habitat. The potential stressors we expect to result from the proposed action are capture, vessel strike, noise, and habitat disturbance.

6.2 Mitigation to Minimize or Avoid Exposure

Although mitigation is part of the ITP and associated conservation plan as discussed above in Section 3.1, GSML’s mitigation is summarized here again along with proposed permit conditions. The specific mitigation involves rescuing and potentially rehabilitating any turtles that are incidentally taken or turtles that are encountered entangled in fishing gear. GSML would resuscitate any captured turtle if needed. Any turtle entangled in fishing gear (i.e., lines or nets) that is encountered, regardless of capture in the trawl, would be disentangled and either released or taken to rehabilitation if too ill or injured. GSML is a member of the STSSN, and under that associated permit GSML will tag, measure, and release any incidentally caught sea turtles. Such data will benefit sea turtle research as discussed in Section 5.9. Finally, GSML performs education and outreach activities to inform the public and recreational fishermen about sea turtle conservation efforts.

The Species Division proposes to condition ITP #21293 for the species involved in this consultation for mitigation purposes (reporting and other permit conditions are not discussed here) as follows:

1. *Tow times.* Tow times shall not exceed 30 minutes.

2. *Sea Turtle Handling and Resuscitation Requirement*s. All incidentally captured sea turtles must be handled as follows:

1) Any specimen taken incidentally during the course of fishing or scientific research activities must be handled with due care to prevent injury to live specimens, observed for activity, and returned to the water according to the following procedures:

(A) Sea turtles that are actively moving must be released over the stern of the boat. In addition, they must be released only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels.

(B) Resuscitation must be attempted on sea turtles that are comatose, or inactive by:

(*1*) Placing the turtle on its bottom shell (plastron) so that the turtle is right side up and elevating its hindquarters at least 6 inches (15.2 cm) for a period of 4 up to 24 hours. The amount of the elevation depends on the size of the turtle; greater elevations are needed for larger turtles. Periodically, rock the turtle gently left to right and right to left by holding the outer edge of the shell (carapace) and lifting one side about 3 inches (7.6 cm) then alternate to the other side. Gently touch the eye and pinch the tail (reflex test) periodically to see if there is a response.

(*2*) Sea turtles being resuscitated must be shaded and kept damp or moist but under no circumstance be placed into a container holding water. A water-soaked towel placed over the head, carapace, and flippers is the most effective method in keeping a turtle moist.

(*3*) Sea turtles that revive and become active must be released over the stern of the boat only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels. Sea turtles that fail to respond to the reflex test or fail to move within 4 hours (up to 24, if possible) must be retained for scientific purposes. GSML will preserve the specimen (by placing it on ice) until it can be determined who will receive the specimen from GSML. GSML will contact the Chief, Endangered Species Division, Office of Protected Resources, National Marine Fisheries Service (address and phone listed under IV. B.) to make this determination.

(C) A turtle is determined to be dead if the muscles are stiff (rigor mortis) and/or the flesh has begun to rot; otherwise the turtle is determined to be comatose or inactive and resuscitation attempts are necessary. (Note- No mortalities are expected under this permit, however this information is being included here in the unlikely event that a turtle death occurs.)

2) Any specimen taken incidentally during the course of fishing or scientific research activities must not be consumed, sold, landed, offloaded, transshipped, or kept below deck.

3. *Gulf Sturgeon Handling Requirements*. Should a Gulf sturgeon be taken incidentally during the course of trawling, it should be returned to the water immediately. Sturgeon tend to inflate their swim bladder when stressed and in air. (If the fish has air in its

bladder, it will float and be susceptible to sunburn or bird attacks.) Efforts should be made to return the fish to neutral buoyancy prior to and during release. Air can be released by gently applying ventral pressure in a posterior to anterior direction. The specimen should then be propelled rapidly downward during release. For help with any questions relating to Gulf sturgeon, GSML should contact Stephania Bolden, Protected Resources, Southeast Regional Office, NMFS, at (727) 570-5312 (Fax: 727-570-5517).

4. GSML will disentangle, to the maximum extent practicable and with vigilante consideration of safety, any live turtle or Gulf sturgeon that is found in fishing gear.

5. *Additional Restrictions*. If observed interactions with sea turtles or Gulf sturgeon within the waters covered by this ITP reach thresholds specified in the AUTHORIZED INCIDENTAL TAKES section of this permit, GSML must immediately stop all trawling activities. GSML must then consult with NMFS to determine the appropriate next steps.

6.3 Exposure and Response Analysis

This section includes analyses of exposure to each stressor and anticipated responses of sea turtles, Gulf sturgeon, and designated critical habitats in the action area. The analyses take into account the mitigation measures discussed above in Section 6.2.

6.3.1 Capture

Sea turtles and Gulf sturgeon in the action area are exposed to potential capture in the GSML trawl. Because the trawl does not have a TED, escape from the net once captured is unlikely. The animal may try to escape by swimming toward the mouth end of the trawl, but the turtle or sturgeon would not likely swim faster than the trawl's towing speed. As a result, the animal would tire and get caught in the tail end of the trawl net.

Sea turtles that undergo forced submergence experience respiratory and metabolic stress, which can disturb their acid-base balance (NMFS 2003). Struggling to escape capture can exacerbate their stress. Turtles that experience recapture could be susceptible to lethal metabolic acidosis because they would not have time to process increased lactic acid loads resulting from the stress of the previous capture (Lutcavage and Lutz 1997). Because of the short tow time (no more than 30 minutes per tow) of the proposed fishing activity, the likelihood of capturing a turtle is low, thus making the likelihood of recapture negligible. Also as a result of the short tow time, a captured turtle would not undergo forced submergence for long enough to result in physiological effects. If a captured turtle is comatose, GSML would follow resuscitation procedures according to the permit conditions. Because of GSML's extensive experience working with sea turtles, we anticipate that any needed resuscitation efforts would be successful.

Although trawls have incidentally caught Gulf sturgeon, reported takes have resulted in unharmed releases (NMFS 2003). The same logic described above for sea turtles applies to Gulf sturgeon—the short tow times and lack of reported Gulf sturgeon take by GSML support a low likelihood that the proposed action would result in incidental take of Gulf sturgeon.

6.3.2 Vessel Strike

The GSML's vessel could strike a sea turtle or Gulf sturgeon while in transit or while trawling. As discussed in the baseline Section 5.3, vessel strikes are a known threat (injurious or fatal) to sea turtles. Because GSML proposes to record turtle sightings while on fishing trips as part of its sea turtle research, the vessel operator would be better informed and able to avoid vessel strikes. Therefore, the probability of the GSML vessel striking a sea turtle is very low. Because Gulf sturgeon are demersal and do not surface to breathe, the likelihood of the vessel striking a Gulf sturgeon is negligible.

6.3.3 Noise

Sources of noise from the proposed action include the vessel's engine noise and very slight noise generated from operating the trawl. Both types of noise contribute to the ambient soundscape in the action area, but we do not expect them to cause take of sea turtles or Gulf sturgeon. Regarding sea turtles, such noise would not likely cause any adverse effect beyond a minor behavioral reaction, such as a direction shift in swimming. For the Gulf sturgeon, a similar minor behavioral reaction could occur, and the noise could also mask bioacoustics that Gulf sturgeon may use to locate prey. Because of the periodic nature of GSML's fishing activities, such noises would occur infrequently and would have negligible effects on ESA-listed species in the action area.

6.3.4 Habitat Disturbance

Trawling disturbs bottom habitat. The substrate in the action area is mostly soft sediment, which would be disturbed and suspended in the water column, which could cause turbidity in the lower water column. The disturbance in areas trawled could also affect foraging habitat by removal of some benthic and infaunal prey and by reducing visibility as a result of suspended sediment. Given the short duration of GSML's tows, habitat disturbance would be spatiotemporally minimal in relation to the large area of available habitat in the region. Sea turtles and Gulf sturgeon would have ample habitat available for use in the vicinity.

The designation of nearshore reproductive critical habitat for Northwest Atlantic Ocean DPS of loggerhead turtle refers to primary impacts, including blocking movement by fishing gear, which would be an obstruction for transit from the surf zone to open water (79 FR 39855). If fishing gear blocks such a transit, it would adversely affect the primary constituent element of waters sufficiently free of obstructions to allow transit. Therefore, because the proposed action may result in incidental capture of loggerheads in the trawl net, the proposed action would also be adversely affecting the designated critical habitat because it would introduce an obstruction (i.e., trawl net) into the nearshore reproductive habitat that could prevent transit of loggerhead hatchlings or nesting females between the surf zone and open water. However, given the low likelihood of a sea turtle capture, as explained above in Section 6.3.1, the likelihood of disrupting transit between the surf zone and open water is also low. In conclusion, we do not expect the proposed action to destroy or adversely modify the nearshore reproductive critical habitat of the Northwest Atlantic Ocean DPS of loggerhead sea turtles.

Similar to loggerhead critical habitat, Gulf sturgeon critical habitat could be affected by activities that obstruct migratory pathways within and between critical habitat units (68 FR 13369). Because the proposed action could result in incidental capture of Gulf sturgeon in the trawl net, the proposed action would also be adversely affecting the designated critical habitat because an obstruction (i.e., trawl net) would prevent migration of Gulf sturgeon within and between critical habitat units. However, given the low likelihood of a Gulf sturgeon capture, as explained above in Section 6.3.1, the likelihood of obstructing the migratory pathways is also low. Additionally, the GSML fishing activities could remove or disturb prey of the Gulf sturgeon. Another essential element of the critical habitat is abundant food items, but because the GSML fishing pressure is low, we do not expect the harvested or disturbed prey to noticeably affect the overall abundance of food items for Gulf sturgeon in the action area. In conclusion, we do not expect the proposed action to destroy or adversely modify the units 11 or 13 of critical habitat of the Gulf sturgeon.

6.4 Risk Assessment

This section assesses the consequences of the responses to the individuals that have been exposed, the populations those individuals represent, and the species those populations comprise. For designated critical habitat, we assess the consequences of these responses on the value of the critical habitat for the conservation of the species for which the habitat had been designated.

The short duration of the GSML tows and the minimization and avoidance measures presented in Section 6.3 present a very low risk to sea turtles, Gulf sturgeon, and their critical habitats. In turn, because the likelihood of exposure and response of any individual sea turtle or Gulf sturgeon is low as discussed in Section 6.3, the proposed action would have a very low, if any, risk to ESA-listed species in the action area.

7 Cumulative Effects

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

During this consultation, we searched for information on future state, tribal, local, or private (non-Federal) actions reasonably certain to occur in the action area. We did not find any information about non-Federal actions other than what has already been described in the Environmental Baseline (Section 5), which we expect will continue in the future. An increase in those activities could result in an increased effect on ESA-listed species and designated critical habitats; however, the magnitude and significance of any anticipated effects remain unknown at this time. The best scientific and commercial data available provide little specific information on any long-term effects of these potential sources of disturbance on ESA-listed species and designated critical habitats.

8 INTEGRATION AND SYNTHESIS

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the Effects of the Action (Section 6) to the Environmental Baseline (Section 5) and the Cumulative Effects (Section 7) to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a ESA-listed species in the wild by reducing its numbers, reproduction, or distribution, or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the Status of Listed Resources (Section 4).

8.1 Sea Turtles

As discussed in Section 5, sea turtles continue to face threats such as climate change, fishery interactions, vessel strikes, and effects from military activities. While the loss of turtles, at any life stage, has likely adversely affected the ability of all sea turtle populations considered in this Opinion to maintain or increase their numbers by limiting the number of individuals in these populations, the loss of reproductive adults results in reductions in future reproductive output. Sea turtle species have delayed maturity and, thus, are demographically vulnerable to increases in mortality, particularly of juveniles and subadults, which have higher reproductive value. The potential for an egg to develop into a hatchling, into a juvenile, and finally into a sexually mature adult sea turtle varies among species, populations, and the degree of threats faced during each life stage. Each juvenile that does not survive to reproduce would be unable to contribute to the maintenance or improvement of the species's status. Reproducing females that are prematurely killed due the threats mentioned in the above sections would not be allowed to realize their reproductive potential, even if they previously produced offspring. Similarly, reproductive males prematurely removed from the population would be unable to contribute reproductively to the population.

Fortunately, as described in the Effects of the Action (Section 6), the proposed action is not expected to result in mortality or injury to any sea turtles. Any incidentally captured sea turtles that were not previously injured would likely be released alive after the 30-minute trawl, and any injured turtles that are incidentally captured or otherwise rescued would be delivered to the rehabilitation facility as appropriate. Additionally, in the unlikely event of a take (possibly one turtle every three years), the effect would be temporary stress to the animal and would not affect the turtle's ability to reproduce and contribute to the maintenance or recovery of the species. Therefore, the takes authorized under the ITP #21293 would not have any negative additive effects upon North Atlantic DPS of green turtle, Kemp's ridley turtle, leatherback turtle, or Northwest Atlantic Ocean DPS of loggerhead turtle.

8.2 Gulf Sturgeon

As discussed in Section 5, Gulf sturgeon continue to face threats such as climate change, fishery interactions, dredging, and dams. Therefore, the takes authorized under the ITP #21293 would not have any negative additive effects upon Gulf sturgeon. The mortality of juvenile, subadult, and adult Gulf sturgeon through incidental capture can potentially result in the loss of these individuals from the population. While the loss of all life stages of sturgeon has likely adversely affected the ability of the Gulf sturgeon population considered in this Opinion to maintain or increase its numbers by limiting the number of individuals in these populations, the loss of reproductive adults reduces future reproductive output.

Fortunately, as described in the Effects of the Action (Section 6), the proposed action is not expected to result in mortality or injury to any Gulf sturgeon. Gulf sturgeon are likely to be released alive after the 30-minute trawl. Additionally, in the unlikely event of a take (possibly one Gulf sturgeon every three years), the effect would be temporary stress to the animal and would not affect the sturgeon’s ability to reproduce and contribute to the maintenance or recovery of the species. Therefore, the takes authorized under the ITP #21293 would not have any negative additive effects upon Gulf sturgeon.

8.3 Critical Habitats

Several threats exist to the various essential features of the different critical habitat units for both the North Atlantic Ocean DPS of loggerheads and the Gulf sturgeon. The features that are relevant to this Opinion are abundance of Gulf sturgeon food items and obstructions to migration of loggerheads or Gulf sturgeon. Commercial and recreational fishing activities contribute to the harvest of Gulf sturgeon’s prey. Threats such as marine debris from ghost fishing gear or military activities may contribute to obstructions to migrations. As discussed in Section 6, the proposed action would introduce trawling gear to the water column and seafloor, which may result in temporary disturbance of the seafloor, removal of organisms, and temporary obstructions when the gear is in the water. Because the proposed action involves only low fishing pressure that is not targeted specifically at Gulf sturgeon’s prey, issuance of ITP #21293 is not expected to have more than a negligible effect on abundance of Gulf sturgeon food items. Because the trawl gear is present in the critical habitat units for only 30-minute tows, the likelihood of obstructing loggerhead hatchling transit to open water, loggerhead nesting female movements between open water and nesting beaches, or Gulf sturgeon migratory pathways is very low. Therefore, issuance of ITP #21293 would not likely have additive effects on designated critical habitat for the Northwest Atlantic Ocean DPS of loggerhead turtles or designated critical habitat for Gulf sturgeon.

9 CONCLUSION

After reviewing the current status of the ESA-listed species, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS’ biological opinion that the proposed action is not likely to jeopardize the continued existence of green turtle North Atlantic DPS, Kemp's ridley turtle, leatherback turtle, loggerhead turtle Northwest Atlantic Ocean DPS, or Gulf sturgeon or to destroy or adversely modify Northwest Atlantic Ocean DPS loggerhead nearshore reproductive designated critical habitat or Gulf sturgeon designated critical habitat.

10 Incidental Take Statement

The proposed GSML conservation plan, draft ITP #21293, and their associated documents clearly identify anticipated impacts to affected species likely to result from the proposed taking and the measures that are necessary and appropriate to minimize those impacts. All conservation measures described in the proposed conservation plan, together with the terms and conditions described in any associated Implementing Agreement and any section 10(a)(1)(B) permit issued with respect to the proposed conservation plan, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement pursuant to 50 CFR §402.14(i). Such terms and conditions are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the Act to apply. If the permittee fails to adhere to these terms and conditions, the protective coverage of the section 10(a)(1)(B) permit and section 7(o)(2) may lapse. The amount or extent of incidental take anticipated under the proposed GSML conservation plan, associated reporting requirements, and provisions for disposition of dead or injured animals are as described in the conservation plan and its accompanying section 10(a)(1)(B) permit.

11 Conservation Recommendations

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

The conservation recommendations for issuance of ITP #21293 are for the Species Division to:

1. Specify in the Incidental Take Authorization that no more than one turtle and one Gulf sturgeon may be taken every three years under ITP #21293.
2. Add Gulf sturgeon takes and encounters to the annual report requirements.
3. Transmit copies of the annual and final reports to Chief, ESA Interagency Cooperation Division, Office of Protected Resources, National Marine Fisheries Service, Silver Spring, MD.

In order for NMFS' Office of Protected Resources ESA Interagency Cooperation Division to be kept informed of actions minimizing or avoiding adverse effects on, or benefiting, ESA-listed species or their critical habitat, the Species Division should notify the ESA Interagency Cooperation Division of any conservation recommendations it implements in its final action.

12 REINITIATION NOTICE

This concludes formal consultation for the Species Division's issuance of ITP #21293 to GSML. As 50 C.F.R. §402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if:

(1) The amount or extent of taking specified in the incidental take statement is exceeded.
(2) New information reveals effects of the agency action that may affect ESA-listed species or critical habitat in a manner or to an extent not previously considered.
(3) The identified action is subsequently modified in a manner that causes an effect to ESA-listed species or designated critical habitat that was not considered in this opinion.
(4) A new species is listed or critical habitat designated under the ESA that may be affected by the action.

13 REFERENCES

ASSRT (Atlantic Sturgeon Status Review Team). 2007. Status review of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Report to National Marine Fisheries Service, Northeast Regional Office. 174 pp.

Avens, L., J. C. Taylor, L. R. Goshe, T. T. Jones, and M. Hastings. 2009. Use of skeletochronological analysis to estimate the age of leatherback sea turtles *Dermochelys coriacea* in the western North Atlantic. Endangered Species Research 8(3):165-177.

Bagley, D. A., W. E. Redfoot, and L. M. Ehrhart. 2013. Marine turtle nesting at the Archie Carr NWR: Are loggerheads making a comeback? Pages 167 *in* T. Tucker, and coeditors, editors. Thirty-Third Annual Symposium on Sea Turtle Biology and Conservation. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Baltimore, Maryland.

Barnosky, A. D., E. A. Hadly, J. Bascompte, E. L. Berlow, J. H. Brown, M. Fortelius, W. M. Getz, J. Harte, A. Hastings, P. A. Marquet, N. D. Martinez, A. Mooers, P. Roopnarine, G. Vermeij, J. W. Williams, R. Gillespie, J. Kitzes, C. Marshall, N. Matzke, D. P. Mindell, E. Revilla, and A. B. Smith. Approaching a state shift in Earth's biosphere. Nature 486(7401):52-58.

Belovsky, G. E. 1987. Extinction models and mammalian persistence. Pages 35-57 *in* M. E. Soulé, ed. *Viable Populations for Conservation*. Cambridge University Press.

Benson, S. R., T. Eguchi, D. G. Foley, K. A. Forney, H. Bailey, C. Hitipeuw, B. P. Samber, R. F. tapilatu, V. Rei, P. Ramohia, J. Pita, and P. H. Dutton. 2011. Large-scale movements and high-use areas of western Pacific leatherback turtles,Dermochelys coriacea. Ecosphere 2(7):art84.

Berg, J. J., M. S. Allen, and K. J. Sulak. 2007. Population assessment of the Gulf of Mexico sturgeon in the Yellow River, Florida. Pages 365 *in* American Fisheries Society Symposium. American Fisheries Society.

Bjorndal, K. A., A. B. Bolten, and M. Y. Chaloupka. 2005. Evaluating trends in abundance of immature green turtles, *Chelonia mydas*, in the greater Caribbean. Ecological Applications 15(1):304-314.

Boreman, J. 1997. Sensitivity of North American sturgeons and paddlefish to fishing mortality. Environmental Biology of Fishes 48(1):399-045.

Cannon, A. C., and J. P. Flanagan. 1996. Trauma and treatment of Kemp's ridley sea turtles caught on hook-and-line by recreational fishermen. Sea Turtles Biology and Conservation Workshop.

Carr, S., F. Tatman, and F. Chapman. 1996. Observations on the natural history of the Gulf of Mexico sturgeon (*Acipenser oxyrinchus desotoi* Vladykov 1955) in the Suwannee River, southeastern United States. Ecology of Freshwater Fish 5(4):169-174.

Caut, S., E. Guirlet, and M. Girondot. 2009. Effect of tidal overwash on the embryonic development of leatherback turtles in French Guiana. Marine Environmental Research 69(4):254-261.

Chaloupka, M., K. A. Bjorndal, G. H. Balazs, A. B. Bolten, L. M. Ehrhart, C. J. Limpus, H. Suganuma, S. Troeng, and M. Yamaguchi. 2008. Encouraging outlook for recovery of a once severely exploited marine megaherbivore. Global Ecology and Biogeography 17(2):297-304.

Chytalo, K. 1996. Summary of Long Island Sound Dredging Windows Strategy Workshop. Management of Atlantic Coastal Marine Fish Habitat: Proceedsing of a Workshop for Habitat Managers. ASMFC Habitat Management Series #2.

Conant, T. A., P. H. Dutton, T. Eguchi, S. P. Epperly, C. C. Fahy, M. H. Godfrey, S. L. MacPherson, E. E. Possardt, B. A. Schroeder, J. A. Seminoff, M. L. Snover, C. M. Upite, and B. E. Witherington. 2009. Loggerhead sea turtle (*Caretta caretta*) 2009 status review under the U.S. Endangered Species Act. Report of the Loggerhead Biological Review Team to the National Marine Fisheries Service August 2009:222 pages.

Dickerson, D., C. Theriot, M. Wolters, C. Slay, T. Bargo, and W. Parks. 2007. Effectiveness of relocation trawling during hopper dredging for reducing incidnetal take of sea turtles. Pages 509-530 *in* R. E. Randell, ed. 2007 World Dreding Congress, Lake Buena Vista, Florida.

Doney, S. C. 2010. The growing human footprint on coastal and open-ocean biogeochemistry. Science 328(5985):1512-1516.

Dutton, P. H., B. W. Bowen, D. W. Owens, A. Barragan, and S. K. Davis. 1999. Global phylogeography of the leatherback turtle (*Dermochelys coriacea*). Journal of Zoology 248:397-409.

Dutton, P. H., V. Pease, and D. Shaver. 2006. Characterization of mtDNA variation among Kemp's ridleys nesting on Padre Island with reference to Rancho Nuevo genetic stock. Pages 189 *in* Twenty-Sixth Annual Conference on Sea Turtle Conservation and Biology.

Eckert, K., B. Wallace, J. Frazier, S. Eckert, and P. Pritchard. 2012. Synopsis of the biological data on the leatherback sea turtle (*Dermochelys coriacea*). 172.

Ehrhart, L. M., D. A. Bagley, and W. E. Redfoot. 2003. Loggerhead turtles in the Atlantic Ocean: Geographic distribution, abundance, and population status. Pages 157-174 *in* A. B. Bolten, and B. E. Witherington, editors. Loggerhead Sea Turtles. Smithsonian Institution Press, Washington, D. C.

Epperly, S., L. Avens, L. Garrison, T. Henwood, W. Hoggard, J. Mitchell, J. Nance, J. Poffenberger, C. Sasso, E. Scott-Denton, and C. Yeung. 2002. Analysis of sea turtle bycatch in the commercial shrimp fisheries of the Southeast U.S. waters and the Gulf of Mexico. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-490, 88 pp.

Foley, A. M., B. A. Schroeder, A. E. Redlow, K. J. Fick-Child, and W. G. Teas. 2005. Fibropapillomatosis in stranded green turtles (Chelonia mydas) from the eastern United States (1980-98): Trends and associations with environmental factors. Journal of Wildlife Diseases 41(1):29-41.

Foster, A. M., and J. P. Clugston. 1997. Seasonal migration of Gulf sturgeon in the Suwannee River, Florida. Transactions of the American Fisheries Society 126(2):302-308.

Fox, D. A., J. E. Hightower, and F. M. Parauka. 2000. Gulf sturgeon spawning migration and habitat in the Choctawhatchee River system, Alabama–Florida. Transactions of the American Fisheries Society 129(3):811-826.

Fox, D. A., J. E. Hightower, and F. M. Parauka. 2002. Estuarine and nearshore marine habitat use by Gulf sturgeon from the Choctawhatchee River system, Florida. Pages 111-126 *in* American Fisheries Society Symposium.

Fuentes, M. M. P. B., M. Hamann, and C. J. Limpus. 2010. Past, current and future thermal profiles of green turtle nesting grounds: Implications from climate change. Journal of Experimental Marine Biology and Ecology 383:56-64.

Fuentes, M. M. P. B., C. J. Limpus, and M. Hamann. 2011. Vulnerability of sea turtle nesting grounds to climate change. Global Change Biology 17:140-153.

Fuentes, M. M. P. B., J. A. Maynard, M. Guinea, I. P. Bell, P. J. Werdell, and M. Hamann. 2009. Proxy indicators of sand temperature help project impacts of global warming on sea turtles in northern Australia. Endangered Species Research 9:33-40.

FWC (Florida Fish and Wildlife Conservation Commission). 2016. Index nesting beach survey totals (1989-2016). Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida.

FWC. 2017. FWC/FWRI Statewide Nesting Beach Survey Program, Loggerhead Nesting Data, 2012-2016. Accessed at http://myfwc.com/media/4148307/loggerheadnestingdata12-16.pdf on July 17, 2017.

Groombridge, B. 1982. Kemp's Ridley or Atlantic Ridley, *Lepidochelys kempii* (Garman 1880). Pages 201-208 *in* The IUCN Amphibia, Reptilia Red Data Book.

Gu, B., D. Schell, T. Frazer, M. Hoyer, and F. Chapman. 2001. Stable carbon isotope evidence for reduced feeding of Gulf of Mexico sturgeon during their prolonged river residence period. Estuarine, Coastal and Shelf Science 53(3):275-280.

Hawkes, L. A., A. C. Broderick, H. Godfrey, B. Godley, and M. J. Witt. 2014. The impacts of climate change on marine turtle reproductoin success. Pages 287-310 *in* B. Maslo, and L. Lockwood, editors. Coastal Conservation. Cambridge University Press, Cambridge.

Hays, G. C. 2000. The implications of variable remigration intervals for the assessment of population size in marine turtles. J Theor Biol 206(2):221-7.

Hazel, J., I. R. Lawler, H. Marsh, and S. Robson. 2007. Vessel speed increases collision risk for the green turtle *Chelonia mydas*. Endangered Species Research 3:105-113.

Heise, R., W. Slack, S. T. Ross, and M. Dugo. 2005. Gulf sturgeon summer habitat use and fall migration in the Pascagoula River, Mississippi, USA. Journal of Applied Ichthyology 21(6):461-468.

Heise, R. J., W. T. Slack, S. T. Ross, and M. A. Dugo. 2004. Spawning and associated movement patterns of Gulf sturgeon in the Pascagoula River drainage, Mississippi. Transactions of the American Fisheries Society 133(1):221-230.

Heppell, S. S., D. T. Crouse, L. B Crowder, and N. B. Thompson. 2005. A population model to estimate recovery time, population size, and management impacts on Kemp’s ridley sea turtles. Chelonian Conservation and Biology 4(4):767-773.

Hildebrand, H. H. 1963. Hallazgo del area de anidacion de la tortuga marina "lora", *Lepidochelys kempii* (Garman), en la costa occidental del Golfo de Mexico (Rept., Chel.). Ciencia, Mexico 22:105-112.

Hill, J. E., F. V. Paladino, J. R. Spotila, and P. S. Tomillo. 2015. Shading and watering as a tool to mitigate the impacts of climate change in sea turtle nests. PLoS One 10(6):e0129528.

Huerta, P., H. Pineda, A. Aguirre, T. Spraker, L. Sarti, and A. Barragán. 2000. First confirmed case of fibropapilloma in a leatherback turtle (*Dermochelys coriacea*). Pages 193 *in* A. Mosier, A. Foley, and B. Brost, eds. Proceedings of the 20th Annual Symposium on Sea Turtle Biology and Conservation. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SESFC-477.

Huff, J. A. 1975. Life history of Gulf of Mexico sturgeon, *Acipenser oxrhynchus desotoi*, in Suwannee River, Florida.

IPCC (Intergovernmental Panel on Climate Change). 2008. Climate Change and Water, Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 210 pp.

IPCC. 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)], Geneva, Switzerland.

Isaac, J. L. 2009. Effects of climate change on life history: Implications for extinction risk in mammals. Endangered Species Research 7(2):115-123.

James, M. C., R. A. Myers, and C. A. Ottensmeyer. 2005. Behaviour of leatherback sea turtles, *Dermochelys coriacea*, during the migratory cycle. Proceedings of the Royal Society Biological Sciences Series B 272(1572):1547-1555.

Kynard, B., and E. Parker. 2004. Ontogenetic behavior and migration of Gulf of Mexico sturgeon, *Acipenser oxyrinchus desotoi*, with notes on body color and development. Environmental Biology of Fishes 70(1):43-55.

Lamont, M. M., I. Fujisaki, and R. R. Carthy. 2014. Estimates of vital rates for a declining loggerhead turtle (*Caretta caretta*) subpopulation: implications for management. Marine Biology 161(11):2659-2668.

Lutcavage, M.E. and P.L. Lutz. 1997. Diving physiology. In *The Biology of Sea Turtles*. Edited by P.L. Lutz and J.A. Musick. CRC Press, Boca Raton, Florida.

Márquez, M. R., A. Villanueva, and P. M. Burchfield. 1989. Nesting population, and production of hatchlings of Kemp's ridley sea turtle at Rancho Nuevo, Tamaulipas, Mexico. Pages 16-19 *in* C. W. C. Jr., and A. M. L. Jr., eds. First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation, and Management.

Masuda, A. 2010. Natal Origin of Juvenile Loggerhead Turtles from Foraging Ground in Nicaragua and Panama Estimated Using Mitochondria DNA.

Mazaris, A. D., A. S. Kallimanis, S. P. Sgardelis, and J. D. Pantis. 2008. Do long-term changes in sea surface temperature at the breeding areas affect the breeding dates and reproduction performance of Mediterranean loggerhead turtles? Implications for climate change. Journal of Experimental Marine Biology and Ecology 367:219-226.

NMFS (National Marine Fisheries Service). 2003. Endangered Species Act Section 7 Biological Opinion on the Issuance of a Section 10 Incidental Take Permit No. 1417 to Dr. Anne Rudloe, Gulf Specimen Marine Laboratories, Inc.

NMFS. 2005. Biological opinion on the continued authorization of reef fish fishing under the Gulf of Mexico (GOM) reef fish fishery management plan (RFFMP) and proposed amendment 23. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Regional Office, Protected Resources Division.

NMFS. 2007. Green Sea Turtle (*Chelonia mydas*) 5-year Review: Summary and Evaluation.

NMFS. 2011. Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle (Lepidochelys kempii), Second Revision.

NMFS. 2013a. Leatherback Sea Turtle (*Dermochelys coriacea*) 5-Year Review: Summary and Evaluation.

NMFS. 2013b. Endangered Species Act Section 7 Biological on the U.S. Navy's Atlantic Fleet Training and Testing Activities from November 2013 through November 2018. Public consultation tracking system number FPR-2012-9025.

NMFS. 2015. Kemp's Ridley Sea Turtle (*Lepidochelys kempii*) 5-year Review: Summary and Evaluation. Silver Spring, MD.

NMFS. 2016a. Endangered Species Act Section 7 Biological and Conference Opinion on the Issuance of Permit No. 18786-01 to the Marine Mammal Health and Stranding Response Program. Public consultation tracking system number FPR-2016-9166.

NMFS. 2016b. Endangered Species Act Section 7 Biological on the Approval of Florida Numeric Nutrient Criteria for Total Phosphorus, Total Nitrgoen, Chlorophyll-a, Dissolved Oxygen Criteria, and Turbidity Limits under Section 303(c) of the Clean Water Act. Public consultation tracking system number FPR-2015-9234.

NMFS. 2017a. Endangered Species Act Section 7 Biological Opinion and Conference Report on the Ongoing Eglin Gulf Testing and Training Range Activities. Public consultation tracking system number FPR-2016-9151.

NMFS. 2017b. Endangered Species Act Section 7 Concurrence Letter for Black Dart Activities near Eglin Air Force Base. Public consultation tracking system number FPR-2017-9190.

NMFS and USFWS (U.S. Fish and Wildlife Service). 1992. Recovery plan for leatherback turtles in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, DC.

NMFS and USFWS. 1998. Recovery plan for the U.S. Pacific populations of the leatherback turtle (*Dermochelys coriacea*). National Marine Fisheries Service, Silver Spring, MD.

NMFS and USFWS. 2007a. Loggerhead sea turtle (*Caretta caretta*) 5-year review: Summary and evaluation. National Marine Fisheries Service and U.S. Fish and Wildlife Service, Silver Spring, Maryland.

NMFS and USFWS. 2007b. Kemp's ridley sea turtle (*Lepidochelys kempii*) 5-year review: Summary and evaluation. National Marine Fisheries Service and U.S. Fish and Wildlife Service, Silver Spring, Maryland.

NMFS and USFWS. 2008. Recovery plan for the northwest Atlantic population of the loggerhead sea turtle (*Caretta caretta*), second revision. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources, Silver Spring, Maryland.

NMFS, USFWS, and SEMARNAT. 2011. Bi-national recovery plan for the Kemp's ridley sea turtle (*Lepidochelys kempii*), second revision. National Marine Fisheries Service, U.S. Fish and Wildlife Service, and SEMARNAT, Silver Spring, Maryland.

NMFS SEFSC. 2009. An assessment of loggerhead sea turtles to estimate impacts of mortality reductions on population dynamics. NMFS Southeast Fisheries Science Center.

Pike, D. A., E. A. Roznik, and I. Bell. 2015. Nest inundation from sea-level rise threatens sea turtle population viability. Royal Society Open Science 2:150127.

Pine, W., and S. Martell. 2009. Status of Gulf sturgeon *Acipenser oxyrinchus desotoi* in the Gulf of Mexico: a document prepared for review, discussion, and research planning. Gulf sturgeon annual working group meeting, Cedar Key, Florida.

Poloczanska, E. S., C. J. Limpus, and G. C. Hays. 2009. Vulnerability of marine turtles in climate change. Pages 151-211 *in* D. W. Sims, ed. *Advances in Marine Biology*, Volume 56. Academic Press, Burlington.

Price, E. R., B. P. Wallace, R. D. Reina, J. R. Spotila, F. V. Paladino, R. Piedra, and E. Vélez. 2004. Size, growth, and reproductive output of adult female leatherback turtles *Dermochelys coriacea*. Endangered Species Research 5:1-8.

Randall, M., and K. Sulak. 2012. Evidence of autumn spawning in Suwannee River Gulf sturgeon, *Acipenser oxyrinchus desotoi* (Vladykov, 1955). Journal of Applied Ichthyology 28(4):489-495.

Reina, R. D., P. A. Mayor, J. R. Spotila, R. Piedra, and F. V. Paladino. 2002. Nesting ecology of the leatherback turtle, *Dermochelys coriacea*, at Parque Nacional Marino Las Baulas, Costa Rica: 1988-1989 to 1999-2000. Copeia 2002(3):653-664.

Reina, R. D., J. R. Spotila, F. V. Paladino, and A. E. Dunham. 2009. Changed reproductive schedule of eastern Pacific leatherback turtles *Dermochelys coriacea* following the 1997-98 El Niño to La Niña transition. Endangered Species Research 7:155-161.

Robinson, R. A., H. Q. P. Crick, J. A. Learmonth, I. M. D. Maclean, C. D. Thomas, F. Bairlein, M. C. Forchhammer, C. M. Francis, J. A. Gill, B. J. Godley, J. Harwood, G. C. Hays, B. Huntley, A. M. Hutson, G. J. Pierce, M. M. Rehfisch, D. W. Sims, M. B. Santos, T. H. Sparks, D. A. Stroud, and M. E. Visser. 2009. Travelling through a warming world: Climate change and migratory species. Endangered Species Research 7:87-99.

Rogillio, H. E., E. A. Rabalias, J. S. Forester, C. N. Doolittle, W. J. Granger, and J. P. Kirk. 2001. Status, movement, and habitat use of Gulf Sturgeon in the Lake Pontchartrain basin, Louisiana. Louisiana Department of Wildlife and Fisheries and National Wildlife Foundation, Shell Marine Habitat Program, Final Report, Baton Rouge.

Ross, S., R. Heise, M. Dugo, and W. T. Slack. 2001. Movement and Habitat use of the Gulf Sturgeon (*Acipenser oxyrinchus desotoi*) in the Pascagoula Drainage of Mississippi: year V. Project No. E-1, Segment 16. University of Southern Mississippi, Mississippi Museum of Natural Science.

Ross, S. T., W. T. Slack, R. J. Heise, M. A. Dugo, H. Rogillio, B. R. Bowen, P. Mickle, and R. W. Heard. 2009. Estuarine and coastal habitat use of Gulf sturgeon (*Acipenser oxyrinchus desotoi*) in the north-central Gulf of Mexico. Estuaries and Coasts 32(2):360-374.

Rostal, D. C. 2007. Reproductive physiology of the ridley sea turtle. Pages 151-165 in P. T. Plotkin, ed. Biology and Conservation of Sea Turtles. Johns Hopkins University Press, Baltimore, Maryland.

Rostal, D. C., J. S. Grumbles, R. A. Byles, M. R. Marquez, and D. W. Owens. 1997. Nesting physiology of Kemp's ridley sea turtles, *Lepidochelys kempii*, at Rancho Nueveo, Tamaulipas, Mexico, with observation on population estimates. Chelonian Conservation and Biology 2(4):538-547.

Rudd, M. B., R. N. Ahrens, W. E. Pine III, and S. K. Bolden. 2014. Empirical, spatially explicit natural mortality and movement rate estimates for the threatened Gulf Sturgeon (*Acipenser oxyrinchus desotoi*). Canadian Journal of Fisheries and Aquatic Sciences 71(9):1407-1417.

Salwasser, H., S. P. Mealey, and K. Johnson. 1984. Wildlife population viability: a question of risk. Pages 421-439 *in* Transactions of the North American Wildlife and Natural Resources Conference.

Schmid, J. R. 1998. Marine turtle populations on the west-central coast of Florida: Results of tagging studies at the Cedar Keys, Florida, 1986-1995. Fishery Bulletin 96(3):589-602.

Seminoff, J. A., C. D. Allen, G. H. Balazs, P. H. Dutton, T. Eguchi, H. L. Haas, S. A. Hargrove, M. Jensen, D. L. Klemm, A. M. Lauritsen, S. L. MacPherson, P. Opay, E. E. Possardt, S. Pultz, E. Seney, K. S. Van Houtan, and R. S. Waples. 2015. Status reviw of the green turtle (*Chelonia mydas*) under the Endnagered Species Act. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center.

Shamblin, B. M., P. H. Dutton, D. J. Shaver, D. A. Bagley, N. F. Putman, K. L. Mansfield, L. M. Ehrhart, L. J. Peña, and C. J. Nairn. 2016. Mexican origins for the Texas green turtle foraging aggregation: A cautionary tale of incomplete baselines and poor marker resolution. Journal of Experimental Marine Biology and Ecology.

Shamblin, B. M., A. B. Bolten, F. A. Abreu-Grobois, K. A. Bjorndal, L. Cardona, C. Carreras, M. Clusa, C. Monzón-Argüello, C. J. Nairn, J. T. Nielsen, R. Nel, L. S. Soares, K. R. Stewart, S. T. Vilaça, O. Türkozan, C. Yilmaz, and P. H. Dutton. 2014. Geographic patterns of genetic variation in a broadly distributed marine vertebrate: New insights into loggerhead turtle stock structure from expanded mitochondrial DNA sequences. Plos One 9(1):e85956.

Shamblin, B. M., A. B. Bolten, K. A. Bjorndal, P. H. Dutton, J. T. Nielsen, F. A. Abreu-Grobois, K. J. Reich, B. E. Witherington, D. A. Bagley, L. M. Ehrhart, A. D. Tucker, D. S. Addison, A. Arenas, C. Johnson, R. R. Carthy, M. M. Lamont, M. G. Dodd, M. S. Gaines, E. LaCasella, and C. J. Nairn. 2012. Expanded mitochondrial control region sequences increase resolution of stock structure among North Atlantic loggerhead turtle rookeries. Marine Ecology Progress Series 469:145-160.

Shoop, C. R., and R. D. Kenney. 1992. Seasonal distributions and abundances of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetological Monographs 6:43-67.

Smith, T. I. 1985. The fishery, biology, and management of Atlantic sturgeon, *Acipenser oxyrhynchus*, in North America. Environmental Biology of Fishes 14(1):61-72.

Soulé, M. E. 1987. Where do we go from here? Pages 175-183 *in* M. E. Soulé, ed. *Viable Populations for Conservation*. Cambridge University Press.

Spotila, J. R., A. E. Dunham, A. J. Leslie, A. C. Steyermark, P. T. Plotkin, and F. V. Paladino. 1996. Worldwide population decline of *Dermochelys coriacea*: Are leatherback turtles going extinct? Chelonian Conservation and Biology 2(2):209-222.

Spotila, J. R., R. D. Reina, A. C. Steyermark, P. T. Plotkin, and F. V. Paladino. 2000. Pacific leatherback turtles face extinction. Nature 405:529-530.

Spotila, J. R. 2004. Sea turtles: A complete guide to their biology, behavior, and conservation. John Hopkins University Press, Baltimore. 227pp.

Stabile, J., J. R. Waldman, F. Parauka, and I. Wirgin. 1996. Stock structure and homing fidelity in Gulf of Mexico sturgeon (*Acipenser oxyrinchus desotoi*) based on restriction fragment length polymorphism and sequence analyses of mitochondrial DNA. Genetics 144(2):767-775.

Sulak, K., and J. Clugston. 1999. Recent advances in life history of Gulf of Mexico sturgeon, *Acipenser oxyrinchus desotoi*, in the Suwannee River, Florida, USA: a synopsis. Journal of Applied Ichthyology 15(4-5):116-128.

Sulak, K., M. Randall, R. E. Edwards, and R. Lehnert. 2009. Defining winter trophic habitat of juvenile Gulf Sturgeon in the Suwannee and Apalachicola rivermouth estuaries, acoustic telemetry investigations. Journal of Applied Ichthyology 25(5):505-515.

Sulak, K. J., and J. P. Clugston. 1998. Early life history stages of Gulf sturgeon in the Suwannee River, Florida. Transactions of the American Fisheries Society 127(5):758-771.

Tapilatu, R. F., P. H. Dutton, M. Tiwari, T. Wibbels, H. V. Ferdinandus, W. G. Iwanggin, and B. H. Nugroho. 2013. Long-term decline of the western Pacific leatherback, *Dermochelys coriacea*: A globally important sea turtle population. Ecosphere 4:15.

TEWG. 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-444.

TEWG. 2007. An Assessment of the Leatherback Turtle Population in the Atlantic Ocean. Pages 116 *in* NOAA Technical Memorandum.

Thomas, C. D. 1990. What Do Real Population Dynamics Tell Us About Minimum Viable Population Sizes? Conservation Biology 4(3):324-327.

Tomas, J., and J. A. Raga. 2008. Occurrence of Kemp's ridley sea turtle (*Lepidochelys kempii*) in the Mediterranean. Marine Biodiversity Records 1(01).

USACE (U.S. Army Corps of Engineers). 2010. Sea turtle data warehouse. U.S. Army Corps of Engineers.

USAF (U.S. Air Force). 2015. Tyndall Air Force Base Integrated Natural Resources Management Plan. Draft. 148 pp.

USFWS. 1995. Gulf Sturgeon Recovery Plan. Pages 170 *in* U. S. F. W. Service, editor. Gulf States Marine Fisheries Commission, Atlanta, GA.

USFWS. 2002. Report on the Mexico/United States of America population restoration project for the Kemp's ridley sea turtle, *Lepidochelys kempii*, on the coasts of Tamaulipas and Veracruz, Mexico. U.S. Fish and Wildlife Service.

USFWS. 2004. Fisheries Resources Annual Report. Pages 47 *in* U. S. F. W. Service, editor, Panama City, FL.

USFWS. 2006. Report on the Mexico/United States of America population restoration project for the Kemp's ridley sea turtle, *Lepidochelys kempii*, on the coasts of Tamaulipas and Veracruz, Mexico. United States Fish and Wildlife Service.

USFWS. 2007. Fisheries Resources Annual Report. Pages 37 *in* U. S. F. W. Service, editor, Panama City, Fl.

USFWS. 2009. Fisheries Resources Annual Report. Pages 56 *in* U. S. F. W. Service, editor, Panama City, FL.

USFWS and NMFS. 1992. Recovery plan for the Kemp's ridley sea turtle (*Lepidochelys kempii*). U.S. Fish and Wildlife Service and National Marine Fisheries Service, St. Petersburg, Florida.

USFWS and NMFS. 2009. Gulf Sturgeon (*Acipenser oxyrinchus destoi*) 5-year review: summary and evaluation. S. R. USFWS, Panama City Ecological Services Field Office, National Marine Fisheries Service, Office of Protected Resources, editor, St. Petersburg, FL.

Vargo, S., P. Lutz, D. Odell, E. Van Vleet, and G. Bossart. 1986. Study of the effects of oil on marine turtles. Prepared for the USDOI Minerals Management Service. 3 volumes.

Waldman, J. R., and I. I. Wirgin. 1998. Status and restoration options for Atlantic sturgeon in North America. Conservation Biology 12(3):631-638.

Wallace, B. P., S. S. Kilham, F. V. Paladino, and J. R. Spotila. 2006. Energy budget calculations indicate resource limitation in Eastern Pacific leatherback turtles. Marine Ecology Progress Series 318:263-270.

Wallace, B. P., P. R. Sotherland, P.S. Tomillo, R. D. Reina, J. R. Spotila, and F. V. Paladino. 2007. Maternal investment in reproduction and its consequences in leatherback turtles. Oecologia 152(1):37-47.

Wilcox, C., G. Heathcote, J. Goldberg, R. Gunn, D. Peel, and B. D. Hardesty. 2015. Understanding the sources and effects of abandoned, lost, and discarded fishing gear on marine turtles in northern Australia. Conservation Biology 29(1):198-206.

Wilkinson, C., and D. Souter. 2008. Status of Caribbean coral reefs after bleaching and hurricanes in 2005. Global Coral Reef Monitoring Network, and Reef and Rainforest Research Centre, Townsville.

Winger, P. V., P. J. Lasier, D. H. White, and J. T. Seginak. 2000. Effects of Contaminants in Dredge Material from the Lower Savannah River. Archives of Environmental Contamination and Toxicology 38(1):128-136.

Witherington, B., P. Kubilis, B. Brost, and A. Meylan. 2009. Decreasing annual nest counts in a globally important loggerhead sea turtle population. Ecological Applications 19(1):30-54.

Wooley, C. M., and E. J. Crateau. 1985. Movement, microhabitat, exploitation, and management of Gulf of Mexico sturgeon, Apalachicola River, Florida. North American Journal of Fisheries Management 5(4):590-605.

Work, P. A., A. L. Sapp, D. W. Scott, and M. G. Dodd. 2010. Influence of small vessel operation and propulsion system on loggerhead sea turtle injuries. Journal of Experimental Marine Biology and Ecology 393(1-2):168-175.

Zurita, J. C., R. Herrera, A. Arenas, M. E. Torres, C. Calderón, L. Gómez, J. C. Alvarado, and R. Villavicencio. 2003. Nesting loggerhead and green sea turtles in Quintana Roo, Mexico. Pages 25-127 *in* J. A. Seminoff, editor Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation, Miami, Florida.

Zwinenberg, A. J. 1977. Kemp’s ridley, *Lepidochelys kempii* (Garman 1880), undoubtedly the most endangered marine turtle today (with notes on the current status of *Lepidochelys olivacea*). Bulletin of the Maryland Herpetological Society 13(3):378-384.