Biological Report

on the
Designation of Marine Critical Habitat for the
Loggerhead Sea Turtle, *Caretta caretta*

2013

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EXECUTIVE SUMMARY

Section 4 of the Endangered Species Act of 1973 (ESA) requires the designation of critical habitat for threatened and endangered species to the maximum extent prudent and determinable, and provides for the revision of critical habitat based on the best scientific data available, as appropriate (16 USC section 1533(a)(3)(A)). Critical habitat may only be designated in areas under U.S. jurisdiction (50 CFR section 424.12(h)). Critical habitat is defined to mean "(i) the specific areas within the geographical area occupied by the species, at the time it is listed [under Section 4], on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed [under Section 4], upon a determination by the Secretary that such areas are essential for the conservation of the species" (16 USC section 1532(5)(A)).

This report contains a biological assessment of specific areas that may be considered for designation of critical habitat for the threatened Northwest Atlantic Ocean and the endangered North Pacific Ocean Distinct Population Segments (DPSs) of the loggerhead sea turtle (*Caretta caretta*). The designation of critical habitat was prompted by a 2011 final rule revising the listing of loggerhead sea turtles under the ESA from a single worldwide listing of the species as threatened to nine DPSs, listed as either threatened or endangered. The two DPSs that are the subject of this biological report – the Northwest Atlantic Ocean and North Pacific Ocean – are the only DPSs of loggerheads that occur within U.S. jurisdiction. Although American Samoa, an unincorporated territory of the United States, is located within the general geographical area associated with the South Pacific Ocean DPS, loggerheads are not known to occur there.

A critical habitat review team (CHRT) consisting of six biologists from the National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NMFS) and two from the U.S. Fish and Wildlife Service (USFWS) was convened to evaluate potential critical habitat within the U.S. portions of the Northwest Atlantic Ocean and North Pacific Ocean DPSs. Five biologists from the states of Florida, Georgia, South Carolina and North Carolina served as consultants to the team. The CHRT did the following:

1) identified and synthesized the best available scientific and commercial information regarding loggerhead habitat use and distribution;
2) described geographical areas occupied by the Northwest Atlantic Ocean and North Pacific Ocean DPSs;
3) developed a means to identify habitat of high conservation value within habitat occupied, based largely on known areas of high use for the various life stages, and identified specific areas of high conservation value;

4) identified and described the physical or biological features (PBFs) essential for conservation of the loggerhead as well as the primary constituent elements (PCEs[1]) that support these features within specific areas of high conservation value (for each loggerhead life stage/ecosystem occurring within the Northwest Atlantic Ocean DPS and the North Pacific Ocean DPS);
5) provided information relating to whether the identified PBFs may require special management by identifying activities that may threaten the PBFs essential to conservation; and
6) enumerated specific potential critical habitat areas that are areas of high conservation value, contain the PBFs and PCEs, and for which there is a basis to conclude the PBFs may require special management considerations or protection.

Within the occupied areas under U.S. jurisdiction, the CHRT identified 38 occupied marine areas within the Northwest Atlantic Ocean DPS to recommend as critical habitat: thirty-six areas that contain one or a combination of nearshore reproductive habitat, winter area, breeding areas, and migratory corridors, and two areas that contain *Sargassum* habitat (Table 1). The USFWS addressed terrestrial areas (nesting beaches) in a separate document.[2] We refer to those terrestrial areas in this report, where necessary, to understand how we identified corresponding marine habitat. No marine areas were identified within the North Pacific Ocean DPS for consideration as critical habitat. We did not identify any unoccupied areas.

The assessment and findings provided in this report will be used in conjunction with other analyses (including the economic analysis and the analysis of other impacts such as national security impacts under Section 4(b)(2)) to inform NMFS' determinations and potential proposed rulemaking regarding designation of critical habitat for loggerhead turtles. See Chapter VII, Areas Recommended for Critical Habitat Designation, for more details.

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[1] The Services' joint regulations specify that known PCE's shall be included in the description of critical habitat. PCE's may include, but are not limited to: roost sites, nesting grounds, spawning sites, feeding sites, seasonal wetland or dryland, water quality or quantity, host species or plant pollinator, geological formation, vegetation type, tide and specific soil types. 50 CFR section 424.12(b).
[2] Because NMFS and the FWS have overlapping jurisdiction for marine sea turtles, FWS has separately reviewed potential terrestrial areas and has issued a proposed rule regarding designation of such areas. See 78 FR 18000, March 25, 2013.

Habitat Type	Physical or Biological Feature	Primary Constituent Elements	Unit Numbers
Nearshore Reproductive	Portion of nearshore waters adjacent to nesting beaches that are used by hatchlings to egress to the open-water environment as well as by nesting females to transit between beach and open water during the nesting season	• Waters directly off the highest density nesting beaches to 1.6 km (1 mile) offshore • Waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water • Waters with minimal manmade structures that could promote predators (e.g., submerged offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents	LOGG-N-1 through LOGG-N-36
Winter	Warm water habitat south of Cape Hatteras near the western edge of the Gulf Stream used by concentration of juveniles and adults during the winter months	• Water temperatures above 10° C during colder months of November through April • Continental shelf waters in proximity to the western boundary of the Gulf Stream • Water depths between 20 and 100 meters	LOGG-N-1 LOGG-N-2
Breeding	Areas with high concentrations of both male and female adult individuals during the breeding season	• Concentrations of reproductive males and females • Proximity to primary Florida migratory corridor • Proximity to Florida nesting grounds	LOGG-N-17 LOGG-N-19
Constricted Migratory	High use migratory corridors that are constricted (limited in width) by land on one side and the edge of the continental shelf and Gulf Stream on the other side	• Constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways • Passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas	LOGG-N-1, LOGG-N-17, LOGG-N-18, LOGG-N-19
Sargassum	Developmental and foraging habitat for young loggerheads where surface waters form	• Convergence zones, surface-water downwelling areas, and other locations	LOGG-S-1 LOGG-S-2

Habitat Type	Physical or Biological Feature	Primary Constituent Elements	Unit Numbers
	accumulations of floating material, especially *Sargassum*.	where there are concentrated components of the *Sargassum* community in water temperatures suitable for the optimal growth of *Sargassum* and inhabitance of loggerheads • *Sargassum* in concentrations that support adequate prey abundance and cover • Available prey and other material associated with *Sargassum* habitat such as, but not limited to, plants and cyanobacteria and animals endemic to the *Sargassum* community such as hydroids and copepods	

Table 1. Summary of areas recommended for critical habitat designation.

LIST OF ABBREVIATIONS AND ACRONYMS

AMAPPS	Atlantic Marine Assessment Program for Protected Species
ASTM	ASTM International
C	Celsius
CCL	Curved Carapace Length
cm	centimeter
CFR	Code of Federal Regulations
CHRT	Critical Habitat Review Team
DPS	Distinct Population Segment
EEZ	Exclusive Economic Zone
ESA	Endangered Species Act
F	Fahrenheit
FENA	Females Estimated to Nest Annually
FR	Federal Register
ft	foot
g	gram
hr	hour
in	inch
INRMP	Integrated Natural Resources Management Plan
KEBR	Kuroshio Extension Bifurcation Region
KEC	Kuroshio Extension Current
kg	kilogram
kJ	kilojoule
km	kilometer
Lat.	Latitude
lb	pound
Long.	Longitude
m	meter
MERIS	Medium Resolution Imaging Spectrometer (European Space Agency)
mg	milligram
MHW	Mean High Water
mm	millimeter
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPTZ	North Pacific Transition Zone
NWR	National Wildlife Refuge
oz	ounce
PBF	Physical or Biological Feature
PCE	Primary Constituent Element
PIFSC	Pacific Islands Fisheries Science Center (NMFS)
PIRO	Pacific Islands Regional Office (NMFS)
ppt	parts per thousand
RU	Recovery Unit
SCL	Straight Carapace Length

SST	Sea Surface Temperature
TEWG	Turtle Expert Working Group
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
yd	yard
yr	year

I: BACKGROUND

I.A. Listing of Loggerheads under the ESA

The loggerhead sea turtle (*Caretta caretta*) was originally listed worldwide as a threatened species on July 28, 1978 (43 FR 32800) pursuant to the Endangered Species Act of 1973, as amended (ESA). No critical habitat was designated for the loggerhead at that time. Pursuant to a joint memorandum of understanding, signed on July 18, 1977, the U.S. Fish and Wildlife Service (USFWS) has jurisdiction over sea turtles on the land and the National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NMFS) has jurisdiction over sea turtles in the marine environment. On September 22, 2011 (76 FR 58868), NMFS and USFWS jointly published a final rule revising the loggerhead's listing from a single worldwide threatened species to nine Distinct Population Segments (DPSs). Five DPSs were listed as endangered (North Pacific Ocean, South Pacific Ocean, North Indian Ocean, Northeast Atlantic Ocean, and Mediterranean Sea), and four DPSs were listed as threatened (Northwest Atlantic Ocean, South Atlantic Ocean, Southeast Indo-Pacific Ocean, and Southwest Indian Ocean). The two DPSs occurring in U.S. jurisdiction are the Northwest Atlantic Ocean DPS (range defined as north of the equator, south of 60° N. lat., and west of 40° W. long.) and the North Pacific Ocean DPS (range defined as north of the equator and south of 60° N. lat.) (76 FR 58868, September 22, 2011). At the time the final listing rule was developed, we lacked comprehensive data and information necessary to identify and describe physical or biological features (PBFs) of the terrestrial and marine habitats. As a result, we found designation of critical habitat to be "not determinable" (See 16 U.S.C. section 1533(b)(6)(C)(ii)). In the final rule we stated that we would consider designating critical habitat for the two DPSs within U.S. jurisdiction in future rulemakings. Information from the public related to the identification of critical habitat, essential PBFs for this species, and other relevant impacts of a critical habitat designation was solicited. We received two responses, one from the Department of the Navy, Commander Navy Region Southeast, dated January 26, 2012, and one from Oceana, dated March 6, 2012.

I.B. Critical Habitat Requirements

Critical habitat is defined in section 3(5)(A) of the ESA (16 U.S.C. 1532(5)) as:

> "(i) the specific areas within the geographical area occupied by the species, at the time it is listed… on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and

> (ii) specific areas outside the geographical area occupied by the species at the time it is listed… upon a determination by the Secretary [of Commerce or Interior] that such areas are essential for the conservation of the species."

Section 3(3) of the ESA defines "conservation" as the use of all methods and procedures which are necessary to bring the species to the point at which the measures provided by listing under the ESA are no longer necessary. Section 4(b)(2) of the ESA requires NMFS and USFWS to designate critical habitat for threatened and endangered species "on the basis of the best scientific data available and after taking into consideration the economic impact, the impact on national security, and any other relevant impact, of specifying any particular area as critical habitat" (16 U.S.C. section 1533(b)(2)). This section goes on to grant the Secretary discretion to exclude any area from critical habitat if the Secretary conducts an optional weighing of benefits and determines "the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat" (16 U.S.C. section 1533(b)(2)). The Secretary may not exclude an area if such exclusion will result in the extinction of the species (16 U.S.C. section 1533(b)(2)). Regulations implementing the ESA also specify that NMFS and USFWS "shall designate as critical habitat areas outside the geographical area presently occupied by a species only when a designation limited to its present range would be inadequate to ensure the conservation of the species" (50 CFR 424.12(e)), and that "critical habitat shall not be designated within foreign countries or in other areas outside of United States jurisdiction" (50 CFR 424.12(h)).

Once critical habitat is designated, section 7 of the ESA requires Federal agencies to ensure that they do not fund, authorize, or carry out any actions that are likely to result in the "destruction or adverse modification" of that habitat (16 U.S.C. section 1536(a)(2)). This standard is separate from the requirement under the same section that Federal agencies ensure their actions are not likely to "jeopardize the continued existence of" listed species.

I.C. Critical Habitat Review Team and Process

NMFS and USFWS convened a critical habitat review team (CHRT) to assist in the assessment and evaluation of critical habitat areas for the Northwest Atlantic Ocean and North Pacific Ocean DPSs. The CHRT consisted of six NMFS and two USFWS biologists with experience and expertise on loggerhead biology, ESA section 7 consultations, management, and the critical habitat designation process. Five biologists from the states of Florida, Georgia, South Carolina and North Carolina served as consultants to the team. The CHRT did the following:

1) identified and synthesized the best available scientific and commercial information regarding loggerhead habitat use and distribution;
2) described geographical areas occupied by the Northwest Atlantic Ocean and North Pacific Ocean DPSs;

3) developed a means to identify habitat of high conservation value within habitat occupied, based largely on known areas of high use for the various life stages, and identified specific areas of high conservation value;
4) identified and described the PBFs essential for conservation of the loggerhead as well as the primary constituent elements (PCEs[3]) that support these features within specific areas of high conservation value (for each loggerhead life stage/ecosystem occurring within the Northwest Atlantic Ocean DPS and the North Pacific Ocean DPS);
5) provided information relating to whether the identified PBFs may require special management by identifying activities that may threaten the PBFs essential to conservation; and
6) enumerated specific potential critical habitat areas that are areas of high conservation value, contain the PBFs and PCEs, and for which there is a basis to conclude the PBFs may require special management considerations or protection.

While both agencies worked closely on the above, USFWS (terrestrial) areas are not included in this report. This report details the areas under NMFS jurisdiction--those in the marine environment. Terrestrial areas are referred to in this report however, when needed to explain how corresponding marine habitat was determined.

Throughout this stepwise process, NMFS reviewed a variety of data sources for marine habitat. Information reviewed included, but is not limited to, loggerhead distribution data from aerial surveys, satellite telemetry data, in-water surveys and studies, fisheries bycatch data, distribution and abundance information on loggerhead prey species and foraging patterns, stable isotope studies, *Sargassum* distribution and abundance patterns, bathymetry, and regional oceanographic information and patterns in the central North Pacific and along the U.S. Atlantic Coast and Gulf of Mexico. The loggerhead recovery plans for the Northwest Atlantic and Pacific and the loggerhead 2009 status review were also used as sources of general information.

Specifically, NMFS first reviewed the most recent and comprehensive assessment for loggerheads by habitat category (e.g., neritic, oceanic), which for most cases was the Loggerhead Turtle Expert Working Group (TEWG) report (2009). This review resulted in the identification of relatively high use areas (generally, those with 60 or more turtle days in the TEWG satellite tracking analysis figures), which served as a proxy for identifying important habitat areas, especially as there is little quantitative data on loggerhead habitat use. This information was supplemented by known and available studies that were not included in the TEWG analysis. In

[3] The Services' joint regulations specify that known PCE's shall be included in the description of critical habitat. PCE's may include, but are not limited to: roost sites, nesting grounds, spawning sites, feeding sites, seasonal wetland or dryland, water quality or quantity, host species or plant pollinator, geological formation, vegetation type, tide and specific soil types (50 CFR section 424.12(b)).

this review, life stages and loggerhead behavior (e.g., migration, foraging) were considered. This approach was used for identifying foraging, migratory, and breeding habitats. Note that foraging areas are considered to be the areas where loggerheads reside during the nonbreeding season and migration is the movement between foraging areas or between foraging areas and nesting areas (Ceriani *et al.* 2012). For the nearshore reproductive habitat, NMFS relied on data and information on nesting distribution and patterns to identify nearshore reproductive areas associated with high density nesting beaches, as described in the draft USFWS Proposed Rule for the Designation of Critical Habitat for the Northwest Atlantic Ocean Distinct Population Segment of the Loggerhead Sea Turtle (78 FR 18000, March 25, 2013). For the *Sargassum* habitat, NMFS reviewed data on the distribution of *Sargassum* and its relationship to loggerhead habitat needs. Additional information on the methodology used to identify specific areas is discussed in Section V.

I.D. Conservation and Recovery Plans

As stated above, the ESA defines critical habitat in part as specific areas occupied at the time of listing on which are found those PBFs that are essential to the conservation of the species. In addition, areas outside of the occupied geographical area may be designated as critical habitat if the areas are determined to be essential to the conservation of the species. The ESA defines "conservation" as "the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary." (16 U.S.C. 1532(3)).

The purpose of this section is to explain what the conservation of loggerhead turtles means for the Northwest Atlantic Ocean and North Pacific Ocean DPSs, as outlined in their respective recovery plans. Because the Northwest Atlantic recovery planis relatively recent and pertains specifically to the conservation needs of this DPS, we believe it constitutes much of the best availableinformation as to the conservation needs of this DPS. Although much older and not specific to the North Pacific Ocean DPS (although there is much overlap), the recovery plan for U.S. Pacific populations also serves as a good source of information regarding the conservation needs of the DPS. Although not regulatory or binding in nature, the recovery plans thus provide important support for our subsequent findings regarding whether habitat features are essential to the conservation of the species.

I.D.1. Northwest Atlantic Ocean DPS

In 2008, a recovery plan was published for the Northwest Atlantic Population of the Loggerhead Sea Turtle (NMFS and USFWS 2008). Because it was published before the DPS listing was finalized in 2011, the recovery plan doesn't specifically use the term DPS. However, the loggerhead population considered in the recovery plan and Northwest Atlantic Ocean DPS listing

are the same. As such, NMFS considers the Northwest Atlantic population of loggerhead in the 2008 recovery plan to be synonymous with the listed Northwest Atlantic DPS.
The goal of the Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle is to ensure that recovery criteria are met so that protections under the ESA are no longer necessary (NMFS and USFWS 2008). The recovery plan describes in detail the demographic recovery criteria and threats-based (listing factor) recovery criteria (NMFS and USFWS 2008; refer to the recovery plan for more information). Importantly, the recovery plan designated five recovery units for the Northwest Atlantic Ocean DPS of the loggerhead. The identification of recovery units stresses the importance of each unit to the DPS as a whole, and the DPS should not be considered for delisting until both the recovery criteria for each recovery unit and the recovery criteria for the entire DPS are met. Discrete recovery objectives are presented in terms of demographic parameters, reduction or elimination of threats to the species (the five listing factors), and any other particular vulnerability or biological needs inherent to the species. The objectives of the recovery plan are to do the following:

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 longterm 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; and
13) Minimize vessel strike mortality.

Generally, the recovery plan stresses the importance of protecting terrestrial habitat, including nests and nesting females, and marine habitat, including the determination of in-water abundance in foraging, migratory, and internesting areas.

A quantitative analysis of threats to Northwest Atlantic loggerheads is presented in the recovery plan. Bycatch in commercial fisheries (particularly bottom trawl, longline, and gillnet fisheries) is the most significant anthropogenic threat to the conservation of Northwest Atlantic loggerheads in the marine environment (NMFS and USFWS 2008). Other significant threats include light pollution on nesting beaches; coastal development, which leads to coastal armoring and other erosion control measures that impact nesting habitat; and nest predation. Among the 34 “Priority 1” actions in the recovery plan (i.e., actions that are necessary to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future) are actions to do the following: 1) minimize the effects of coastal armoring; 2) maintain the current length and quality of protected nesting beach; 3) acquire and protect additional properties on key nesting beaches; 4) protect and monitor important neritic and oceanic habitats; and 5) implement various measures to minimize fishery-related impacts to the species and its habitat.

I.D.2. North Pacific Ocean DPS

The Recovery Plan for U.S. Pacific Populations of the Loggerhead Turtle outlines clear recovery criteria for loggerheads in the Pacific ocean. Most of these criteria do not apply directly to U.S. waters because they pertain to the population when in locations outside of the U.S.(NMFS and USFWS 1998). Among the criteria for delisting loggerheads in the U.S. Pacific are the following:

1) All regional stocks that use U.S. waters have been linked to source beaches based on reasonable geographic parameters;
2) All females estimated to nest annually (FENA) at "source beaches" are either stable or increasing for over 25 years;
3) Each stock must average 5,000 FENA (or a biologically reasonable estimate based on the goal of maintaining a stable population in perpetuity) over six years; and
4) Existing foraging areas are maintained as healthy environments.

The recovery plan calls for identification of important marine habitat and long-term protection and management of those habitats, including foraging habitats (*Sargassum* beds, coral reefs and sponge habitats). Increased human presence in this and other sea turtle habitats has contributed to reef degradation, primarily by coastal construction, increased recreational and fisheries use, and increased industrialization. Habitat loss and degradation need to be prevented or slowed. Other threats include incidental capture in commercial and recreational fisheries.

In summary, the recovery plans for the Northwest Atlantic and U.S. Pacific populations of loggerheads highlight that recovery of the species depends on multiple factors, including an increase in in-water abundance (particularly on foraging grounds), and healthy marine habitat. Therefore, NMFS considered that the conservation of loggerheads includes marine areas for reproduction, foraging, and migration among these areas. Multiple life stages may engage in these behaviors and suitable habitat for these behaviors is essential for the conservation of loggerhead sea turtles.

II: LOGGERHEAD NATURAL HISTORY

The purpose of this chapter is to provide a synopsis of the loggerhead species and its life history, which is comprised of the nine DPSs, including the Northwest Atlantic Ocean and North Pacific Ocean DPSs.

II.A. Species Description

The loggerhead belongs to the family Cheloniidae along with all other sea turtle species except the leatherback (*Dermochelys coriacea*). The genus *Caretta* is monotypic. The carapace of adult and juvenile loggerheads is reddish-brown. The dorsal and lateral head scales and the dorsal scales of the flippers are also reddish-brown, but with light to medium yellow margins. The unscaled areas of the integument (neck, shoulders, limb bases, inguinal area) are dull brown dorsally and light to medium yellow laterally and ventrally. The plastron is medium to light yellow, and the thick, bony carapace is covered by non-overlapping scutes that meet along seam lines. There are 11 or 12 pairs of marginal scutes, five pairs of costals, five vertebrals, and a nuchal (precentral) scute that is in contact with the first pair of costal scutes. The plastron is composed of paired gular, humeral, pectoral, abdominal, femoral, and anal scutes and connected to the carapace by three pairs of poreless inframarginal scutes. Mean straight carapace length (SCL) of nesting females in the southeastern United States, the only location where loggerheads nest in the United States, averages 90 centimeters (cm) (35 inches (in)) (NMFS 2001). Hatchlings vary from light to dark brown to dark gray dorsally and lack the reddish-brown coloration of adults and juveniles. Flippers are dark gray to brown above with distinct white margins. The ventral coloration of the plastron and other areas of the integument are generally yellowish to tan. The carapace has three keels and the plastron has two keels. At emergence, hatchlings average 45 millimeters (mm) (1.8 in) SCL and weigh approximately 20 grams (g) (0.7 ounces (oz)) (Dodd 1988).

II.B. Life History and Habitat

Loggerheads are long-lived, slow-growing animals that use multiple habitats across entire ocean basins throughout their life history. This complex life history encompasses terrestrial, inshore/estuarine, nearshore, and open ocean habitats. The three basic ecosystems in which loggerheads live are categorized in this report as the following:

1) Terrestrial zone (supralittoral) – the nesting beach where oviposition (egg laying), embryonic development, and hatching occurs.
2) Neritic zone – the nearshore marine environment (from the surface to the sea floor) where water depths do not exceed 200 meters (m) (656 feet (ft)). The neritic zone generally includes the continental shelf, but in areas where the continental shelf is very narrow or

nonexistent, the neritic zone conventionally extends from the shore to areas where water depths reach 200 m (656 ft). Use of neritic habitat also occurs inshore, in bays and estuaries.

3) Oceanic zone – the vast open ocean environment (from the surface to the sea floor) where water depths are greater than 200 m (656 ft).

To ensure that we considered the habitat needs of every life stage, the CHRT evaluated loggerhead life stages, ecosystems, and corresponding habitat requirements in the identification of critical habitat. We began by adopting, with revisions, the eight life stages and ecosystems they occupy from the Northwest Atlantic Loggerhead Recovery Team: 1) egg (terrestrial zone), 2) hatchling stage (terrestrial zone), 3) hatchling swim frenzy and transitional stage (neritic zone), 4) juvenile stage (oceanic zone), 5) juvenile stage (neritic zone), 6) adult stage (oceanic zone), 7) adult stage (neritic zone), and 8) nesting female (terrestrial zone) (NMFS and USFWS 2008).

However, as the CHRT considered each life stage and its corresponding habitat needs, we found it necessary to combine some of these life stages and, in other instances, to identify additional habitat needs within a single life stage (See Table 2 below). Therefore, we combined the nesting female, egg and hatchling stages into a single group under Terrestrial Habitat. We chose to split the hatchling swim frenzy and transitional stages (the latter referred to in this report as Post-hatchling Transition), because the habitat needs for these stages, although close and contiguous temporally, are different. We combined the neritic juvenile and adult stages, because the habitat needs are similar. All neritic habitat is considered in one section, and includes that for the hatchling swim frenzy stage, internesting females, foraging adults and juveniles, breeding adults, and migrating adults and juveniles. We combined oceanic juvenile and adult stages into one oceanic habitat. The life stages that use *Sargassum* habitat (post-hatchling transition and juvenile) are considered in neritic and oceanic zones because *Sargassum* occurs in both.

Life Stage	Ecosystem	Habitat
Nesting female	Terrestrial	Nesting beaches
Egg	Terrestrial	Nesting beaches
Hatchling (on beach)	Terrestrial	Nesting beaches to shorelines
Hatchling (swim frenzy)	Neritic	Nearshore coastal waters
Post-hatchling transition	Neritic	Nearshore surface waters
Juvenile	Oceanic	Ocean surface waters, currents and gyres
Adult	Oceanic	Predominantly ocean surface waters, currents and gyres
Juvenile	Neritic	Nearshore coastal waters including foraging habitat and migratory corridors
Adult	Neritic	Nearshore coastal waters including foraging, breeding, internesting habitat and migratory corridors

Table 2. Life Stage and Ecosystem and associated Habitat (adapted from NMFS and USFWS 2008).

II.B.1. Terrestrial -- Nesting Female, Egg, and Hatchling

Loggerhead sea turtles occur throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans (Dodd 1988). However, the majority of loggerhead nesting is at the western rims of the Atlantic and Indian Oceans. The most recent reviews show that only two loggerhead nesting aggregations have greater than 10,000 females nesting per year: Peninsular Florida, in the United States, and Masirah Island, in Oman (Baldwin *et al.* 2003; Ehrhart *et al.* 2003; Kamezaki *et al.* 2003; Limpus and Limpus 2003b; Margaritoulis *et al.* 2003). Nesting aggregations with 1,000 to 9,999 females nesting annually occur in Georgia through North Carolina (United States), Quintana Roo and Yucatan (Mexico), Brazil, Cape Verde Islands (Cape Verde), Western Australia (Australia), and Japan. Smaller nesting aggregations with 100 to 999 nesting females annually occur in the Northern Gulf of Mexico (United States), Dry Tortugas (United States), Cay Sal Bank (The Bahamas), Tongaland (South Africa), Mozambique, Arabian Sea Coast (Oman), Halaniyat Islands (Oman), Cyprus, Peloponnesus (Greece), Zakynthos (Greece), Crete (Greece), Turkey, and Queensland (Australia) (NMFS and USFWS 2008). This global nesting information is provided for context, but note the remainder of this document will focus on the Northwest Atlantic Ocean and North Pacific Ocean DPSs (e.g., loggerheads in U.S. waters).

Loggerheads nest on ocean beaches and occasionally on estuarine shorelines. A study in central east Florida found that loggerheads appear to prefer relatively narrow, steeply sloped, coarsegrained beaches, although nearshore contours may play a role in nesting beach site selection (Provancha and Ehrhart 1987). Nests are typically laid between the high tide line and the dune front (Routa 1968; Witherington 1986; Hailman and Elowson 1992).

In the Northwest Atlantic, the only place in the United States where nesting occurs, the nesting season extends from about late April through early September with nesting occurring primarily at night. Loggerheads typically lay approximately 3 to 6 nests per season (Murphy and Hopkins 1984; Frazer and Richardson 1985; Hawkes *et al.* 2005; Scott 2006; Tucker 2010; Ehrhart, unpublished data) at intervals of approximately 12 to 15 days (Caldwell 1962; Dodd 1988). Mean clutch size varies from about 100 to 126 eggs (Dodd 1988). Remigration intervals (number of years between successive nesting migrations) typically average from 2.5 to 3.7 years (Richardson *et al.* 1978; Bjorndal *et al.* 1983; Ehrhart, unpublished data). Available literature suggests a fairly wide range of age at sexual maturity in the Northwest Atlantic, from as early as approximately 25 years to as late as 45 years (Snover 2002; Conant *et al.* 2009; Scott *et al.* 2012). For the Northwest Atlantic nesting assemblages, data from Little Cumberland Island, Georgia, observed reproductive longevity as long as 25 years (Dahlen *et al.* 2000). This is likely an underestimate given tag loss and incomplete surveys of nesting beaches at night. Comparable data for adult males do not exist.

Sea turtle eggs require a high-humidity substrate that allows for sufficient gas exchange and temperatures conducive to egg development (Miller 1997; Miller *et al.* 2003). Loggerhead nests incubate for variable periods of time. The warmer the sand surrounding the egg chamber, the faster the embryos develop (Mrosovsky and Yntema 1980). Egg incubation duration for the Northwest Atlantic DPS varies depending on time of year and latitude but typically ranges from about 42 to 75 days (Dodd and Mackinnon 2006; Dodd and Mackinnon 2007; Dodd and Mackinnon 2008; Dodd and Mackinnon 2009; Dodd and Mackinnon 2010). Sand temperatures prevailing during the middle third of the incubation period also determine the sex of hatchlings (Mrosovsky and Yntema 1980). Incubation temperatures near the upper end of the tolerable range produce only female hatchlings while incubation temperatures near the lower end of the tolerable range produce only male hatchlings. The pivotal temperature (i.e., the incubation temperature that produces equal numbers of males and females) in loggerheads is approximately 29° C (84.2° F) (Limpus *et al.* 1983; Mrosovsky 1988; Marcovaldi *et al.* 1997). Moisture conditions in the nest influence incubation period, hatching success, and hatchling size (McGehee 1990; Carthy *et al.* 2003).

Loggerhead hatchlings pip and escape from their eggs over a 1- to 3-day interval and move upward and out of the nest over a 2- to 4-day interval (Christens 1990). The time from pipping to emergence ranges from 4 to 7 days with an average of 4.1 days (Godfrey and Mrosovsky 1997). Hatchlings emerge from their nests en masse almost exclusively at night, and presumably using decreasing sand temperature as a cue (Hendrickson 1958; Mrosovsky 1968; Witherington *et al.* 1990). Moran *et al.* (1999) concluded that a lowering of sand temperatures below a critical threshold, which most typically occurs after nightfall, is the most probable trigger for hatchling emergence from a nest. After an initial emergence, there may be secondary emergences on subsequent nights (Carr and Ogren 1960; Witherington 1986; Ernest and Martin 1993; Houghton and Hays 2001).

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

II.B.2. Neritic -- Hatchling Swim Frenzy and Post-Hatchling Transition

Immediately after hatchlings emerge from the nest, they begin a period of frenzied activity. During this active period, hatchlings move from their nest to the surf, swim, and are swept through the surf zone, and continue swimming away from land for approximately 20 to 30 hours (Carr and Ogren 1960; Carr 1962; Carr 1982; Wyneken and Salmon 1992; Witherington 1995). This frenzied swimming is generally agreed to be a mechanism for limiting time spent in the nearshore coastal waters, thus reducing exposure to predators such as fish and birds that tend to be concentrated in and near those waters. This frenzied activity by hatchlings is known to be energetically very demanding on the hatchlings (Clusella Trullas *et al.* 2006). Also, the swim frenzy is based upon an internal clock that determines when the hatchlings switch from frenzy to post-frenzy swimming (Wyneken and Salmon 1992; Wyneken 2000). Orientation cues used by hatchlings as they crawl, swim through the surf, and migrate offshore are discussed in detail by Lohmann and Lohmann (2003) and include visual cues on the beach, wave orientation in the nearshore, and later magnetic field orientation as they proceed further toward open water.

Post-hatchling transition stage describes neonate sea turtles that have matured to the point beyond the period of frenzied swimming (Wyneken and Salmon 1992). Bolten (2003) notes that the post-hatchling transition stage occurs in the neritic environment, and ends when the small turtles enter the oceanic zone. Post-hatchling loggerheads are largely inactive, exhibit infrequent low-energy swimming, and have begun to feed, no longer relying on their retained yolk as is done in the swim frenzy stage (Witherington 2002). As post-hatchlings, loggerheads are found at or near the ocean surface in neritic waters along the continental shelf and they often inhabit areas where surface waters converge to form downwelling, which are associated with linear accumulations of floating material like *Sargassum* (Witherington 2002). This neritic post-hatchling stage is weeks or months long and may be a transition to the oceanic stage that loggerheads enter as they grow and are carried by ocean currents (Witherington 2002; Bolten 2003).

II.B.3. Oceanic -- Juvenile, and Adult

The oceanic juvenile stage begins when loggerheads first enter the oceanic zone (Bolten 2003). Juvenile loggerheads originating from nesting beaches in both the Northwest Atlantic and western Pacific Oceans appear to use oceanic developmental habitats and move with the predominant ocean gyres for several years before returning to their neritic foraging habitats (Pitman 1990; Bowen *et al.* 1995; Zug *et al.* 1995; Musick and Limpus 1997; Bolten 2003). The presence of *Sargassum* is also important for the oceanic juvenile life stage, as it offers a concentrated, protected foraging area, with facilitated dispersal by associated oceanic currents. Turtles in this stage use active and passive movements relative to oceanic currents and winds, with 75% of their time spent in the top 5 m (16 ft) of the water column (Howell *et al.* 2010; Witherington *et al.* 2012).

The major currents in the Gulf of Mexico and U.S. EEZ of the Northwest Atlantic Ocean include the Mexican Current, Yucatan Current, Gulf Loop Current, Florida Current, and Gulf Stream[4]. In the western Atlantic, Caribbean Sea and Gulf of Mexico, post-hatchling and oceanic juvenile sea turtle habitat occurs at the margins of the Mexican Current, Yucatan Current, Gulf Loop Current, Florida Current, and Gulf Stream; at the margins and centers of eddies produced by these currents; at tidal rips and other convergence zones at the plume seaward of the Mississippi River delta; at consolidated patches (lines, mats) of pelagic *Sargassum*; and at other convergence zones indicated by salinity fronts, temperature fronts, water-color changes, or floating debris (including pelagic *Sargassum*). All these habitat features are dynamic and transitory. In the Atlantic, the use of currents such as the Gulf Stream and the Florida Loop Current have been documented and modeled. Evidence shows that the juvenile sea turtles do not just use the

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[4] The western boundary current in the western Gulf of Mexico is called the Mexican Current. The Yucatan Current flows through the small passage connecting the Caribbean Sea and the Gulf of Mexico known as the Yucatan Channel, and provides most of the inflow into the Gulf of Mexico. The clockwise flow that extends northward into the Gulf of Mexico and joins the Yucatan Current and the Florida Current is known as the Gulf Loop Current (Hofmann and Worley 1986). The Florida current can be considered the "official" beginning of the Gulf Stream System (Gyory *et al.* 2012). It can be defined as that section of the system which stretches from the Florida Straits up to Cape Hatteras, North Carolina. The Gulf Stream flows in the North Atlantic northeastward off the North American coast between Cape Hatteras and the Grand Banks of Newfoundland. In popular conception, the Gulf Stream also includes the Florida Current and the West Wind Drift (east of the Grand Banks).

currents as passive transport, but will actively swim to maintain a position in currents that provide favorable transport away from coastal areas and cold waters that would present lower odds of survival (Putman *et al.* 2012). In fact, the importance of such current systems, and access to those currents by hatchling sea turtles, are thought to influence the evolution of sea turtle nesting location choices and may explain the limited loggerhead nesting in large sections of the Gulf of Mexico that would have otherwise suitable beaches (Putman *et al.* 2010).

The actual duration of the oceanic juvenile stage varies with loggerheads leaving the oceanic zone over a wide size range (Bjorndal *et al.* 2000). In the North Pacific, juveniles may spend an estimated 27 years in their oceanic phase (Conant *et al.* 2009) with juvenile loggerheads not returning to coastal neritic habitats until around 60 cm (24 in) SCL (Ishihara *et al.* 2011, referring to coastal waters of Japan; Y. Matsuzawa and Sea Turtle Association of Japan, unpublished data). In the Atlantic, Bjorndal and colleagues (Bjorndal *et al.* 2000; Bjorndal *et al.* 2003) estimated the duration of the oceanic juvenile stage to be between 7 and 11.5 years, with juveniles recruiting to neritic habitats in the western Atlantic over a size range of 46–64 cm (18–25 in) CCL (Bolten *et al.* 1993; TEWG 2009). However, Snover (2002) suggests a much longer oceanic juvenile stage duration for Northwest Atlantic loggerheads with a range of 9–24 years and a mean of 14.8 years over similar size classes, although Snover *et al.* (2010) suggests that recruitment to neritic habitat starts at approximately 45.5 cm (18 in) SCL. Studies conducted in the Northwest Atlantic and Mediterranean indicate that some juveniles move between neritic and oceanic zones (Keinath 1993; Laurent *et al.* 1998; Witzell 2002; Bolten 2003; Morreale and Standora 2005; Mansfield 2006; McClellan and Read 2007; Eckert *et al.* 2008; Mansfield *et al.* 2009; Arendt *et al.* 2012c). The subsequent neritic juvenile stage is discussed in Section II.B.4.

Adults may also periodically move between neritic and oceanic zones (Harrison and Bjorndal 2006; Hawkes *et al.* 2006; Girard et al. 2009; Reich *et al.* 2010; Eder *et al.* 2012). Hatase *et al.* (2002) used stable isotope analyses and satellite telemetry to demonstrate that some adult female loggerheads nesting in Japan inhabit oceanic habitats rather than neritic habitats. Kobayashi *et al.* (2011) identified that 34 non-reproductive loggerheads (size 64.0–92.0 cm (25.2–36.2 in) SCL) originally captured and satellite tagged in Taiwan spent portions of their time in neritic habitats of 12 nations, exhibiting a quasi-resident behavior between Taiwan, China, Japan, and South Korea, and 12.5 percent of their time in the high seas. In Japan and Cape Verde, the adult females inhabiting oceanic habitats were significantly smaller than those in neritic habitats (Hatase *et al.* 2002; Hawkes *et al.* 2006; Eder *et al.* 2012). Reich *et al.* (2010) analyzed stable isotopes and epibionts from Florida nesting loggerheads. Their results suggested that some loggerheads nesting in Florida also may inhabit oceanic habitats (and were smaller in size than those associated with neritic prey), potentially exhibiting the oceanic vs. neritic dichotomy reported by nesting loggerheads in Japan and Cape Verde Islands (Hatase *et al.* 2002; Hawkes *et al.* 2006; Reich *et al.* 2010). However, Pajuelo *et al.* (2012b) evaluated the stable isotope values from Reich *et al.* (2010) and from northern nesting areas in conjunction with satellite telemetry data. This study identified three neritic foraging areas based on isotopic ratios, with differences associated with latitudinal gradients (Pajuelo *et al.* 2012b). The best available science currently does not establishhe extent to which adult loggerheads occupy oceanic habitats, or theeffects on survival probabilities and reproductive output.

II.B.4. Neritic -- Juvenile and Adult

The neritic juvenile stage begins when loggerheads exit the oceanic zone and enter the neritic zone (Bolten 2003). After migrating to the neritic zone, juvenile loggerheads continue maturing until they reach adulthood, engaging in foraging and migratory behavior. Some juveniles move between neritic and oceanic zones (Keinath 1993; Laurent *et al.* 1998; Witzell 2002; Bolten 2003; Morreale and Standora 2005; Mansfield 2006; McClellan and Read 2007; Eckert *et al.* 2008; Mansfield *et al.* 2009; Arendt *et al.* 2012c).

The neritic zone provides important foraging habitat, internesting habitat, breeding habitat, and migratory habitat for adult loggerheads. As discussed in the section above, some adults may also periodically move between neritic and oceanic zones (Harrison and Bjorndal 2006; Hawkes *et al.* 2006; Girard et al. 2009; Reich *et al.* 2010; Kobayashi *et al.* 2011; Eder *et al.* 2012). See Schroeder *et al.* (2003), Limpus and Limpus (2003a), and Kobayashi *et al.* (2011) for reviews of this life stage.

In neritic zones, loggerheads are primarily carnivorous, although they do consume some plant matter as well (see Bjorndal 1997; and Dodd 1988, for reviews). Loggerheads feed on a wide variety of food items with ontogenetic, regional, and even individual differences in diet. Loggerhead diets have been described from just a few coastal regions, and little information is available about differences or similarities in diet at various life stages. In general, loggerheads in neritic habitats within the Northwest Atlantic prey on benthic invertebrates, primarily mollusks and benthic crabs (NMFS and USFWS 2008). Loggerheads occurring in the Eastern Pacific while in neritic habitats of Baja California Sur, Mexico, feed extensively on pelagic red crabs (*Pleuroncodes planipes*) (Wingfield *et al.* 2011).

III: IDENTIFICATION AND DESCRIPTION OF GEOGRAPHICAL AREAS OCCUPIED BY THE NORTHWEST ATLANTIC OCEAN DPS AND NORTH PACIFIC OCEAN DPS

Designation of critical habitat first requires identification of the geographical area occupied by the species at the time of its listing. NMFS has long interpreted ‘‘geographical area occupied’’ in the definition of critical habitat to mean essentially the range of the species at the time of listing (which, for the loggerhead DPSs, was September 22, 2011 (76 FR 58868)). Loggerhead sea turtles occur throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans (Dodd 1988). Because critical habitat can only be designated in U.S. territory, NMFS paid particular attention to habitat and those DPSs within the U.S. EEZ, the Northwest Atlantic Ocean and North Pacific Ocean DPSs. For both of these DPSs, there is no known unoccupied marine habitat. As such, NMFS identified the geographical area occupied as south of 60° N. lat., north of the equator, and west of 40° W. long. for the Northwest Atlantic DPS, and south of 60° N. lat. and north of the equator for the North Pacific Ocean DPS (76 FR 58868, September 22, 2011). While this is the range occupied by the species, NMFS reviewed data for only U.S. EEZ waters within that range (i.e., Atlantic oceanic waters extending to the boundary of the U.S. EEZ, not all the way to 40° N. lat.). Within the U.S. EEZ, loggerhead sea turtle nesting occurs only within the Northwest Atlantic Ocean DPS, and USFWS defined the terrestrial portion of the geographical area occupied in this DPS as those areas where nesting has been documented annually for a 10-year period (2002 to 2011).

As ectothermic reptiles, the distribution of loggerheads is limited geographically and temporally by water temperature (Epperly *et al.* 1995a; Braun-McNeill *et al.* 2008b; Mansfield *et al.* 2009). Water temperatures too low or too high may affect feeding rates and physiological functioning (Milton and Lutz 2003). While loggerheads have been found in waters as low as 7.4 to 8° C (review in Braun-McNeill *et al.* 2008b; Weeks *et al.* 2010), generally, a suppression of metabolic activity can occur in prolonged exposure to water temperatures below 8-10° C (Morreale *et al.* 1992; Milton and Lutz 2003). As such, for the purposes of this assessment, the CHRT considers the water temperature habitat range for all loggerheads to be above 10° C. This temperature range will apply to all areas and habitat categories subsequently discussed.

The remainder of this section will review the specific areas occupied within the species' geographical range, grouped by DPS, ecosystem, and then habitat categories.

III.A. Northwest Atlantic Ocean DPS

The Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle identified five recovery units for the Northwest Atlantic population (NMFS and USFWS 2008). Recovery units are “a special unit of the listed entity that is geographically or otherwise identifiable and is essential to the recovery of the entire listed entity, i.e., recovery units are individually necessary to conserve genetic robustness, demographic robustness, important life history stages or some other feature necessary for long-term sustainability of the entire listed entity" (NMFS and USFWS 2010). Because recovery of all recovery units are, by definition, necessary for the conservation and recovery of the Northwest Atlantic Ocean DPS, we identified habitat needs with the need of each recovery unit in mind. In the case of nearshore reproductive areas, we identified habitat for hatchlings in their swim frenzy and internesting females specific to these recovery units. Four of these recovery units (discussed below) represent nesting assemblages in the southeastern United States and were delineated based on a combination of geographic isolation and geopolitical boundaries. The fifth recovery unit (Greater Caribbean Recovery Unit) includes all nesting assemblages within the Greater Caribbean, which are outside the U.S. EEZ with the exception of Puerto Rico and the U.S. Virgin Islands. Only one record of a loggerhead turtle has been recorded in Puerto Rican waters, where it was tracked from a nesting beach in Bonaire to a foraging ground near the east coast of the mainland of Puerto Rico near Ceiba and Naguabo (Diez and Montero-Acevedo 2012). Only two loggerhead sea turtles have been documented as nesting in the U.S. Virgin Islands (and thus must have inhabited the marine waters offshore); both loggerheads have been documented nesting since 2003 on Buck Island Reef National Monument off the north coast of St. Croix (Pollock *et al.* 2009). Marine waters offshore of Puerto Rico and the U.S. Virgin Islands are not proposed as critical habitat and will not be discussed further, due to limited records of inhabitance (Pollock *et al.* 2009). Therefore, there are four recovery units within the Northwest Atlantic Ocean DPS that are being considered when analyzing potential critical habitat for designation:

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

Peninsular Florida Recovery Unit: The Peninsular Florida Recovery Unit is defined as loggerheads originating from nesting beaches from the Florida-Georgia border through Pinellas County on the west coast of Florida, excluding the islands west of Key West, Florida.

Dry Tortugas Recovery Unit: The Dry Tortugas Recovery Unit is defined as loggerheads originating from nesting beaches throughout the islands located west of Key West, Florida, because these islands are geographically separated from other recovery units.

Northern Gulf of Mexico Recovery Unit: The Northern Gulf of Mexico Recovery Unit is defined as loggerheads originating from nesting beaches from Franklin County on the northwest Gulf coast of Florida through Texas (the western extent of U.S. nesting range).

From the time loggerheads enter the water from the beach as hatchlings, they remain in the marine habitat, with the exception of females coming ashore to nest and then returning to the water. Marine habitat includes neritic and oceanic habitat, and both will be discussed in the following sections.

III.A.1. Terrestrial

Terrestrial habitat was described in the USFWS proposed rule (78 FR 18000, March 25, 2013).

III.A.2. Neritic

Neritic habitat consists of the nearshore marine environment from the surface to the sea floor where water depths do not exceed 200 m (656 ft), including inshore bays and estuaries. For purposes of describing potential critical habitat in the Atlantic, we considered loggerhead behavior and broke discussions of neritic habitat into: 1) Nearshore Reproductive Habitat (hatchling swim frenzy and internesting female habitat); 2) Neritic Juvenile and Adult Habitat (including foraging, breeding, and constricted migratory habitat); and 3) *Sargassum* Habitat. However, because of the overlap of many of these habitats, all but the *Sargassum* Habitat will be labeled Neritic Habitat in any specific areas proposed for designation as critical habitat.

III.A.2.a. Nearshore Reproductive Habitat

NMFS identified the nearshore reproductive habitat to include habitat for the hatchling swim frenzy and for females during the internesting period. The nearshore habitat off the nesting beaches serves as important reproductive habitat for both hatchling and nesting female loggerheads. This nearshore zone is a vulnerable, pivotal transitional habitat area for hatchling transit to open waters, and for nesting females to transit back and forth between open waters and nesting beaches during their multiple nesting attempts throughout the nesting season. The location of nearshore reproductive habitat is, naturally, determined largely by the location of the nesting beaches. The four recovery units identified in the Northwest Atlantic loggerhead recovery plan represent nesting assemblages and, thus, the geographical areas utilized for nesting by each unit contain this nearshore reproductive habitat.

Immediately after hatchlings emerge from the nest, they begin a period of frenzied activity. During this active period, hatchlings move from their nest to the surf, swim, and are swept through the surf zone, and continue swimming away from land for approximately 20–30 hours (Carr and Ogren 1960; Carr 1962; Carr 1982; Wyneken and Salmon 1992; Witherington 1995). This frenzied swimming is generally agreed to be a mechanism for limiting time spent in the nearshore coastal waters, thus reducing exposure to predators such as fish and birds that tend to be concentrated in and near those waters. In a summary of loggerhead hatchling swim speed studies, Wyneken (1997) presents speeds of 1.28 and 1.31 km/hour (hr) (0.79 and 0.81 miles/hr) from a laboratory study and field study, respectively, and 0.83 to 0.89 km/hr (0.51 and 0.55 miles/hr) in a study where light pollution from nearby development potentially caused orientation issues for the hatchlings. Using this range of swim frenzy speeds and the 20–30 hour swim frenzy period, hatchlings can reach distances of 16.6 km (10.0 miles) to 39.3 km (24.0 miles) from the beach during the swim frenzy. Orientation cues used by hatchlings as they crawl, swim through the surf, and migrate offshore are discussed in detail by Lohmann and Lohmann (2003) and include visual cues on the beach, wave orientation in the nearshore, and later magnetic field orientation as they proceed further toward open water. Any obstructions to swift egress from the beach and through the water to open ocean, whether via blockage or disorientation, as well as structures that aggregate potential predators to hatchlings, can affect the successful movement of hatchlings through nearshore habitat.

The nearshore habitat off nesting beaches is also used by nesting females as they transit between the nesting beach and the open waters or internesting areas. The habitat characteristics of this nearshore zone are important in female nest site selection and successful repeat nesting. In addition to nesting beach suitability and proximity to nearshore oceanic currents needed for hatchling transport, the underwater nearshore approach profile is an important consideration for nesting female loggerheads. Nesting females lay an average of 3 to 5.5 nests per season (NMFS and USFWS 2008). During each approach to the nesting beach and return to sea after nesting, habitat suitable for transit between the beach and open waters is necessary. Nesting females typically favor beach approaches with few obstructions or physical impediments such as reefs or shallow water rocks which may make the entrance to nearshore waters more difficult or even injure the female as she attempts to reach the surf zone (Salmon 2006). During the internesting period (between nesting attempts), loggerhead sea turtles have been shown to utilize varying strategies. It is rare for turtles to travel well offshore during internesting, with the vast majority remaining no more than a few miles from shore. However, the nearshore areas used range from individuals remaining directly off the beach on which they had just nested, to individuals traveling substantial distances along shore before settling into a resting area to await the next nesting attempt, with habitats types ranging from the back side of barrier islands, to sand, to structure (Hopkins and Murphy 1981; Stoneburner 1982; Mansfield *et al.* 2001; Griffin 2002; Scott 2006; Tucker 2009; Hart *et al.* 2010).

III.A.2.b. Neritic Juvenile and Adult Habitat

Neritic habitat supports both juvenile and adult loggerheads. In the Northwest Atlantic, after departing the oceanic zone, neritic juvenile loggerheads inhabit continental shelf waters from Cape Cod Bay, Massachusetts, south through Florida, The Bahamas, Cuba, and the Gulf of Mexico (Musick and Limpus 1997; Spotila *et al.* 1997a; Hopkins-Murphy *et al.* 2003). Notable inshore habitat includes estuarine waters such as Long Island Sound, Delaware Bay, Chesapeake Bay, Pamlico and Core Sounds, the large open sounds of South Carolina and Georgia, Mosquito and Indian River Lagoons, Biscayne Bay, Florida Bay, and numerous embayments fringing the Gulf of Mexico (Musick and Limpus 1997; Spotila *et al.* 1997a; Hopkins-Murphy *et al.* 2003). Long-term in-water studies indicate that juvenile loggerheads reside in particular developmental foraging areas for many years (Lutcavage and Musick 1985; Mansfield 2006; Ehrhart *et al.* 2007; Braun-McNeill *et al.* 2008a; Arendt *et al.* 2012f). Although sea turtle migrations and distribution in neritic habitat are largely correlated to environmental conditions such as sea surface temperature (SST) (Coles and Musick 2000; Braun-McNeill *et al.* 2008b), Mansfield *et al.* (2009) postulate that it is also probable that seasonal philopatry or site fidelity plays a strong role in determining habitat use among juvenile loggerheads. Mansfield *et al.* (2009) further state that these changes may be 'predictable' and cyclical, driven by natural environmental and/or resource fluctuations (e.g., the thermal environment becomes seasonally inhospitable to the animal), or they may be due to changes in habitat quality over time (e.g., declines in prey availability).

Habitat preferences of Northwest Atlantic non-nesting adult loggerheads in the neritic zone differ from the juvenile stage in that relatively enclosed, shallow water estuarine habitats with limited ocean access are less frequently used. Areas such as Pamlico Sound, North Carolina, and the Indian River Lagoon, Florida, regularly used by juvenile loggerheads, are only rarely frequented by adults (Ehrhart and Redfoot 1995; Epperly *et al.* 2007). In comparison, estuarine areas with more open ocean access, such as the Delaware Bay and the Chesapeake Bay in the U.S. mid-Atlantic, as well as the nertitic shelf waters of the Mid-Atlantic Bight[5] and the South Atlantic Bight are regularly used by both juvenile and adult loggerheads, primarily during warmer seasons (Lutcavage and Musick 1985; Spotila *et al.* 1998; Stezer 2002; Mansfield 2006; Hawkes *et al.* 2007; Mansfield *et al.* 2009; Hawkes *et al.* 2011; Arendt *et al.* 2012b; Arendt *et al.* 2012c; Arendt *et al.* 2012d; Ceriani *et al.* 2012; Pajuelo *et al.* 2012b; Griffin *et al.*, unpublished data). Shallow water habitats with large expanses of open ocean access, such as Florida Bay, provide

[5] A "bight" refers to a curve or recess in a coastline, river, or other geographical feature (Online Oxford Dictionary 2012). The Mid-Atlantic Bight is defined here as the region enclosed by the coastline from Cape Cod (Massachusetts) to Cape Hatteras (North Carolina). The South-Atlantic Bight is definied hear as extending from Cape Hatteras (North Carolina) to West Palm Beach (Florida).

year-round resident foraging areas for significant numbers of male and female adult loggerheads, including nesting females (Schroeder *et al.* 1998; Witherington *et al.* 2006). Offshore, adults inhabit continental shelf waters, from New York south through Florida, The Bahamas, Cuba, and the Gulf of Mexico (Schroeder *et al.* 2003; Hawkes *et al.* 2007; Foley *et al.* 2008; Hawkes *et al.* 2011; Griffin *et al.*, unpublished data).

This general loggerhead distribution has been substantiated by analyses by the Loggerhead TEWG. As that report represents the most comprehensive accumulation of available loggerhead distribution data, at least through 2007/2008, and it was used as a primary data source for this document, we re-state much of the information here and supplement it with more recent data. The TEWG used three approaches to identify spatial overlap, high use areas, and seasonal movements and habitat occupancy among loggerheads captured along the eastern United States and the Gulf of Mexico (TEWG 2009). One approach used historic aerial survey data to provide verification for the observed distributions derived from satellite telemetry. The other approach included analyzing available satellite telemetry data to determine areas of high use based on seasonal sex-, size-, or subpopulation-specific data (TEWG 2009). This summary from TEWG (2009) represents the best summary of available data, both privately and publicly held, with the exception of NMFS and Florida Fish and Wildlife Conservation Commission data on the Florida Bay. Preliminary examination of NMFS data from ongoing aerial surveys (e.g., Atlantic Marine Assessment Program for Protected Species (AMAPPS)) does not alter the patterns reported by the TEWG in any substantial way (NMFS 2011; NMFS 2012a; Richards 2012, pers. comm.).

To identify loggerhead sea turtle distributions along the east coast of the United States and Gulf of Mexico, the TEWG (2009) used aerial and shipboard survey data. These data originated from a variety of survey sources spanning from the late 1970s to 2002. The majority of these data were derived from aerial surveys, with nearly 100,000 records. Transect lines and loggerhead sightings data were binned by season and plotted (Figures 1–4). “Winter” was defined as January through March; “spring” as April through June; “summer” as July through September; and “fall” as October through December. In addition to loggerhead sightings, the TEWG included sightings of unidentified sea turtles because it is likely many were loggerhead turtles.

The majority of sightings occurred along the continental shelf approximately out to the 200 m (656 ft) bathymetric contour line. Seasonal composites indicate few to no turtles occurring coastally north of 36° N. lat., or just north of Cape Hatteras, North Carolina, during winter (Figure 1B). By the spring and summer, turtles occurred in nearshore coastal waters north of Cape Hatteras, North Carolina, with sightings occurring frequently as far north as Cape Cod, Massachusetts, during summer (Figures 2B, 3B). There were few turtles north of Cape Cod. Some turtles were observed beyond the continental shelf, ranging as far east as approximately 60° W. long., and between 30° N. to 45° N. lat. (Figure 3B). Generally, loggerhead turtles were sighted in the northeast region south of Cape Cod during the summer wherever there was effort, but had more restricted northern distributions during other seasons.

Nearshore coastal surveys were infrequently conducted throughout the Gulf of Mexico; most surveys were further offshore. When surveys did cover nearshore areas, sightings usually were reported. This was especially true during fall surveys off the west coast of Florida (Figure 4A), indicating a high density of loggerheads sighted during those surveys (Figure 4B).

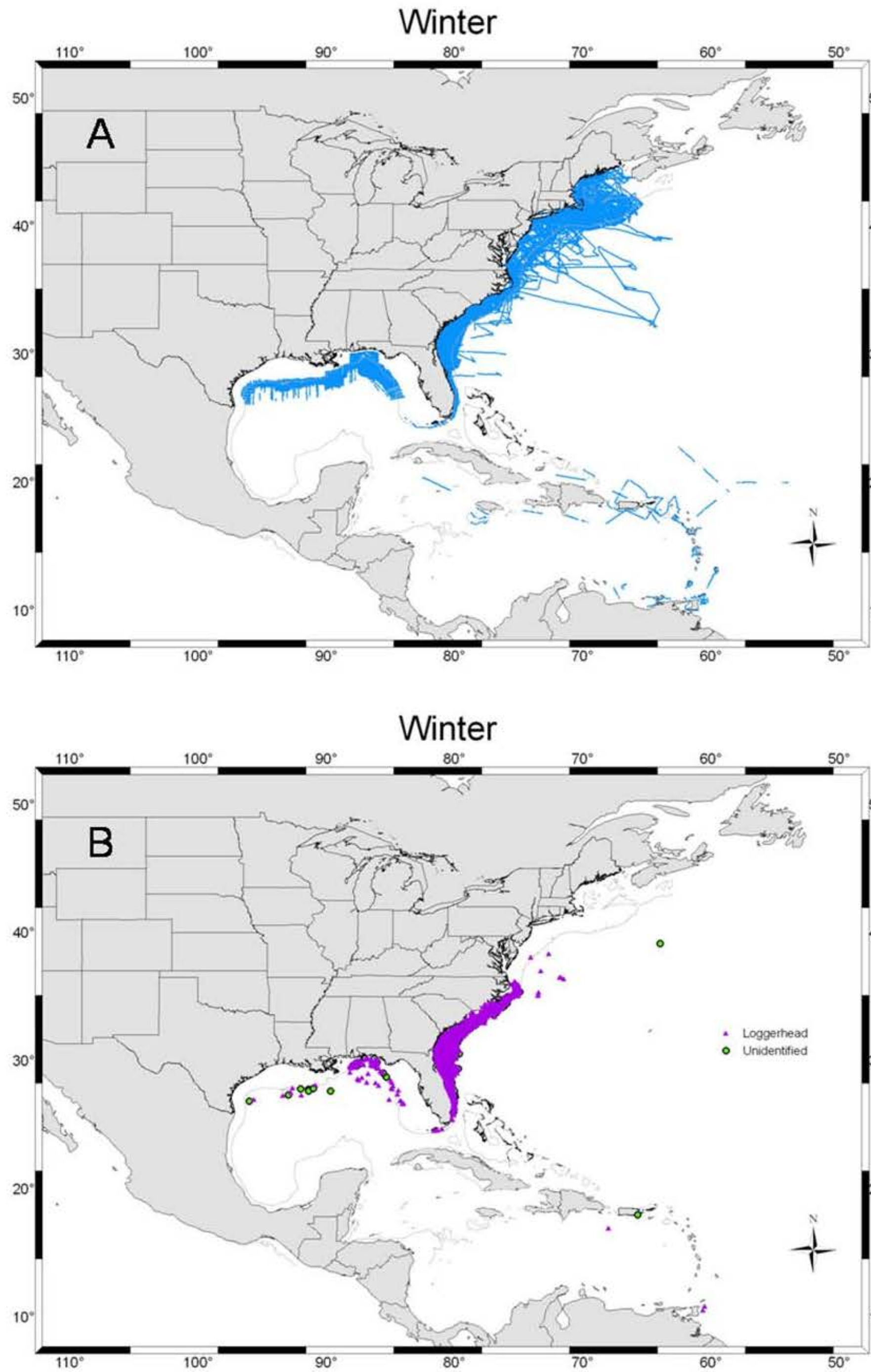


Figure 1A & B. Winter (January-March) loggerhead sea turtle sightings from aerial and shipboard surveys. (A) transect lines flown depicted in blue; (B) observed loggerhead sightings (purple) and unidentified sea turtles (green). Bathymetric contour line = 200 m. (From TEWG 2009, Figures 13A-B.)

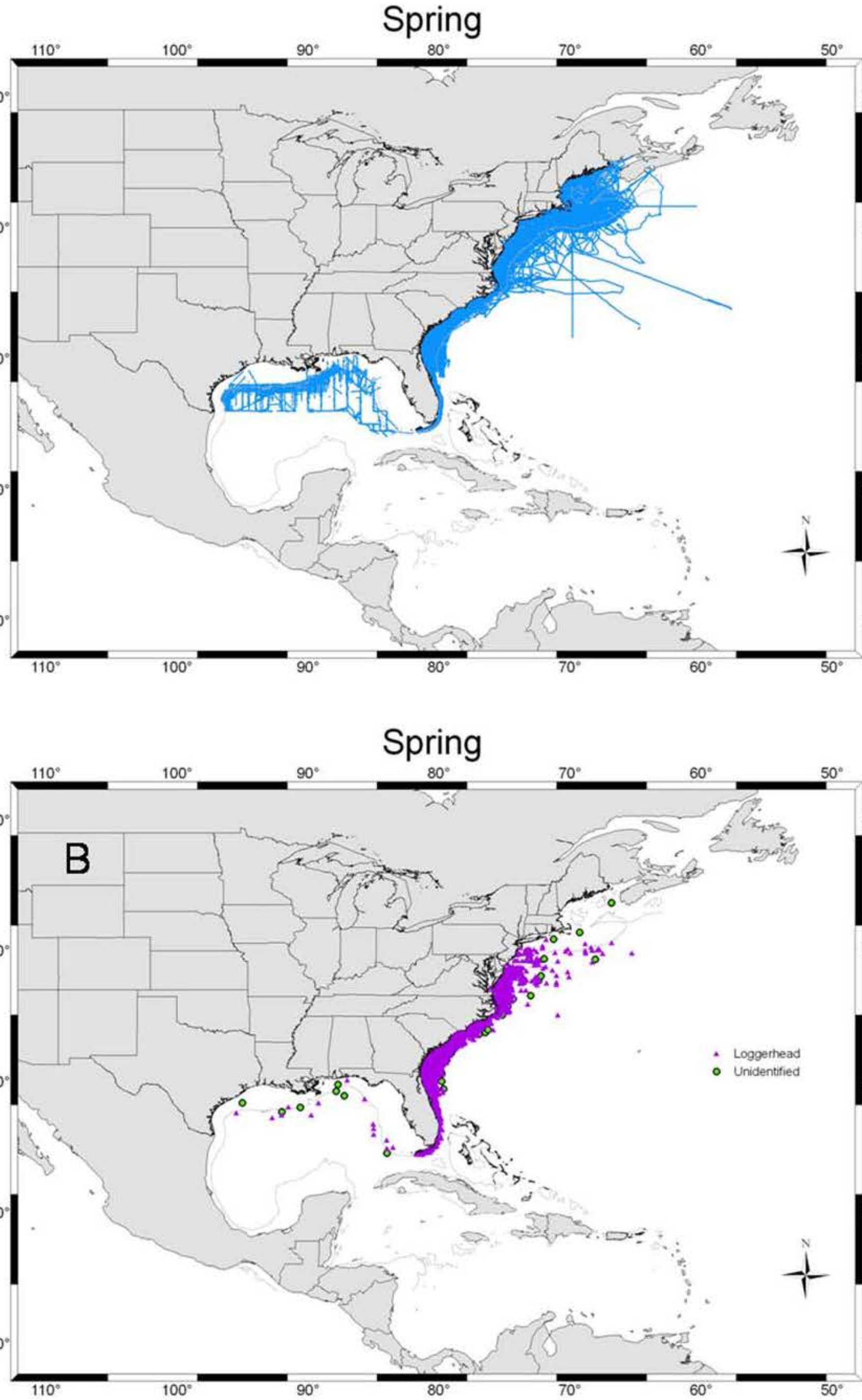


Figure 2A & B. Spring (April-June) loggerhead sea turtle sightings from aerial and shipboard surveys. (A) transect lines flown depicted in blue; (B) observed loggerhead sightings (purple) and unidentified sea turtles (green). Bathymetric contour line = 200 m. (From TEWG 2009, Figures 14A-B.)

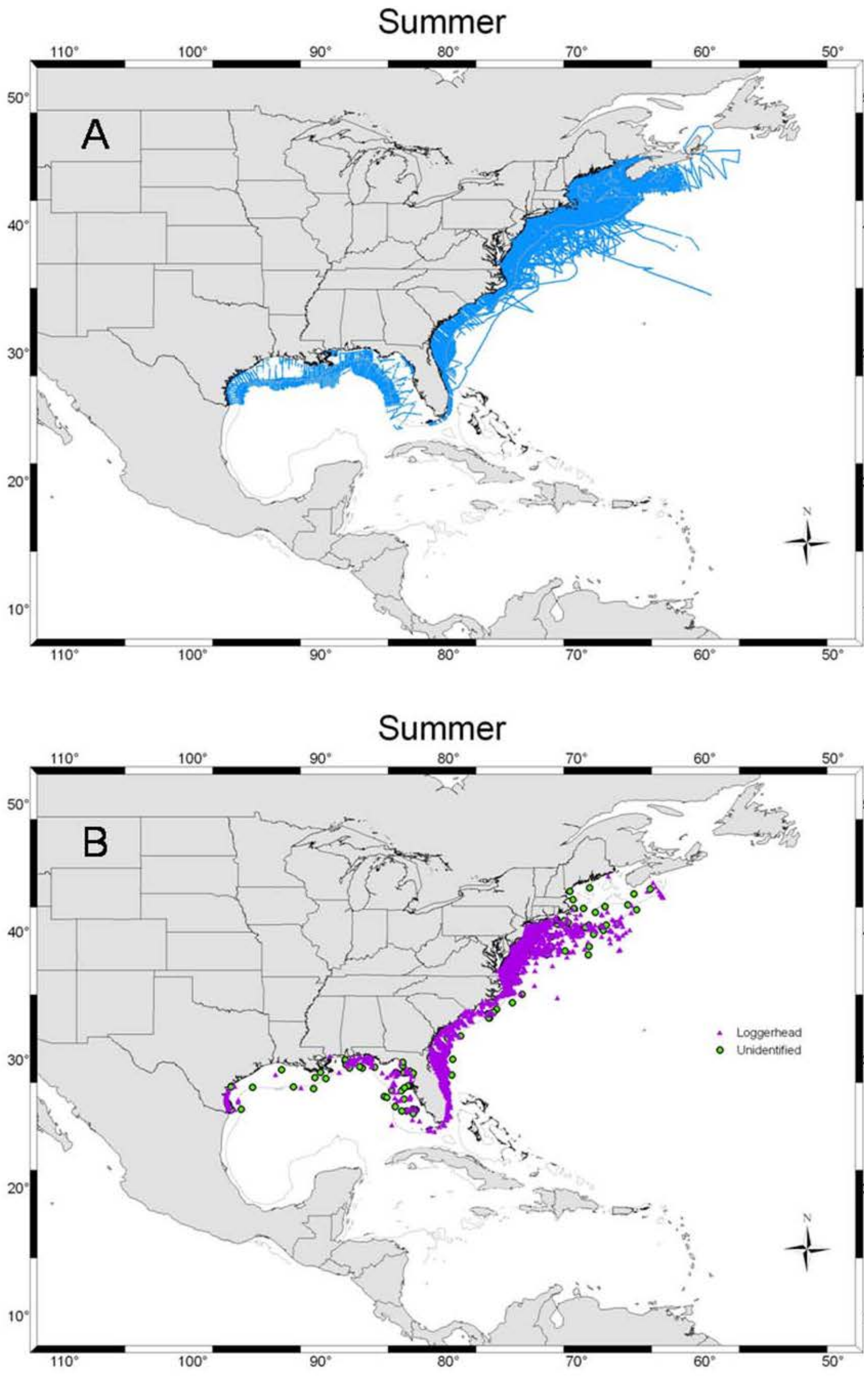
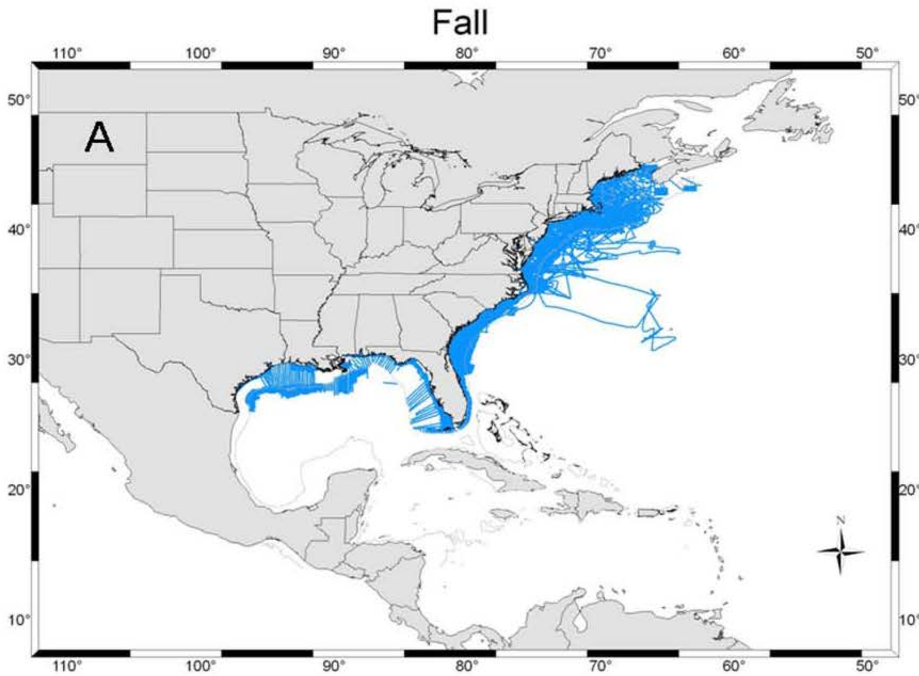


Figure 3A & B. Summer (July-September) loggerhead sea turtle sightings from aerial and shipboard surveys. (A) transect lines flown depicted in blue; (B) observed loggerhead sightings (purple) and unidentified sea turtles (green). Bathymetric contour line = 20



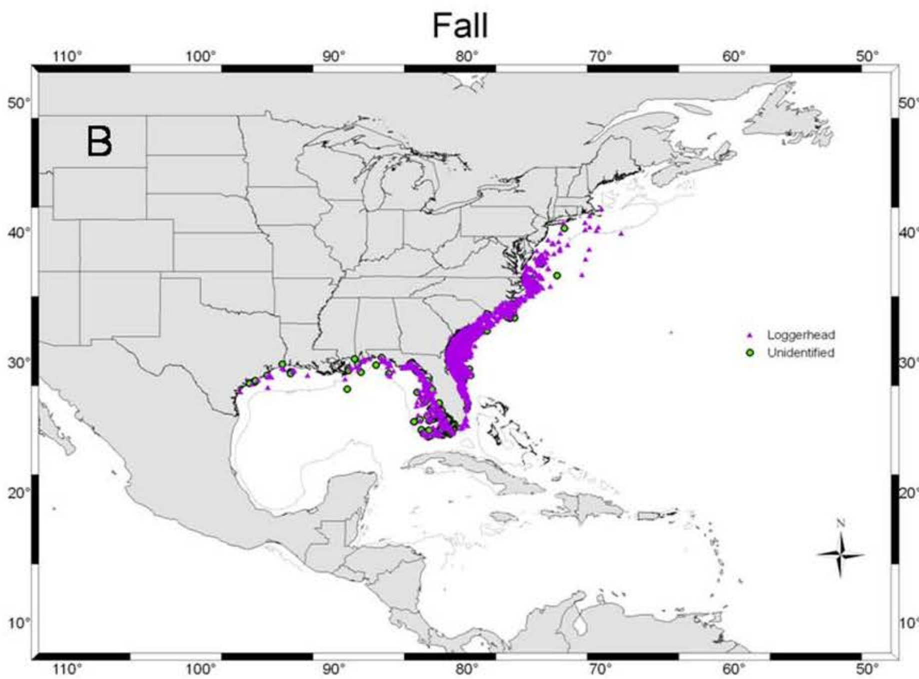


Figure 4A & B. Fall (October-December) loggerhead sea turtle sightings from aerial and shipboard surveys. (A) transect lines flown depicted in blue; (B) observed loggerhead sightings (purple) and unidentified sea turtles (green). Bathymetric contour line = 200 m. (From TEWG 2009, Figures 16A-B.)

The TEWG (2009) examined 248 individual sea turtle satellite tracks that included 24,535 tracking days. Track data were collected between 1986 and 2007. Satellite telemetry data contributors and methodology can be found at TEWG (2009), and much of the data incorporated by the TEWG has subsequently been published in Mansfield *et al.* (2009), Girard *et al.* (2009), Hawkes *et al.* (2011), and Arendt *et al.* (2012a-c). The majority of both turtles and track days occurred along the continental shelf out to the 200 m (656 ft) bathymetric contour line. Another high use area occurred along the southern Gulf coast of Florida between the Dry Tortugas and Cape San Blas. There were some turtles that tracked beyond the continental shelf to the northern Atlantic. Those turtles ranged as far east as approximately 35° W. long. and remained predominantly between 30° N. to 46° N. latitude.

Specifically, track data from 108 neritic juveniles were analyzed, spanning from 1986 through 2007 and representing 9,833 track days (TEWG 2009). With the exception of seven juvenile turtles tracked from Texas and Louisiana, all juvenile loggerheads were captured and tracked from waters ranging off Georgia north to off Long Island, New York. No juvenile loggerheads were captured and tracked from the eastern Gulf of Mexico or from Florida. The majority of tracked juveniles occurred along the continental shelf out to the 200 m (656 ft) bathymetric contour line (Figures 5A-D). However, almost a fifth of the turtle tracks ranged beyond the continental shelf into the northern Atlantic (TEWG 2009; Mansfield *et al.* 2009; Arendt *et al.* 2012c). Those turtles ranged as far east as approximately 35° W. long. and between approximately 30° N. and 46° N. lat. (Figures 5A-D). Another high use area occurred along shelf waters off eastern Texas and western Louisiana. Some juveniles tagged and released north of Florida, including as far north as Virginia, migrated south along the eastern Florida shoreline (Keinath 1993; Mansfield 2006; Mansfield *et al.* 2009). Turtles tagged and released in Texas remained on the shelf offshore of the Texas and Louisiana coastlines (Renaud and Carpenter 1994).

Seasonal composites (Figures 5A-D) indicate few to no juvenile turtles occurring close to shore north of Cape Hatteras, North Carolina, during the winter. From spring through fall, turtles occurred in nearshore coastal waters with high use areas occurring from South Carolina north into Virginia's Chesapeake Bay and coastal waters of the Mid-Atlantic Bight. During the colder fall and winter months, turtles had a high frequency of days spent south of Cape Hatteras through Florida.

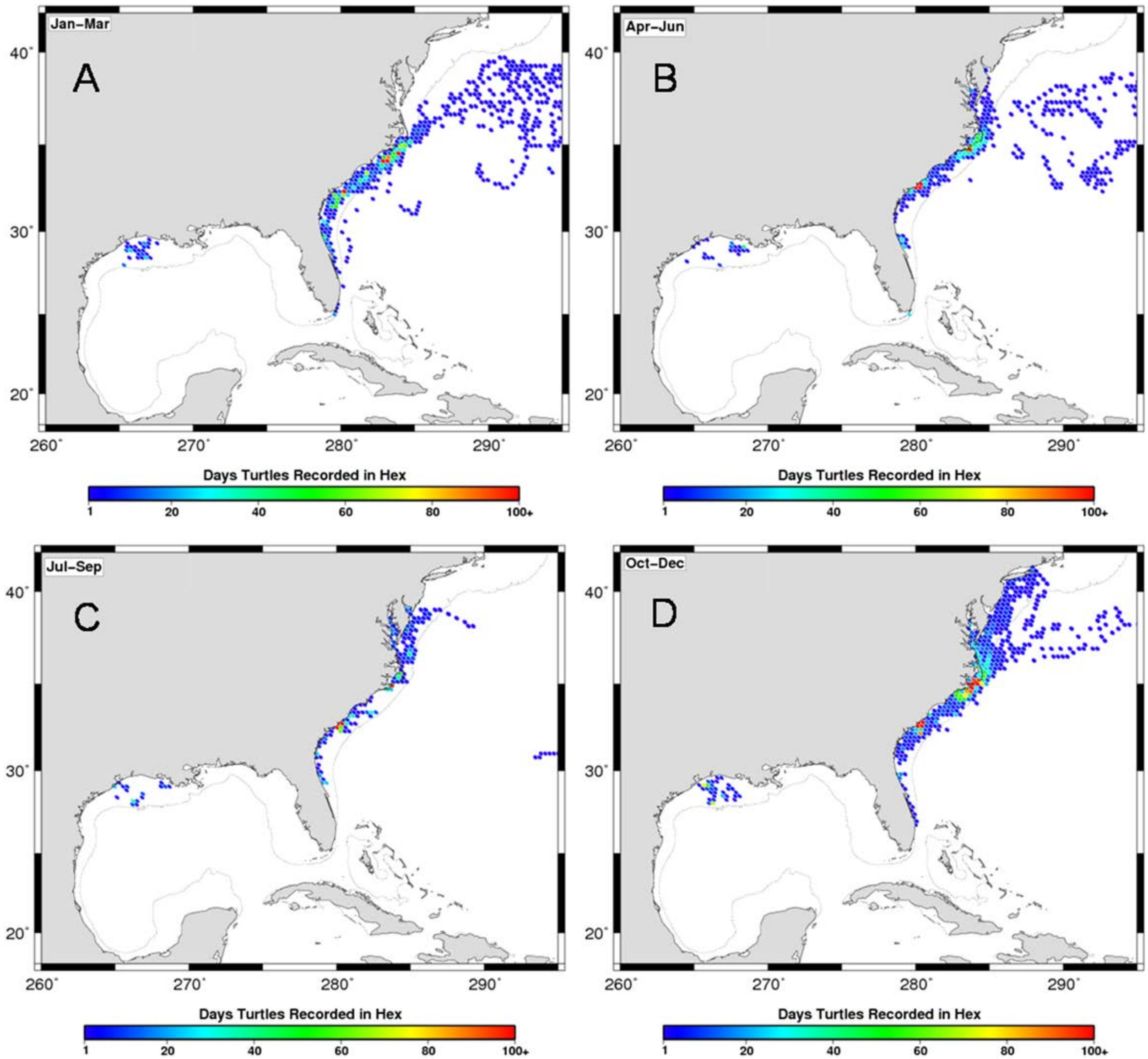


Figure 5A-D. Seasonal movements and coastal habitat use of all juvenile loggerhead sea turtles (n=108 animals; 9,833 days). (A) Winter, January through March (n=61 animals; 2,291 days); (B) Spring, April through June (n=71 animals; 2,325 days); (C) Summer, July through September (n=64 animals; 1,610 days); (D) Fall, October through December (n=87 animals; 3,607 days). Bathymetric contour line=200 m. There are four hexes per degree; each hex represents approximately 669 km^2. The longitudes are based on 360', starting at 0 from the Prime Meridian moving east. (From TEWG 2009, Figures 6A-D.)

Tracks from 36 male loggerheads (mostly adults) collected between 1991 and 2007, representing 2,612 track days, showed that the majority remained along the continental shelf out to the 200 m (656 ft) bathymetric contour line (Figures 6A-D; TEWG 2009). Four originated from the west coast of Florida, 29 from the east coast off Cape Canaveral, and 3 from Virginia. A small number of males moved from the Delmarva Peninsula beyond the continental shelf into waters as far east as 60° W. long. (Mansfield 2006; Arendt *et al.* 2012a). High use areas occurred in shelf waters off Cape Canaveral, Florida, along the west coast of Florida, and in the vicinity of Cape Hatteras, North Carolina. Turtles released from Florida's west coast ranged from the southern tip of the state up to the Panhandle. Seasonal composites (Figures 6A-D) indicate no male turtles occurred along the coast north of Cape Hatteras, North Carolina, during the winter months; however, males captured near Cape Canaveral, Florida during the breeding season later foraged as far north as New Jersey (Arendt *et al.* 2012b).

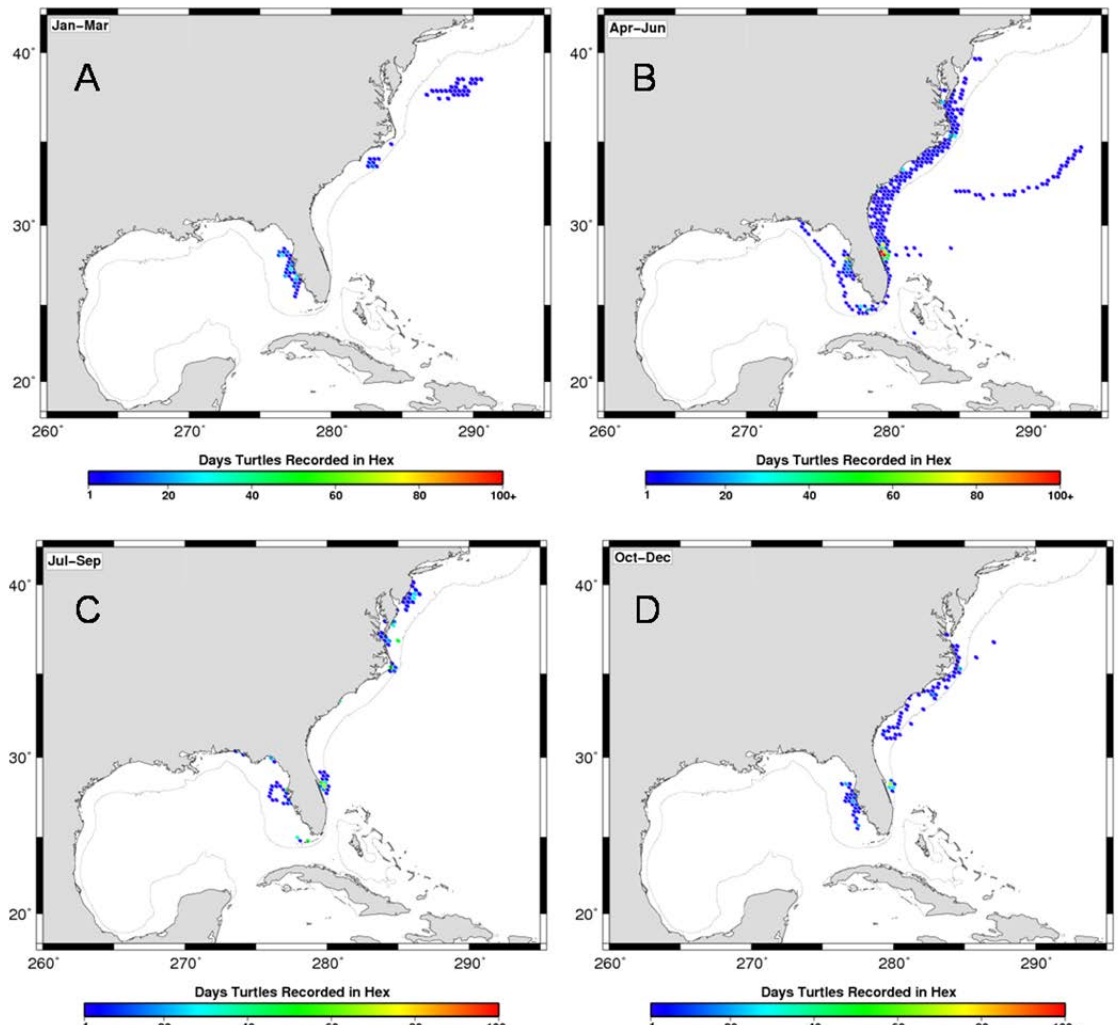


Figure 6A-D. Seasonal movements and coastal habitat use of all male loggerhead sea turtles (n=36 animals; 2,612 days). Maps zoomed to coastal region. (A) Winter, January through March (n=7 animals; 189 days); (B) Spring, April through June (n=36 animals; 1,448 days); (C) Summer, July through September (n=24 animals; 702 days); (D) Fall, October through December (n=9 animals; 273 days). Bathymetric contour line=200 m. There are four hexes per degree; each hex represents approximately 669 km^2. The longitudes are based on 360', starting at 0 from the Prime Meridian moving east. (From TEWG 2009, Figures 8A-D.)

Tracking data for at least 99 adult female turtles tagged between 1992 and 2007 and representing 11,863 days of tracking (TEWG 2009) showed that with few individual exceptions, the majority of adult females remained on the continental shelf (Figures 7A-D). The majority of tracks (67) originated from the Northern Recovery Unit nesting beaches ranging from Georgia to Virginia. Thirty-three originated from the west coast and Panhandle region of Florida. High use areas occurred near shore from the North Carolina-South Carolina border north to Delaware Bay, and from Tampa Bay south to the Dry Tortugas (Figures 7A-D). Turtles ranged as far south as the Gulf side of the Yucatan Peninsula and north and west coasts of Cuba.

Seasonal composites (Figures 7A-D) indicate few to no turtles occurring along the coast north of Cape Hatteras, North Carolina during January through March (see also Hawkes *et al.* 2011). Turtles occurred more frequently offshore, remaining in deeper waters closer to the edge of the continental shelf. Fewer track data were available for the winter months resulting in the fewest track days occurring during this season. By the spring and summer, turtles occurred in nearshore coastal waters with high use areas occurring from the North Carolina-South Carolina border north into Virginia's Chesapeake Bay and coastal waters. Additional discrete areas of higher use occurred adjacent to the nesting beaches from which the turtle tracks originated. Some nesting females originating from northern nesting beaches have been documented migrating north of Cape Hatteras post-nesting (Plotkin and Spotila 2002; Hawkes *et al.* 2007; Pajuelo *et al.* 2012b; Griffin *et al.*, unpublished data).

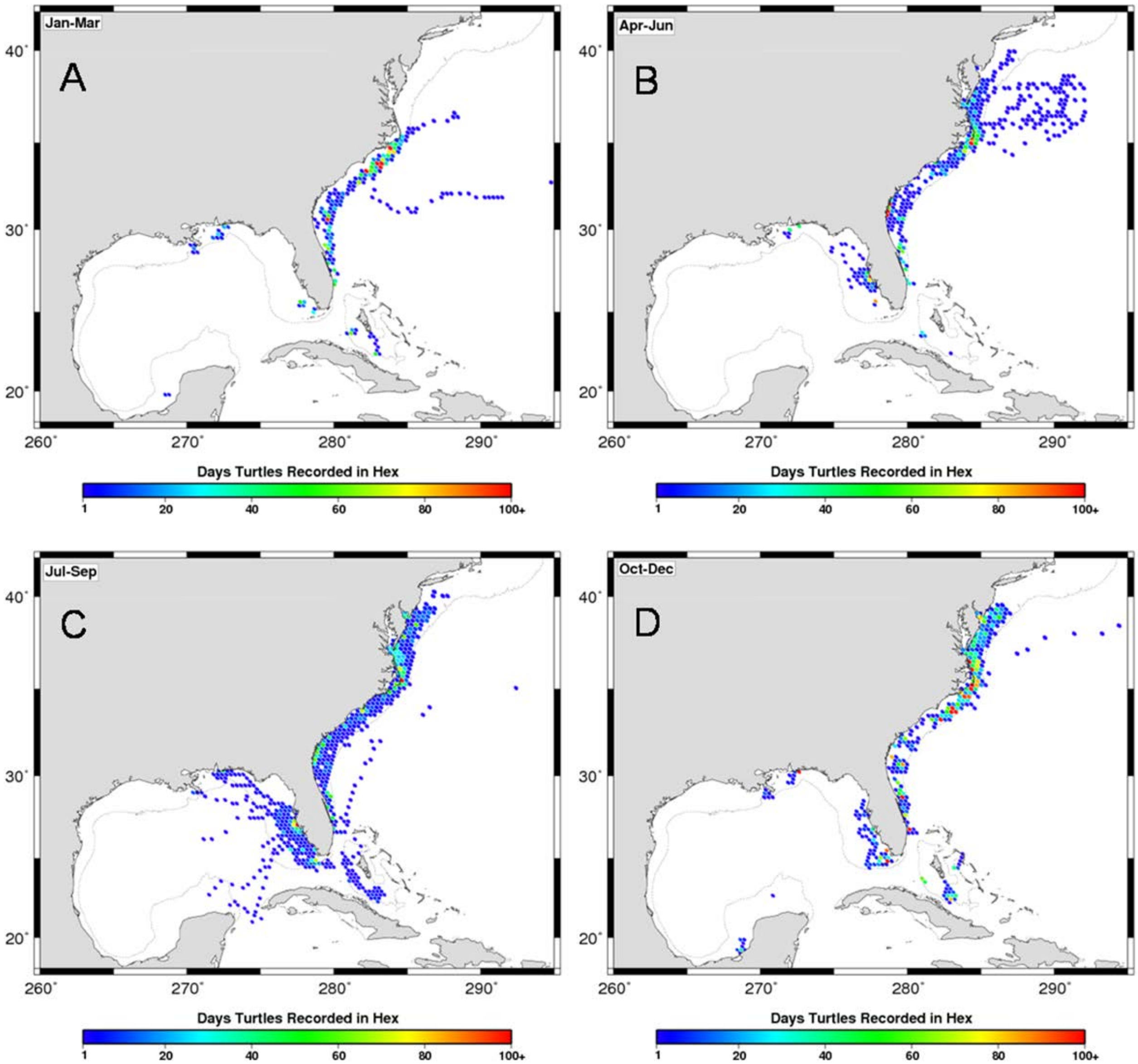


Figure 7A-D. Seasonal movements and coastal habitat use of all nesting loggerhead sea turtles tagged during the summer nesting (n=99 animals; 11,863 days). (A) Winter, January through March (n=54 animals; 1,895 days); (B) Spring, April through June (n=74 animals; 2,456 days); (C) Summer, July through September (n=99 animals; 3,279 days); (D) Fall, October through December (n=74 animals; 4,233 days). Bathymetric contour line=200 m. Note that 38 Florida nesting turtles were not included in these analyses. There are four hexes per degree; each hex represents approximately 669 km^2. The longitudes are based on 360', starting at 0 from the Prime Meridian moving east. (From TEWG 2009, Figures 10A-D.)

For the Northern U.S. subpopulation of nesting loggerheads (n=64; 11,863 track days), high use areas occurred coastally from the North Carolina-South Carolina border north into the Chesapeake Bay and Delaware Bay and directly offshore of the Georgia nesting beaches where several turtles were captured and tagged (Figure 8A). There was some movement by northern nesters south to Florida and into the Gulf of Mexico (Mansfield 2006), as well as some movement off the shelf, particularly east of the Mid-Atlantic Bight. Turtles tracked from the west coast of Florida mostly remained in shelf waters within the eastern Gulf of Mexico (Figure 8B). These turtles ranged as far south as the Gulf side of the Yucatan Peninsula, into the region associated with the Greater Caribbean recovery unit, along the north and west coasts of Cuba, and coastally along the northern Gulf of Mexico offshore of Louisiana and the Panhandle. In addition, Ceriani *et al.* (2012) tracked 14 post-nesting females from Florida's east-central coast. These loggerheads were found to (1) migrate north to the Mid Atlantic Bight (n=6), (2) stay in the waters off Cape Canaveral (n=4), or (3) migrate south to Bahamian and southeast Gulf of Mexico waters (n=4). The few turtles tracked from the Northern Gulf of Mexico subpopulation of nesting females ranged from their nesting beaches (Gulf Islands National Seashore, Florida District) south to the Florida Keys and Dry Tortugas (Figure 8C).

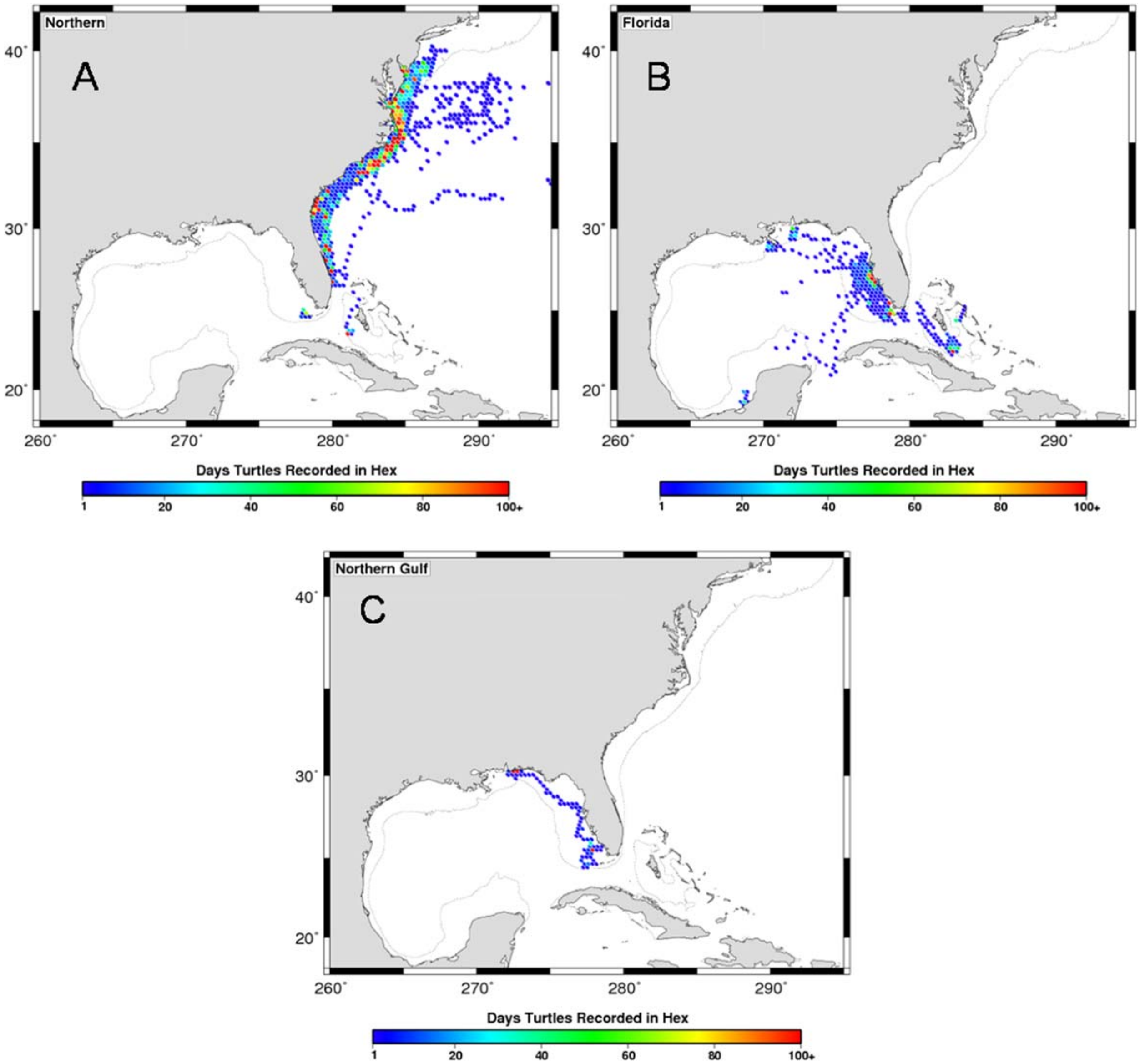


Figure 8A-C. Seasonal movements and habitat use of all nesting loggerhead sea turtles by subpopulation (n=99 animals; 11,863 days). Maps zoomed to coastal region. (A) Northern U.S. subpopulation (n=67 animals; 9,425 days); (B) Peninsular Florida Subpopulation (n=29 animals; 1,938 days); (C) Northern Gulf of Mexico Subpopulation (n=3 animals; 500 days). Bathymetric contour line=200 m. Note that 38 Florida nesters were not included in these analyses. There are four hexes per degree; each hex represents approximately 669 km^2. The longitudes are based on 360', starting at 0 from the Prime Meridian moving east. (From TEWG (2009, Figures 11A-C.)

The TEWG (2009) summarized survey data provide very broad-scale information related to sea turtle distributions along the U.S. coastline. Observed seasonal aerial sightings are very similar to distributions of sea turtles tracked using satellite telemetry. Overall these data show a similar shelf-constrained distribution as well as similar seasonal distributions, particularly during winter months in the northeast.

Loggerheads in neritic habitat show exceptional variability in depth preference, latitude, and general habitat preferences (Hopkins-Murphy *et al.* 2003). NMFS considered available information in evaluating neritic habitat areas, which led to categorizing neritic habitat by loggerhead behavior, i.e., foraging, wintering, breeding, and migration (and accounting for differences in seasonal habitat use). The various loggerhead life history stages using the various habitats were considered within the behavior categories.

III.A.2.b.(i). Foraging Habitat

In U.S. Atlantic waters, foraging loggerheads commonly occur throughout the continental shelf from Florida to Cape Cod, Massachusetts, and in the Gulf of Mexico from Florida to Texas, although their presence in more northern waters (north of Cape Hatteras) is dependent upon suitable water temperature (Shoop and Kenney 1992; Keinath 1993; Epperly *et al.* 1995a; Morreale and Standora 2005; Braun-McNeill *et al.* 2008b; NMFSa 2012). In other words, the foraging grounds for juvenile and adult loggerheads are essentially the entire continental shelf, including estuaries, bays, and sounds (Hopkins-Murphy *et al.* 2003; Morreale and Standora 2005).

Morreale and Standora (2005) note that the attraction to key coastal habitats is likely high productivity, especially benthic biota. These coastal waters, in particular bays and estuaries, contain an abundance of resources which contribute to juvenile health and growth (Morreale and Standora 2005). Neritic juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation (Dodd 1988; NMFS and USFWS 2008). Diet studies have found that food items vary with geographic area and season (Burke and Standora 1993; Plotkin *et al.* 1993; Ruckdeschel and Shoop 1998; Youngkin 2001). Diet shifts over time are also known to occur (Youngkin 2001; Seney and Musick 2007). Specifically, Seney and Musick (2007) evaluated gut contents of juvenile loggerheads in the Chesapeake Bay and documented a shift from predominately horseshoe crabs during the early to mid-1980s, to predominately blue crabs during the 1980s, to finfish (assumed to be discarded by fisheries) in the mid-1990s and in 2000–2002. Adult loggerheads are primarily coastal dwelling and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats, similar to juveniles (NMFS and USFWS 2008). While diet studies have found that hard-shelled arthropods and mollusks dominate neritic loggerhead gut contents (Hopkins-Murphy *et al.* 2003), it is apparent that loggerheads do not have one prey item on which they consistently forage throughout their range.

In-water surveys may also help identify habitat features of important foraging grounds. Arendt *et al.* (2012d) conducted trawl surveys from South Carolina to northern Florida and found loggerhead capture locations to be clustered throughout the survey area. While there were spatial hotspots and cold spots in this area, the origin of spatial clusters could not be explained by biotic and other environmental parameters (Arendt *et al.* 2012d). Mansfield *et al.* (2009) also examined environmental parameters (e.g., SST, chlorophyll *a*, sea surface height, net primary productivity) associated with satellite tracked juvenile loggerheads in the neritic and oceanic environment. Parameter ranges varied by season and by habitat, with the highest chlorophyll values associated with neritic loggerheads during the summer (Mansfield *et al.* 2009).

In addition to the satellite telemetry and aerial survey data indicating high use areas, diet studies examining stomach contents, and trawl studies mentioned above, stable isotope analyses of nitrogen and carbon in loggerhead tissues can provide information on forage species and the environment in which loggerheads foraged (Vander Zanden *et al.* 2010; Ceriani *et al.* 2012; Pajuelo *et al.* 2012a; Pajuelo *et al.* 2012b). Vander Zanden *et al.* (2010) examined scute layers of 15 Florida nesting loggerheads. This analysis found that individual loggerheads were specialist foragers within a generalist population. Specialization is not likely limited to a diet of a single prey item (as loggerhead stomach samples often contain several prey species), but rather a consistent mixture of prey, habitat and geographical location (Vander Zanden *et al.* 2010). Further, a combination of stable isotope and satellite telemetry data were evaluated for females nesting in Florida (Ceriani *et al.* 2012) and nesting on North Carolina, Georgia, and Florida beaches and in a Florida foraging area (Pajuelo *et al.* 2012b). Both studies identified three groups of foraging and migrating loggerheads, where the first group was consistent between studies and the second and third groups varied slightly. The identified groups include: (1) females that migrated north to seasonal foraging grounds in the Mid-Atlantic Bight, with subsequent migration to winter in the South Atlantic Bight; (2) females with year round residency in southern foraging grounds of the Bahamas and southeast Gulf of Mexico (Ceriani *et al.* 2012), (3) females that migrated to year round foraging areas of the subtropical Northwest Atlantic (defined generally as waters south of Cape Canaveral; Pajuelo *et al.* 2012b); (4) females with residency adjacent to the breeding area of eastern central Florida (Ceriani *et al.* 2012), and (5) females that migrated to year round foraging areas of the South Atlantic Bight (Pajuelo *et al.* 2012b). Specifically, Pajuelo *et al.* (2012b) found that loggerheads nesting at higher latitudes mostly foraged in the Mid-Atlantic Bight (72-80%), whereas turtles nesting at lower latitudes (Florida) mostly used the subtropical Northwest Atlantic foraging areas (46-84%). While individual loggerheads and turtles within recovery units may forage at specific locations and have high fidelity to foraging sites, the available data indicates the loggerhead population as a whole uses a wide range of foraging locations. There may also be some individual variability in foraging preference within the large scale foraging areas (Ceriani *et al.* 2012), and occasional shifts in foraging grounds can also be expected (Pajuelo *et al.* 2012b). Large scale geographic regions (e.g., Mid-Atlantic Bight, South Atlantic Bight) used by adult loggerheads to forage can be identified by stable isotope studies, but feeding areas at a finer scale will require the use of additional biomarkers (Pajuelo *et al.* 2012b). Similar results were also observed for resident and migrant adult male loggerhead sea turtles (Pajuelo *et al.* 2012a).

III.A.2.b.(ii). Winter Habitat

Although winter habitat was first evaluated with foraging habitat, NMFS decided to look more closely at winter areas given the unique nature and patterns of this seasonal habitat. As such, this section will focus on loggerhead habitat during the colder months which may also include some foraging habitat.

Cold water temperatures can be lethal for ectothermic marine turtles, with temperatures lower than 10° C leading to cold stunning, the metabolic suppression of activity which may result in stranding and death (George 1997; Milton and Lutz 2003). Water temperatures north of Cape Hatteras decrease in the fall, which coincides with a southerly migration of loggerheads in search of more favorable habitat (Lutcavage and Musick 1985; Byles 1988; Shoop and Kenney 1992; Keinath 1993; Morreale and Standora 2005; Mansfield *et al.* 2009). Hawkes *et al.* (2011) suggested that loggerheads inhabiting northern foraging areas during the summer likely move to winter areas to avoid declining water temperatures (which fall as low as 5° C), whereas loggerheads found in southern foraging areas (off Georgia and Florida) year round do not need to migrate across latitudes in the fall and winter because water temperatures generally remain above 18° C in winter. Aerial surveys conducted off North Carolina and Virginia suggest that turtles are rarely encountered in nearshore waters north of Oregon Inlet or Cape Hatteras during the winter months (Shoop and Kenney 1992; Keinath 1993; Epperly *et al.* 1995a; NMFS 2012a). This pattern is generally supported by satellite tracking of both adult and juvenile loggerhead turtles (Mansfield *et al.* 2009; Hawkes *et al.* 2011; NEFSC and Coonamessett Farm Foundation, unpublished data; Griffin *et al.*, unpublished data). That said, loggerhead distribution relative to Cape Hatteras may vary seasonally and/or annually depending on water temperatures (Epperly *et al.* 1995a; Braun-McNeill *et al.* 2008b), which may vary from year to year.

Loggerhead distribution and behavior in the colder months may vary depending on location and associated environmental features (e.g., Gulf Stream), as well as life stage. Morreale and Standora (2005) note that all turtles migrate southward past Cape Hatteras when water temperatures cool, but the end destination appears to vary. That is, some turtles continue moving to a position far enough south to ensure suitable temperatures throughout the winter (e.g., off Florida), while others move to the closest position with reasonable temperatures (e.g., southern North Carolina). Most satellite tracked juvenile loggerheads from South Carolina were found to spend the winter off South Carolina and Georgia waters, with wider dispersal than in the summer (Arendt *et al.* 2012c). Some juveniles have also been found to leave the continental shelf for oceanic waters during the winter (Keinath 1993; Morreale 1999; Morreale and Standora 2005; Mansfield *et al.* 2009; Arendt *et al.* 2012c), suggesting a further degree of dispersal. This pattern of offshore migration may be a function of finding suitable water temperatures in the Gulf Stream when colder temperatures penetrate the nearshore environment (Morreale and Standora 2005). Similarly, loggerheads were observed to move into deeper offshore waters during the winter in aerial surveys along the Florida east coast (Fritts *et al.* 1983). Fritts *et al.* (1983) postulate that these subtle movements away from shore and into deeper waters may bring loggerheads closer to warm eddies from the Gulf Stream and provide a thermoregulatory advantage. The Gulf Stream does not provide such a distinct temperature gradient near western Florida, as it is irregularly influenced by warm waters from the Loop Current (Fritts *et al.* 1983). However, some adult female loggerheads satellite tracked in the northern Gulf of Mexico were found to move farther offshore or south during the winter (Foley *et al. in review*).

Distribution patterns may vary by area given the influence of warm water currents; however, the consistent pattern is that loggerheads inhabit areas with suitable water temperatures in the winter. While some data suggest wider dispersal in winter than in the summer and movement into oceanic waters (Mansfield *et al.* 2009; Arendt *et al.* 2012c), other evidence indicates loggerheads concentrate in certain areas during the winter. Cape Canaveral, Florida, is one of these winter areas with a concentration of loggerheads, some of which may be brumating[6] (Carr *et al.* 1980; Henwood 1987; Ogren and McVea 1995; Morreale and Standora 2005). The combination of water temperatures, shallow water, and relative production contribute to the suitability of Cape Canaveral during the winter (Morreale and Standora 2005). Henwood (1987) found the greatest concentrations of juvenile loggerheads in the Cape Canaveral ship channel from October to March, where they left the channel in the spring as environmental conditions and foraging opportunities improved, only to return in subsequent winters.

The region south of Cape Hatteras, North Carolina, has been identified as a high use concentration area for loggerheads in the winter months (Keinath 1993; Epperly *et al.* 1995a; Morreale 1999; Mansfield *et al.* 2009; TEWG 2009; Hawkes *et al.* 2011; Ceriani *et al.* 2012; Griffin *et al.*, unpublished data). The difference between wintering areas off Florida and the Gulf of Mexico and waters of southern North Carolina (at what is thought to be the northern extent of suitable winter habitat) is the spatial extent and availability of hospitable habitat, the latter of which is constrained by the influence of the Gulf Stream and colder waters to the north (and inland). The area off southern North Carolina provides consistent warm water habitat and is the closest thermally habitable winter environment for turtles that forage further north (Keinath 1993; Mansfield *et al.* 2009). Favorable temperature and depth regimes occur throughout the winter along the western edge of the Gulf Stream from Cape Hatteras south (Epperly *et al.* 1995a). The Gulf Stream flows along the shelf edge from the south, coming close to shore off

[6] Brumation is defined as winter dormancy in ectothermic vertebrates that demonstrate physiological changes which are independent of body temperature (Mayhew 1965).

Cape Hatteras, then turning offshore to the northeast. The western edge of the Gulf Stream provides warm waters and, together with the confluence of other water masses, creates a dynamic and highly productive environment (Figure 9; SAFMC 2002; Mansfield *et al.* 2009). High upwelling coastal regions have been noted as particular importance for potential foraging areas (McCarthy *et al.* 2010). The rest of this section will focus on winter habitat specifically in North Carolina; for reference, the North Carolina coast, with capes, bays, and inlets noted, is included in Figure 10.

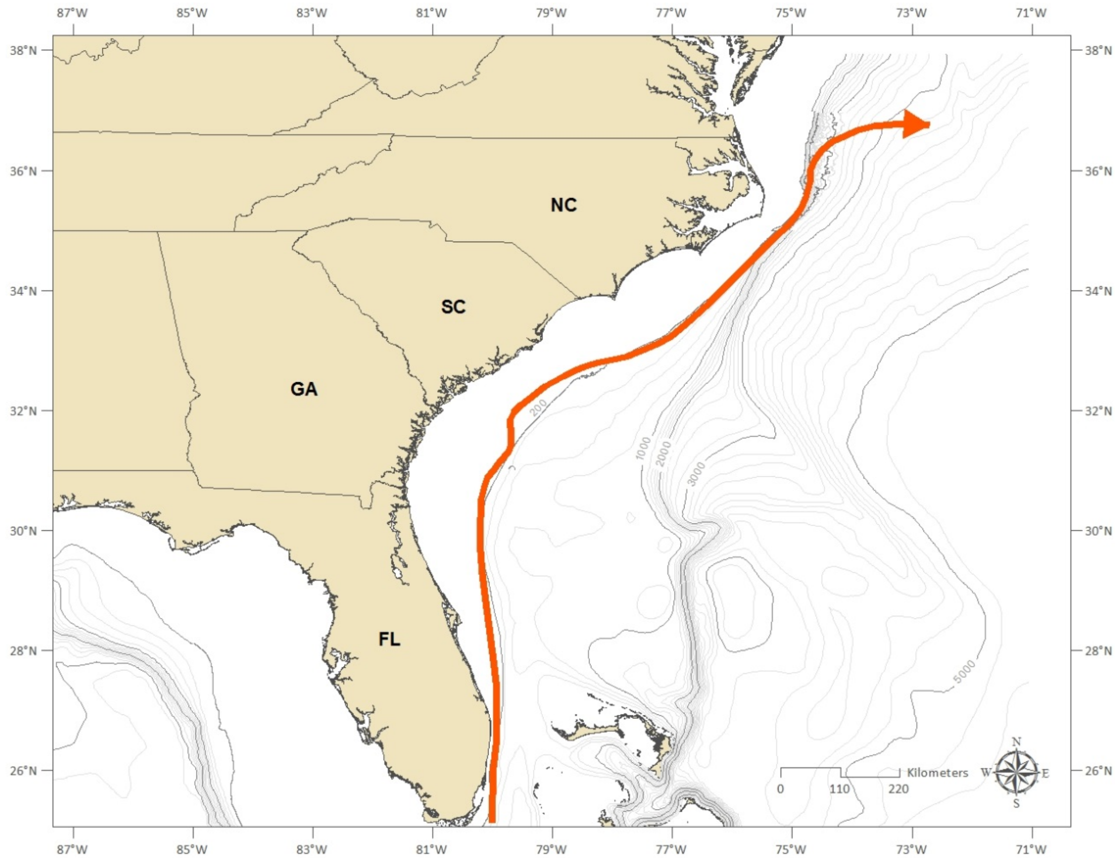


Figure 9. Gulf Stream off the U.S. Coast.

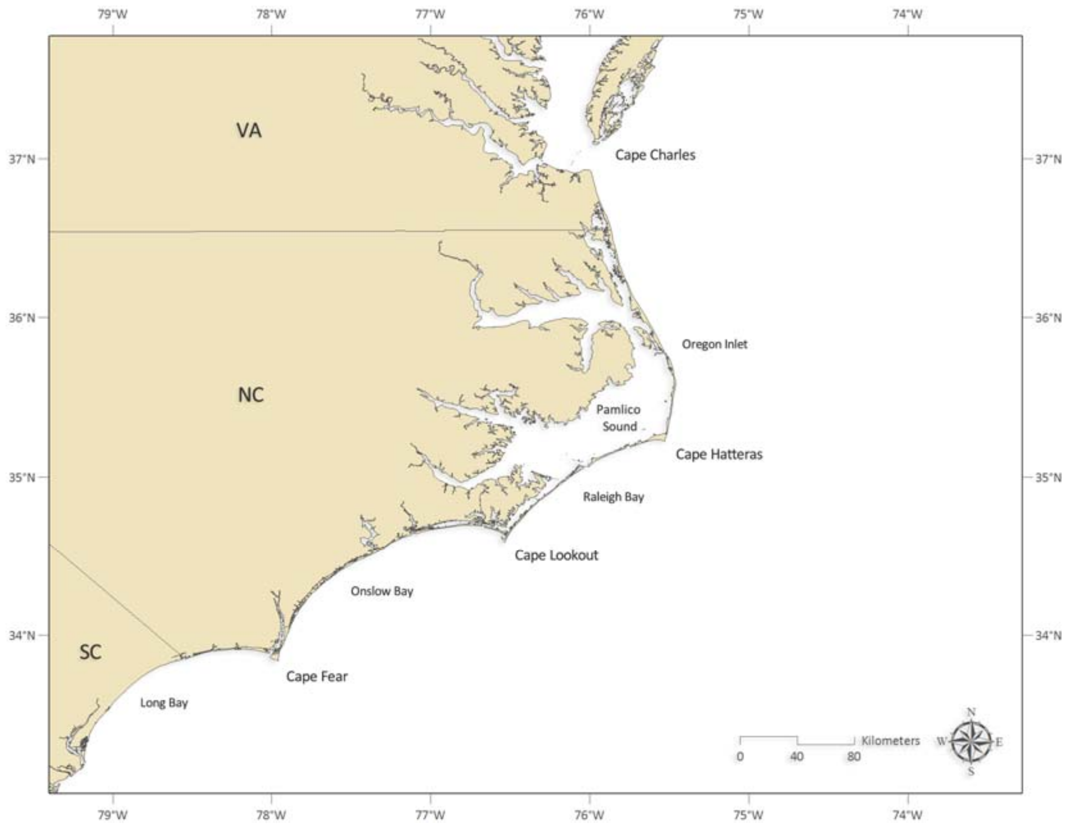


Figure 10. The central Atlantic coast of the United States, with geographical locations of North Carolina noted.

Winter habitat off North Carolina may be particularly important for those turtles seasonally inhabiting northern foraging grounds. In satellite tracks of 68 adult females tagged from the Northern Recovery Unit between 1998 and 2008 (North Carolina, n=24; South Carolina, n=15; Georgia, n=29; Griffin *et al.*, unpublished data), three groups of adult females were observed: (1) Seasonal large scale migrants, which moved north to foraging grounds above 35° N. lat. with subsequent migration south for the winter (n=42); (2) seasonal small scale migrants, which migrated on a west/east gradient, occurring in between Cape Hatteras and Cape Canaveral (n=9); and (3) year-round inhabitants, traveling to foraging areas south of 34° N. lat. where they remained year round (n=14). Three turtles had incomplete data to assign to a group. Data collected from the same subset of satellite tracked adult loggerheads (n=68) suggest turtles may be particularly densely aggregated during the winter (Hawkes *et al.* 2011). During the winter, home ranges for the northern migratory turtles were smaller than in the summer (339 km^2 compared to 645.1 km^2 (130.9 $miles^2$ compared to 249.1 $miles^2$)). These migratory adults were concentrated in a relatively small area (<30,000 km^2 (11583.1 $miles^2$)) on the narrow shelf off North Carolina, south of Cape Hatteras to approximately the North Carolina/South Carolina border. Hawkes *et al.* (2011) found that for those turtles that were tracked through two seasons, the home range repeatability was within 14.5 km (9.0 miles) for the summer (n=8) and 10.3 km (6.4 miles) for the winter (n=3).

The pattern of site fidelity to wintering habitat south of Cape Hatteras has also been demonstrated by juvenile turtles during their neritic phase (Mansfield *et al.* 2009; Avens 2012; NMFS, unpublished data; McClellan, unpublished data). McClellan and Read (2006) found that most of 18 satellite tracked juvenile loggerheads occupied waters off the coast of North Carolina between Oregon Inlet and Onslow Bay during the winter. Additionally, 8 (of 17) juvenile loggerheads tracked by Mansfield *et al.* (2009) established notable fidelity to the waters between Cape Hatteras and Cape Fear during the winter, occurring offshore in association with the western edge of the Gulf Stream near the outer continental shelf. Juvenile loggerhead sea turtles captured off Charleston, South Carolina and monitored by satellite telemetry during the winter were generally located further south than the juvenile loggerheads monitored by McClellan and Read (2007) and Mansfield *et al.* (2009), which Arendt *et al.* (2012c) suggested may represent distinct resident foraging groups occupying the same coastal expanse.

Of areas south of Cape Hatteras, Onslow Bay appears to be particularly heavily utilized during the winter. Griffin *et al*. (unpublished data) analyzed satellite tracks from the same group of post-nesting loggerheads as Hawkes *et al.* (2011) and documented an offshore concentration area (e.g., 10 to 12 loggerheads per 0.01° x 0.01° grid cell) during the winter southeast of Onslow Bay, North Carolina, in between Frying Pan Shoals (off Cape Fear) and Cape Lookout Shoals. This analysis found 29% of tracked adult loggerheads to inhabit this confined area at some point in the winter, which is noteworthy considering the large area along the western edge of the Gulf Stream with water temperatures suitable to loggerheads. The continental shelf is wider around Onslow Bay, compared to Raleigh Bay (between Cape Hatteras and Cape Lookout), and contains a greater prevalence of hard bottom habitat (Deaton *et al.* 2010). Hard bottom habitat is defined by Street *et al.* (2005) as "exposed areas of rock or consolidated sediments, distinguished from surrounding unconsolidated sediments, which may or may not be characterized by a thin veneer of live or dead biota, generally located in the ocean rather than in the estuarine system". In addition to areas of natural hard bottom, man-made structures, including artificial reefs, shipwrecks, and jetties, provide additional substrata for the development of hard bottom communities (Deaton *et al.* 2010). There are as yet no studies quantifying loggerhead substrate preferences, but loggerheads have been found to more frequently inhabit areas with hard bottom substrate (Hopkins-Murphy *et al.* 2003). Hard bottom habitat extends from the shoreline to beyond the continental shelf edge, generally occurring in clusters in specific areas (SEAMAP-SA 2001). Parker *et al.* (1983) estimated that hard bottom accounts for approximately 14% (504,095 acres) of the substratum between 27 and 101 m water depth from Cape Hatteras to Cape Fear. Over 92% of the identified hard bottom in North Carolina waters are south of Cape Lookout, particularly in the southern half of Onslow Bay and in northern Long Bay (Deaton *et al.* 2010). There are also outcrops of hard bottom in shallow water near the shoals of Cape Fear and Cape Lookout. Further studies of the extent to which loggerhead turtles rely on hard bottom habitats would enable further resolution of habitat suitability and provide additional insight into the relationship between hard bottom and loggerhead distribution in southern North Carolina waters. However, it is noteworthy that satellite telemetry data show a concentration of loggerheads in Onslow Bay during the winter (Mansfield et al. 2009; Hawkes *et al.* 2011; Griffin *et al.*, unpublished data; Avens 2012; NMFS, unpublished data) and there is also a prevalence of hard bottom habitat in the same area, albeit somewhat patchy and dispersed throughout the area (Deaton *et al.* 2010).

Hawkes *et al.* (2011) postulate that some northern migratory turtles may winter in offshore waters in southern North Carolina, because they are deeper and thus would be expected to be more thermally stable than inshore waters. In the winter, Hawkes *et al.* (2011) found seasonal migratory turtles in cooler, deeper waters farther offshore than in the summer (winter median: 21.1° C (70.0° F), 39.3 m (128.9 ft) depth and 75.5 km (46.9 miles) offshore, versus summer median: 23.4° C (74.1° F), 21.7 m (71.2 ft) depth and 17.2 km (10.7 miles) offshore). This same pattern of loggerheads moving into deeper offshore shelf waters during the winter has been observed in other areas (Fritts *et al.* 1983; Arendt *et al.* 2012c; Foley *et al. in review*; Griffin *et al.*, unpublished data), and for juvenile loggerhead turtles off North Carolina (McClellan, unpublished data). From 2009-2012, NEFSC and Coonamessett Farm Foundation satellite tagged 87 juvenile loggerheads from mid-Atlantic foraging grounds and found that loggerhead winter locations south of Cape Hatteras were generally between the 20 m (65.6 ft) and 100 m (328.1 ft) bathymetry contour (NEFSC and Coonamessett Farm Foundation, unpublished data). Six adult female loggerheads tracked from Florida nesting beaches also spent the entire winter on the continental shelf in between the edge of the Gulf Stream and the 50 m (164 ft) isobath in between Cape Hatteras and Cape Fear (Ceriani *et al.* 2012; Ceriani 2012, pers. comm.). Further, Duke University conducted vessel surveys from 2007-2012 in offshore Onslow Bay waters. During the months of November through April, the average depth of loggerhead sightings (n=79) was approximately 43 m (141.1 ft), with a range of 32.7 to 237.7 m (107.3 to 779.9 ft; Read 2013, pers. comm.). Given the available data, the CHRT considered winter loggerhead distribution south of Cape Hatteras through Onslow Bay to be generally confined to depths between 20 m (65.6 ft) and 100 m (328.1 ft).

Water temperature is likely the primary driver of winter loggerhead distribution and habitat use off North Carolina. As stated, loggerheads have been documented in more offshore waters during the winter than in the summer, and in cooler water temperatures (Fritts *et al.* 1983; Hawkes *et al.* 2011; Arendt *et al.* 2012c; Foley *et al. in review*; Griffin *et al.*, unpublished data; McClellan, unpublished data). Off the coast of North Carolina, satellite tracked adult female loggerheads inhabited waters with a median temperature of 21.1° C (70.0° F) during the winter, with a range of 17.8 to 23.5° C (64 to 74.3° F; Hawkes *et al.* 2011). Available information on satellite tracked juvenile loggerheads in the winter off North Carolina found a mean temperature of 15.5° C (59.9° F; McClellan, unpublished data). Epperly *et al.* (1995a) found an association of aerial observed turtles with warm waters west of the Gulf Stream in Raleigh, Onslow and Long Bays; relatively few turtles were sighted in waters less than 11° C (51.8° F). Given the available data and range of temperatures, the CHRT considered the suitable water temperature south of Cape Hatteras through Onslow Bay during the winter to be above 10° C (50° F), near the lower range for loggerhead thermal tolerance.

The nature of loggerhead behavior during the winter has not been quantified, but turtles off southern North Carolina during the winter are likely exhibiting the suite of typical loggerhead behavior including foraging, diving, and resting. Epperly *et al.* (1995a) recorded sea turtle captures in the summer flounder trawl fishery from November through February, with most of the turtles caught south of Cape Hatteras. Turtles were generally active when caught, not brumating or cold-stunned, and had been on the bottom and apparently had been feeding recently. Brumation has been described for sea turtles in the Cape Canaveral ship channel, Florida (Carr *et al.* 1980; Ogren and McVea 1995), and Mansfield *et al.* (2009) note that there have been unpublished anecdotal observations of turtles brumating in nearshore waters off southern North Carolina during the winter. Further, dive durations for both adult loggerheads (Hawkes *et al.* 2007; Arendt *et al.* 2012b) and juvenile loggerheads (Arendt *et al.* 2012c) during the winter (not limited to North Carolina) were significantly longer than in the summer. It is possible that loggerheads south of Cape Hatteras in the winter are exhibiting two different strategies, which may not be mutually exclusive: (i) actively inhabiting the western edge of the Gulf Stream to capitalize on the warm water influence and increased productivity (Epperly *et al.* 1995a; Mansfield *et al.* 2009), or (ii) staying near the ocean bottom and maintaining low activity levels throughout the winter (based upon diving patterns; Arendt *et al.* 2012b; Arendt *et al.* 2012c; Hawkes *et al.* 2007). Epperly *et al.* (1995a) hypothesized that the presence of turtles in the winter around Cape Hatteras may be explained by turtles searching out warm water areas associated with the western wall of the Gulf Stream, but actively avoiding the Gulf Stream to avoid being transported northward. Gulf Stream currents can reach high velocities (average speed 6.4 km per hour (4 miles per hour); http://oceanservice.noaa.gov/facts/gulfstreamspeed.html), and may constrain the preferred habitat to a narrowly defined area, if extra costs are incurred to maintain home ranges in those fast moving waters. The narrowness of the continental shelf and the potential influence of the Gulf Stream serve to concentrate sea turtles emigrating from the Mid-Atlantic Bight and North Carolina Sounds (Epperly *et al.* 1995a). However, some juvenile loggerheads have been found to enter the Gulf Stream around Cape Hatteras (McClellan and Read 2007; Mansfield *et al.* 2009; Arendt *et al.* 2012c), so instead of avoiding the Gulf Stream, some turtles may benefit from its warm water transport.

In general, loggerhead behavior in the winter may vary given the influence of cooler water temperatures and the preference for waters near the Gulf Stream for a thermoregulatory advantage. While loggerheads from northern foraging areas may inhabit other areas during the winter (e.g., Georgia and Florida; Hawkes *et al.* 2007; Mansfield *et al.* 2009), the best available data indicates that the area south of Cape Hatteras is an important winter concentration area, especially for turtles from the Northern Recovery Unit and other Recovery Units that may forage in northern waters. There may be some variability in the greatest concentration of loggerheads during the winter in the southern North Carolina area, given variations in SST, but the important habitat features that consistently provide for winter concentrating habitat occur south of Cape Hatteras. Based upon satellite tracks and the habitat features in the area, the important winter habitat extends to the waters off Cape Fear in the south. Inhabiting the area between Cape Hatteras and Cape Fear during the winter at the edge of the Gulf Stream minimizes migratory distance back to northerly summer foraging areas, and therefore the time and energy needed to reach them, while avoiding cold winter temperatures in inshore waters at the same latitude, and reducing the energetic costs necessary to maintain a position within the strong currents of the Gulf Stream (Epperly *et al.* 1995a; Hawkes *et al.* 2007; Mansfield *et al.* 2009). The greatest loggerhead concentration in the winter area south of Cape Hatteras occurs from November through April (Mansfield *et al.* 2009; Hawkes *et al.* 2011; Griffin *et al.*, unpublished data).

III.A.2.b.(iii). Breeding Habitat

Loggerhead breeding likely occurs anywhere that reproductively active males and females encounter each other during the breeding season. However, efficient propagation of such a widely dispersed species would require that breeding-age adults either remain in regular proximity to each other or migrate to specific locations at specific times to gather for breeding. Arendt *et al.* (2012b) concluded that loggerheads in the Northwest Atlantic Ocean DPS use both strategies. Some reproductively mature males and females co-occur on foraging grounds year round, while others migrate to and concentrate in established areas during the breeding season (Hawkes *et al.* 2011; Arendt *et al.* 2012b; Foley *et al. in review*). Mating primarily begins a few weeks prior to the nesting season and may last more than six weeks (Miller *et al.* 2003). The nesting season for loggerhead turtles in the Northwest Atlantic is typically from late April to early September (NMFS and USFWS 2008). While evidence of spatial clustering and in-water site fidelity is seen for loggerheads of various age groups including adults (Hawkes *et al.* 2011; Arendt *et al.* 2012d), overall adult loggerhead sea turtles are widely distributed throughout the Northwest Atlantic and Gulf of Mexico outside of the mating and nesting season. Given the importance of this life stage and behavior (breeding) to the conservation of loggerheads, NMFS reviewed the available data on known breeding areas to identify high use breeding areas. It is possible that there are other important breeding areas throughout the southeast Atlantic and Gulf of Mexico, but the best available data supports specific high-density breeding aggregations and certain resulting habitat features. NMFS recognizes the data limitations and inherent difficulty in identifying every breeding area that marine species inhabit, so used the known concentration areas in which to frame the evaluation for critical habitat designation.

While mating is also prevalent offshore of the nesting beaches, two primary breeding sites have been identified in the scientific literature as containing large concentrations of reproductively active male and female loggerheads in the spring, prior to the nesting season. The first is off southern Florida, from the shore out to the 200 m (656 ft) contour in between the Marquesas Keys and the Martin County/Palm Beach County line. Foley *et al.* (*in review*) concludes that this area is serving as a concentrated breeding site based upon their research on turtle movements in the migratory corridor, along with other studies on adult male and female movements and capture data, and anecdotal reports of mating pairs. This is further supported by unpublished data of reproductively active male and female loggerheads in this area prior to the nesting season (Foley 2012, pers. comm.).

The second area identified as a concentrated breeding site is located in the nearshore waters just south of Cape Canaveral, Florida. That the area off Cape Canaveral is utilized by loggerheads to congregate for breeding is not surprising. The location is central to the high value Florida east coast nesting beaches as defined in the draft USFWS Proposed Rule for the Designation of Critical Habitat for the Northwest Atlantic Ocean Distinct Population Segment of the Loggerhead Sea Turtle (78 FR 18000, March 25, 2013) and at the northern extent of the Southern Florida migratory corridor (see Constricted Migratory Habitat below). Arendt *et al.* (2012a) analyzed the spatial distribution of tagged adult male turtles and determined minimum convex polygons (MCPs) that defined the areas utilized by the males both during and after the breeding season. NMFS determined that the breeding season MCP provided the best available starting point for delineating aconcentrated breeding site that is essential to the conservation of the species. This breeding MCP encompasses a total area of 4,019.7 km^2 (1552.0 mi^2), incorporating both inshore areas such as portions of the Indian River and Banana River lagoons and extending offshore to depths below 60 m (196.9 ft.). While mating does occur across a larger area than the MCP and further out from shore, it appears to be more common closer to the nesting grounds (Owens 2012, pers. comm.). NMFS then truncated the area defined by the MCP to exclude the inshore waters (the Port basin and canals, and the Indian River and Banana River portions) and establish the western boundary of the critical habitat breeding area as the COLREGS lines, with the remainder of the area matching the breeding area MCP from Arendt *et al.* (2012a). While the inshore areas of the MCP were based upon actual satellite-derived locations, they only represented a small percentage of the points used to generate the MCP (Arendt pers. comm. 2013). According to researchers who have done extensive work in the area, the actual occurrence of adult, breeding loggerhead sea turtles in those inshore waters is not common (Bagley pers. comm. 2013; Chambers pers. comm. 2013; Provancha pers. comm. 2013).

While it is clear that these areas represent important breeding areas for loggerhead sea turtles, we had difficulty identifying specific habitat features that define the areas and provide their functionality as a breeding area. There is little to distinguish the area from areas to the north and south along Florida’s east coast with regard to depth contour, geological features, or other habitat variables. The presence of Port Canaveral and the associated shipping channels was considered, but anecdotal information indicates that loggerhead aggregations occurred in the area prior to the creation of the Port (Arendt 2012, pers. comm.). Additionally, the aggregation of loggerheads in the Canaveral area extends well beyond the shipping channels, including the area north of the cape (Schroeder and Thompson 1987).

Given the lack of clear habitat features, it is reasonable to conclude that the importance of the breeding areas is based primarily on their locations. The first area is located within the southern Florida migratory corridor leading to the prime nesting habitat, and the second area is central to the prime nesting habitat along the east coast of Florida and at the northern end of the migratory corridor.

III.A.2.b.(iv). Constricted Migratory Habitat

Loggerhead sea turtles are wide ranging, with individuals often traveling long distances among nesting, breeding, and foraging sites. NMFS examined satellite telemetry information regarding the movements of loggerhead sea turtles, as well as the geographical features of the continental shelf habitat. As neritic loggerhead distribution is limited to continental shelf waters, the features of the shelf are particularly important to investigate. The continental shelf appears to be a natural delineation for migratory corridors of juveniles and adults. Although some individuals take less direct migratory routes, and some even cross the shelf out to open waters to access foraging grounds in the Caribbean (Arendt *et al.* 2012b; Ceriani *et al.* 2012), telemetry data from most studies shows all but a few individuals migrating to or from nesting and foraging grounds use waters between land and the shelf break and/or nearshore current (Gulf Stream/Florida Current).

As a result, NMFS has identified two migratory corridors that are constricted in width, as indicated by both the width of the continental shelf and available satellite tracks, and thus more vulnerable to perturbations than other migratory areas along the continental shelf. These occur off the coast of North Carolina and Florida.

North Carolina. As noted above, sea turtles are highly migratory and ectothermic, thus linked to the thermal constraints of their environment (Spotila *et al.* 1997b). Many sea turtles migrate northward into waters of Virginia through Massachusetts when water temperatures increase in the spring, and southward as water temperatures decline in the fall (Lutcavage and Musick 1985; Byles 1988; Shoop and Kenney 1992; Keinath 1993; Morreale and Standora 1998; Morreale and Standora 2005; Braun-McNeill *et al.* 2008b; Mansfield *et al.* 2009; Hawkes *et al.* 2011; Griffin *et al.*, unpublished data). Loggerheads inhabit these northern foraging areas from approximately May through November (Shoop and Kenney 1992; Morreale 1999; Mansfield *et al.* 2009). During the winter, loggerheads are generally found south of Cape Hatteras (Epperly *et al.* 1995a; Griffin *et al.*, unpublished data).

Loggerheads found migrating along the U.S. Atlantic coast into northern foraging waters may be juveniles (Mansfield *et al.* 2009) or adults (Hawkes *et al.* 2011; Arendt *et al.* 2012b; Ceriani *et al.* 2012; Griffin *et al.*, unpublished data). Available genetic information indicates that juvenile loggerheads foraging in northern areas originate from multiple recovery units in the Northwest Atlantic Ocean DPS (Rankin-Baransky *et al.* 2001; Bass *et al.* 2004; Bowen *et al.* 2004). Adult loggerheads found in northern foraging areas likely originate from the Northern Recovery Unit (TEWG 2009) and the Peninsular Florida Recovery Unit (Ceriani *et al.* 2012), as indicated by satellite tracks of post-nesting females. As such, loggerheads migrating to and from northern foraging areas include mixed genetic stocks as well as neritic adults and juveniles.

For those loggerheads that migrate northward in the spring (to foraging areas in the Mid-Atlantic Bight), and southward in the fall (to waters with more suitable water temperatures, e.g., south of Cape Hatteras), passage through the waters off North Carolina is necessary. The continental shelf offshore North Carolina narrows to approximately 30 km (18.6 miles) in width off Cape Hatteras (SAFMC 2002). The shelf width of the Mid-Atlantic Bight is approximately 100 km, narrowing off Cape Hatteras, and then increasing southward from Cape Hatteras to roughly 100 km (62 miles) in Onslow Bay (Werner *et al.* 1999). The shelf break depth ranges from approximately 150 m (492 ft) in the Mid-Atlantic Bight to 50 m (164 ft) off Cape Hatteras to 70 m (230 ft) in Onslow Bay (Werner *et al.* 1999). Arendt *et al.* (2012b) calculated distance from shore to the 100 fathom (182.88 meter) line in 0.25 degree intervals to evaluate male loggerhead migration routes relative to the width of the continental shelf. This analysis found that the width of the shelf offshore North Carolina narrows considerably between 34.75° and 36° N. lat. This results in a narrow strip of available neritic habitat off North Carolina.

Tracking studies have found that loggerheads inhabit a narrow corridor offshore of Cape Hatteras during their migratory routes (Mansfield *et al.* 2009; Hawkes *et al.* 2011; Arendt *et al.* 2012b; Griffin *et al.*, unpublished data). This narrow corridor of continental shelf waters extends to the north and south, until the continental shelf widens and the turtles have a larger available area to inhabit. Satellite tracked adult female (Griffin *et al.*, unpublished data) and adult male

(Arendt *et al.* 2012b) loggerheads were found to occupy most of the wide continental shelf during migration, narrowing their tracks at Cape Hatteras. Loggerheads use the narrow continental shelf waters off North Carolina to transit to neritic foraging areas in the north and to return to warm water winter areas and/or nesting areas in the south, and some juveniles may transition into oceanic habitats at this juncture (Keinath 1993; Morreale and Standora 2005; McClellan and Read 2007; Mansfield *et al.* 2009; Griffin *et al.*, unpublished data). At Cape Hatteras, juvenile loggerheads have been tracked entering the Gulf Stream, some of which travel to the North Atlantic gyre off the Grand Banks (McClellan and Read 2007; Mansfield *et al.* 2009). However, it is also worth noting that juveniles captured and tagged further south shifted east of the continental shelf between 33.2 and 34.8° N, exclusively south of the shelf constriction off the North Carolina coast (Arendt *et al.* 2012c). Nevertheless, the influence of the fast moving Gulf Stream may promote distribution to oceanic environments for younger loggerheads, but may also play a role in constricting migratory movements of neritic adults and juveniles. While some loggerheads may move offshore with the Gulf Stream at the junction of Cape Hatteras, the majority of telemetry data shows neritic juveniles and adults transiting the waters of the narrow continental shelf along the North Carolina Outer Banks (Morreale and Standora 2005; Mansfield *et al.* 2009; Hawkes *et al.* 2011; Arendt *et al.* 2012b; Griffin *et al.*, unpublished data).

This migratory corridor is most heavily used during the spring (April, May and June) and fall (September, October, November) migration period. Mansfield *et al.* (2009) tracked 15 neritic juvenile loggerheads following a north-south migratory route. These turtles migrated south past Cape Hatteras between September 20 and November 15, beginning when SST dropped below 20° C (68° F). Five of these loggerheads were tracked migrating back to waters north of Cape Hatteras from mid-May to early June, when SST warmed above 21° C (69.8° F). This migratory pattern has also been found in adult female telemetry studies (n=42), with a median southern migration date of October 13 (range August 27-December 23) and a median migration date to the north of March 9 (range February 4-May 14; Hawkes *et al.* 2011). Further, Arendt *et al.* (2012a; 2012b) satellite tagged 29 adult male loggerheads from Port Canaveral, Florida, and found that 16 migrated after the breeding season, 11 males of which migrated to the north. All of the migratory males that passed by North Carolina did so through a narrow continental shelf corridor between 34.7° and 35.3° N. lat., moving northward between May and June (Arendt *et al.* 2012b). Two were tracked southward through the same corridor between September and November; contact with the other nine northern foraging males was lost in August, but they also likely overwintered in the south given unsuitable water temperatures north of Cape Hatteras (Arendt *et al.* 2012b). Adult female loggerheads have also been tracked through this corridor after nesting (in July and August; Mansfield 2006; Griffin *et al.* 2012, unpublished data). Based upon these studies, the specific date of passage along the narrow shelf area off Cape Hatteras is variable, but it is apparent that the corridor off Cape Hatteras is used by migrants from April through November, most heavily during the spring and fall time periods.

Southern Florida. Foley *et al.* (*in review*) identified four post-nesting migratory corridors used by Florida turtles: Two on the continental shelf of the Florida Panhandle, one near Cuba and thus out of U.S. waters, and one along the southeastern coast of Florida from the Keys to the central east coast of the state. A northward migratory route along the continental shelf from the nesting and breeding areas of the central east coast of Florida has also been shown to be important in a number of studies (Meylan *et al.* 1983; Dodd and Byles 2003; Arendt *et al.* 2012b; Ceriani *et al.* 2012). Turtles from the NRU that migrated south to the Keys and the Bahamas also used this migratory route off of east Florida (Griffin *et al.*, unpublished data)

Of the migratory corridors along the continental shelf that have been identified for Florida turtles, the one that is constricted (where the shelf narrows) occurs in southeastern Florida. This southern Florida corridor stretches from the western edge of the Marquesas Keys to Cape Canaveral, with the shelf, and migratory route used by the turtles, widening substantially beyond each of the end points. The narrow shelf (a few km wide along the Florida Keys to under 2 km (1.2 mi) wide at its narrowest off West Palm Beach, with a gradual widening north of West Palm Beach up to Cape Canaveral where it is around 50 km (31.1 miles) wide) results in a highly defined, constricted migratory corridor serving as a densely-used turtle "highway" that appears to be important for a large proportion of the Peninsular Florida Recovery Unit. Foley *et al.* (*in review*) found that eight of the 15 post-nesting females they tracked from the Archie Carr National Wildlife Refuge (NWR) followed the narrow route along the coast of southern Florida. Of those eight, seven ended their migration on the southwest Florida shelf and one continued west of Cuba. Ceriani *et al.* (2012) saw two of their 14 tracked turtles from the Archie Carr NWR utilize the southern Florida corridor for post nesting migration, while others traveled north along the shelf or out to the Caribbean. The importance of that route was also noted from anecdotal information cited in Meylan *et al.* (1983) where aerial surveys for bluefin tuna resulted in the sightings of hundreds of loggerhead turtles along the Florida Keys reef tract in mid-to-late May 1976 and 1977, during what is the breeding season and early nesting season. The same surveys found only a few turtles at any given time in April and early May in the same areas. The use of this migratory corridor has also been documented for some adults and juveniles making their fall migration from the Mid-Atlantic Bight area to the Gulf of Mexico (Mansfield 2006; Mansfield *et al.* 2009). While most of the research conducted has involved post-nesting females, there is information that male loggerheads also use the same corridor for reproduction-related migrations (Arendt *et al.* 2012b). It is also notable that a portion of the Southern Florida migratory corridor also serves as a concentrated breeding site.

III.A.3. *Sargassum*

This section applies to habitat found in both the neritic and oceanic environment. In the Northwest Atlantic, post-hatchling, small oceanic juvenile, and some neritic juvenile loggerheads inhabit areas where surface waters converge to form local downwelling (Witherington 2002;

Witherington *et al.* 2012). These areas are characterized by accumulations of floating material, especially pelagic *Sargassum* (a genus of brown macroalgae), and are common between the Gulf Stream and the southeastern U.S. coast, and between the Loop Current and the western Florida coast in the Gulf of Mexico. Surface convergence zones consolidate a variety of floating material, including woody material, seagrass, and synthetic debris (as observed by Witherington *et al.* 2012), but pelagic *Sargassum* is prolific.

Pelagic *Sargassum* primarily includes *Sargassum natans* (more abundant) and *Sargassum fluitans*. These holopelagic species are typically 20 to 80 cm in diameter and contain numerous pneumatocysts which keep the plants positively buoyant (SAFMC 2002). *Sargassum* is generally found at the water surface (up to 3 m (9.8 ft) in depth; Casazza and Ross 2010), but sinks with downwelling velocities exceeding 4.5 cm/sec. Propagation is by vegetative fragmentation (SAFMC 2002). *Sargassum* and other flotsam can be arranged within long linear or meandering rows collectively termed "windrows" as a result of Langmuir circulations, internal waves, and convergence zones along fronts, but when currents and winds are negligible, *Sargassum* is also found in broad irregular mats or scattered clumps (Comyns *et al.* 2002; SAFMC 2002).

Witherington *et al.* (2012) found that the distribution of post-hatchling and early juvenile loggerheads was determined by the presence of *Sargassum*. *Sargassum* rafts are likely not the only habitat of this life stage, as young turtles move through other areas where *Sargassum* does not occur (Carr and Meylan 1980); however, loggerheads may be actively selecting these habitats for shelter and foraging opportunities. Behavioral studies have shown that neonate loggerheads are attracted to floating seaweed and hide motionless for long periods of time in the weed (Mellgren *et al.* 1994; Mellgren and Mann 1996). Further, Smith and Salmon (2009) conducted laboratory and field experiments with post-hatchling loggerhead and green turtles and found that the turtles oriented towards *Sargassum.* Post-hatchlings remain at or near the surface for the majority of the time while in the *Sargassum* environment (Mansfield *et al.* 2012; Mansfield and Putman *in press*). Witherington *et al.* (2012) found the majority of loggerheads to be within 1 m (3.3 ft) of *Sargassum*, and of those turtles, most were inactive at the surface, suggesting that they were drifting with *Sargassum* rather than transiting through it. Of the turtles that were active at the surface, most were found with their front flippers or mouths actively touching or manipulating *Sargassum*, a behavior consistent with active foraging (Witherington *et al.* 2012). Available information indicates that the pelagic *Sargassum* habitat occurring in areas with surface downwelling is important cover and foraging habitat for post-hatchling and juvenile loggerheads. Neritic size loggerheads are also found in association with *Sargassum* on the continental shelf (Witherington 2012, pers. comm.).

Pelagic *Sargassum* supports a diverse assemblage of marine organisms, including over 100 species of fish, fungi, micro- and macro-epiphytes, at least 145 species of invertebrates, four species of sea turtles, and numerous marine birds (SAFMC 2002). The planktonic community beneath the *Sargassum* along the Gulf Stream front is more productive than the core of the Gulf Stream or the waters of the outer continental shelf, and potential loggerhead food is in greater abundance than the surrounding water (Richardson and McGillivary 1991). Witherington (2002) captured post-hatchling loggerheads in association with floating material near a Gulf Stream front off east-central Florida. Sixty-six loggerheads were given a gastric-esophageal lavage, with results showing a preference to animal material (71 percent; including hydroids, copepods, and *Membranipora*) over plant material (23 percent; including *Sargassum* fragments, sea grasses and cyanobacteria). Lavage samples also included tar and plastics. Of the identifiable biota within the lavage samples, 70 percent were organisms associated with the *Sargassum* community (see Witherington 2002). Witherington *et al.* (2012) propose that the diet of turtles found within the *Sargassum* community is that of a generalist, opportunistic omnivore.

Sargassum is widespread and the geographical and temporal distributions are variable and not well understood. Most pelagic *Sargassum* in the Atlantic circulates between 20° N. and 40° N. lat. and 30° W. long. and the western edge of the Florida Current/Gulf Stream (SAFMC 2002; Dooley 1972). These downwelling *Sargassum* areas also occur close to the shore and in the Gulf of Mexico (Bortone *et al.* 1977; Gower and King 2011), and may occur in the Atlantic as far north as the Grand Banks (Dooley 1972; SAFMC 2002). Gower and King (2011) mapped the distribution and movement of pelagic *Sargassum* in the Gulf of Mexico and western Atlantic using satellite imagery and found a temporal pattern from year to year. Results from 2002–2008 show high concentrations of *Sargassum* in the northwest Gulf of Mexico in all years (besides 2002) from March to June (Figure 11). *Sargassum* emerged initially in the northwest Gulf of Mexico in the spring (March) of each year, and there was a spread eastward into the central and eastern Gulf of Mexico. *Sargassum* detection counts were very low in the Atlantic for the months of March, April, and May from 2003 to 2007; however, in 2008, significant *Sargassum* remained in the area northeast of The Bahamas in those months. In July, *Sargassum* appeared in both the Gulf of Mexico and a widespread area of the Atlantic east of Cape Hatteras, spreading further east (approximately to 45° W. long.) by September and ending up northeast of The Bahamas in February of the following year (Gower and King 2011; Figure 11). Gower and King (2011) report that the northeast trade winds then move the *Sargassum* south and west over autumn and winter (October to February). After September, few concentrations are present in the Gulf of Mexico. This monthly movement is consistent from year to year and likely influenced by prevailing surface currents and winds, and supported by historical surveys from ships (Gower and King 2011). Based on their findings, Gower and King (2011) conclude that that most pelagic *Sargassum* has a life span of one year or less, with the major “nursery area” being in the northwest Gulf of Mexico. This was the pattern observed from satellite imagery in 2002 to 2007 and subsequently observed in 2009–2010 (Gower 2012, pers. comm.), and provides some level of temporal distribution and possible important concentration over large areas. However, it should be used as a guide and not an ultimate predictor of *Sargassum* occurrence in small areas over time, as patterns observed in 2011 were different, e.g., significant concentrations were at approximately 7° N. lat. and 45° W. long. in April, spreading to Africa and the Caribbean by July (Gower 2012, pers. comm.).

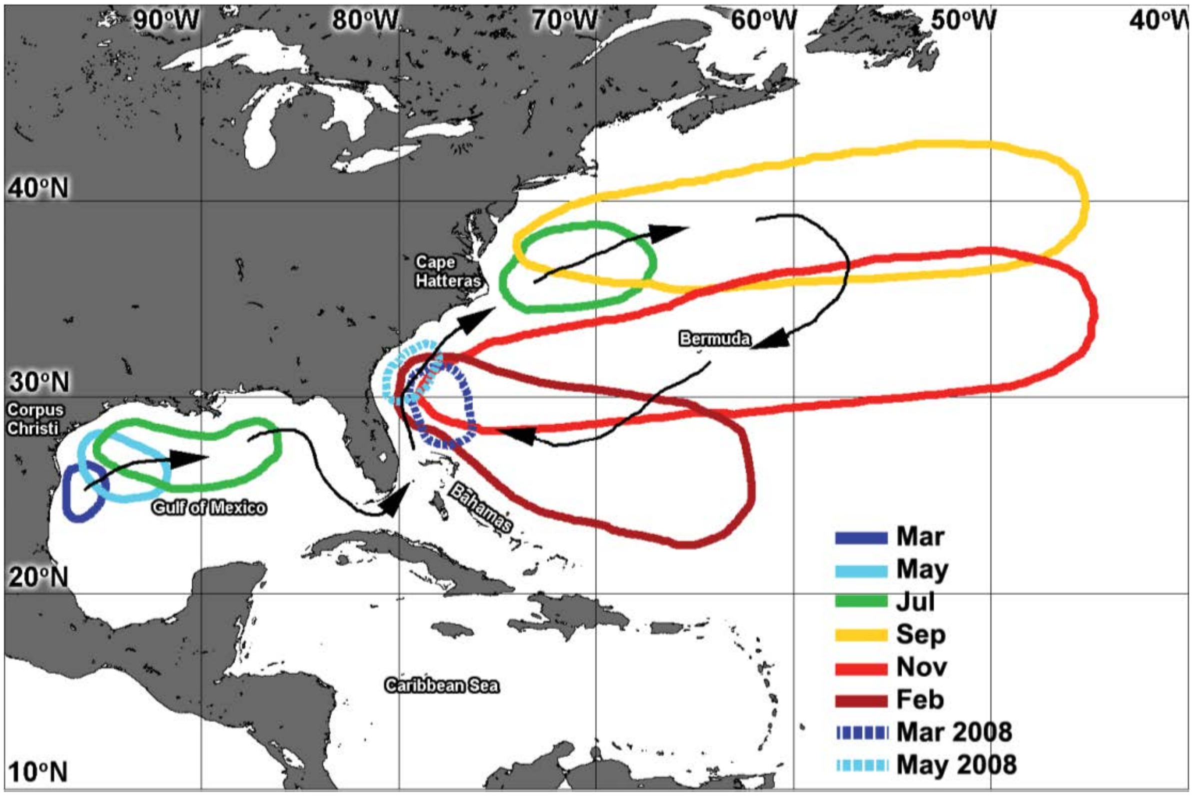


Figure 11. Simplified outline diagram showing the average extent of *Sargassum* in March, May, July, September, November and February, based on Medium Resolution Imaging Spectrometer count distributions by month, 2002-2008. (From Gower and King 2011, with permission.)

The presence or absence of the major and persistent circulation features may offer guidance as to where *Sargassum* drift habitats might persist and where they may be extremely transient. Gower *et al.* (2006) reported that freely floating pelagic *Sargassum* may be expected to reach highest concentrations in ocean areas where surface water remains for long periods of time in a slowly rotating gyre, such as the Sargasso Sea in the north Atlantic or the western Gulf of Mexico. Continental shelf waters in the western Gulf of Mexico are relatively narrow and may be influenced by the mesoscale eddies that have travelled westward after separating from the Loop Current (Ohlmann *et al.* 2001). The broad continental shelf within the eastern Gulf of Mexico lacks such circulation features. The work of Yang *et al.* (1999) suggests that the Loop Current is not a major influence on surface drift within portions the western Florida shelf. This would suggest that if drifting objects like *Sargassum* are present within such areas, they could be relatively persistent. While the persistence of *Sargassum* habitat and young loggerheads in the eastern Gulf of Mexico can only be speculated upon at this time, Hardy *et al.* (2011) did find *Sargassum* in dispersed patches using high resolution imagery (Figure 12). Further, Witherington *et al.* (2012) documented both post-hatchling loggerheads and *Sargassum* habitat in the eastern Gulf of Mexico. Within the Gulf Stream, off southeast Florida might be an area where *Sargassum* habitat is extremely transient.

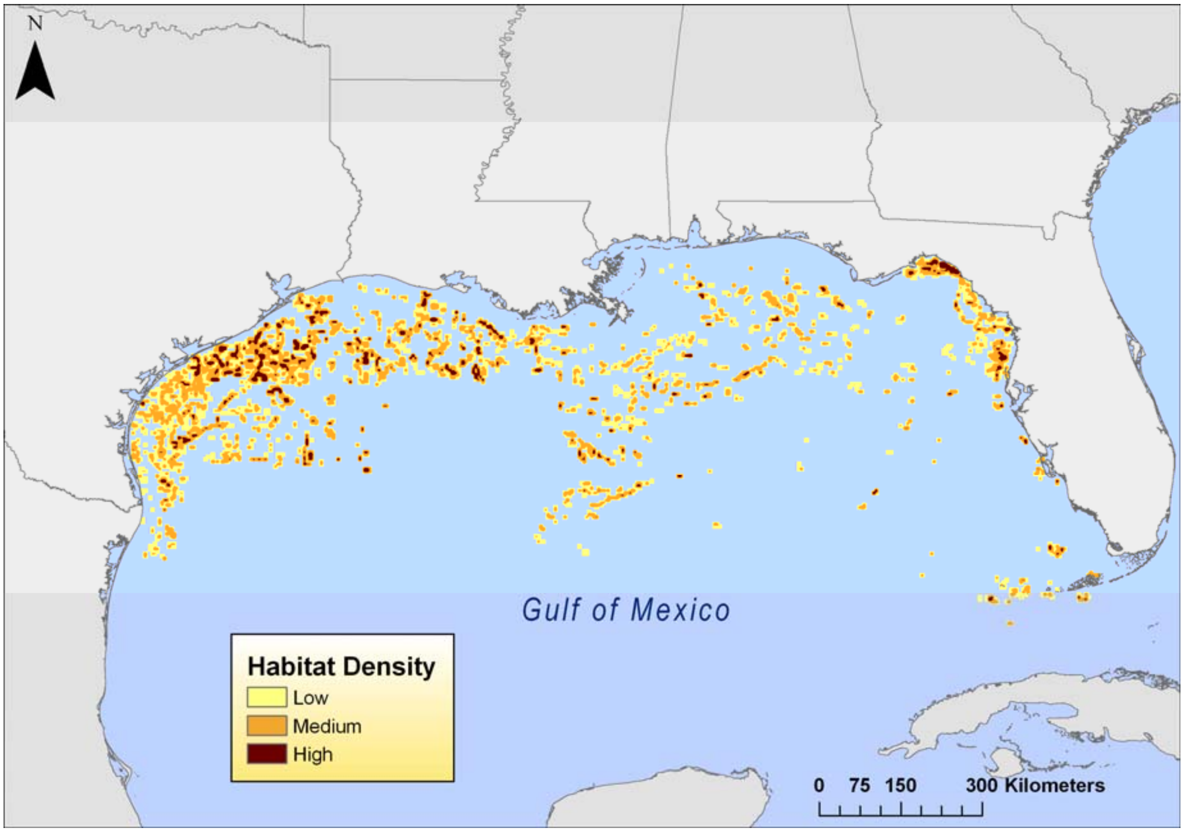


Figure 12. The density of *Sargassum*-dominated floating algae drift habitat in the northern Gulf of Mexico during 2010. (From Hardy *et al.* 2011, with permission.)

In the western North Atlantic, the highest *Sargassum* production has been found in the Gulf Stream, lowest on the shelf, and intermediate in the Sargasso Sea, with *Sargassum* contributing about 0.5 percent of the total primary production in the respective area, but nearly 60 percent of the total in the upper 1 m (3 ft) of the water column (Howard and Menzies 1969; Carpenter and Cox 1974; Hanson 1977). *Sargassum* production varies by season, with the greatest biomass (as found in 2002–2008) occurring off the southeastern U.S. coast after July (Gower and King 2011). This roughly coincides with peak hatchling production in the southeastern United States (Mansfield and Putman *in press*). Specifically, for loggerheads nesting in the United States, the hatching season occurs from late June to early November (NMFS and USFWS 2008).

The specific density of *Sargassum* that may result in high concentration of loggerhead turtles is unknown. It has been suggested that turtle density increases with *Sargassum* density and

Sargassum consolidation, especially when *Sargassum* consolidation is linear (Witherington *et al.* 2012). *Sargassum* consolidation is greatest at strong convergences, which occur at fronts, especially at the margins of major surface currents. Witherington *et al.* (2012), however, captured most turtles in *Sargassum* outside these dense convergence zones (i.e., in scattered patches, weak convergences, windrows), so a direct correlation between strong convergences and essential loggerhead habitat cannot be made from that study. That said, the highest density of post-hatchling loggerheads was found near the Gulf Stream (a major convergence) off Florida; little effort and few captures occurred at major convergences in the Gulf of Mexico (Witherington *et al.* 2012).

While the presence of post-hatchlings is somewhat dictated by the Gulf Stream and oceanic currents, and juveniles may be found in waters cooler than 12° C (53.6° F), it is very likely that waters colder than 12° C (53.6° F) would not support growth of *Sargassum* (Hanisak and Samuel 1987). This temperature is also a reasonable near minimum threshold for juvenile loggerheads (Braun-McNeill *et al.* 2008b; Epperly *et al.* 1995a; Witzell and Azarovitz 1996; Coles and Musick 2000). As such, any *Sargassum* that occurs in northern areas in colder months (e.g., north of Cape Hatteras from November to April, with water temperature below 12° C (53.6° F)) would not be important habitat for loggerheads.

Within U.S. waters, neonate loggerheads (n=17) have been satellite tracked from Florida nesting beaches north to approximately 40° N. lat., remaining in waters deeper than 200 m (Mansfield *et al. in review* in Mansfield and Putman, *in press*). This study did not associate loggerhead tracks with *Sargassum,* but instead with the occurrence of the Gulf Stream. Neonate loggerheads are one of the life stages that use *Sargassum*, and the limited available satellite telemetry on this life stage indicates that their distribution in U.S. waters is in the same approximate area as the highest concentration of *Sargassum*, generally south of 40° N. lat.

III.A.4. Oceanic

Although adults transition between neritic and oceanic habitat, the oceanic habitat is predominantly used by young loggerhead sea turtles that leave neritic areas as neonates or young juveniles, and remain in oceanic habitat moving with the predominant ocean gyres for several years. The ocean currents and gyres, such as the Gulf Stream and Florida Loop Current in the Atlantic, serve as important dispersal mechanisms for hatchlings and neonate sea turtles as well as vital developmental habitat for those early age classes. The presence of *Sargassum* is important for the oceanic juvenile life stage, as it offers a concentrated, protected foraging area, with facilitated dispersal by associated oceanic currents. After leaving the oceanic zone, juvenile loggerheads generally continue maturing in the neritic zone until they reach adulthood, although some juveniles may move between neritic and oceanic zones (Witzell 2002; Bolten 2003; Morreale and Standora 2005; McClellan and Read 2007; Eckert *et al.* 2008; Mansfield *et al.*

2009). Adult loggerheads are generally found in neritic waters, although some adults may also periodically move between neritic and oceanic zones (Harrison and Bjorndal 2006; Girard *et al.* 2009; Reich *et al.* 2010).

The oceanic juvenile stage in the North Atlantic has been primarily studied in the waters around the Azores and Madeira (Bolten 2003). In Azorean waters, satellite telemetry data and flipper tag returns suggest a long period of residency (Bolten 2003), whereas off Madeira, turtles appear to be transient (Dellinger and Freitas 2000). Preliminary genetic analyses indicate that juvenile loggerheads found in Moroccan waters are of western Atlantic origin (M. Tiwari, NMFS, and A. Bolten, unpublished data).

Other concentrations of oceanic juvenile turtles exist in the Atlantic (e.g., in the region of the Grand Banks off Newfoundland; Witzell 2002). Much of the information on the prevalence of juvenile loggerheads in U.S. oceanic waters comes from captures in the pelagic longline fishery (Witzel 1999; Yeung 2001; NMFS 2004; Watson *et al.* 2005; LaCasella *et al. in review*). High loggerhead bycatch has been observed in the U.S. Northeast distant pelagic fishing statistical reporting area, which is in the western North Atlantic, including the Grand Banks (Witzel 1999; Yeung 2001). However, fishery dependent data may not necessarily indicate important loggerhead habitat, as it is only representative of the distribution of fishing effort. Previous genetic information indicated the Grand Banks were foraging grounds for a mixture of loggerheads from all the North Atlantic rookeries (Bowen *et al.* 2005; LaCasella *et al.* 2005), but recent analysis shows that juvenile loggerheads in the central North Atlantic (e.g., the Grand Banks) are almost exclusively of Northwest Atlantic Ocean DPS nesting stock origin (instead of Northeast Atlantic Ocean or Mediterranean Sea DPSs), with the majority coming from the large eastern Florida rookeries (LaCasella *et al.*, *in review*).

There are limited fishery-independent studies on the oceanographic features associated with loggerhead high use areas in the Atlantic oceanic environment. However, McCarthy *et al.* (2010) analyzed movement of satellite tracked juvenile loggerheads (n=10) in relation to the environment they occupied within the North Atlantic Ocean. This study interpreted track sinuosity as an indicator of foraging. All loggerheads exhibited behavior interpreted as foraging in waters with high chlorophyll *a* and shallower parts of the ocean compared to deeper, low chlorophyll areas (McCarthy *et al.* 2010). Based upon their data, high chlorophyll values were generally considered to be above 0.2 mg m^{-3} and deep water was considered to be deeper than 3,600 m (11,811 ft; McCarthy 2013, pers. comm.). Further, straighter tracks (not interpreted as foraging) occurred in warmer SST and areas with more disperse, less-powerful currents. The research by McCarthy *et al.* (2010) suggests juvenile loggerheads may spend more time foraging in shallow oceanic waters (represented by seamounts) with high chlorophyll. Mansfield *et al.* (2009) also associated oceanographic features to satellite tracked juvenile loggerheads from Virginia. None of the six oceanic turtles exhibited site fidelity to a particular oceanographic region, but all remained in waters above 10° C (Mansfield *et al.* 2009). These turtles were found in areas of high primary productivity and along the edges of mesoscale eddies (identified by sea surface height anomalies). Chlorophyll values varied by season, with the highest oceanic turtle value occurring in the spring (0.44 mg m^{-3} ± 0.38 SD; Mansfield *et al.* 2009).

<u>III.B. North Pacific Ocean DPS</u>

III.B.1. Terrestrial

In the North Pacific, no loggerhead nesting occurs within U.S. jurisdiction. Loggerhead nesting has been documented only in Japan (Kamezaki *et al.* 2003), although low level nesting may occur outside of Japan in areas around the South China Sea (Chan *et al.* 2007).

III.B.2. Neritic and Oceanic

In the North Pacific Ocean, loggerhead turtles, which hatch on Japanese beaches, undertake extensive developmental migrations using the Kuroshio and North Pacific Current (Polovina *et al.* 2001; Polovina *et al.* 2006; Kobayashi *et al.*, 2008), and some turtles reach the vicinity of Baja California in the eastern Pacific (Uchida and Teruya 1988; Bowen *et al.* 1995; Peckham *et al.* 2007). After spending years foraging in the central and eastern Pacific, loggerheads return to their natal beaches for reproduction (Resendiz *et al.* 1998; Nichols *et al.* 2000) and remain in the western Pacific for the remainder of their life cycle (Iwamoto *et al.* 1985; Kamezaki *et al.* 1997; Sakamoto *et al.* 1997; Hatase *et al.* 2002; Ishihara *et al.* 2011). Despite the long-distance developmental movements of loggerheads in the North Pacific, current scientific evidence, based on genetic analysis, flipper tag recoveries, and satellite telemetry, indicates that individuals originating from Japan remain in the North Pacific for their entire life cycle, never crossing the equator or mixing with individuals from the South Pacific (Bowen *et al.* 1995; Hatase *et al.* 2002; LeRoux and Dutton 2006; Dutton 2007; Boyle *et al.* 2009).

Within the U.S. EEZ, loggerheads are found in waters northwest of the Hawaiian Islands, and off the U.S. west coast, primarily the Southern California Bight, south of Point Conception.

The following section is divided into the central north Pacific and the eastern Pacific off the U.S. west coast because these are the only areas where the North Pacific Ocean DPS may occur within U.S. jurisdiction. The following section is not divided by habitat type due to the limited occurrence of loggerheads within the North Pacific Ocean DPS in habitats under U.S. jurisdiction.

<u>III.B.2.a. Central North Pacific</u>

In the central North Pacific Ocean, foraging juvenile loggerheads congregate in the boundary between the warm, vertically-stratified, low chlorophyll water of the subtropical gyre and the vertically-mixed, cool, high chlorophyll transition zone water. This boundary area is referred to as the Transition Zone Chlorophyll Front and is favored foraging and developmental habitat for juvenile loggerhead turtles (Polovina *et al.* 2001). Satellite telemetry of loggerheads also identified the Kuroshio Extension Current (KEC), specifically the Kuroshio Extension Bifurcation Region (KEBR), as a forage hotspot (Polovina *et al.* 2006; Kobayashi *et al.* 2008). The KEBR is an area of high primary productivity that concentrates zooplankton and other organisms that in turn attract higher trophic level predators, including sea turtles (Polovina *et al.* 2004). Loggerhead sea turtle habitat in the North Pacific occurs between 28° N. and 40° N. lat. (Polovina *et al.* 2004) and SST of 14.45° C to 19.95° C (58.01° F to 67.91° F) (Kobayashi *et al.* 2008), but is highly correlated at the 17/18° C (63/64° F) isotherm (Howell *et al.* 2008). Table 3 provides a summary of the range of environmental preferences identified to date of loggerhead turtles using oceanic habitat in the North Pacific.

Tagging studies in the central North Pacific indicate that juvenile loggerheads are shallow divers that forage at depths between 0 and 100 m (0 and 328 ft) (Polovina *et al.* 2003; Polovina *et al.* 2004). Analysis of data of 17 juvenile loggerheads (43.5 to 66.5 cm (17.1 to 26.2 in) SCL) equipped with satellite-linked depth recorders foraging within the Kuroshio Extension Bifurcation Region (KEBR) of the North Pacific Transition Zone Chlorophyll Front suggest turtles may spend more than 80 percent of their time at depths less than 5 m (16.4 ft), and more than 90 percent of their time at depths less than 15 m (49.2 ft) (Howell *et al.* 2010). Diet analysis of 52 loggerhead sea turtles collected as bycatch from 1990 to 1992 in the high-seas driftnet fishery operating between 29.5° N. and 43° N. lat. and between 150° E. and 154° W. long., within SSTs ranging from 16° to 20° C (61° to 68° F), demonstrated that these turtles fed predominately at the surface (Parker *et al.* 2005). Most turtles in this study were collected from the area west of and around the Emperor seamounts, between 160° E. and 180° E. long., which Parker *et al.* (2005) concluded might be an important foraging habitat for loggerhead turtles in the North Pacific. (Note that this area is outside of the U.S. Exclusive Economic Zone (EEZ) around Hawaii and not considered for designation as critical habitat.) All 52 stomachs examined by Parker *et al.* (2005) contained prey items, the most common of which were *Janthina* spp. (Gastropoda); *Carinaria cithara* (Heteropoda); a chondrophore, *Velella velella* (Hydrodia); *Lepas* spp. (Cirripedia), *Planes* spp. (Decapoda: Grapsidae), and pyrosomas (*Pyrosoma* spp.). Kobayashi *et al.* (2008) describes that the Transition Zone Chlorophyll Front located at surface chlorophyll *a* level of 0.2 mg/m^3 ($5.39 * 10^{-6}$ oz/yd^3) represents the zone of surface convergence that concentrates the buoyant, surface prey of loggerheads.

Environmental variable or habitat	**Range definition for habitat**	**Reference**
Currents/Fronts	Kuroshio Extension Bifurcation Region (KEBR) Kuroshio Extension Current (KEC) Transition Zone Chlorophyll Front	Kobayashi *et al.* 2008; Polovina *et al.* 2004; Polovina *et al.* 2006
Productivity - Chlorophyll *a* (mg/m^3)	0.11 mg/m^3 to 0.31 mg/m^3	Kobayashi *et al.* 2008, Table 3
Water Surface Temperature – SST (^oC)	14.45° C to 19.95° C (58.01° F to 67.91° F)	Kobayashi *et al.* 2008, Table 3
Correlation between SST and Transition Zone Chlorophyll Front	17/18° C (63/64° F) isotherm; chlorophyll *a* level of 0.2 mg/m^3	Howell *et al.* 2008; Kobayashi *et al.* 2008
Prey Quality – mean energy density (kJ/g)	11.2 kJ/g	Peckham *et al.* 2011
Water depth	40–80 percent of time at surface and 90 percent of time at depths <15 m (49 ft)	Polovina *et al.* 2004; Howell *et al.* 2010

Table 3. Summary of the range of environmental variables for North Pacific loggerhead turtles using oceanic habitat in the central North Pacific.

Within the U.S. EEZ around Hawaii, North Pacific loggerhead turtle developmental, foraging and transiting habitat described above occurs both seasonally and inter-annually within the southernmost fringe of the Transition Zone Chlorophyll Front, as indicated by satellite tracking (Figure 13) and longline fishery interactions (Figure 14). The Transition Zone Chlorophyll Front located north and northwest of Hawaii is an oceanic foraging area for juveniles (Polovina *et al.* 2006); however, the area extending into the U.S. EEZ is very limited compared to the foraging area overall. Further, the area of the U.S. EEZ around Hawaii does not provide suitable SST, and therefore suitable loggerhead habitat, from July to November.

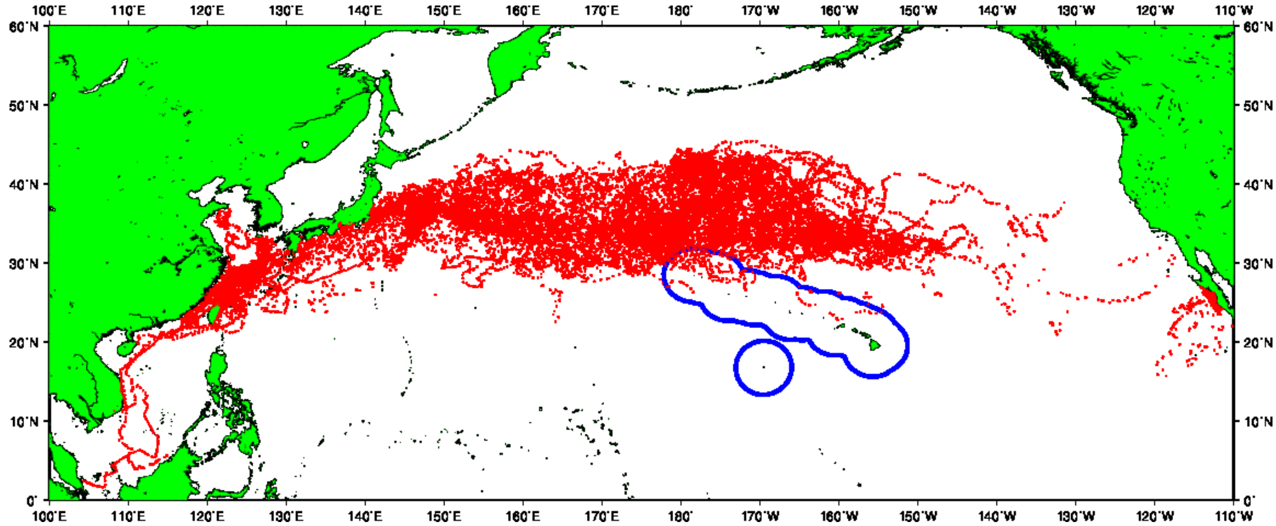


Figure 13. Satellite telemetry positions (n=54,655) of 183 tagged loggerhead sea turtles (1997 to 2009). Loggerheads were incidentally captured and released from Hawaii's pelagic longline fishery, Japan coastal pound net fishery, Taiwan coastal pound net fishery, Baja California gillnet fishery, or captive raised in Japan and released within the Kuroshio Extension Current. (From Kobayashi *et al.* 2008; Kobayashi *et al.* 2011, with permission.).

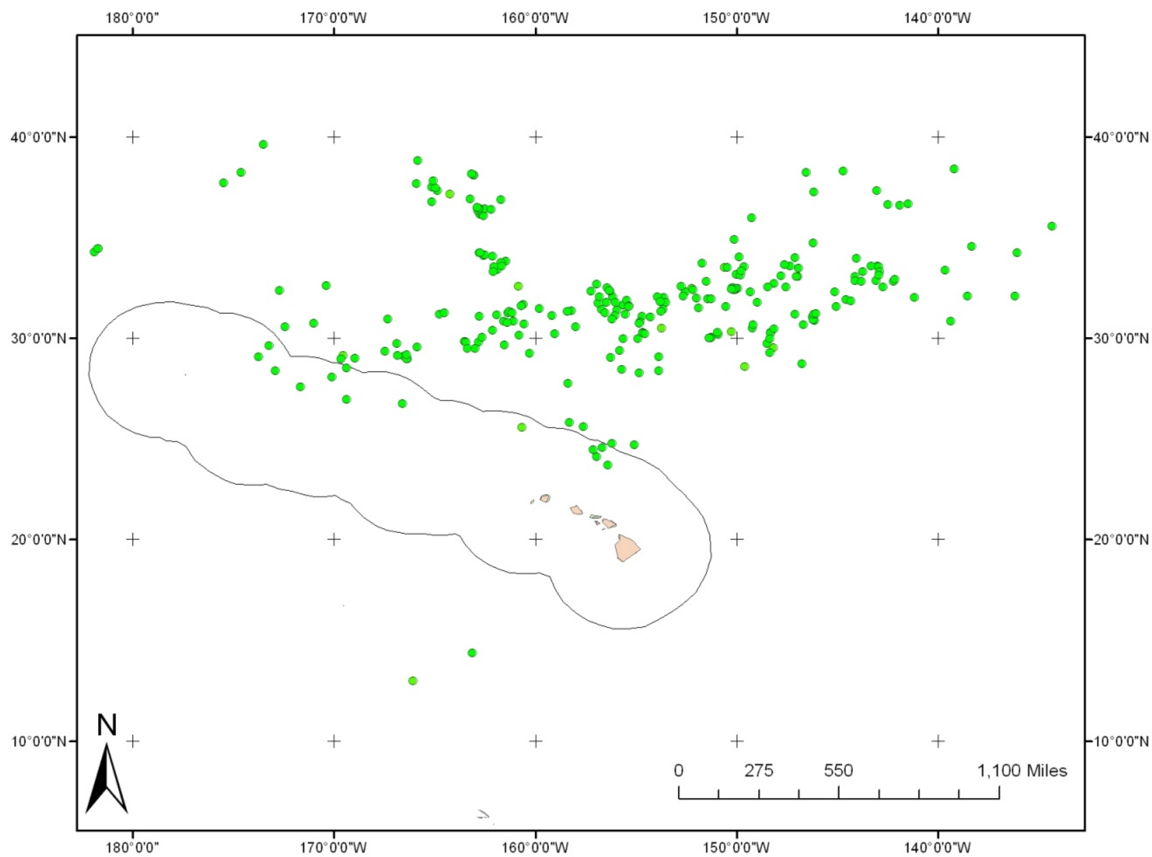


Figure 14. North Pacific loggerhead sea turtle interactions with the Hawaii-based pelagic longline fisheries, 1994 through February 2012. (From NMFS PIRO Observer Program, unpublished data)

III.B.2.b. Eastern Pacific/U.S. West Coast

Loggerheads, which have been documented off the U.S. west coast and southeastern Alaska, are primarily found south of Point Conception, the northern boundary of the Southern California Bight. In Alaska, only two loggerheads have been documented since 1960, with one carcass found in December 1991 off Shuyak Island (north of Kodiak Island) and one loggerhead sighted off Cape Georgena in July 1993 (both areas south of 60° N. lat. and east of 160° W. long.) (Hodge and Wing 2000). In Oregon and Washington, records have been kept since 1958, with nine strandings recorded over approximately 54 years (less than one stranding every 6 years) (NMFS Northwest Region stranding records database, unpublished data). In California, 48 loggerheads have either stranded or been taken in the drift gillnet fishery since 1990.

Of 32 documented strandings in California from 1990 to 2012, only four loggerheads have stranded north of Point Conception. The majority of strandings occurred in months associated with warmer SSTs (July-September), although loggerheads also stranded in the colder months (December-February) (NMFS Southwest Region sea turtle stranding database, unpublished data). An examination of the records from 1990 to 2010 showed that just over half of the loggerheads (14 of 26) stranded in the Southern California Bight area during non-El Niño events (El Niño events declared during 1992–1993, 1997–1998, and 2006) (Allen *et al.* 2013).

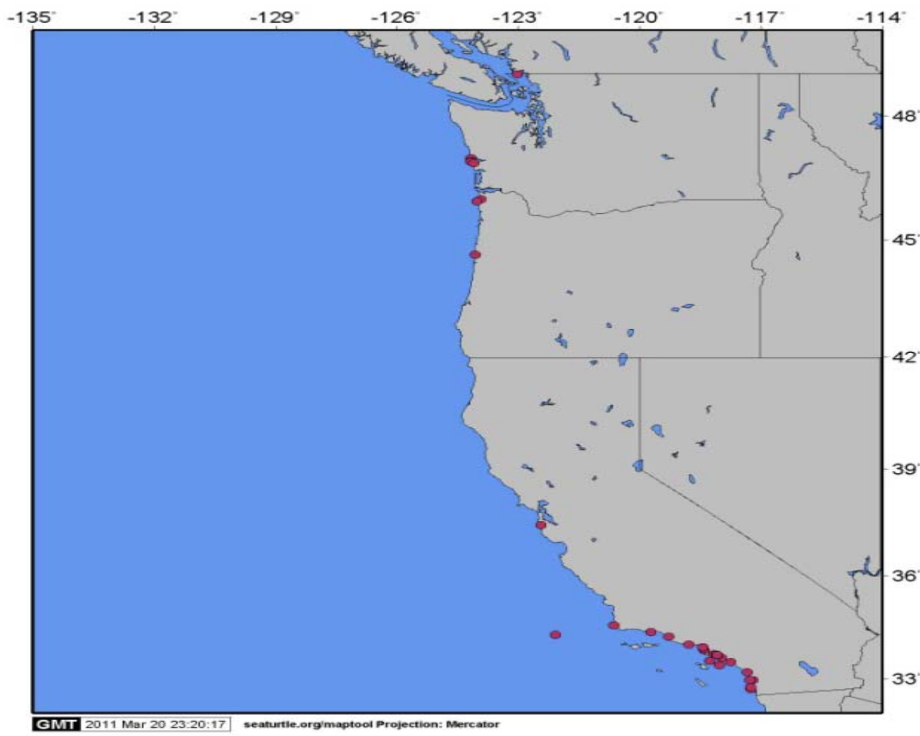


Figure 15. Stranded loggerheads off the U.S. west coast: Pacific Northwest data from 1958-2012; and California data from 1990-2012.

The only fishery that has been documented as interacting with loggerheads off the U.S. west coast and Alaska is the California/Oregon (now just California) drift gillnet fishery targeting swordfish and thresher sharks. This fishery has been observed by the NMFS Southwest Region since 1990, with roughly 20 percent observer coverage. Since 1990, 16 loggerheads have been observed taken by this fishery. In addition, three unidentified hard-shelled turtles were observed taken by the fishery, which were likely all loggerheads, as they were caught in the same area as loggerheads documented prior and since, and occurred during an El Niño year (1993), which is when all but one of the known loggerheads were observed taken by the fishery (see later text for a fuller discussion). As seen in Figure 16, all of the fishery interactions have taken place south of Point Conception. Loggerheads observed taken by the California drift gillnet fishery ranged in curved carapace length from 35.5 to 59.0 cm (14.0 to 23.2 in) (average 45.6 ± 2.2 cm (18.0 ± 0.9), with the majority under 50.0 cm (19.7 in) in length (n=8) (Allen *et al.* 2013, Table 1). Therefore, the loggerhead turtles caught in these drift gillnets were most likely early and late oceanic stage juveniles (Ishihara *et al.* 2011).

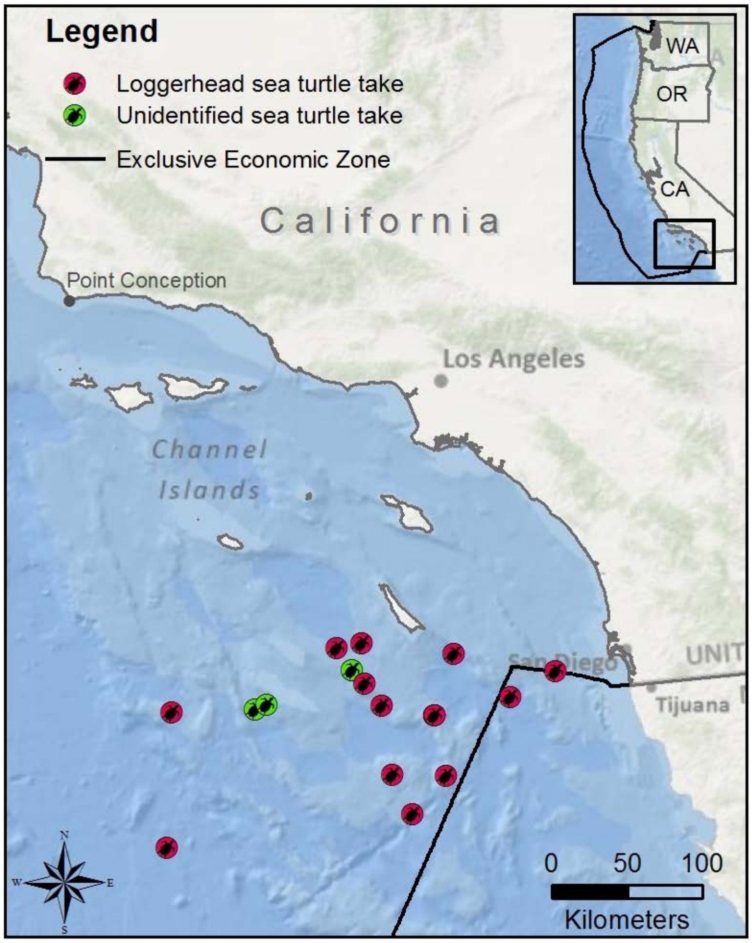


Figure 16. California drift gillnet fishery interactions. (NMFS-Southwest Regional Office Observer Program, unpublished data).

Two closures have been implemented for conservation of sea turtles; one implemented in 2001 from central California through southern Oregon to protect leatherback turtles (specifically from 45° N. lat. southward to Point Sur, California, and along a diagonal line due west of Point Conception (50 CFR 660.713)), and one implemented in 2003 to protect loggerhead sea turtles by implementing a gillnet closure area east of 120° W. long. during the months of June, July and/or August during forecasted or occurring El Niño events off the coast of southern California (68 FR 69962). The loggerhead regulations were modified in 2004 (69 FR 1844, April 7, 2004) and 2007 (72 FR 31756, June 8, 2007). Because the oceanographic conditions specified in the final rule have never been met, this closure has never been implemented (Allen *et al.* 2013). Only one loggerhead has been observed taken incidentally in the California drift gillnet fishery since 2003, following the implementation of the loggerhead conservation area closure (NMFS-SWR Observer Program, unpublished data).

Figure 17. Pacific sea turtle conservation areas closed to drift gillnet fishing. The Pacific leatherback conservation area is closed annually from August 15-November 15, while the southern closure, implemented to protect loggerheads, is closed during June, July and/or August during forecasted or occurring El Niño events.

Off the U.S. west coast, the southward flowing California Current moves along the California coast, after which it swings westward as the California Current Extension and becomes or joins the North Pacific Equatorial Current. Normally this current brings low salinity, low nutrient waters relative to upwelled waters along the coast (Chavez *et al.* 2002). Northerly-moving countercurrents include (1) the Davidson Countercurrent, flowing northward and coastally between Point Conception and the Pacific Northwest; (2) the Southern California Countercurrrent, moving coastally from southern Baja California and expanding into a gyre inside the islands off southern California; and (3) the California undercurrent transporting deeper waters (~200 m (~ 656 ft)) northward toward California from the Baja peninsula, and bringing warmer, higher saline and nutrient/oxygen-poor waters into the Southern California Bight (in Boyd 1967; Bograd and Lynn 2001). The seasonal behavior of these current features may influence prey of loggerheads and other marine species. In normal years (i.e. non-El Niño years), the Southern California Bight experiences coastal upwelling around Point Conception, showing the highest abundance of phytoplankton in the region (Bograd and Lynn 2001) while the northern coastal region (around the northern Channel Islands) experiences peak chlorophyll levels in March-May (Hayward and Venrick 1998). The southern region is less defined, but near-surface chlorophyll concentrations are lower than the north. Oligotrophic offshore waters (which include a major part of the California Current system) generally experience low and relatively uniform chlorophyll concentrations at the surface and maximum concentrations below the mixed layer, similar to the central North Pacific (Hayward and Venrick 1998). Overall, the Southern California Bight is little influenced by coastal upwelling, and is therefore nutrient-limited over much of the year.

During some El Niños, anomalies in the wind field in the western equatorial Pacific generate Kelvin waves that move eastward, depressing the thermocline, deepening the nutricline, and developing warm surface temperatures. Reduced coastal upwelling also leads to less nutrient-rich waters and less biological production (Chavez *et al.* 2002). The normal current pattern, as described above, is also altered, with a reduced southward surface transport of the California Current and increased northward flow of the deeper California Undercurrent, bringing more tropical planktonic species such as warm-water krill and, most importantly for loggerheads, pelagic red crabs, found to be an important prey species of these turtles off central Baja California (Schwing *et al.* 2005; Peckham *et al.* 2011). While these crabs are normally distributed in large numbers in upwelled waters off central Baja (Longhurst 2004), their distribution may extend northward depending on the northerly moving countercurrents. As described above, with more intense northerly countercurrents, which occur during El Niños, these crabs may be found in great numbers off southern California (Aurioles-Gamboa *et al.* 1993) and as far north as Monterey, California, where huge numbers stranded in 1959 and early 1960 during an intensification of the countercurrent system and intrusion of warmer species (Boyd 1967; Longhurst 2004). Thousands of pelagic red crabs were also documented as present and stranded during the 1992–1993 El Niño and the 1997–1998 El Niño (Fernandez 1998).

A comparison of the PBFs within the Southern California Bight under El Niño and non-El Niño conditions with those in central Baja California, reveals significant differences. This helps explain why loggerheads are found primarily off Baja and rarely off southern California. South of Point Eugenia on the Pacific coast of Baja California and particularly within the shelf waters of Ulloa Bay, pelagic red crabs have been found in great numbers, attracting top predators such as tunas, whales and sea turtles, particularly loggerheads (Blackburn 1969; Pitman 1990; Wingfield *et al.* 2011). This area is highly productive due to its unique geomorphological and physical oceanographic features, which promote upwelling through persistent positive wind-stress and wind stress curl (Ekman pumping). Within Ulloa Bay, water is recirculated in the upwelling shadow, providing warmer SSTs. Indeed, spatial analysis showed that three environmental conditions (SSTs, chlorophyll *a* and frontal probability) were significant to turtle presence. Within Ulloa Bay, this front, created by the convergence between cold and warm water, enhances prey abundance and, maintains high densities of red crabs in the nearshore area. Thus, foraging opportunities and thermal conditions are optimal for loggerhead sea turtles

(Wingfield *et al.* 2011) and these turtles have been documented in the thousands in this area off Baja California (Pitman 1990; Seminoff *et al.* 2006). Pitman (1990) found loggerhead distribution off Baja to be strongly associated with the red crab, which often occurred in such numbers as to "turn the ocean red."

Allen *et al.* (2013) reported a significant difference in stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotope ratios between eight loggerheads bycaught by the California drift gillnet fishery in the Southern California Bight and loggerheads in Baja, Mexico. The team also found that isotope ratios of Southern California Bight turtles were highly similar to those of loggerheads sampled in the central Pacific. However, of hundreds of loggerheads foraging in oceanic and neritic habitats of the North Pacific that have been studied via satellite telemetry (Nichols *et al.* 2000; Polovina *et al.* 2003; Polovina *et al.* 2004; Polovina *et al.* 2006; Kobayashi *et al.* 2008; Howell *et al.* 2010; Peckham *et al.* 2011), few turtles exhibited movements toward the U.S. west coast or toward the Baja California Peninsula. Further review of the loggerhead tagging database of turtles tagged in the central north Pacific showed only 2 out of 54,655 track records showed up in the U.S. west coast EEZ (Kobayashi, 2012, pers. comm). This occurred in October 1998 and was found to be a transition period between the 1997–1998 El Niño and a La Niña (Benson *et al.* 2002). In addition, Peckham *et al.* (2011) reported that of 40 loggerheads outfitted with satellite transmitters off the Baja peninsula, none of the turtles traveled north to southern California.

Little is known about the importance of prey to loggerheads found in southern California waters. Few necropsies have been conducted on loggerheads stranded or bycaught off the U.S. west coast. Based on the stable isotope analysis by Allen *et al.* (2013), loggerheads found off the U.S. west coast may employ a strategy similar to that of loggerheads found in the central North Pacific, *i.e.* that they forage opportunistically on a wide variety of prey. However, identifying oceanographic and biological features that aggregate prey in the Southern California Bight is not as clear as in the central north Pacific (concentrations of phytoplankton which attract neustonic and oceanic organisms etc.; Parker *et al.* 2005). Confounding this is the documented presence (and assumed co-occurrence) of both loggerheads and pelagic red crabs in the Southern California Bight during non-normal (El Niño) years. Because loggerheads are rarely found off the U.S. west coast and they are generally opportunistic feeders, no prey could be identified as a biological feature of habitat for this species.

Although nearly all (15 of 16) loggerheads observed taken by the California drift gillnet fishery occurred during El Niño events, Allen *et al.* (2013) point out that loggerheads have stranded off southern California during non-El Niño events. An examination of the records showed that the SSTs surrounding bycaught turtles were similar to the SSTs that loggerheads associated with off the central North Pacific (14° C to 19.95° C (58° F to 68° F) (Kobayashi *et al.* 2008). Given this wide range and non-predictability of SST as a habitat feature within the Southern California Bight, we could not identify SST as a habitat feature for loggerheads. In addition, given the variability in oceanographic (e.g. currents, lack of prolific or profound year-round upwelling or fronts/gyres) and biological (e.g. chlorophyll-a) features that are associated within the Southern California Bight during both non-El Niño and El Niño years, and which differ so profoundly from other areas where loggerheads are regularly found in large numbers (i.e. the central north Pacific Ocean and off central Baja California, Mexico), we could identify no such habitat features associated with loggerheads found off the Southern California Bight.

IV: PHYSICAL OR BIOLOGICAL FEATURES ESSENTIAL TO THE CONSERVATION OF LOGGERHEAD TURTLES

IV.A. ESA Regulations

Joint NMFS–USFWS regulations state that in identifying critical habitat, the agencies "shall consider those physical or biological features that are essential to the conservation of a given species and that may require special management considerations or protection" (50 CFR 424.12(b)). Features to consider may include, but are not limited to:

(1) Space for individual and population growth, and for normal behavior;
(2) Food, water, air, light, minerals, or other nutritional or physiological requirements;
(3) Cover or shelter;
(4) Sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and generally
(5) Habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

The regulations also require agencies to "focus on the principal biological or physical constituent elements" (hereafter referred to as "Primary Constituent Elements" or PCEs) within the specific areas considered for designation, which "may include, but are not limited to, the following: … nesting grounds, spawning sites, feeding sites, seasonal wetland or dryland, water quality or quantity, … geological formation, vegetation type, tide, and specific soil types" (50 CFR 424.12(b)).

IV.B. Physical and Biological Features and Primary Constituent Elements Essential for Conservation

After taking into consideration the different life stages, behaviors,and ecosystems associated with loggerheads, NMFS identified PBFs essential for conservation of loggerhead sea turtles for each of the following habitats (affected life stages indicated in parentheses with each): 1) Terrestrial (nesting) habitat (nesting females, eggs, and hatchlings); 2) Neritic habitat (internesting females, swim frenzy hatchlings, foraging juveniles and adults, winter concentrating juveniles and adults, breeding adults, and migratory juveniles and adults); 3) *Sargassum* habitat (juveniles); and 4) Oceanic Habitat (mostly juveniles but some adults). Terrestrial habitat has been addressed separately by the USFWS, so we will only discuss marine (neritic, *Sargassum*, and oceanic) habitat. Based on the best available scientific information, NMFS identified the following PBFs of habitat essential for the conservation of loggerhead sea turtles. We also identified the PCEs that support the PBFs, including those necessary for maintaining any associated natural processes. Note that because habitat has been presented by habitat type, not all critical habitat will contain all PBFs. Further, in delineating the PCEs, we do not intend to suggest that all must be present for the PBF to be present. A particular area of critical habitat is able to serve its function when one or more of the PBFs or PCEs is present.

IV.B.1. Northwest Atlantic Ocean DPS

IV.B.1.a. Terrestrial

The USFWS identified PBFs and accompanying PCEs for terrestrial habitat in their proposed rule (78 FR 18000, March 25, 2013).

IV.B.1.b. Neritic

Neritic habitat in the United States occurs only within the Northwest Atlantic Ocean DPS. NMFS has described neritic habitat as waters that are less than 200 meters (656 ft) in depth. NMFS described the essential PBFs and PCEs of neritic habitat as occurring in five categories, which were determined in consideration of the types of loggerhead behavior essential for conservation: Nearshore Reproductive, Foraging, Winter, Breeding, and Constricted Migratory.

IV.B.1.b(i). Nearshore Reproductive Habitat

NMFS describes the essential PBF of nearshore reproductive habitat as a portion of the nearshore waters adjacent to nesting beaches that are used by hatchlings to egress to the open-water environment as well as by nesting females to transit between beach and open water during the nesting season.

PCEs that support this habitat are the following:

1) Nearshore waters with direct proximity to nesting beaches that support critical aggregations of nesting turtles (e.g., highest density nesting beaches)[7] to 1.6 km (1 mile) offshore
2) Waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water
3) Waters with minimal manmade structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents

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[7] Critical habitat nesting beaches identified by USFWS and those initially identified as critical habitat nesting beaches but later exempted due to the existence of an adequate Integrated Natural Resources Management Plan (INRMP).

IV.B.1.b.(ii). Foraging Habitat

NMFS describes the essential PBF of foraging habitat as sites on the continental shelf or in estuarine waters known to be used by significantly large numbers of juveniles or adults as foraging areas.

The PCEs that support this habitat are the following:

1) Sufficient prey availability and quality, such as benthic invertebrates, including crabs (spider, rock, lady, hermit, blue, horseshoe), mollusks, echinoderms and sea pens to support meaningful aggregations of feeding turtles
2) Water temperatures to support loggerhead inhabitance, generally above 10° C

IV.B.1.b.(iii). Winter Habitat

NMFS describes the essential PBF ofwinter habitat as warm water habitat south of Cape Hatteras near the western edge of the Gulf Stream that supports meaningful aggregations of juveniles and adults during the winter months.

PCEs that support this habitat are the following:

1) Water temperatures above 10° C during the colder months of November through April
2) Continental shelf waters in proximity to the western boundary of the Gulf Stream
3) Water depths between 20 and 100 meters

IV.B.1.b.(iv). Breeding Habitat

NMFS describes the essential PBF of breeding habitat as sites that support meaningful aggregations of both male and female adult individuals during the breeding season.

PCEs that support this habitat are the following:

1) Meaningful concentrations of reproductive male and female loggerheads
2) Proximity to primary Florida migratory corridor
3) Proximity to Florida nesting grounds

IV.B.1.b.(v). Constricted Migratory Habitat

NMFS describes the essential PBF of constricted migratory habitat as high use migratory corridors that are constricted (limited in width) by land on one side and the edge of the continental shelf and Gulf Stream on the other side.

PCEs that support this habitat are the following:

1) Constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways
2) Passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas

IV.B.1.c. *Sargassum*

Sargassum habitat occurs in both the neritic and oceanic environment. NMFS describes the PBF of loggerhead *Sargassum* habitat as developmental and foraging habitat for young loggerheads where surface waters form accumulations of floating material, especially *Sargassum*. [Note: This covers a large area because of the dynamic nature of *Sargassum* habitat; however, consideration of effects to this habitat will be most concerned with impacts to the Sargassum itself, such as large scale directed take or large scale pollutants (such as would occur in an oil spill).]

PCEs that support this habitat are the following:

1) Convergence zones, surface-water downwelling areas, and other locations where there are concentrated components of the *Sargassum* community in water temperatures suitable for the optimal growth of *Sargassum* and inhabitance of loggerheads
2) *Sargassum* in concentrations that support adequate prey abundance and cover
3) Available prey and other material associated with *Sargassum* habitat such as, but not limited to, plants and cyanobacteria and animals endemic to the *Sargassum* community such as hydroids and copepods
4) Sufficient water depth and proximity to available currents to ensure offshore transport, and foraging and cover requirements by *Sargassum* for post-hatchling loggerheads, i.e., >10 m depth to ensure not in surf zone

IV.B.1.d. Oceanic

NMFS described oceanic habitat as waters that are 200 meters (656 ft) or greater in depth.

Other than *Sargassum* habitat, noted above, NMFS did not identify any additional PBFs of oceanic habitat essential to conservation of the species within the Northwest Atlantic Ocean DPS.

IV.B.2. North Pacific Ocean DPS

IV.B.2.a. Terrestrial

The North Pacific Ocean DPS nests on beaches outside of U.S. jurisdiction; therefore, no terrestrial nesting habitat was proposed by FWS for critical habitat designation.

IV.B.2.b. Neritic

The North Pacific Ocean DPS does not occur in neritic habitat under U.S. jurisdiction; therefore, neritic habitat is not considered further.

IV.B.2.c. Oceanic

NMFS describes the essential PBF of loggerhead turtle oceanic habitat in the North Pacific Ocean as waters that support suitable conditions in sufficient quantity and frequency to provide meaningful foraging, development, and/or transiting opportunities to the populations in the North Pacific.

PCEs in the central North Pacific Ocean that support this habitat include:

1) Currents and circulation patterns of the North Pacific (KEBR, and the southern edge of the KEC characterized by the Transition Zone Chlorophyll Front) where physical and biological oceanography combine to promote high productivity (chlorophyll a = 0.11–0.31 mg/m^3) and sufficient prey quality (energy density ≥ 11.2 kJ/g) of species
2) Appropriate SSTs (14.45° to 19.95° C (58.01° to 67.91° F)), primarily concentrated at the 17° to 18° C (63° to 64° F) isotherm

PCEs in the eastern North Pacific Ocean that support this habitat include:

1) Sites that support meaningful aggregations of foraging juveniles
2) Sufficient prey densities of neustonic and oceanic organisms

V: MEANS USED TO IDENTIFY CRITICAL HABITAT

The discussion below describes the means used by NMFS to identify specific sites that are considered essential to the conservation of the species, given the PBFs and PCEs listed above. . We include a summary of the means used to identify terrestrial Habitat, even though terrestrial critical habitat has been separately proposed by USFWS, because the critical habitat for Nearshore Reproductive Habitat is so closely associated with the terrestrial habitat. In general, NMFS reviewed all available loggerhead distribution information, including satellite telemetry, aerial survey, shipboard survey, fishery bycatch, stranding, in-water, and stable isotope data, as well as available information on features of the habitat, to systematically evaluate areas for designation. We did this by identifying relatively high use areas (generally, those with 60 or more turtle days) in the TEWG figures, which served as a proxy for identifying habitat areas of suitable quality because there is little quantitative data on loggerhead habitat use. This information was supplemented by known and available studies that were not included in the TEWG analysis. The means used to identify specific habitat in each category (e.g., nearshore reproductive, foraging, migratory, etc.) differed from category to category because each category and life history stage warrant different considerations. Lacking information that allowed us to use quantitative criteria, such as was done for terrestrial habitat, identification of most marine habitat was necessarily conducted in a more qualitative manner.

V.A. Northwest Atlantic Ocean DPS

V.A.1. Terrestrial

USFWS identified terrestrial areas to include in the proposed designation by applying the following considerations by recovery unit:

1) Beaches that have the highest nesting densities;
2) beaches that represent a geographic spatial distribution sufficient to ensure genetic diversity;
3) beaches that collectively provide a good representation of total nesting; and
4) beaches adjacent to the selected high density nesting beaches (per the first 3 criteria) that can serve as expansion areas.

The amount and distribution of terrestrial critical habitat being proposed for designation will conserve recovery units of Northwest Atlantic loggerhead sea turtles by

1) maintaining their existing nesting distribution;
2) allowing for movement between beach areas depending on habitat availability (response to changing nature of coastal beach habitat) and supporting genetic interchange;

3) allowing for an increase in the size of each recovery unit to a level where the threats of genetic, demographic, and normal environmental uncertainties are diminished; and
4) maintaining their ability to withstand local or unit level environmental fluctuations or catastrophes.

USFWS used the following process to select appropriate terrestrial critical habitat units for Northwest Atlantic loggerhead sea turtles. For each recovery unit, they looked at nesting densities by State (or units within the state in the case of Florida) to ensure a good spatial distribution of critical habitat. They identified beach segments as islands or mainland beaches separated by creeks, inlets, or sounds, except for long, contiguous beaches, in which case they used political boundaries, e.g., Myrtle Beach. USFWS then divided beach nesting densities (mean density of nests counts from 2006–2011) into quartiles (four equal groups) by State or, for peninsular Florida, by 5 units within the state, and selected beaches that were within the upper quartile for designation as critical habitat. USFWS also identified adjacent beaches for each of the high density nesting beaches that were in the upper quartile, i.e., USFWS selected one beach to the north and one to the south of each of the high density nesting beaches identified for inclusion as critical habitat. Because loggerheads are known to exhibit high site fidelity to individual nesting beaches, and because they nest on dynamic beaches that may be significantly degraded or lost through natural processes and upland development, protecting beaches adjacent to high nesting density beaches should provide sufficient habitat to accommodate nesting females whose primary nesting beach has been lost. These areas also will facilitate recovery by providing additional nesting habitat for population expansion. For the Dry Tortugas Recovery Unit, USFWS recommends designating all islands west of Key West, Florida where loggerhead nesting has been documented as terrestrial critical habitat, due to the extremely small size of this recovery unit.

Using the rationale described above, 88 units were identified by USFWS as terrestrial critical habitat for the loggerhead sea turtle. The methodology used for identifying critical habitat is described in detail in the USFWS proposed rule (78 FR 18000, March 25, 2013).

V.A.2. Neritic

Within the United States, the only loggerheads inhabiting neritic habitat are those within the Northwest Atlantic Ocean DPS.

V.A.2.a. Nearshore Reproductive Habitat

NMFS describes the essential PBF of nearshore reproductive habitat as a portion of the nearshore waters adjacent to nesting beaches that are used by hatchlings to egress to the open-water environment as well as by nesting females to transit between beach and open water during the nesting season. We identified the PCEs that support this habitat as the following: 1) Nearshore waters with direct proximity to nesting beaches that support critical aggregations of nesting turtles (e.g., highest density nesting beaches)[8] to 1.6 km offshore; 2) waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water; and 3) waters with minimal manmade structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents. We sought to identify sites that support critical aggregations of nesting turtles (highest density nesting) and their adjacent beaches , and to represent a broad spatial distribution that covers all four recovery units identified in the recovery plan, each of which it is necessary to conserve in order to delist the entire listed entity. It is rare to have a recovery plan -- and a recent one -- to turn to while designating critical habitat, and we were fortunate to have that to guide us in determine habitat needs for conservation. Conserving loggerhead sea turtles in each of these recovery units will ensure a geographic spatial distribution sufficient to ensure genetic diversity, and a good representation of loggerheads within the Northwest Atlantic Ocean DPS.

As indicated above, the identification of nearshore reproductive habitat was based primarily on the location of beaches identified as high density nesting beaches by USFWS, as well as beaches adjacent to the high density nesting beaches that can serve as expansion areas, in accordance with the process described in Terrestrial Habitat above (section V.A.1). These include waters off the four high density nesting beaches which were not proposed for designation as terrestrial critical habitat by USFWS because they occur on military lands that are exempt from designation due to the existence of an adequate Integrated Natural Resources Management Plan (INRMP). They are identified here as essential nearshore reproductive habitat because their INRMPs did not address waters off the beach. Because the nesting beach habitat considered for designation by USFWS has the densest nesting within given geographic locations, the greatest number of hatchlings is presumed to be produced on these beaches and the greatest number of nesting females presumably nests on these beaches.

In determining the boundary for this nearshore reproductive habitat, there was no clear distance from shore indicated in available information and from discussions with experts on hatchling movements. NMFS considered using 1.6 km (1 mile),4.8 km (3 miles), and distances further from shore. Clearly, the further distance from shore, the greater portion of habitat included. A study from Georgia (Scott 2006, p. 91) showed that satellite tagged turtles were observed within

[8] Critical habitat nesting beaches identified by USFWS and those initially identified as critical habitat nesting beaches but later exempted due to the existence of an adequate Integrated Natural Resources Management Plan (INRMP).

state jurisdictional waters (3 miles (4.8 km)) 82 percent of the time. However, longshore dispersal during internesting is also relatively high and turtles may disperse miles away from the nesting beach. Scott (2006, pp. 48-58 and 138) reported that 14 of the 22 turtles (64%) had mean distances along shore from the nesting site of $\geq$10 km (6.2 miles) and 7 (32%) had mean distances of $\geq$20 km (12.4 miles). Numerous other studies have documented similar longshore movement distances during the internesting period (Hopkins and Murphy 1981; Stoneburner 1982; Mansfield *et al.* 2001; Mansfield 2006; Griffin 2002; Tucker 2009; Hart *et al.* 2010). Hatchlings which remain in a swim frenzy for 20-30 hours (Carr and Ogren 1960; Carr 1962; Carr 1982; Wyneken and Salmon 1992; Witherington 1995), presumably move well beyond 4.8 km (3 miles). However, in considering habitat needs of these turtles, it was noted that nearshore waters pose the greatest opportunity for disruption of the habitat functions necessary for offshore egress for hatchlings and transit to and from the nesting beach by nesting females.

NMFS determined that a distance of 1.6 km (1 mile) from the mean high water line of each identified high-density nesting beach would most accurately identify the areas essential to the conservation of loggerhead sea turtles. Threats to the essential function of the hatchling swim frenzy habitat include physical impediments to offshore egress, predator concentration, disruption of wave angles used for orientation to open water, and the formation of strong longshore currents resulting from artificial structures (such as breakwaters or groins), the vast majority of which would occur well within the 1.6 km (1 mile) line. Studies such as Witherington and Salmon (1992) have shown that predation of hatchling sea turtles was substantially higher in the vicinity of reef structure, even patchy, low-relief reefs, than over open sand. As discussed in section II.B.2, hatchling dispersal during the swim frenzy is both energetically expensive and time-limited. Disorientation and prolonging of the time in which hatchlings attempt to reach deeper, open waters can be expected to have a significant, though unquantifiable, impact on the hatchlings. One such effect can be excess resource expenditures resulting in physiological effects reducing fitness or survival as a result of excessively high lactate levels that are known to occur during frenzy activity (Dial 1987). As they go further from shore, hatchling dispersal is expected to increase substantially due to individual differences in the angles they swim away from shore and the effects of longshore currents, and the likelihood for significant habitat disruption preventing the hatchlings from reaching their post-hatchling transition habitat is much lower. Likewise, internesting female use of in-water habitats beyond the very nearshore waters is expected to be much more dispersed as discussed previously. A distance of 1.6 km (1 mile) from the mean high water line would include the areas most in need of protection from potential habitat disruptions such as the construction and placement of structures that could alter the nearshore habitat conditions and thus affect hatchling egress to open waters from those beaches and nesting female transit to and from the nesting beaches.

As a result of it being so closely linked to the terrestrial critical habitat designation, the amount and distribution of nearshore reproductive habitat being proposed for designation will conserve recovery units of loggerhead sea turtles for similar reasons that terrestrial habitat designations will conserve recovery units. Specifically, designation of nearshore reproductive habitat off the high density and adjacent nesting beaches will conserve Northwest Atlantic loggerhead sea turtles by doing the following:

1) Protecting nearshore habitat adjacent to a broad distribution of nesting sites;
2) allow for movement between beach areas depending on habitat availability (response to changing nature of coastal beach habitat) and supporting genetic interchange;
3) allow for an increase in the size of each recovery unit to a level at which the threats of genetic, demographic, and normal environmental uncertainties are diminished; and
4) maintain their ability to withstand local or unit level environmental fluctuations or catastrophes.

Using the rationale described above, we identified 36 units of nearshore reproductive habitat.

V.A.2.b. Foraging Habitat

NMFS describes the essential PBF of foraging habitat as sites on the continental shelf or in estuarine waters known to be used by significantly large numbers of juveniles or adults as foraging areas. We identified the PCEs that support this habitat as the following: 1) Sufficient prey availability and quality, such as benthic invertebrates, including crabs (spider, rock, lady, hermit, blue, horseshoe), mollusks, echinoderms and sea pens to support meaningful aggregations of feeding turtles; and 2) water temperatures to support loggerhead inhabitance, generally above 10° C.

Therefore, we sought to identify sites of high use by loggerheads that contained high aggregations of prey within the suitable temperature range. Given the widespread nature of loggerhead foraging, NMFS found identification of foraging areas for consideration as critical habitat particularly challenging.

NMFS identified high use areas throughout the Atlantic and Gulf of Mexico, as these areas likely have habitat features that are critical to population recovery. In order to identify high use foraging areas, available data on sea turtle distribution were considered. Specifically, NMFS evaluated information from aerial and shipboard surveys, stable isotope analyses, satellite telemetry studies, and in-water studies to identify areas of known high use foraging habitat. First, aerial survey and, in some cases, shipboard survey information obtained from available reports were evaluated for loggerhead concentration patterns (Shoop and Kenney 1992; Epperly *et al.* 1995a and Epperly *et al.* 1995b; Keinath 1993; Keinath *et al.* 1996; Mansfield 2006; TEWG 2009; NMFS 2011; NMFSa 2012; Virginia Aquarium 2011a, 2011b, 2012a, 2012b.

Some of these papers had been corrected for survey effort (e.g., Shoop and Kenney 1992), whereas others contained maps of documented sightings. This information was substantiated by evaluating available loggerhead data in OBIS-SEAMAP (http://seamap.env.duke.edu/datasets). The aerial survey information showed that loggerheads were dispersed from inshore waters and across the continental shelf from Massachusetts through the Gulf of Mexico. Seasonal differences in distribution were apparent.

Second, NMFS reviewed available stable isotope papers, which can be used to identify distinct foraging regions based upon the carbon and nitrogen values of the prey (Wallace *et al.* 2009; Vander Zanden *et al.* 2010; Ceriani *et al.* 2012; Pajuelo *et al.* 2012a; Pajuelo *et al.* 2012b). The analyses (some of which were combined with satellite telemetry) revealed distinct foraging areas, but on a broad scale. That is, the Mid- and South Atlantic Bights were recognized as prime foraging areas for adult loggerheads, but within these large foraging grounds, finer scale feeding areas could not be identified with the available methodology. The stable isotope papers corroborated the aerial survey information of widespread inhabitance (foraging) in the Atlantic.

In order to evaluate more specific foraging areas and the habitat features of these high use areas, NMFS then considered satellite telemetry data from published and available sources (Hawkes *et al.* 2007; McClellan and Read 2007; Mansfield *et al.* 2009; TEWG 2009; Hawkes *et al.* 2011; Arendt *et al.* 2012a; Arendt *et al.* 2012b; Arendt *et al.* 2012c; Foley *et al. in review*; Griffin *et al.*, unpublished data; McClellan, unpublished data; NEFSC and Coonamessett Farm Foundation, unpublished data; Virginia Aquarium 2011a, 2011b, 2012a, 2012b). This analysis resulted in a number of high use areas that were further evaluated in consideration of the identified habitat features that would dictate such a high use area. High use areas were considered to be areas with identified home ranges (Hawkes *et al.* 2011), kernel density utilization distributions (Mansfield 2006; McClellan, unpublished data) or a concentration of satellite telemetry points in a particular area (note that the level of "concentration" varied by study and one value for number of turtles per cell/grid/area was not calculated in order to not alter the individual results; Mansfield *et al.* 2009; TEWG 2009; Hawkes *et al.* 2011; Griffin *et al.*, unpublished data).

There are limited in-water habitat assessments for loggerheads. However, in-water loggerhead capture studies were reviewed in order to gauge the prevalence of the identified habitat features. Such in-water information included regional trawl surveys off South Carolina to northern Florida (Arendt *et al.* 2012d; Arendt *et al.* 2012f) and long-term capture studies in North Carolina and Florida (Ehrhart *et al.* 2007; Epperly *et al.* 2007). NMFS fishery bycatch analyses for bottom trawl, dredge, and gillnet gear were also evaluated in the event those assessments would provide oceanographic correlate information associated with turtle interactions, which would then be helpful in habitat assessments (Murray 2009; Warden 2011; Murray 2011). For example, for commercial trawls, bycatch rates were highest in waters <50 m (164 ft) deep and SST >15°C (59° F) and south of 37° N. lat. (Warden 2011). Observable interaction rates between sea turtles and commercial scallop dredges in the Mid-Atlantic were higher with warm SST (generally >17° C (62.6° F)), depth of around 40-60 m (131-197 ft), and without chain mat use (Murray 2011). For gillnets, rates were highest in SST >15° C (59° F) with large mesh gillnets and south of 36° N. lat (Murray 2009). It should be noted that these bycatch reports are largely a reflection of where fishing effort is occurring (overlapping with high turtle distribution) and may not be a true reflection of important loggerhead habitat, e.g., there was limited observed bottom trawl effort south of Cape Hatteras. To that regard, Murray and Orphanides (*in press*) recently evaluated fishery-independent and dependent data to identify environmental conditions associated with turtle presence and the subsequent risk of a bycatch encounter if fishing effort is present. This information was also reviewed by the CHRT, finding that fishery independent encounter rates were a function of latitude, SST, depth, and salinity. When the model was fit to fishery dependent data (gillnet, bottom trawl, and scallop dredge), it found a decreasing trend in encounter rates as latitude increases, an increasing trend as SST increases, a bimodal relationship between encounter rates and salinity, and higher encounter rates in depths between 25 and 50 m (Murray and Orphanides *in press*).

The above information supports the widespread nature of loggerhead foraging behavior and associated habitat, spread all along the Atlantic coast wrapping around to the southwest Florida coast and into the Gulf of Mexico. It was difficult to identify habitat features necessary for foraging beyond water temperature and sufficient prey availability and quality, and these both occur year-round in the Gulf of Mexico and the Atlantic coast up to North Carolina, and as far north as Massachusetts in the summer. While loggerheads forage in warm waters throughout the continental shelf, and there are some known foraging habitats, the CHRT found no information on specific prey density or quality essential for the conservation of loggerheads, which would help prioritize foraging areas. Foraging areas are likely populated by loggerheads due to abundant or suitable benthic biota, but it is possible that there are other environmental cues that may factor into loggerhead foraging habitat selection. NMFS discussed evaluating foraging habitat by substrate type (e.g., hard bottom), but there are no quantitative studies that would help identify the required concentrations and types of foraging substrate, and all are likely to be widespread but patchy throughout the continental shelf. As such, the habitat features of the considered high use foraging areas could not be differentiated and prioritized compared to neighboring areas or identified foraging areas in different regions. Despite our efforts, the CHRT could identify no reliable criteria that could be used for these purposes.

Despite the lack of unique habitat features in loggerhead foraging areas, NMFS, in reviewing the literature, identified numerous areas of known important foraging habitat, although this list is not inclusive. Further, NMFS recognizes that additional analysis and research will help identify additional sites and prioritize the various foraging areas and their contribution to conservation of loggerheads.

In addition to the entire Mid-Atlantic and South Atlantic Bights, and the shelf in the eastern Gulf of Mexico, these areas include, but are not limited to, the following:

- Delaware Bay, New Jersey/Delaware (Spotila *et al.* 1998; Stezer 2002; Mansfield 2006; Griffin *et al.*, unpublished data);
- Chesapeake Bay, Virginia (Lutcavage and Musick 1985; Keinath *et al.* 1987; Byles 1988; Mansfield 2006; Seney and Musick 2007; Mansfield *et al.* 2009; Griffin *et al.*, unpublished data);
- Off the Outer Banks of North Carolina (Shoop and Kenney 1992; McClellan and Read 2007; Mansfield *et al.* 2009; Hawkes *et al.* 2011; Griffin *et al.*, unpublished data);
- Pamlico and Core Sounds, North Carolina (Avens *et al.* 2003; Sasso *et al.* 2007; McClellan 2009; Wallace *et al.* 2009);
- Shipping channels in the southeast United States, e.g., Canaveral Harbor entrance channel, Florida; Fernandina Harbor St. Marys River entrance channel (Kings Bay), Florida; Brunswick Harbor ocean bar channel, Georgia; Savannah Harbor ocean bar channel, Georgia; Charleston Harbor entrance channel, South Carolina (Van Dolah and Maier 1993; Dickerson *et al.* 1995; Arendt *et al.* 2012e);
- Inshore waters of the northern Indian River Lagoon System, Florida (north of South Bay, the Banana River, and Mosquito Lagoon; Medonca and Ehrhart 1982; Witherington and Ehrhart 1989; Ehrhart *et al.* 2007);
- Nearshore waters around Cape Canaveral, Florida (Henwood 1987; Arendt *et al.* 2012a);
- Florida Bay, and waters around the Florida Keys (Schroeder and Foley, unpublished data);
- Continental shelf waters of southwest Florida (Girard *et al.* 2009; Foley 2012, pers. comm.; Hart *et al.* 2012);
- St. Joseph Bay, Florida Panhandle (Lamont 2012, pers. comm.)
- Waters around Dry Tortugas (Hart *et al*. in prep)

Because we are not recommending any foraging areas for designation in this report, NMFS will specifically request input from the public and peer reviewers as to the importance of these areas to foraging, as well as any other areas we may have overlooked.

V.A.2.c. Winter Habitat

In reviewing foraging habitat for high use areas, seasonal differences (e.g., summer vs. winter) were considered. Although considered as part of the general foraging area habitat, NMFS specifically evaluated winter concentration areas and related habitat features. Because warm water winter habitat is essential for northern foraging ectothermic sea turtles and the availability of preferred habitat (water temperature) is confined to specific (southern) areas, NMFS decided to highlight this habitat category as an area of particular importance for loggerheads.

NMFS describes the essential PBF of winter habitat as warm water habitat south of Cape Hatteras near the western edge of the Gulf Stream that supports meaningful aggregations of juveniles and adults during the winter months. PCEs that support this habitat are the following: 1) water temperatures above 10° C during the colder months of November through April; 2) continental shelf waters in proximity to the western boundary of the Gulf Stream; and 3) water depths between 20 and 100 meters.

In the consideration of winter habitat, the same data sets in section V.A.2.b were evaluated. The same steps were also followed as above, but greater emphasis was placed on the satellite telemetry data to identify seasonal differences in distribution. While there were other high use areas identified, this analysis revealed a consistent high use area during the colder months off the coast of North Carolina that may be a particularly important area for northern foraging loggerheads. As such, NMFS narrowed in on that area to evaluate the habitat features that would dictate such a high use area. Available data on oceanographic features (including bottom habitat type, bathymetry, oceanic circulation patterns, and water temperature) were considered.

While loggerheads obviously inhabit other southern areas during the winter (e.g., Florida), the information reviewed indicated that the features off North Carolina serve to concentrate juvenile and adult loggerheads, especially those foraging in northern latitudes. Inhabiting the area off southern North Carolina during the winter at the edge of the Gulf Stream minimizes migratory distance to summer foraging areas, and therefore time and energy needed, while avoiding cold winter temperatures in inshore waters at the same latitude, and reducing energetic costs necessary to maintain a position within the strong currents of the Gulf Stream (Epperly et al. 1995a; Hawkes *et al.* 2007). Based upon satellite telemetry and aerial survey information, the greatest loggerhead concentration in the winter off North Carolina occurs south of Cape Hatteras (in particular the area in between Cape Lookout and Cape Fear) from November through April (Mansfield *et al.* 2009; Hawkes *et al.* 2011; Griffin *et al.*, unpublished data). Further, based upon satellite telemetry data/analyses and bathymetry in the high use areas, the greatest loggerhead concentration in the winter south of Cape Hatteras to Cape Fear occurs from 20 to 100 meters (Hawkes *et al.* 2011; McClellan, unpublished data; NEFSC and Coonamessett Farm Foundation, unpublished data; Read 2013, pers. comm.). NMFS identified this winter habitat area as extending from Cape Hatteras, at the 20 meter depth contour straight across 35.27° N. lat. to the 100 m (328 ft) depth contour, south to Cape Fear at the 20 m (66 ft) depth contour (approximately 33.47° N. lat., 77.58° W. long.) extending in a diagonal line to the 100 m (328 ft) depth contour (approximately 33.2° N. lat., 77.32° W. long.). This southern diagonal line (in lieu of a straight latitudinal line) was chosen to encompass the loggerhead concentration area (observed in satellite telemetry data) and identified habitat features, while excluding the less appropriate habitat (e.g., nearshore waters at 33.2° N. lat.).

The designation of critical habitat in southern North Carolina during the winter will help conserve loggerhead sea turtles by (1) maintaining the habitat in an area of concentrated sea turtles during a discrete time period and for a distinct group of loggerheads (e.g., northern foragers); and (2) allowing for variation in seasonal concentrations based on water temperatures and Gulf Stream patterns.

V.A.2.d. Breeding Habitat

While breeding likely takes place anywhere that reproductively active male and female turtles encounter each other during the breeding season and off of the nesting beaches, the focus for evaluating critical habitat areas only included the areas that have been identified in which concentrated breeding aggregations are known to occur. We infer that areas supporting meaningful aggregations of the species are the highest quality habitat. NMFS describes the essential PBF of concentrated breeding habitat as sites that support meaningful aggregations of both male and female adult individuals during the breeding season. PCEs that support this habitat are the following: 1) meaningful concentrations of reproductive male and female loggerheads; 2) proximity to primary Florida migratory corridor; and 3) proximity to Florida nesting grounds.

These were identified via a review of the literature and expert opinion. It was determined that such areas are essential to the conservation of the species because, as a result of the high concentration of breeding, the areas likely represent very important, established locations for breeding activities and the propagation of the species. Although there is no clear, distinct boundary for these concentrated breeding sites, we chose to constrain the boundaries of the proposed designation to what we consider the "core" areas in which data has shown adult males to congregate to gain access to receptive females.

We identified two primary breeding sites that have been noted in the scientific literature as containing large concentrations of reproductively active male and female loggerheads in the spring, prior to the nesting season. The first is contained within the Southern Florida migration corridor from the shore out to the 200 m (656 ft) contour along the stretch of the corridor between the Marquesas Keys and the Martin County/Palm Beach County line. The second area identified as a concentrated breeding site is located in the nearshore waters just south of Cape Canaveral, Florida. We attempted to identify specific habitat features or boundaries to help delineate the areas to be potentially proposed as critical habitat but review of the literature and communication with the researchers that determined the areas to be concentrated breeding sites did not reveal such features. In the face of a lack of clear habitat features, it is reasonable to conclude that the importance of the breeding areas is based primarily on their locations. The first area is located within the southern Florida migratory corridor leading to the prime nesting habitat, and the second area is central to the prime nesting habitat along the east coast of Florida and at the northern end of the migratory corridor.

The designation of critical habitat in the two Florida breeding areas will help conserve loggerhead sea turtles by maintaining the habitat in a documented high use area used for behavior essential for the propagation of the species.

V.A.2.e. Constricted Migratory Habitat

In the evaluation of habitat needs by life stages, NMFS considered loggerhead migratory movement and behavior. NMFS describes the essential PBF of constricted migratory habitat as high use migratory corridors that are constricted (limited in width) by land on one side and the edge of the continental shelf and Gulf Stream on the other side. PCEs that support this habitat are the following: 1) constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways; and 2) passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas.

While satellite tracking has identified various migratory routes for loggerheads, constricted, high use corridors that are used for traveling from nesting, breeding, and foraging sites by both juvenile and adult loggerheads, are essential to the conservation of the species. The corridors provide the function of a relatively safe, efficient route for a large proportion of the population to move between areas that are vital to the species for foraging and reproduction. Because they are constricted, they are more vulnerable to perturbations than other migratory areas along the continental shelf.

Satellite telemetry information showed the majority of neritic stage loggerhead migratory tracks to be on the continental shelf, with two defined shelf constriction areas off North Carolina and Florida (McClellan and Read 2007; Hawkes *et al.* 2007; Mansfield *et al.* 2009; TEWG 2009; Hawkes *et al.* 2011; Arendt *et al.* 2012b; Arendt *et al.* 2012c; Ceriani *et al.* 2012; Foley *et al. in review*; Griffin *et al.*, unpublished data; NEFSC and Coonamessett Farm Foundation, unpublished data; Virginia Aquarium 2011a, 2011b, 2012a, 2012b). This satellite telemetry information included both neritic stage juveniles and adults from multiple Recovery Units, and also provided details on seasonality of loggerhead movements and behavior on either end of the migratory area (e.g., foraging, breeding and nesting areas). There are some loggerhead tracks and fishery bycatch reports from waters off the continental shelf, as there is not a specific barrier that would prevent loggerheads from moving off the continental shelf. That said, the vast majority of loggerhead distribution information indicates that the preferred habitat for migratory neritic stage loggerheads is the waters of the continental shelf. The constricted shelf waters off

North Carolina and southern Florida were identified as high use which was equated to high conservation value.

NMFS then focused on the areas with identified constricted migratory tracks: North Carolina and southern Florida. Available in-water studies (Foley *et al. in review*), and available mid-Atlantic fishery bycatch assessments (Murray 2009; Warden 2011; Murray and Orphanides (*in press*)) were reviewed to better understand loggerhead distributional patterns of these two areas and habitat features that may result in these patterns. The information examined did not reveal any patterns or information different from the satellite telemetry data.

Next, the oceanographic features of the high use migratory areas were examined. Neritic loggerheads inhabit the continental shelf, so the width of the shelf was determined. While the shelf width off southern Florida (typically 3-4 km (1.9-2.5 miles) off Palm Beach and Miami-Dade Counties) (Banks *et al*. 2008) is narrower than the shelf width off North Carolina (approximately 30 km around Cape Hatteras) (Townsend *et al*. 2004), both areas are constricted relative to the surrounding shelf width. This results in the available neritic habitat being more narrowly confined in these areas. The location of the Gulf Stream was also assessed as currents may be a factor in guiding sea turtle migrations/distribution. The constricted shelf waters off southern Florida and Cape Hatteras are also associated with near-land contact by the Gulf Stream (Putman *et al.* 2010). Finally, SST, bathymetry and substrate type were considered in the evaluation of habitat features associated with these high use migratory areas.

North Carolina. Based upon the best available information, including the width of the continental shelf, water depth, and satellite telemetry tracks corroborating the narrow constriction zone off Cape Hatteras (Mansfield *et al.* 2009; Hawkes *et al.* 2011; Arendt *et al.* 2012b; Arendt *et al.* 2012c; Griffin *et al.*, unpublished data), NMFS identified a loggerhead migratory area off North Carolina. This corridor serves as a concentrated migratory pathway for loggerheads transiting to neritic foraging areas in the north, and back to winter, foraging, and/or nesting areas in the south. Some juveniles may also transition to oceanic habitats at this juncture. The majority of loggerheads will pass through this migratory corridor in the spring (April to June) and fall (September to November), but loggerheads could be present in this area from April through November and given variations in water temperatures and individual turtle migration patterns, these time periods are variable.

In determining the specific area of the North Carolina migratory habitat, the CHRT reviewed the continental shelf width and geographical features off North Carolina. To reiterate, this region was highlighted as an important corridor given the constriction of the continental shelf in relation to the surrounding area, in conjunction with the available satellite telemetry information showing a high use migratory area. Considering the analysis in Arendt *et al.* (2012b), the distance from shore to the 100 fathom (182.88 meter) line narrows considerably between 34.75° and 36° N. lat.

This analysis was conducted in 0.25 degree intervals. By looking at the geographical features within this identified latitudinal range, the CHRT found that Cape Lookout intersects the 0.25 degree latitude intervals (e.g., 34.5° and 34.75° N. lat.) at the southern end. As such, then NMFS reviewed the geographical features of the North Carolina coast (e.g., capes, inlets, bathymetry) in consideration of the continental shelf width to ensure the identified latitudinal range was most appropriate. We identified Cape Lookout as a more appropriate feature (instead of 34.75° N. lat.) for the southern end of the narrow continental shelf width off North Carolina and concentration of loggerhead migratory tracks. The area is used by loggerheads from the shoreline (barrier islands) to the edge of the continental shelf.

Southern Florida. The migratory corridor from the Marquesas Keys to the Cape Canaveral area is the only identified corridor south of the North Carolina corridor. This corridor stretches along the Florida coast from the westernmost edge of the Marquesas Keys (82.17° W. long.) to the tip of Cape Canaveral (28.46° N. lat.). The northern border stretches from shore to the 30-m contour line. The seaward border then stretches from the northeastern-most corner to the intersection of the 200-m contour line and 27° N. lat. parallel. The seaward border then follows the 200-m contour line to the westernmost edge at the Marquesas Keys. Adult male and female turtles use this corridor to move from foraging sites to the nesting beach or breeding sites from March to May, and then use this corridor to move from the nesting beach or breeding sites from August to October, while juveniles and adults use it to move south during fall migrations to warmer waters (Mansfield 2006; Mansfield *et al*. 2009; Arendt *et al.* 2012b; Foley *et al. in review*).

The designation of critical habitat in the North Carolina and southern Florida migratory corridors will help conserve loggerhead sea turtles by 1) preserving passage conditions to and from important nesting, breeding and foraging areas; and 2) protecting the habitat in a narrowly confined area of the continental shelf with documented high use by loggerheads.

V.A.3. *Sargassum*

The conservation of loggerhead sea turtles, in particular the post-hatchling and small oceanic juvenile stages, is dependent upon suitable foraging and shelter habitat, both of which are provided by *Sargassum* in the Atlantic and Gulf of Mexico (Witherington *et al.* 2012). Within the United States, the only loggerheads found in association with *Sargassum* occur within the Northwest Atlantic Ocean DPS. *Sargassum* habitat refers to the overarching habitat type that contains multiple life stages (e.g., post-hatchling, juvenile), ecosystem zones (e.g., neritic and oceanic), and behavior categories (e.g., foraging and shelter).

NMFS describes the PBF of loggerhead *Sargassum* habitat as developmental and foraging habitat for young loggerheads where surface waters form accumulations of floating material, especially *Sargassum*. PCEs that support this habitat are the following: 1) convergence zones, surface-water downwelling areas, and other locations where there are concentrated components of the *Sargassum* community in water temperatures suitable for the optimal growth of *Sargassum* and inhabitance of loggerheads; 2) *Sargassum* in concentrations that support adequate prey abundance and cover; 3) available prey and other material associated with *Sargassum* habitat such as, but not limited to, plants and cyanobacteria and animals endemic to the *Sargassum* community such as hydroids and copepods; and 4) sufficient water depth and proximity to available currents to ensure offshore transport, and foraging and cover requirements by *Sargassum* for post-hatchling loggerheads, i.e., >10 m depth to ensure not in surf zone.

Witherington *et al.* (2012) found that the presence of floating *Sargassum* itself, irrespective of other detectable surface features, defined habitat utilized by juvenile sea turtles. It is difficult to identify specific areas where these weedlines are likely to form consistently, because *Sargassum* habitat is widespread and dynamic, dependent upon varying oceanic currents. Surface current maps and high resolution pelagic *Sargassum* density maps will further assist in describing geographic occurrence of *Sargassum* at a particular point in time. While predictions are challenging, near-real time detection of *Sargassum* concentrations is possible using daily satellite imagery (MODIS) and the higher resolution Landsat imagery when available. These tools can be used to assess *Sargassum* in near-real time, but future predictions must rely on current systems in the Gulf of Mexico and Atlantic Ocean to identify concentrations of post-hatchling and juvenile loggerhead habitat (including *Sargassum*).

NMFS evaluated available satellite imagery of *Sargassum* (from Gower and King (2011) and Hardy *et al.* (2011)) and Atlantic Ocean and Gulf of Mexico current information to identify general *Sargassum* circulation patterns. In the Atlantic, most pelagic *Sargassum* circulates between 20° N. and 40° N. lat. and 30° W. long. and the western edge of the Florida Current/Gulf Stream (SAFMC 2002). However, *Sargassum* does occur as far north as the Grand Banks. That said, critical habitat can only be designated for U.S. waters and therefore, the area NMFS considered for critical habitat was limited to U.S. waters. Given the available information on *Sargassum* and loggerhead distribution, NMFS considered *Sargassum* habitat essential for the conservation of loggerhead turtles to occur south of 40° N. lat. throughout the Atlantic and Gulf of Mexico U.S. EEZ.

Given growth rates in culture (Hanisak and Samuel 1987), we know that pelagic *Sargassum* occurs in waters greater than 12° C. The *Sargassum* community, hence important habitat for post-hatchling and juvenile loggerheads, is known to occur in the U.S. Atlantic and Gulf of Mexico EEZ waters as far north as 40° N. lat. when water temperatures are 12° C and greater (Dooley 1972; Hanisak and Samuel 1987; Gower and King 2011).

While the *Sargassum* traditionally circulates more in offshore waters, Witherington (2012, pers. comm.) indicates *Sargassum* habitat can occur close to shore, generally deeper than the 10 m depth contour. While *Sargassum* may extend all the way to land, the value of *Sargassum* habitat to loggerhead turtles in the tidal range is debatable. The tidal zone is generally defined as the marine environment that experiences the effects of tidal and longshore currents and breaking waves to a depth of 5 to 10 m (16 to 33 ft) below the low-tide level, depending on the intensity of storm waves (Encyclopedia Britannica 2012). The *Sargassum* found farther offshore contains concentrated features of this habitat important to loggerhead turtles (e.g., forage, cover, dispersal aid). As such, NMFS considered the 10 m depth contour as the shoreward boundary of *Sargassum* habitat to represent the features essential for the conservation of loggerhead turtles.

Based upon this rationale, NMFS identified two large contiguous areas (one in the Atlantic Ocean and another in the Gulf of Mexico) where the processes supporting dynamic *Sargassum* habitat, and the essential features of that habitat, will occur. This habitat extends from the 10 m depth contour to the U.S. boundary of the EEZ.

The designation of *Sargassum* critical habitat will help conserve loggerhead sea turtles by 1) providing for essential forage, cover and transport habitat for a particularly vulnerable life stage (e.g., post-hatchlings); and 2) ensuring habitat longevity for a habitat type that is important to multiple life stages and not able to be easily replicated.

V.A.4. Oceanic

Sargassum habitat is the only habitat in the Atlantic that occurs in oceanic waters for which NMFS identified PBFs essential to conservation of loggerheads. While loggerheads occur in oceanic waters within the United States EEZ and utilize the Gulf Stream and Florida Loop Current as important dispersal features to access the developmental habitat of the ocean gyres, NMFS could find no specific habitat features that were essential to the conservation of the species within this area other than *Sargassum*.

V.B. North Pacific Ocean DPS

V.B.1. Terrestrial

Within the North Pacific Ocean DPS, loggerheads nest only on beaches outside of U.S. jurisdiction. Thus, no terrestrial nesting habitat is proposed for critical habitat designation.

V.B.2. Neritic

Within the North Pacific Ocean DPS, loggerheads do not occur in neritic habitat within U.S. jurisdiction. Thus, neritic habitat is not considered further.

V.B.3. Oceanic

Within the North Pacific Ocean DPS, loggerheads occur predominantly in oceanic waters.

V.B.3.a. Central North Pacific

NMFS describes the essential PBF of loggerhead turtle oceanic habitat in the North Pacific Ocean as waters that support suitable conditions in sufficient quantity and frequency to provide meaningful foraging, development, and/or transiting opportunities to the populations in the North Pacific. PCEs in the central North Pacific Ocean that support this habitat include 1) currents and circulation patterns of the North Pacific (KEBR, and the southern edge of the KEC characterized by the Transition Zone Chlorophyll Front) where physical and biological oceanography combine to promote high productivity (chlorophyll a = 0.11–0.31 mg/m^3) and sufficient prey quality (energy density ≥ 11.2 kJ/g) of species; and 2) appropriate SSTs (14.45° to 19.95° C (58.01° to 67.91° F)), primarily concentrated at the 17° to 18° C (63° to 64° F) isotherm.

As stated in section III.B.2., the Transition Zone Chlorophyll Front is favored foraging and developmental habitat for juvenile loggerhead turtles (Polovina *et al.* 2001). Loggerhead sea turtle habitat in the North Pacific occurs between 28° N. and 40° N. lat. (Polovina *et al.* 2004) and SST of 14.45° C to 19.95° C (58.01° F to 67.91° F) (Kobayashi *et al.* 2008), but is highly correlated at the 17/18° C (63/64° F) isotherm (Howell *et al.* 2008). Kobayashi (unpublished data) estimated the proportion of the habitat available to loggerheads that occurs in the U.S. EEZ around Hawaii while taking into account seasonal and interannual variability, which climatology might obscure due to averaging. Kobayashi used a 1997–2006 time series of monthly Pathfinder 0.1 degree lat./long. resolution SST data and tabulated the fraction of pixels in the EEZ that were less than 17.5° C (63.5° F) out of total pixels. This tabulation resulted in 0.68 percent of the total habitat being identified as potential loggerhead oceanic habitat occurring within the U.S. EEZ around Hawaii. Using pixels less than 20° C (68° F) in the tabulation identified a maximum of 4.20 percent of potential loggerhead habitat within the U.S. EEZ. This analysis of habitat variables corresponds with tracking locations of North Pacific loggerheads, the majority of which (157 of 183 turtles) used oceanic areas solely outside the U.S. EEZ, with 0.88 percent of location records (n = 481) within the U.S. EEZ (Figure 13). Kobayashi further examined the seasonal variability of the broader range of SST (14.45° C to 19.95° C (58.01° F to 67.91° F)). His analysis showed that this range of SST does not exist within the U.S. EEZ from July through November, therefore further limiting suitable loggerhead habitat within the U.S. EEZ around Hawaii to only a portion of the year.

Limited data exist to characterize westward migratory routes or habitat of adults traveling back to Japan where they will breed and nest, perhaps using the westbound Northern Equatorial Current. Tracking data are available from the Grupo Tortuguero Proyecto Caguama project, which deployed 48 satellite transmitters on loggerhead turtles foraging in Baja California Sur, Mexico (Peckham *et al.* 2011). Of these 48 deployments, five turtles migrated westward out of the Lopez Mateos, Ulloa Bay, Baja California Sur foraging hotspot toward the U.S. EEZ around Hawaii (Peckham 2012, pers. comm.; *http://www.seaturtle.org/tracking/?project_id=22*; tracks for Zapata, Yamilet, Adelita, Angel, and 5524). Only three (two adults, 1 subadult) transited through the U.S. EEZ around Hawaii, including the first (Adelita) satellite tracked trans-Pacific migration in 1996 (Nichols *et al.* 2000).

Further, evaluation of NOAA PIFSC Marine Turtle Research Program stranding data indicates that since 1982 only two loggerheads have been recorded as stranded in the Hawaiian Islands which may suggest low use of US EEZ waters. Despite satellite track and stranding information, limited data exist to determine to what extent the U.S. EEZ is used by loggerheads traveling from the eastern to western Pacific.

Despite historic population decline and nesting trend variability (Kamezaki *et al.* 2003; Conant *et al.* 2009; Van Houtan and Halley 2011)., loggerheads appear to have remained widely distributed and continue to occupy most, if not all, of their historical range in the central Pacific Ocean. Accordingly, those oceanic areas within loggerhead range that are infrequently used generally do not provide the significant function that they might for a species with a constricted range. The potential loggerhead habitat occurring in the U.S. EEZ around Hawaii represents between 0.68 percent and 4.2 percent of the total habitat in the central portion of the Pacific. This habitat represents a small percentage of suitable habitat and the variables that make it suitable only occur within the U.S. EEZ around Hawaii a portion of the year in spite of loggerheads using areas north of it throughout the year.

Habitat within the U.S. EEZ in the central North Pacific does not provide meaningful foraging, development, and/or transiting opportunities to the North Pacificd DPS, and therefore does not contain the PBFs and PCEs outlined in the previous section.

V.B.3.b. Eastern Pacific/U.S. West Coast

NMFS describes the essential PBF of loggerhead turtle oceanic habitat in the North Pacific Ocean as waters that support suitable conditions in sufficient quantity and frequency to provide meaningful foraging, development, and/or transiting opportunities to the populations in the North Pacific. PCEs in the eastern North Pacific Ocean that support this habitat include 1) sites that support meaningful aggregations of foraging juveniles; and 2) sufficient prey densities of neustonic and oceanic organisms.

Given that so few loggerheads have been found off the coasts of Alaska (two since 1960), Oregon and Washington (nine since 1958), and California north of Point Conceptions (four of 32 off the coast of California since 1990), the only area considered for designation of critical habitat off the U.S. west coast is the area in southern California from Point Conception south to the U.S.-Mexico border (also referred to as the Southern California Bight).

Waters off the Pacific coast of Baja California and particularly within the shelf waters of Ulloa Bay, are highly productive. Loggerheads have been documented in the thousands in this area (Pitman 1990; Seminoff *et al.* 2006) and their occurrence is strongly associated with the red crab which has often occurred in such numbers as to “turn the ocean red” (Pitman 1990). In comparison, based on interactions with the California drift gillnet fishery and stranding records, recorded observations are generally rare events, with 16 loggerheads taken in 4,165 observed sets from 1990–2010 (Allen *et al.* 2013) and 28 loggerheads observed stranded in the Southern California Bight from 1990 to 2012 (average ~1.3 loggerheads/year).

Based on the rarity of the presence of loggerheads and their prey both historically and currently in waters off the U.S. west coast, U.S. waters in the eastern Pacific do not provide meaningful foraging, development, and/or transiting opportunities to the population in the North Pacific, and therefore does not contain the PBFs and PCEs outlined in the previous section.

VI: SPECIAL MANAGEMENT CONSIDERATIONS

An occupied area may be designated as critical habitat if it contains one or more of the PBFs essential to conservation, and if such features "may require special management considerations or protection" (16 U.S.C. section 1532(5)(a)(i)(II)). Joint NMFS and USFWS regulations (50 CFR 424.02(j)) define "special management considerations or protection" to mean "any methods or procedures useful in protecting PBFs of the environment for the conservation of listed species." NMFS determined that the PBFs identified earlier may require special management considerations due to a number of factors that may affect them. These factors include activities, structures or other byproducts of human activities. The list below is not necessarily inclusive of all factors .

Major categories of factors, by habitat type, follow. All of these may have an effect on one or more PBF or PCE within the range of the Northwest Atlantic Ocean DPS and may require special management considerations as described below.

VI.A. Northwest Atlantic Ocean DPS

VI.A.1. Terrestrial

The USFWS addressed special management considerations for terrestrial units in their proposed rule.

VI.A.2. Neritic

VI.A.2.a. Nearshore Reproductive Habitat

1) Offshore structures including but not limited to, breakwaters, groins, jetties, or artificial reefs which can block or impede efficient passage of hatchlings or females, and/or which concentrate hatchling predators and thus result in greater predation on hatchlings
2) Lights which can attract predators and/or disorient hatchlings and nesting females.
3) Oil spills and response which can affect habitat conditions for efficient passage of hatchlings or females
4) Alternative offshore energy development (turbines) which can affect habitat conditions for efficient passage of hatchlings or females
5) Fishing gear that can block or impede efficient passage of hatchlings or females
6) Dredging and disposal activities which can affect habitat conditions for efficient passage of hatchlings or females

VI.A.2.b. Winter Habitat

1) Dredging and disposal of sediments which can affect sufficient habitat availability
2) Oil and gas activities, such as construction, removal of platforms and oil spills, which can affect sufficient habitat availability
3) Power generation and alternative offshore energy development activities such as installation of turbines, windfarms, and means to convert wave or tidal energy into power which affect sufficient habitat availability
4) Aquaculture structures such as net pens and fixed structures which can affect sufficient habitat availability
5) Climate change which can result in increases in water temperatures and affect ocean circulation patterns in the mid-Atlantic

VI.A.2.c. Breeding Habitat

1) Fishing activities which can disrupt use of habitat and thus affect concentrations of reproductive loggerheads
2) Dredging and disposal of sediments which can affect concentrations of reproductive loggerheads
3) Oil spills and response which can affect concentrations of reproductive loggerheads
4) Alternative offshore energy development (turbines) which can affect concentrations of reproductive loggerheads
5) Climate change which can affect currents and water temperatures and affect concentrations of reproductive loggerheads

VI.A.2.d. Constricted Migratory Habitat

The primary impact to the functionality of the identified corridors as migratory routes for loggerhead sea turtles would be a loss of passage conditions that allow for the free and efficient migration along the corridor. The loss of such passage conditions could come from large-scale construction projects that result in the placement of substantial structures along the path of the migration, or other similar habitat alterations, requiring large-scale deviations in the migration movements. This impact is expected to be much more likely, and have a greater impact, in the most constricted areas of the migratory routes.

1) Oil and gas activities, such as construction and removal of platforms, lighting and noise, which can alter habitat conditions needed for efficient passage

2) Power generation activities such as turbines, windfarms, conversion of wave or tidal energy into power, which can alter habitat conditions needed for efficient passage
3) Dredging and disposal of sediments which can alter habitat conditions needed for efficient passage
4) Channel blasting, including use of explosives to remove existing bridge or piling structures or to deepen navigation channels, which can alter habitat conditions needed for efficient passage
5) Marina and dock/pier development which can alter habitat conditions needed for efficient passage
6) Offshore breakwaters which can alter habitat conditions needed for efficient passage
7) Aquaculture structures such as net pens and fixed structures and artificial lighting which can alter habitat conditions needed for efficient passage
8) Fishing activities, particularly those using fixed gear (pots, pound nets), which can alter habitat conditions needed for efficient passage
9) Noise pollution from construction, shipping and/or military activities, which can alter habitat conditions needed for efficient passage

VI.A.3. *Sargassum*

1) Commercial harvest of *Sargassum* which would directly decrease the amount of habitat
2) Oil and gas exploration, development, and transportation which affect the *Sargassum* habitat itself and the loggerhead prey items found within this habitat; This occurs both in the process of normal operations and during blowouts and oil spills, which release toxic hydrocarbons and also require other toxic chemicals for cleanup
3) Channel dredging and spoil disposal which can create localized areas of elevated turbidity and, potentially, resuspension or introduction of toxic and harmful substances
4) Vessel operations which can include the routine disposal of trash and wastes and the accidental release or spillage of cargo, trash or toxic substances, or result in the transfer and introduction of exotic and harmful organisms through ballast water discharge, which may then impact the loggerhead prey species found in *Sargassum* habitat

VI.B. North Pacific Ocean DPS

NMFS did not identify any specific areas within the U.S. EEZ in the North Pacific that contain PBFs essential to the conservation for the North Pacific Ocean DPS; therefore, we did not analyze special management considerations.

VII: AREAS RECOMMENDED FOR CRITICAL HABITAT DESIGNATION

The critical habitat areas described below constitute our best assessment at this time of areas determined to be occupied at the time of listing and containing at least one of the PBFs and PCEs essential for the conservation of the species and that may require special management.

VII.A. North Atlantic Ocean DPS

VII.A.1. Terrestrial

The USFWS identified terrestrial critical habitat in their proposed rule for terrestrial loggerhead habitat (78 FR 18000, March 25, 2013).

VII.A.2 Neritic

VII.A.2.a General Descriptions

VII.A.2.a.(i). Nearshore Reproductive Habitat General Description

These units are those directed at conserving hatchling swim frenzy and internesting turtle habitat directly off high density nesting beaches and beaches adjacent to them, as defined by USFWS in their proposed rule to designate critical habitat for the loggerhead sea turtle (78 FR 18000, March 25, 2013). Generally, the units include nearshore areas extending directly seaward from the coast 1.6 km (one mile) from each end of the unit (in cases of long, straight beaches, usually found along the east coast) or 90 degrees from the coast seaward 1.6 km (one mile) (in cases of beaches along islands or where the rounding at their ends would potentially include a significant number of nests, and thus hatchlings and nesting females for that beach). Where beaches were within 1.6 km (one mile) of each other, nearshore areas were connected, either along the shoreline or by delineating on GIS a straight line from the end of one beach to the beginning of another (either from island to island or across an inlet or the mouth of an estuary). Although generally following these rules, the exact delineation of each unit was determined individually because each was unique. Appendix 1 identifies NMFS nearshore reproductive habitat unit numbers as they correspond to U.S. Fish and Wildlife Service terrestrial unit numbers.

VII.A.2.a.(ii). Winter Habitat General Description

NMFS has identified the winter concentration area off North Carolina as the continental shelf waters between the 20 and 100 meter (65.6 and 328 feet) depth contours, from Cape Hatteras to Cape Fear (diagonal line to the 100 meter (328 feet) depth contour) (Figure 18). The east and western boundaries of this habitat are the 20 m and 100 m (65.6 and 328 feet) contours, respectively. The northern boundary of this unit starts at Cape Hatteras (35.27° N) in a straight latitudinal line between 20-100 meter (65.6 and 328 feet) depth contours. The southern boundary is a 37.5 km (23.25 mile) line that extends from the 20 meter (65.6 feet) depth contour at approximately 33.47° N, 77.58° W (off Cape Fear) to the 100 meter (328 feet) depth contour at approximately 33.2° N, 77.31° W.

VII.A.2.a.(iii). Breeding Habitat General Description

NMFS has identified two concentrated breeding habitat areas (Figures 26 and 28). The first breeding habitat area is located in the nearshore waters just south of Cape Canaveral, Florida, beginning south of Titusville extending south to Floridana Beach. This area incorporates both inshore areas such as portions of the Indian River and Banana River lagoons and extends offshore to depths below 60 m (196.8 feet). This Cape Canaveral, Florida breeding habitat area is consistent with what is reported in Arendt *et al.* 2012a. The second breeding habitat area runs along southeastern Florida from the Martin County/Palm Beach County line to the Marquesas Keys (82.167° W. long.), with east and west boundaries from the shore out to the 200 m (656 feet) contour.

VII.A.2.a.(iv). Migratory Habitat General Description

NMFS has identified two migratory habitat areas - North Carolina and southern Florida.

The North Carolina migratory corridor contains the waters between 36° N. lat. and Cape Lookout (approximately 34.58° N) from the edge of the Outer Banks, North Carolina, barrier islands to the 200 meter (656 feet) depth contour (continental shelf) (Figure 18).

The southern Florida migratory corridor stretches along the Florida coast from the tip of Cape Canaveral (28.46° N. lat.) to the westernmost edge of the Marquesas Keys (82.17° W. long.) (Figure 26-28). The northern border stretches from shore to the 30 m (98.4 feet) contour line. The seaward border then stretches from the northeastern-most corner to the intersection of the 200 m (656 feet) contour line and 27° N. lat. parallel. The seaward border then follows the 200 m (656 feet) contour line to the westernmost edge at the Marquesas Keys (82.17° W. long.).

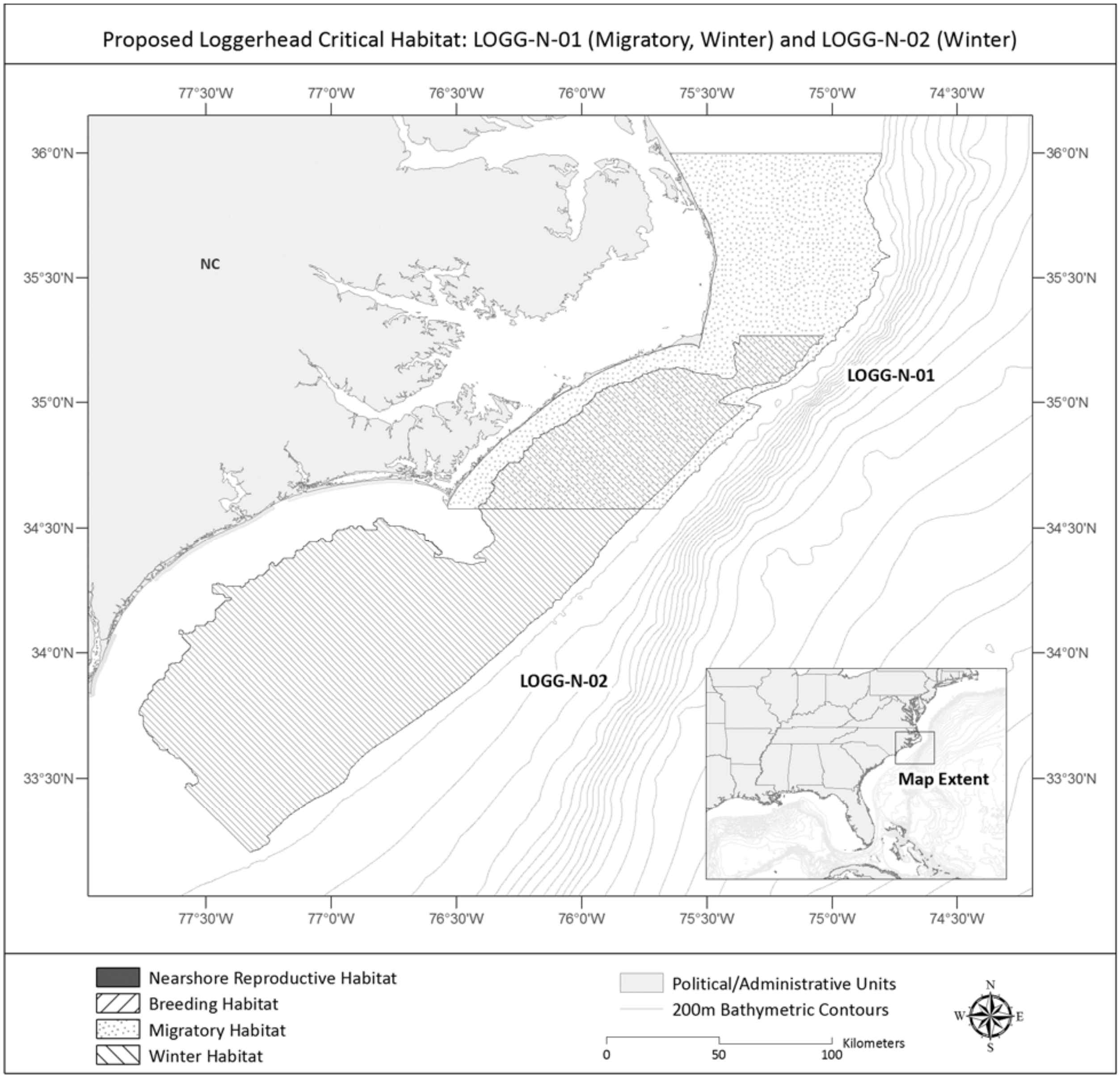

Figure 18. Winter and Northern Migratory Habitat (LOGG-N-01-02)

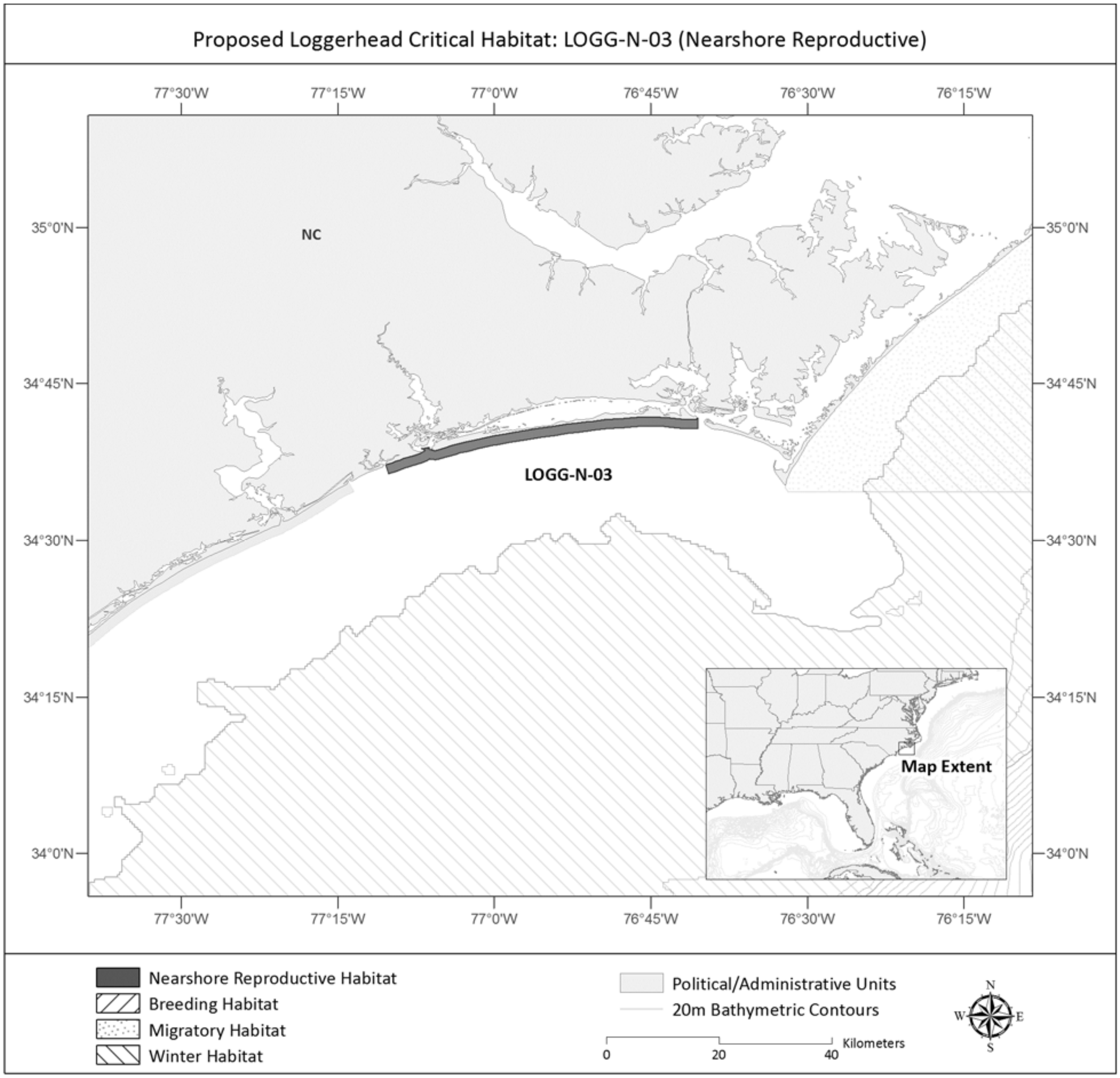

Figure 19. Nearshore Reproductive Habitat (LOGG-N-03)

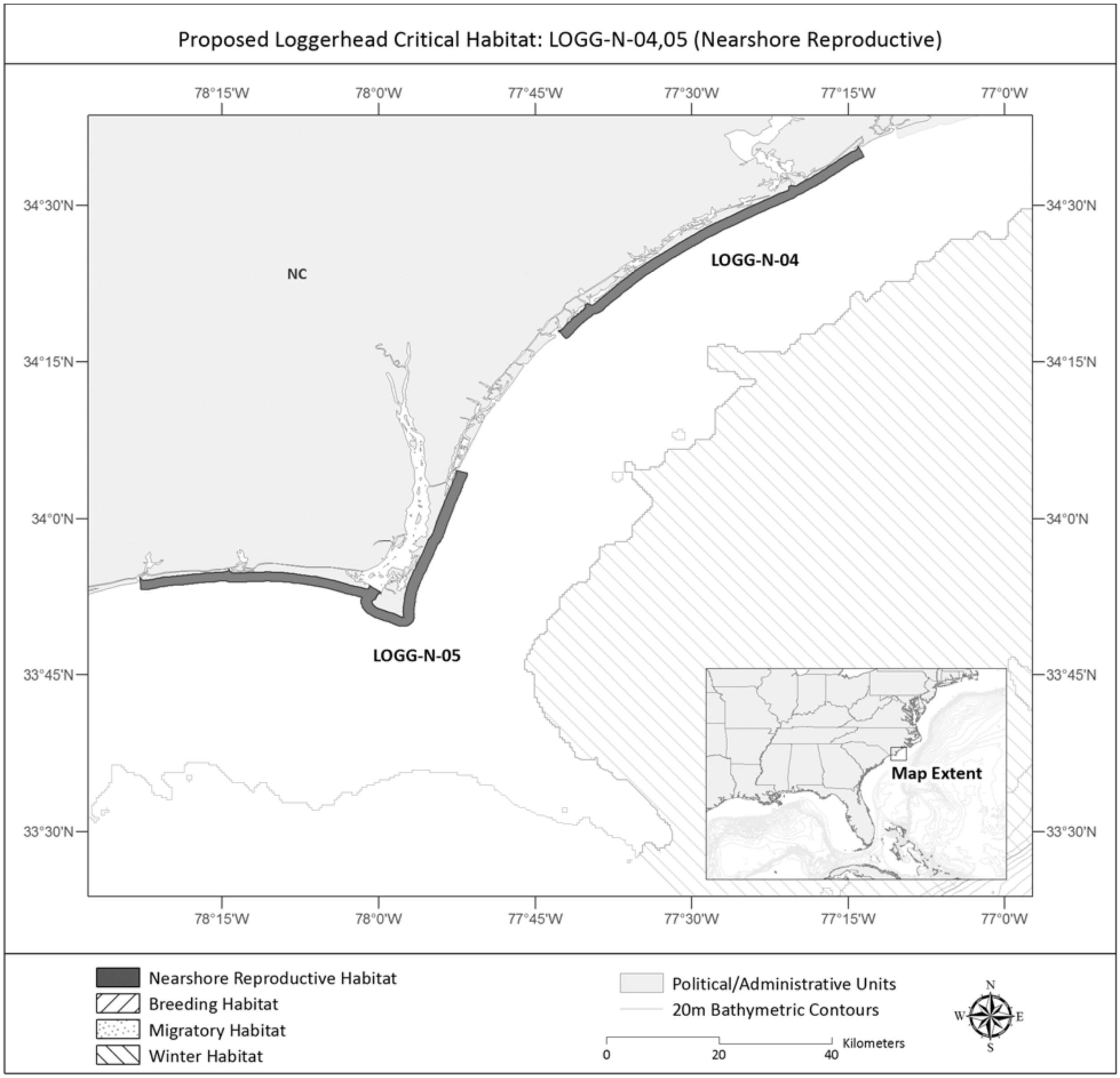

Figure 20. Nearshore Reproductive Habitat (LOGG-N-04-05)

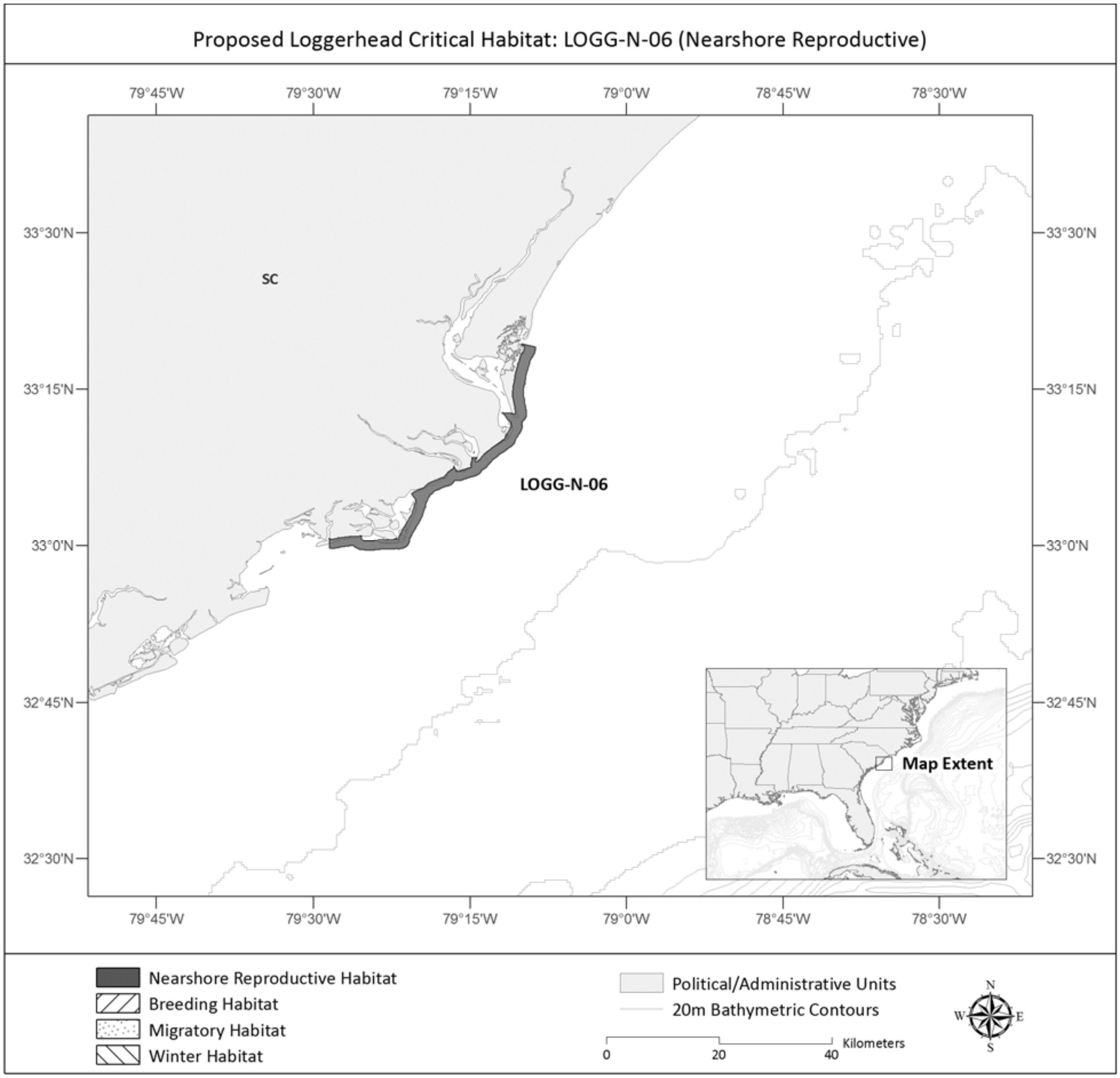

Figure 21. Nearshore Reproductive Habitat (LOGG-N-06)

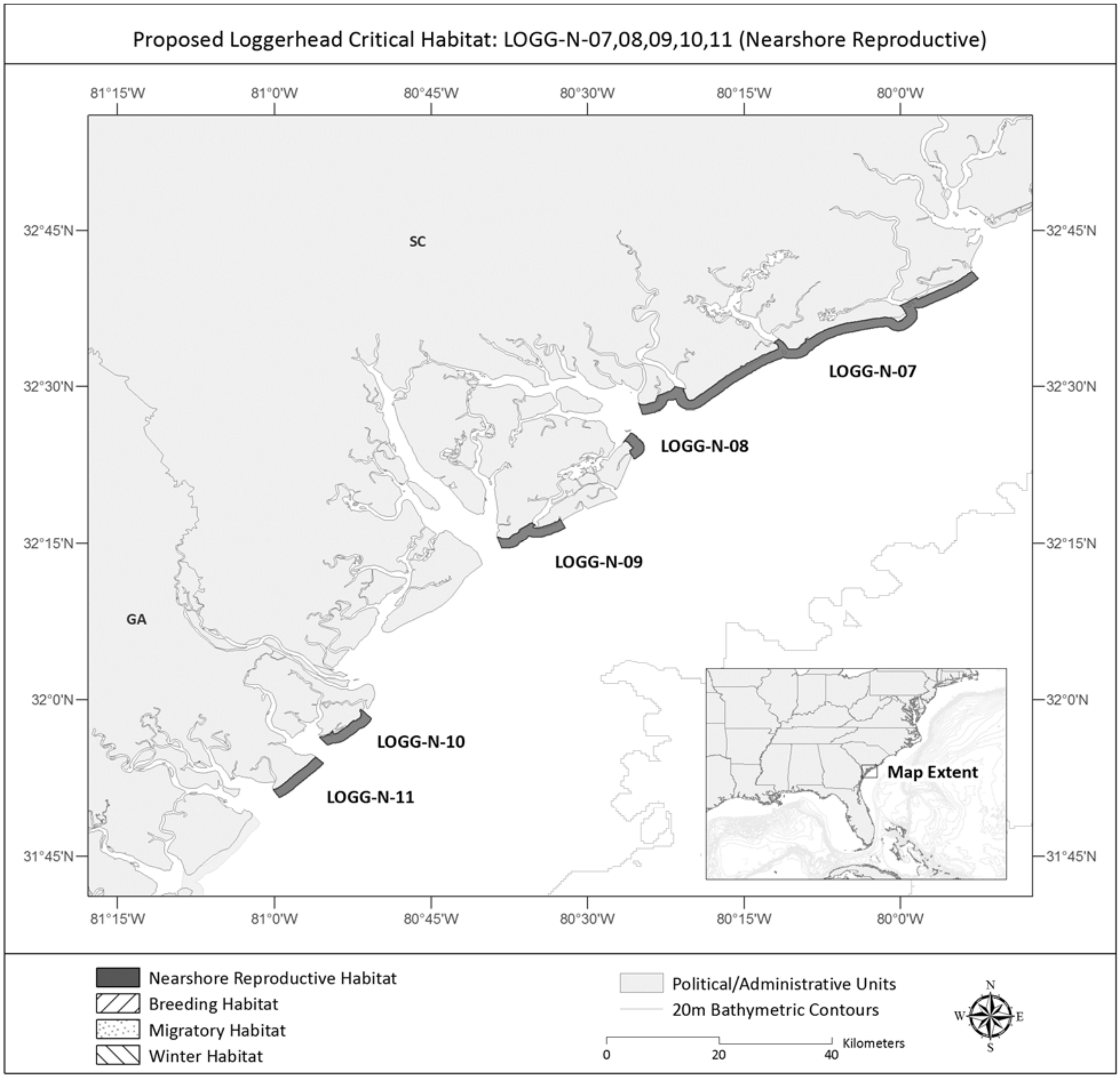

Figure 22. Nearshore Reproductive Habitat (LOGG-N-07-11)

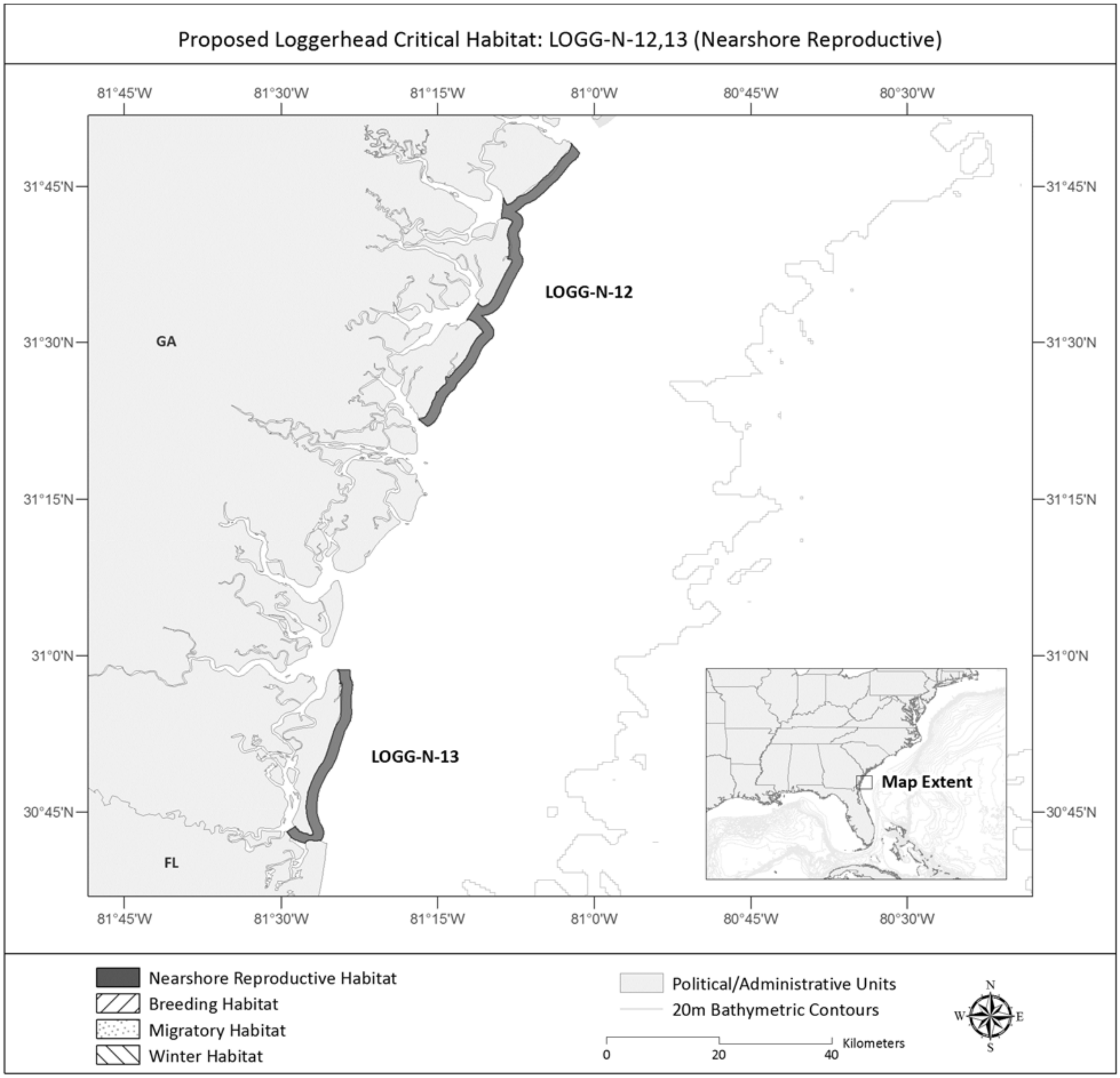

Figure 23. Nearshore Reproductive Habitat (LOGG-N-12-13)

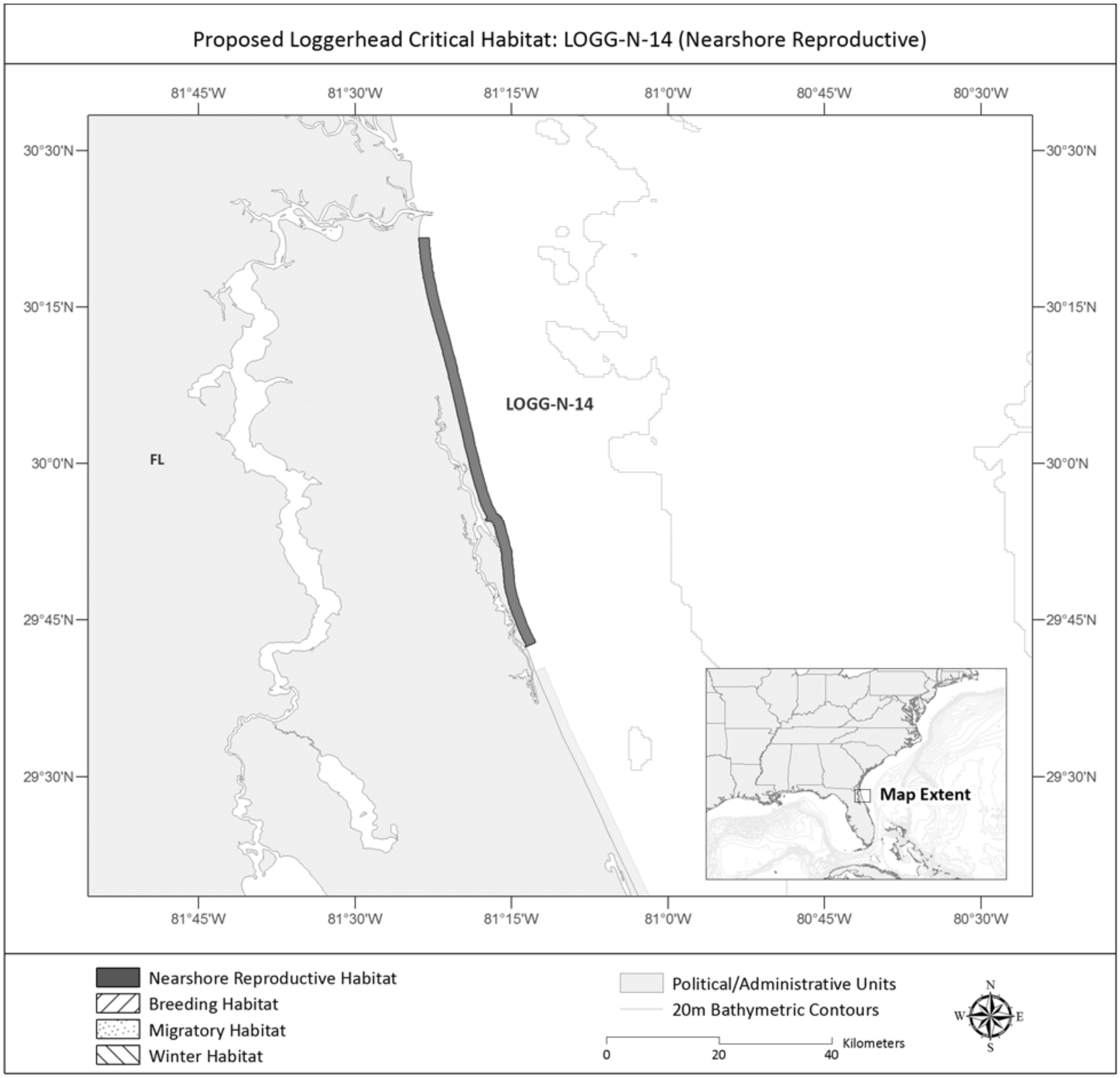

Figure 24. Nearshore Reproductive Habitat (LOGG-N-14)

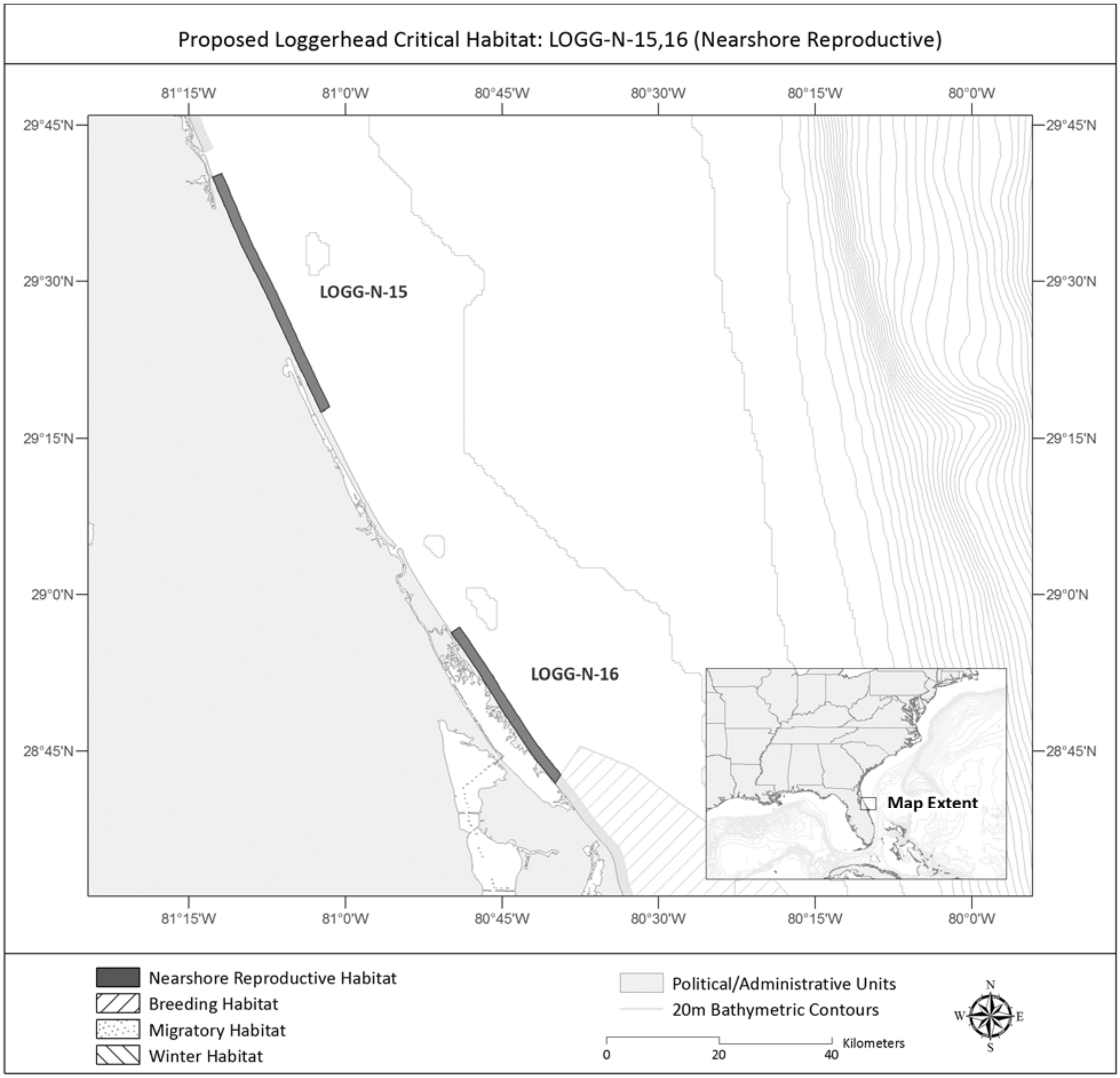

Figure 25. Nearshore Reproductive Habitat (LOGG-N-15-16)

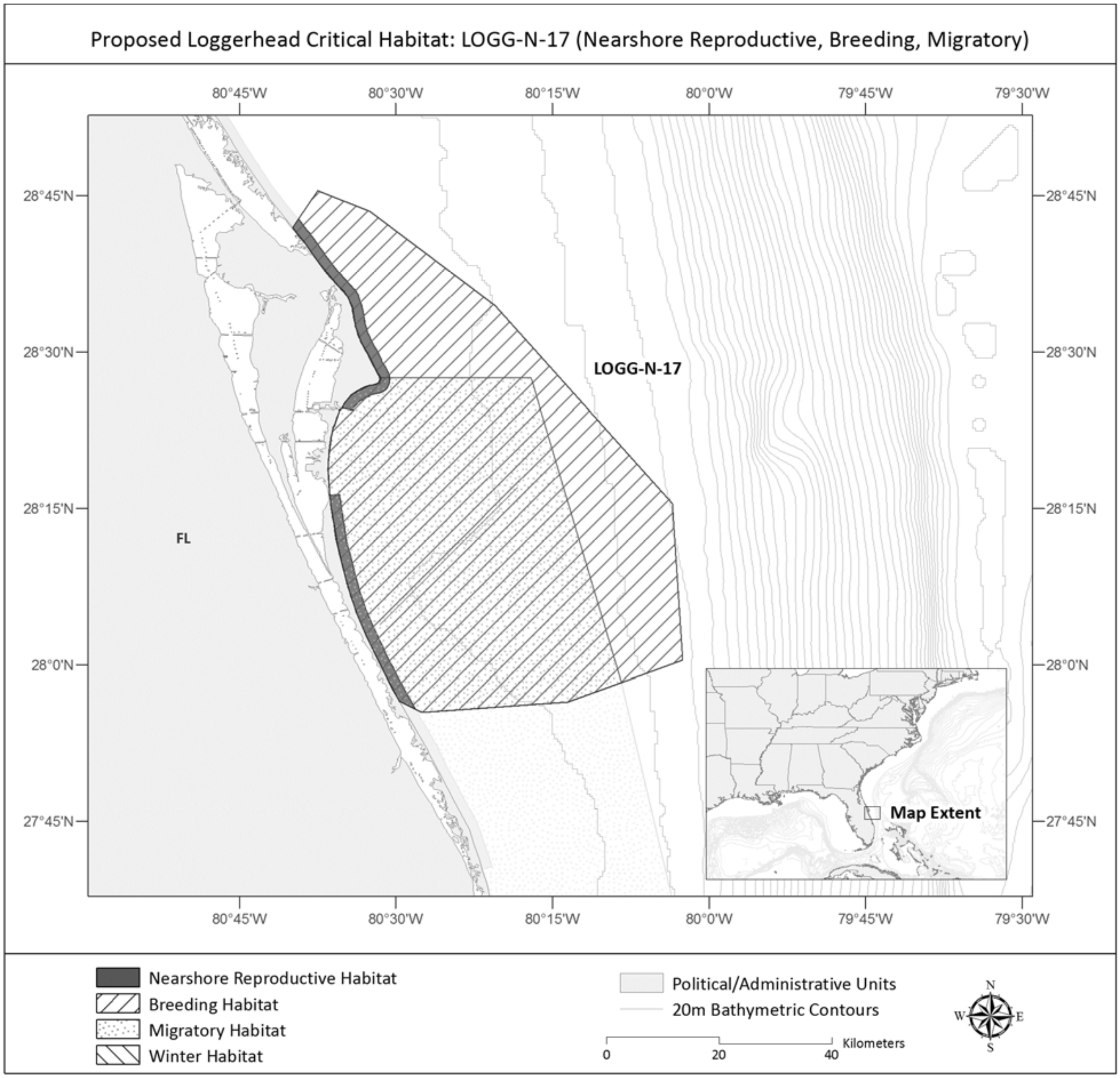

Figure 26. Nearshore Reproductive, Breeding, and Migratory Habitat (LOGG-N-17)

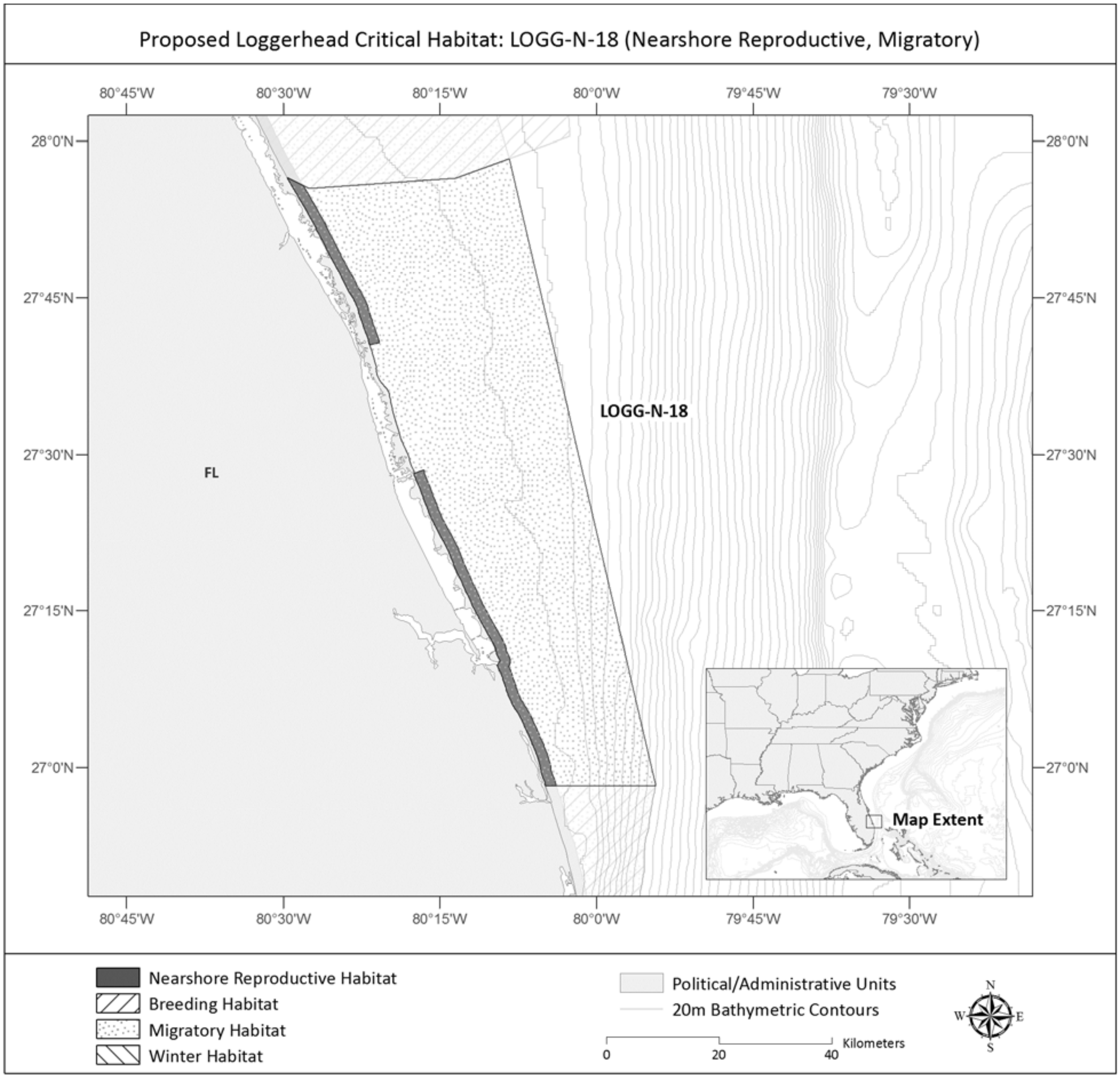

Figure 27. Nearshore Reproductive and Migratory Habitat (LOGG-N-18)

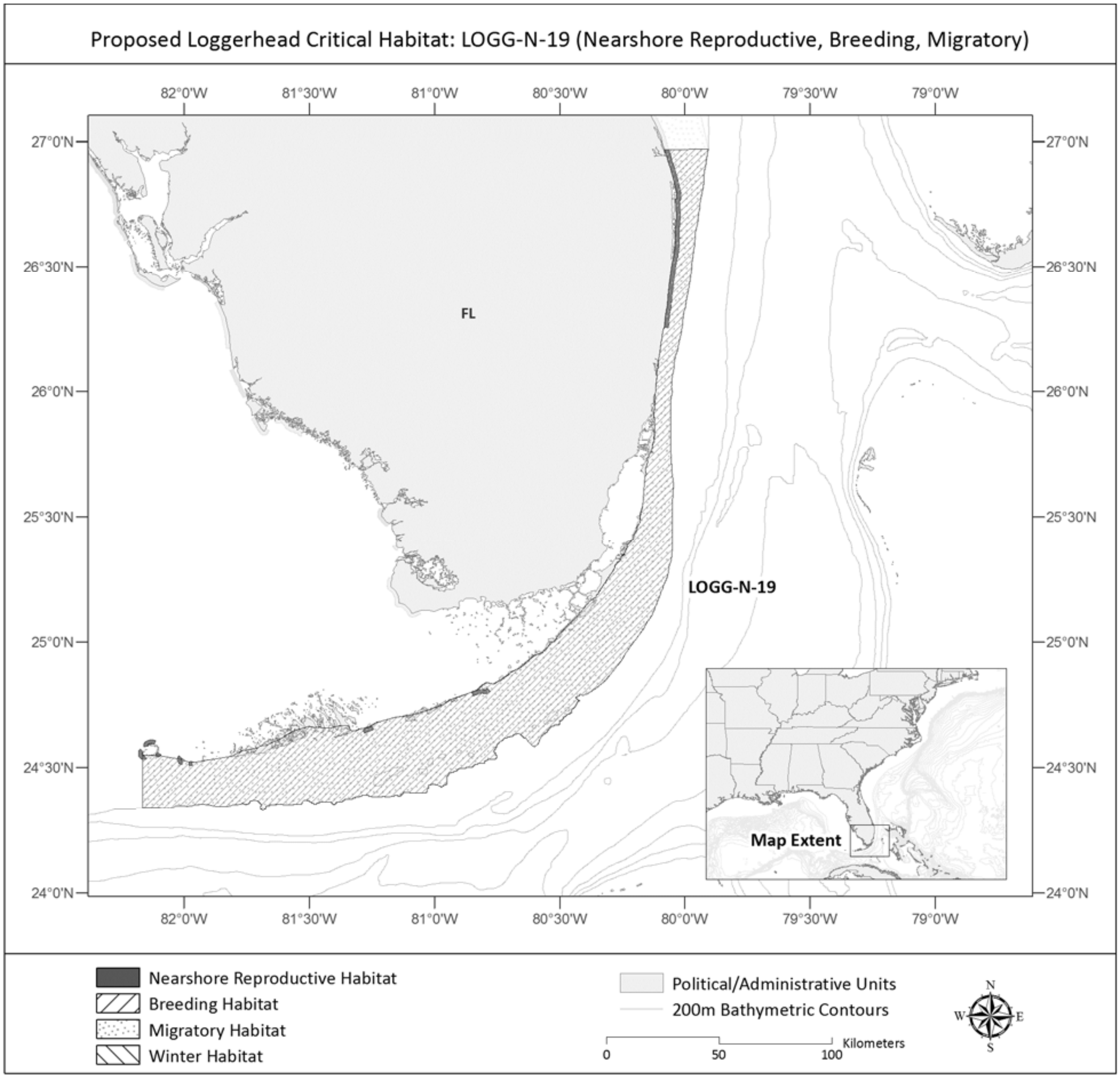

Figure 28. Migratory, Breeding and Nearshore Reproductive Habitat (LOGG-N-19)

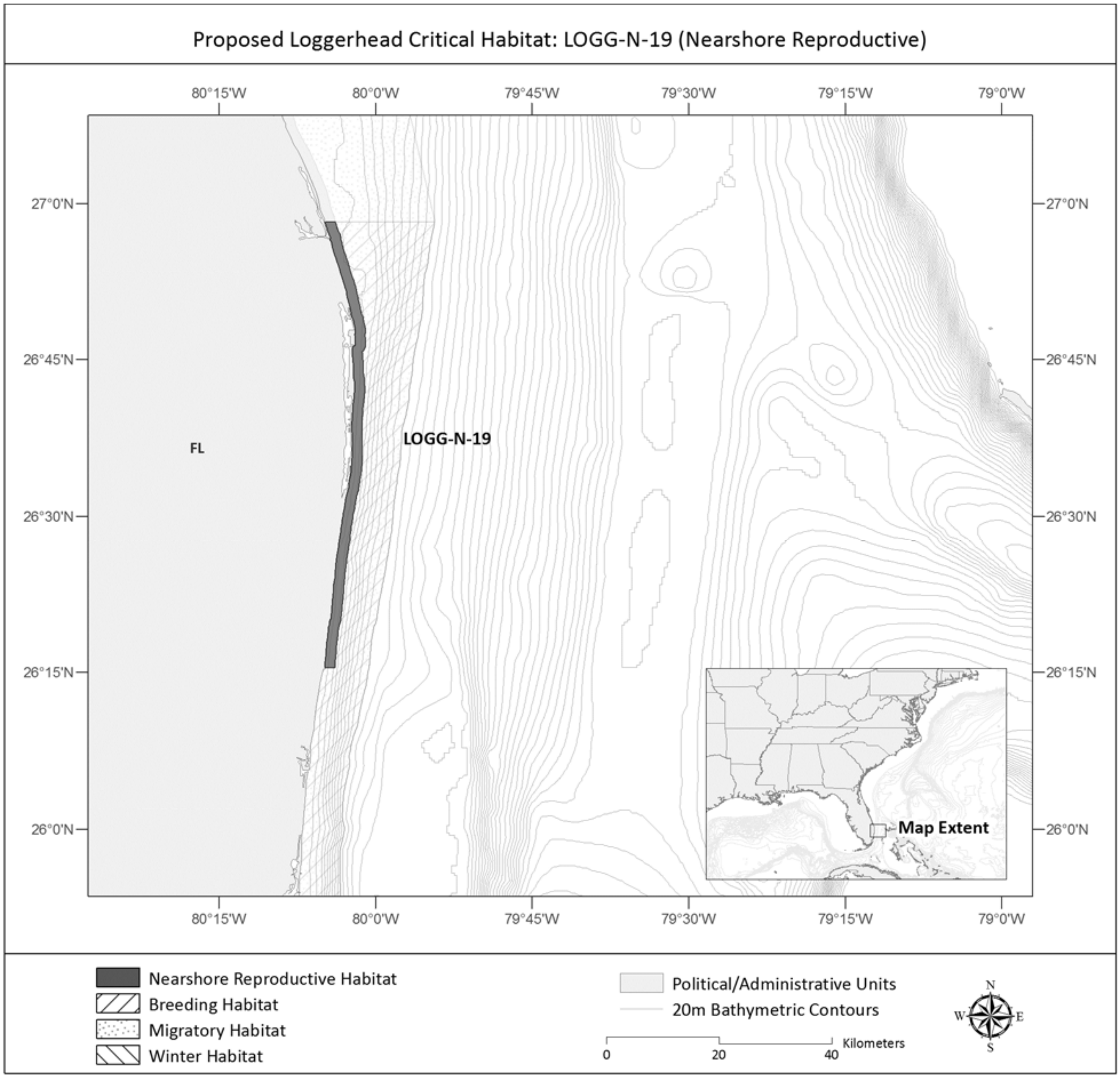

Figure 29. Nearshore Reproductive Habitat (LOGG-N-19)

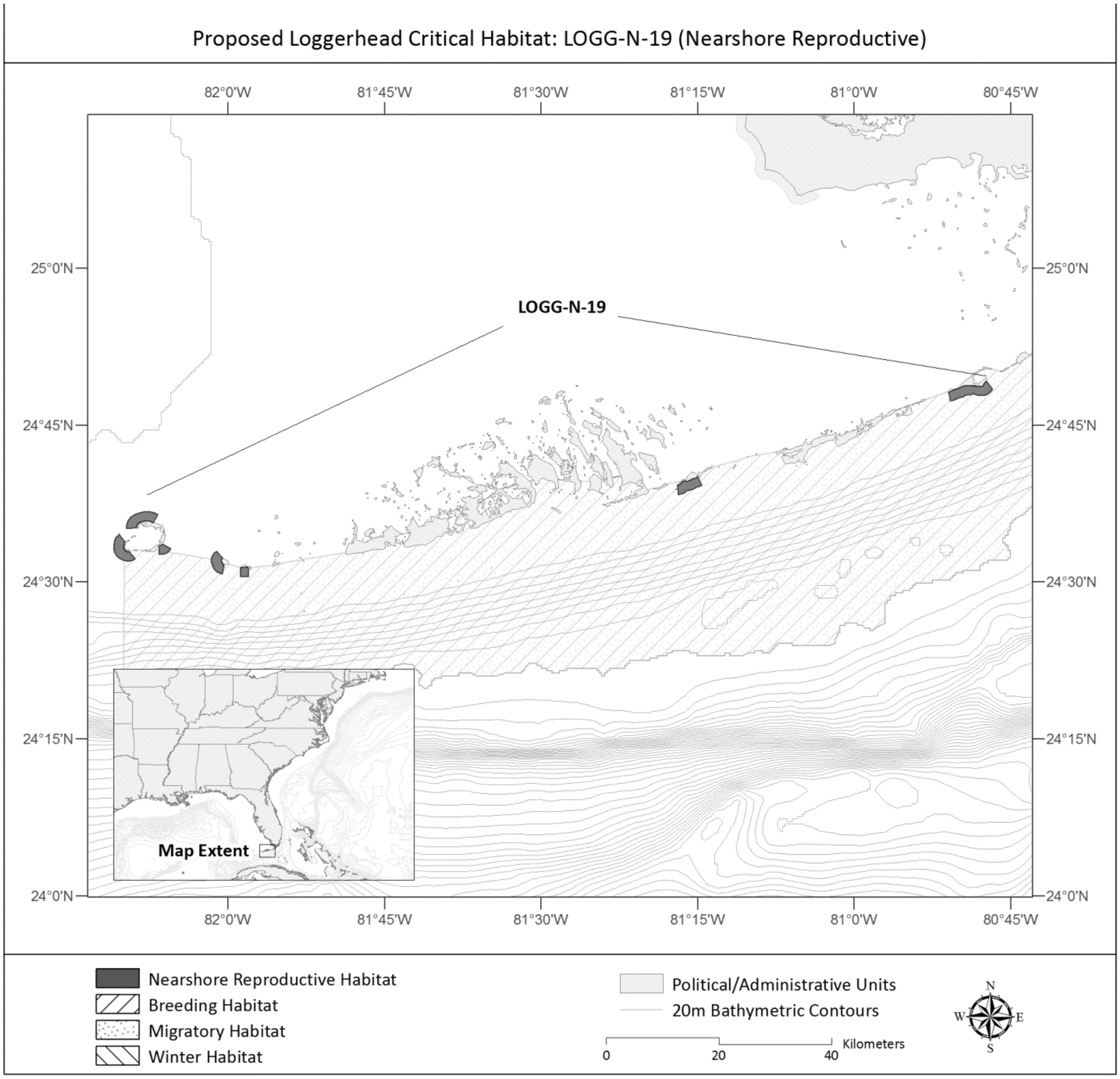

Figure 30. Nearshore Reproductive Habitat (LOGG-N-19)

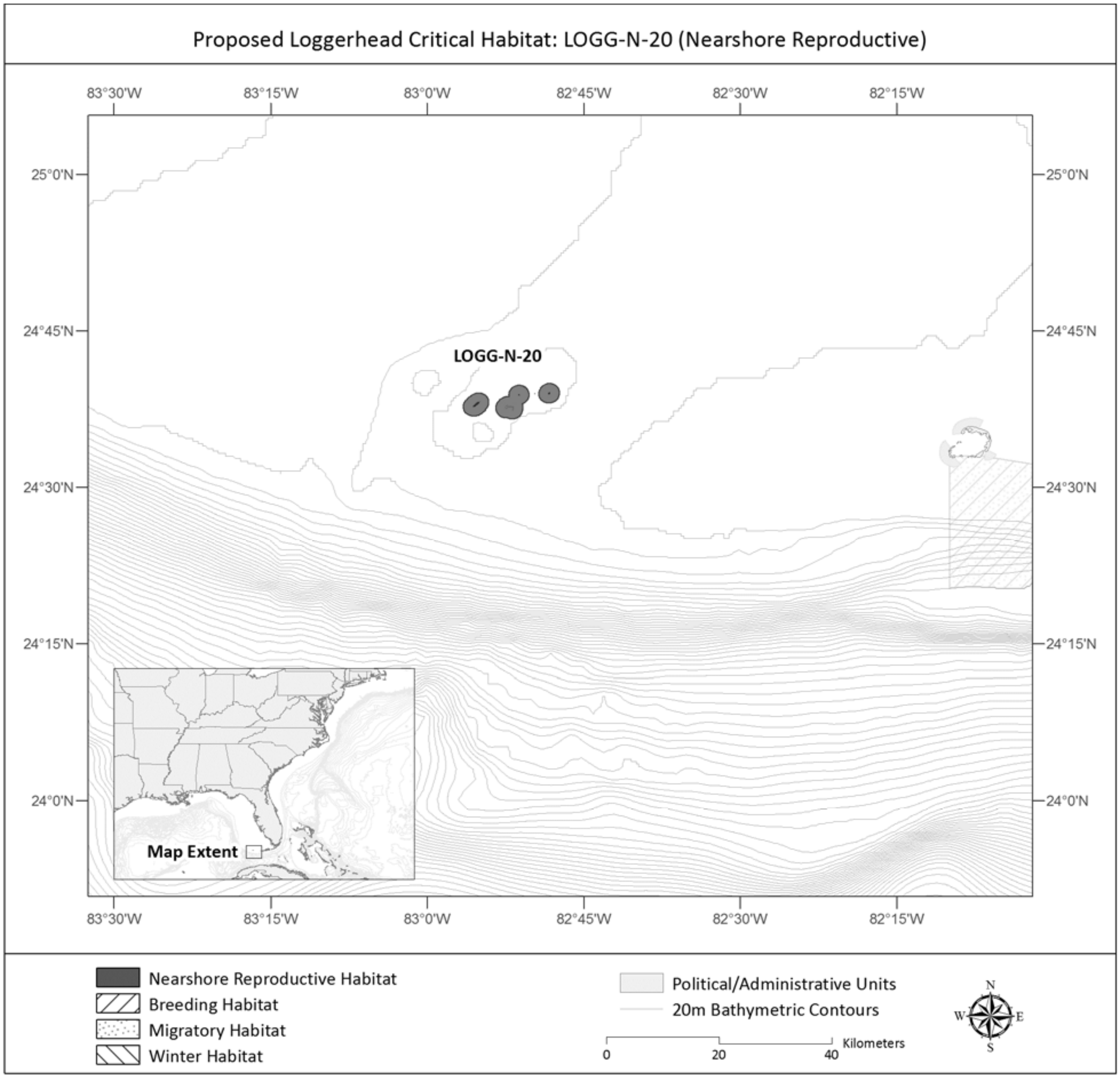

Figure 31. Nearshore Reproductive Habitat (LOGG-N-20)

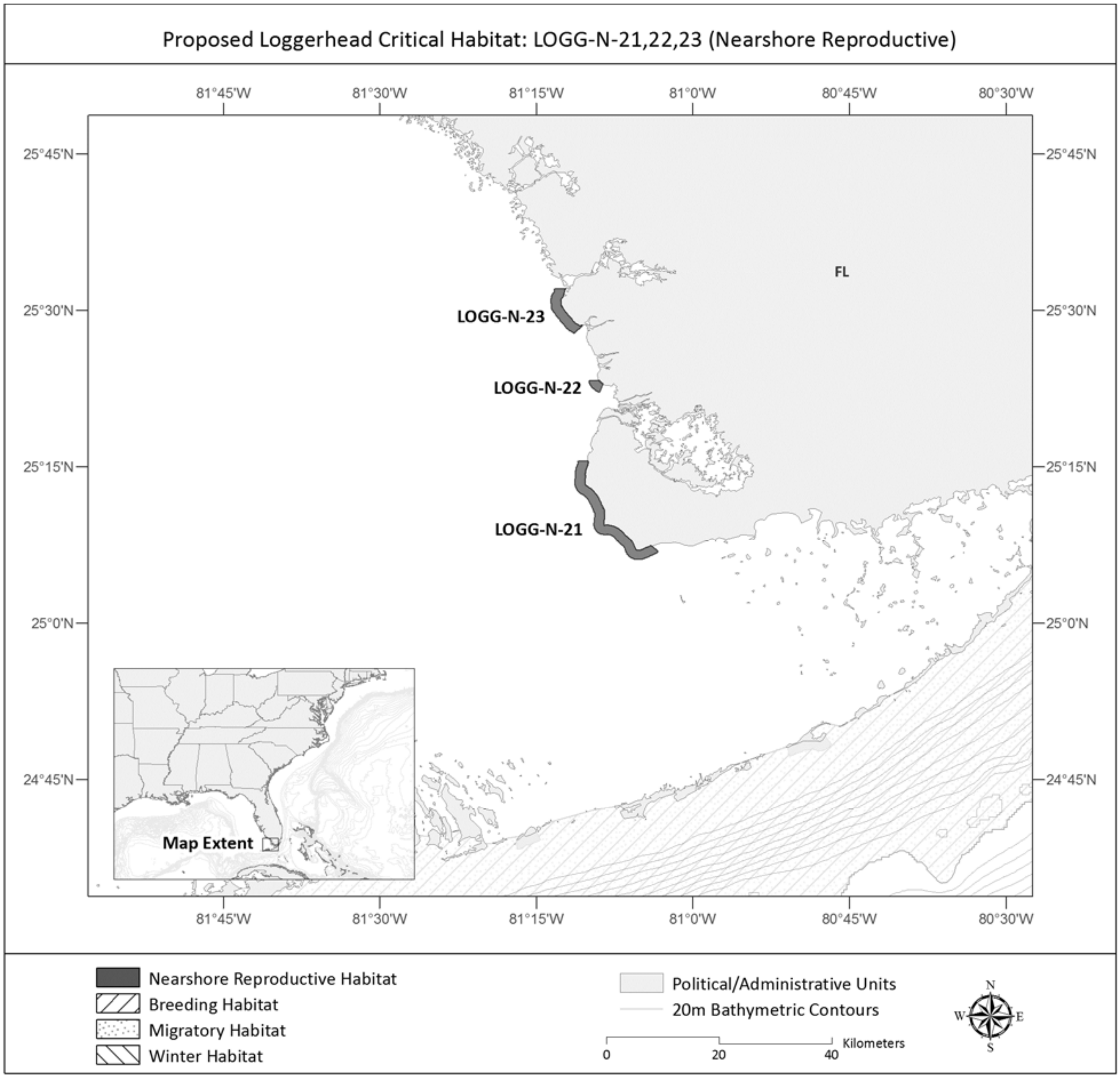

Figure 32. Nearshore Reproductive Habitat (LOGG-N-21-23)

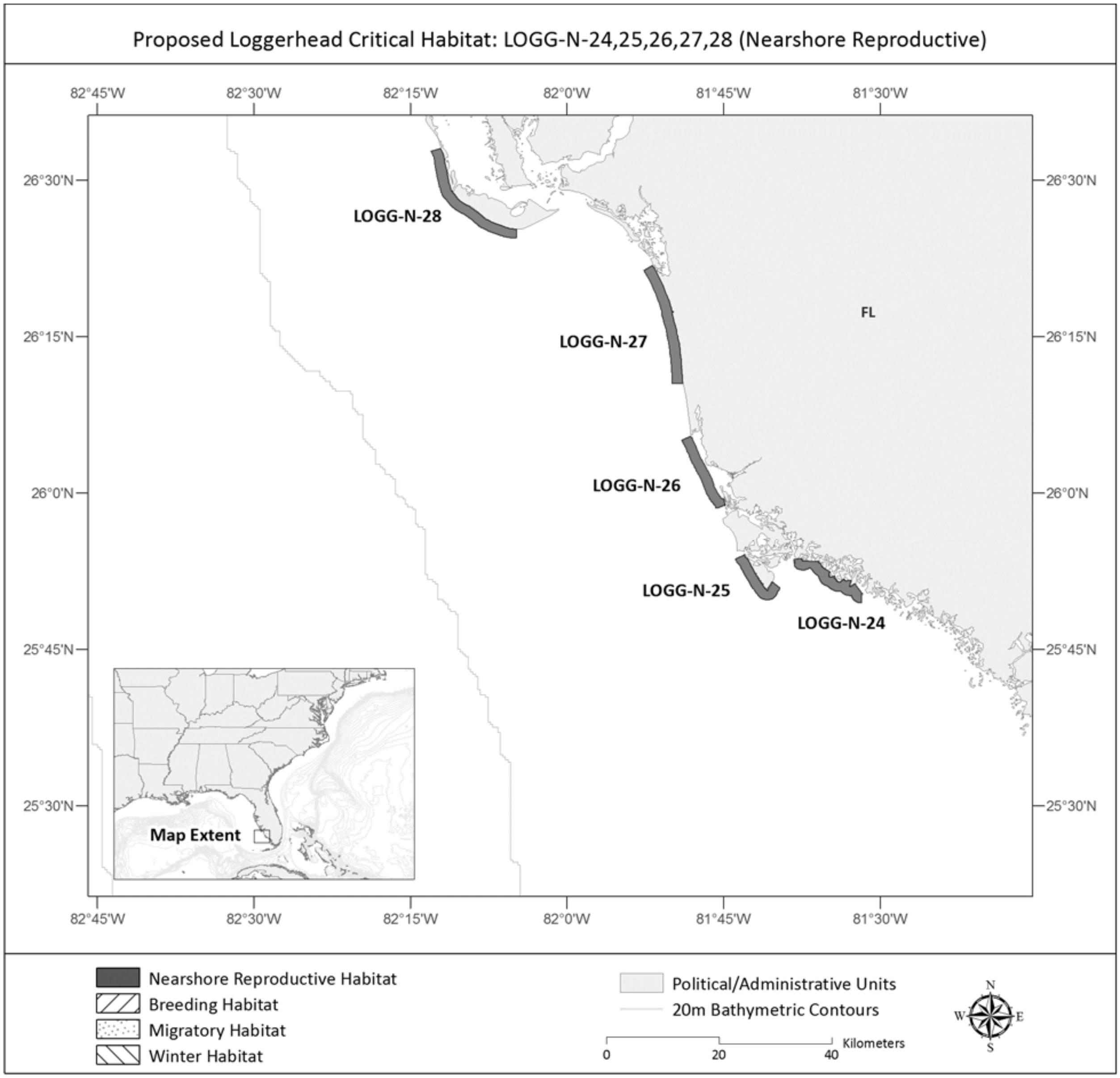

Figure 33. Nearshore Reproductive Habitat (LOGG-N-24-28)

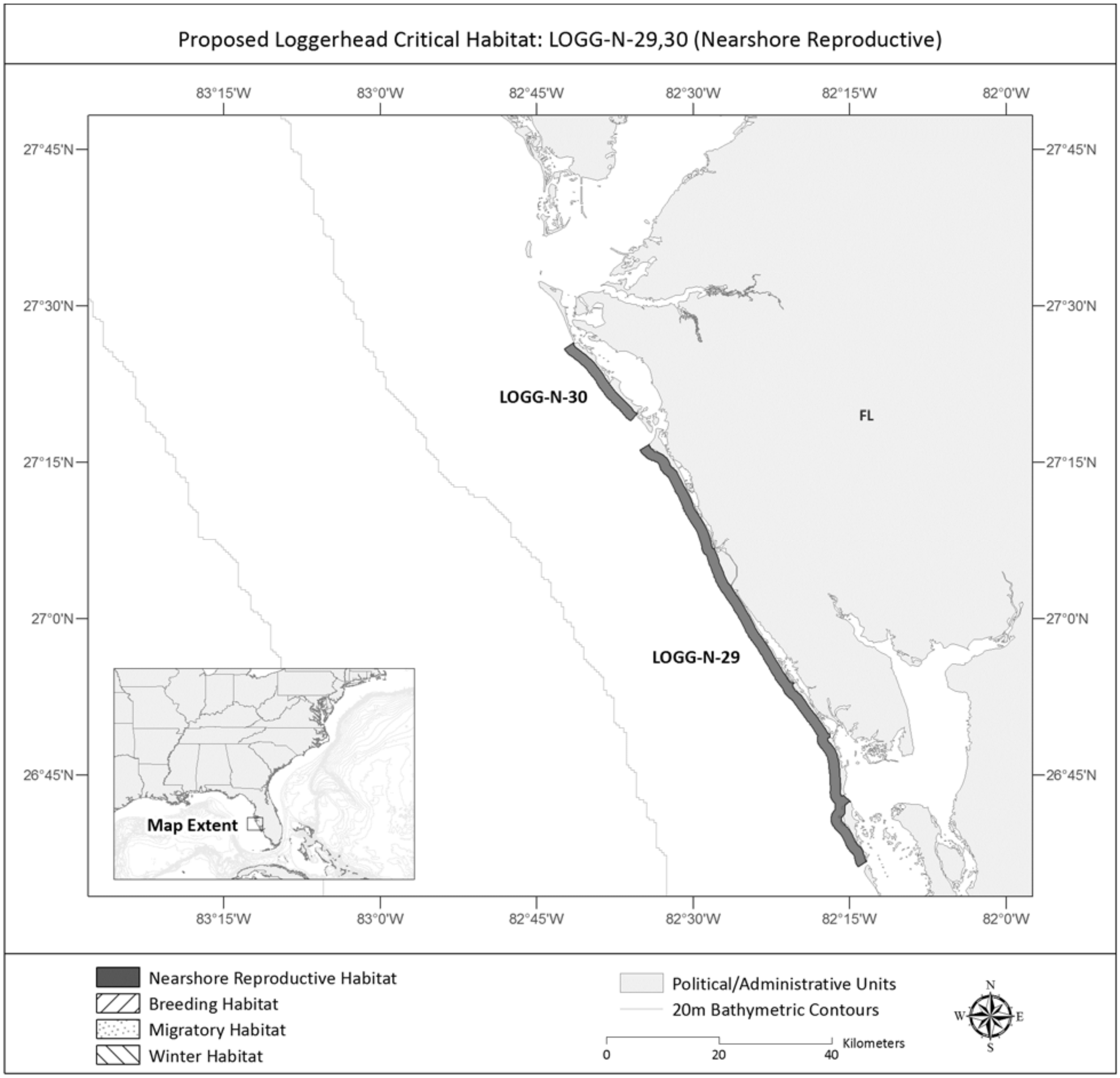

Figure 34. Nearshore Reproductive Habitat (LOGG-N-29-30)

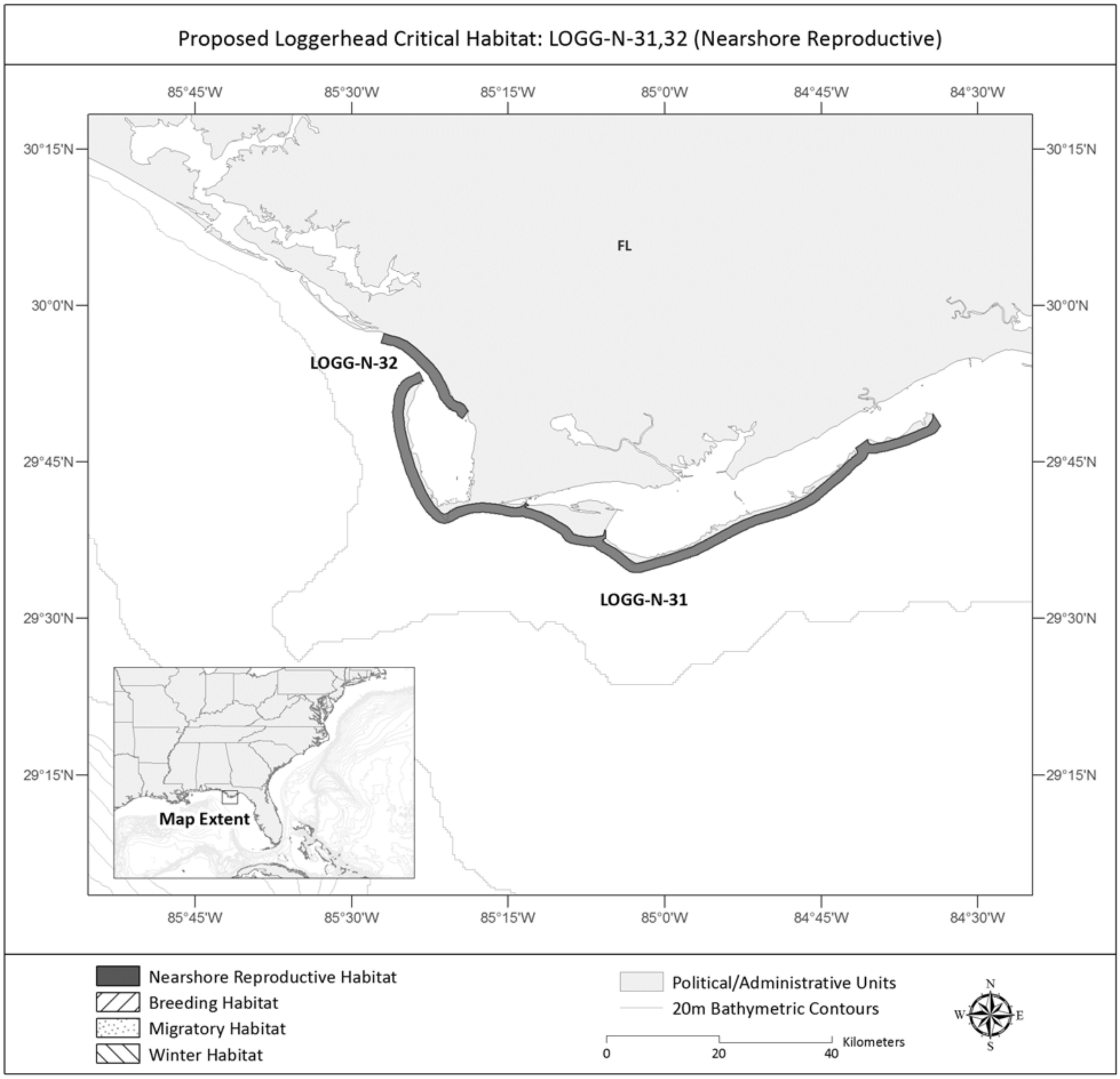

Figure 35. Nearshore Reproductive Habitat (LOGG-N-31-32)

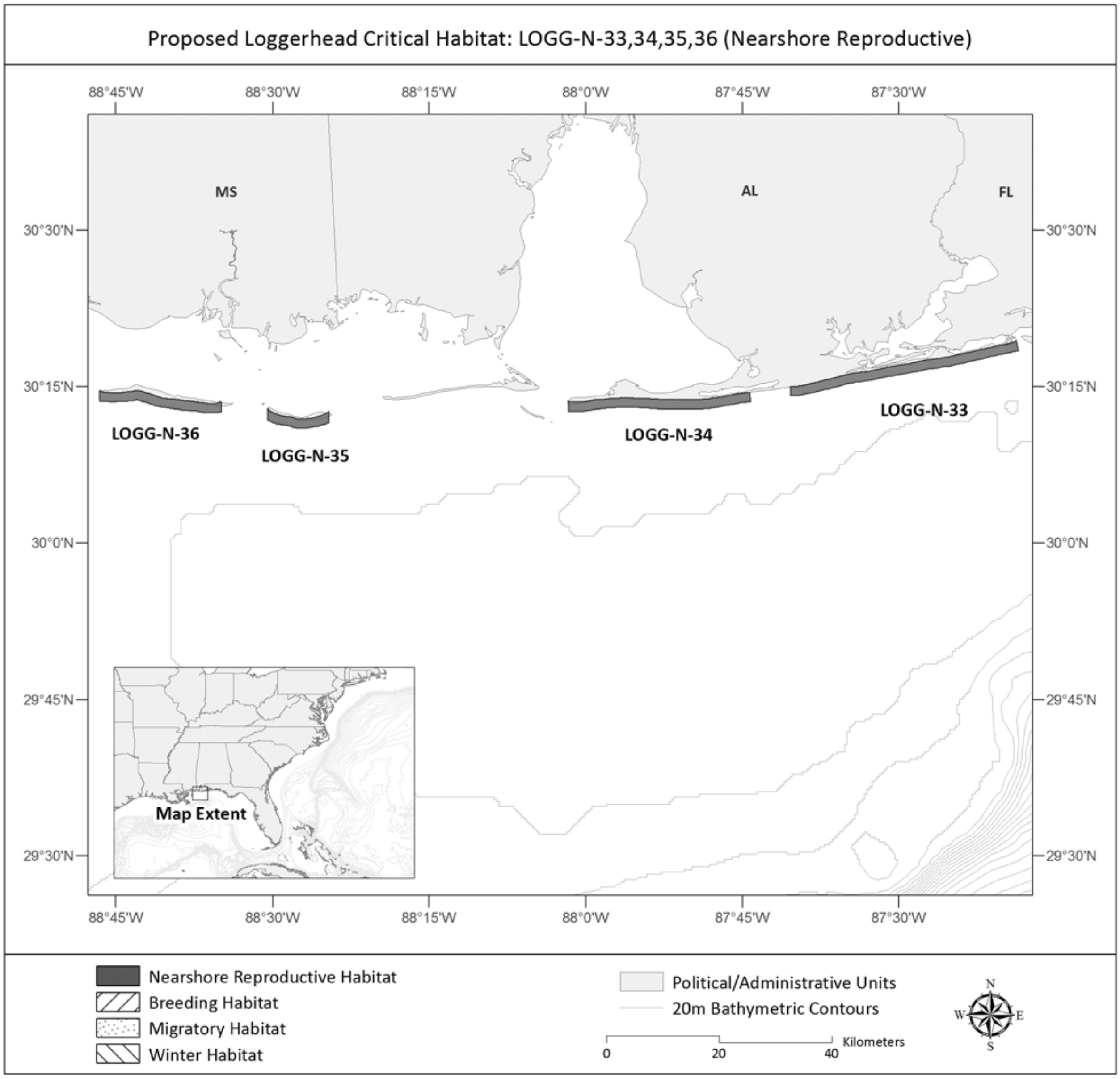

Figure 36. Nearshore Reproductive Habitat (LOGG-N-33-36)

VII.A.2.b. Specific Unit Descriptions

***LOGG-N-1* – North Carolina Migratory Corridor and Northern Portion of the North Carolina Winter Concentration Area –** This unit contains migratory and winter habitat. The unit includes the North Carolina migratory corridor and the overlapping northern half of the North Carolina winter concentration area. NMFS has defined the migratory corridor off North Carolina as the following: the waters between 36° N. lat. and Cape Lookout (approximately 34.58° N) from the edge of the Outer Banks, North Carolina, barrier islands to the 200 meter (656 feet) depth contour (continental shelf).

The migratory corridor overlaps with the northern portion of winter concentration area off North Carolina. The east and western boundaries of winter habitat are the 20m and 100m (65.6 and 328 feet) contours, respectively. The northern boundary of winter habitat starts at Cape Hatteras (35° 16' N) in a straight latitudinal line between 20-100 meter (65.6-328 feet) depth contours and ends at Cape Lookout (approximately 34.58° N).

***LOGG-N-2* – Southern Portion of the North Carolina Winter Concentration Area –** This unit contains winter habitat only. The boundaries include waters between the 20 and 100 meter (65.6 and 328 feet) depth contours between Cape Lookout to Cape Fear. The east and western boundaries of winter habitat are the 20 m and 100 m (65.6 and 328 feet) contours, respectively. The northern boundary is Cape Lookout (approximately 34.58° N). The southern boundary is a 37.5 km (23.25 mile) line that extends from the 20 meter (65.6 feet) depth contour at approximately 33.47° N, 77.58° W (off Cape Fear) to the 100 meter (328 feet) depth contour at approximately 33.2° N, 77.32° W.

LOGG-N-3 – Bogue Banks and Bear Island, Carteret and Onslow Counties: This unit contains nearshore reproductive habitat only. The unit consists of nearshore area from Beaufort Inlet to Bear Inlet (crossing Bogue Inlet) and seaward 1.6 km (one mile). This unit is adjacent to high density nearshore reproductive habitat (Bogue Inlet to Bear Inlet) and is adjacent to the expansion of high density nearshore reproductive habitat (Beaufort Inlet to Bear Inlet) of loggerhead sea turtles in North Carolina.

LOGG-N-4 – Onslow Beach (Marine Corps Base Camp Lejeune), Topsail Island and Lea-Huttaf Island, Onslow and Pender Counties: This unit contains nearshore reproductive habitat only. The unit consists of nearshore area from Browns Inlet to Rich Inlet (crossing New River Inlet and New Topsail Inlet) and seaward 1.6 km (one mile). The land from Browns Inlet to New River Inlet is managed by Marine Corps Base Camp Lejeune in accordance with an INRMP (and excluded from critical habitat designation by USFWS), but coastal waters are not addressed in the INRMP.

LOGG-N-5 – Pleasure Island, Bald Head Island, Oak Island, and Holden Beach, New Hanover and Brunswick Counties: This unit contains nearshore reproductive habitat only. The unit consists of nearshore area from Carolina Beach Inlet around Cape Fear to Shallotte Inlet and seaward 1.6 km (one mile). This unit is adjacent to both high density nearshore reproductive habitat and expansion of high density nearshore reproductive habitat of loggerhead sea turtles in North Carolina.

LOGG-N-6 – North, Sand, South and Cedar Islands, Georgetown County; Murphy, Cape, Lighthouse Islands and Racoon Key, Charleston County: This unit contains nearshore reproductive habitat only. The unit consists of nearshore area from North Inlet to Five Fathom Creek Inlet and seaward 1.6 km (one mile). This unit is adjacent to both high density nearshore reproductive habitat and expansion of high density nearshore reproductive habitat of loggerhead sea turtles in South Carolina.

LOGG-N-7 – Folly, Kiawah, Seabrook, Botany Bay Islands, Botany Bay Plantation, Interlude Beach and Edingsville Beach, Charleston County; Edisto Beach State Park, Edisto Beach, and Pine and Otter Islands, Colleton County: This unit contains nearshore reproductive habitat only. The unit consists of nearshore area from Lighthouse Inlet to Saint Helena Sound and seaward 1.6 km (one mile). This unit is adjacent to both high density nearshore reproductive habitat and expansion of high density nearshore reproductive habitat of loggerhead sea turtles in South Carolina.

LOGG-N-8 – Harbor Island, Beaufort County: This unit contains nearshore reproductive habitat only. The unit consists of nearshore area from Harbor Inlet to Johnson Inlet and seaward 1.6 km (one mile). This unit is adjacent to the expansion of nesting from another unit that has high density nesting by loggerhead sea turtles in South Carolina.

LOGG-N-9– Little Capers, St. Phillips, and Bay Point Islands, Beaufort County: This unit contains nearshore reproductive habitat only. The unit consists of nearshore area from Pritchards Inlet to Port Royal Sound and seaward 1.6 km (one mile). This unit is adjacent to both high density nearshore reproductive habitat and expansion of high density nearshore reproductive habitat of loggerhead sea turtles in South Carolina.

LOGG-N-10 – Little Tybee Island, Chatham County: This unit contains nearshore reproductive habitat only. The boundaries of this unit are from Tybee Creek Inlet to Wassaw Sound and seaward 1.6 km (one mile). The management authority in close proximity to the unit is The Nature Conservancy, which manages the Little Tybee Island Natural Heritage Preserve. This unit provides adjacent support to the expansion of nesting from a unit that has high density nesting by loggerhead sea turtles in Georgia.

LOGG-N-11 – Wassaw Island, Chatham County: This unit contains nearshore reproductive habitat only. The boundaries of the unit are from Wassaw Sound to Ossabaw Sound and seaward 1.6 km (one mile). The management authority in close proximity is the USFWS, which manages the Wassaw NWR. This unit is adjacent to high density nesting by loggerhead sea turtles in Georgia.

LOGG-N-12 – Ossabaw Island, Chatham County; St. Catherines Island, Liberty County; Blackbeard Island, McIntosh County; Sapelo Island, McIntosh County: This unit contains nearshore reproductive habitat only. The boundaries of this unit are nearshore areas from Ossabow Sound to Deboy Sound seaward 1.6 km (one mile). The management authority in close proximity is the Georgia Department of Natural Resources, which manages the islands. This unit is adjacent to Ossabaw Island and Blackbeard Island, which have high density nesting by loggerhead sea turtles in Georgia. This unit is also adjacent to St. Catherines Island and Sapelo Island, which support expansion of nesting from an adjacent unit that has high density nesting by loggerhead sea turtles in Georgia.

LOGG-N-13 – Little Cumberland Island, Camden County; Cumberland Island, Camden County: This unit contains nearshore reproductive habitat only. The boundaries of this unit are nearshore areas from St. Andrew Sound to the St. Marys River and seaward 1.6 km (one mile). The management authority in close proximity is the National Park Service, which manages Cumberland Island as part of the Cumberland Island National Seashore. This unit is adjacent to Little Cumberland Island, which supports expansion of nesting from an adjacent unit that has high density nesting by loggerhead sea turtles in Georgia. This unit is also adjacent to Cumberland Island, which has high density nesting by loggerhead sea turtles in Georgia.

LOGG-N-14 – South Duval County — Old Ponte Vedra, Duval and St. Johns Counties; Guana Tolomato Matanzas NERR — St. Augustine Inlet, St. Johns County; St. Augustine Inlet — Matanzas Inlet, St. Johns County: This unit contains nearshore reproductive habitat only. The boundaries of the unit are nearshore areas from the south boundary of Kathryn Abbey Hanna Park in Duval County to Matanzas Inlet seaward 1.6 km (one mile). There are several management authorities in close proximity. Fort Matanzas National Monument is managed by the National Park Service. Anastasia State Park and part of the Guana Tolomato Matanzas NERR are managed by the Florida Department of Environmental Protection (FDEP) Coastal and Aquatic Managed Areas. Vilano Oceanfront Park is managed by the St. Johns County Recreation and Parks Department. This unit is adjacent to high density nesting beaches and supports expansion of nesting from an adjacent unit that has high density nesting by loggerhead sea turtles in the Northern Florida Region of the Peninsular Florida Recovery Unit.

LOGG-N-15 – River to Sea Preserve at Marineland — North Peninsula State Park, Flagler and Volusia Counties; Ormond-by-the-Sea — Granada Blvd, Volusia County: This unit contains nearshore reproductive habitat only. The boundaries of the unit are nearshore areas from the north boundary of River to Sea Preserve at Marineland to Granada Boulevard in Ormond Beach and seaward 1.6 km (one mile). There are several management authorities in close proximity. North Peninsula State Park is managed by FDEP. River to Sea Preserve at Marineland and Varn Park are managed by the Flagler County Parks and Recreation Department. This unit is adjacent to high density nesting beaches by loggerhead sea turtles in the Northern Florida Region of the Peninsular Florida Recovery Unit.

LOGG-N-16 – Canaveral National Seashore North, Volusia County; Canaveral National Seashore South to the Start of Titusville/Floridana Beach Concentrated Breeding Area: This unit contains nearshore reproductive habitat only. Boundaries of the unit are nearshore areas from the north boundary of Canaveral National Seashore to the start of the Titusville/Floridana

Beach concentrated breeding area and seaward 1.6 km (one mile). The Canaveral National Seashore is managed by the National Park Service. This unit supports expansion of nesting from an adjacent unit that has high density nesting by loggerhead sea turtles in the Central Eastern Florida Region of the Peninsular Florida Recovery Unit. This unit is also adjacent to high density nesting by loggerhead sea turtles in the Central Eastern Florida Region of the Peninsular Florida Recovery Unit.

***LOGG-N-17 – Titusville to Floridana Beach Concentrated Breeding Area, Northern Portion of the Florida Migratory Corridor, Nearshore Reproductive Habitat to Merritt Island NWR–Kennedy Space Center, Cape Canaveral Air Force Station, Brevard County, and Nearshore Reproductive Habitat Patrick Airforce Base and Central Brevard Beaches*:** This unit includes overlapping areas of nearshore reproductive habitat, migratory habitat, and breeding habitat. The concentrated breeding habitat area is from the shore out to depths less than 60 m (196.8 feet) (consistent with what is reported in Arendt *et al.* 2012a) beginning south of Titusville extending south to Floridana Beach. This overlaps with waters in the northern portion of the Florida migratory corridor, which begins at the tip of Cape Canaveral Air Force Station (28.46° N. lat.) and ends at Floridana beach, including waters from shore to the 30 m (98.4 feet) contour line.

Additionally, the above two habitat areas overlap with two nearshore reproductive habitat areas. The first begins south of Titusville to the south boundary of the Cape Canaveral Air Force Station/Canaveral Barge Canal Inlet and seaward 1.6 km (one mile). The second begins at Patrick Air Force Base, Brevard County, through the central Brevard Beaches to Floridana Beach and seaward 1.6 km (one mile). Brevard County and FWS are the management authorities in close proximity. Merritt Island NWR–Kennedy Space Center is managed by USFWS. Nearshore reproductive area is adjacent to high density nesting by loggerhead sea turtles in the Central Eastern Florida Region of the Peninsular Florida Recovery Unit.

LOGG-N-18 – Florida Migratory Corridor - Floridana Beach to Martin County/Palm Beach County Line and Nearshore Reproductive Habitat of South Brevard Beaches, Brevard County; Sebastian Inlet – Indian River Shores, Indian River County; Nearshore Reproductive Habitat of Fort Pierce inlet to Martin County/Palm Beach County Line – This unit contains nearshore reproductive habitat and migratory habitat. The unit contains a portion of the Florida migratory corridor, which is located in the nearshore waters from shore to the 30 m (98.4 feet) contour off Floridana Beach to the Martin County/Palm Beach County line. This overlaps with two nearshore reproductive habitat areas. The first nearshore reproductive area includes nearshore areas from Floridana Beach to the south end of Indian River Shores and seaward1.6 km (one mile). The second overlapping nearshore reproductive habitat area begins at Fort Pierce inlet to Martin County/Palm Beach County line and seaward 1.6 km (one mile). Brevard County and Indian River County are the management authorities in close proximity. This nearshore reproductive area is adjacent to high density nesting by loggerhead sea turtles in the Central Eastern Florida Region of the Peninsular Florida Recovery Unit.

LOGG-N-19 - Southern Florida Migratory Corridor; Southern Florida Concentrated Breeding Area; and Nearshore Reproductive Areas of: Martin County/Palm Beach County line to Hillsboro Inlet (Jupiter Inlet, Martin and Palm Beach Counties; Jupiter Inlet — Lake

Worth Inlet, Palm Beach County; Lake Worth Inlet — Boynton Inlet, Palm Beach County; Boynton Inlet — Boca Raton Inlet, Palm Beach County; Boca Raton Inlet — Hillsboro Inlet, Palm Beach and Broward Counties), Long Key, Bahia Honda Key, Woman Key, Boca Grande Key, and Marquesas Keys, Monroe County – This unit contains nearshore reproductive habitat, migratory habitat, and breeding habitat. The unit contains the southern Florida migratory corridor habitat, overlapping southern Florida breeding habitat, and overlapping nearshore reproductive habitat. The southern portion of the Florida concentrated breeding area and the southern Florida migratory corridor are both located in the nearshore waters starting at the Martin County/Palm Beach County line to the westernmost edge of the Marquesas Keys (82.17° W. long.). The seaward border then follows the 200 m (656 feet) contour line to the westernmost edge at the Marquesas Keys.

The overlapping nearshore reproductive habitat includes 1) nearshore waters starting at the Martin County/Palm Beach County line to Hillsboro Inlet and seaward 1.6 km (one mile); 2) Long Key, which is bordered on the east by the Atlantic Ocean, on the west by Florida Bay, and on the north and south by natural channels between Keys (Fiesta Key to the north and Conch Key to the south), and has boundaries following the borders of the island seaward to 1.6 km (one mile); 3) the boundaries of Bahia Honda Key follow the Key shoreline seaward 1.6 km (one mile); 4) Woman Key, which contains nearshore areas seaward to 1.6 km (one mile) surrounding Woman Key from 24.524, -82.979 (at the western end of the key) to 24.524, -82.967 (at the eastern end of the key); 5) Boca Grande Key, with boundaries surrounding Boca Grande Key from 24.537, -82.008 (at the northern end of the key) to 24.527, -82.006 (at the southern end of the key) and seaward to 1.6 km (one mile); 6) the Marquesas Keys unit boundary, including nearshore areas seaward to 1.6 km (one mile) from four islands where loggerhead sea turtle nesting has been documented within the Marquesas Keys: Marquesas Key, Unnamed Key 1, Unnamed Key 2, and Unnamed Key 3.

The counties are the management authorities in close proximity to Palm Beach County Line to Hillsboro inlet. The management authority in close proximity to Long Key is FDEP, which manages the island as Long Key State Park. There are several management entities in close proximity to Bahia Honda Key, which is managed by FDEP as Bahia Honda State Park. The Marquesas Keys are part of the Key West NWR, which is managed by USFWS. Nearby Key West NWR is managed by USFWS.

These nearshore reproductive units are adjacent to high density nesting by loggerhead sea turtles, support expansion of nesting from an adjacent unit that has high density nesting by loggerhead sea turtles in the Central Eastern Florida Region of the Peninsular Florida Recovery Unit, are adjacent to high density nesting by loggerhead sea turtles in the Southeastern Florida Region of the Peninsular Florida Recovery Unit, were selected as critical habitat to ensure access to the unique nesting habitat in the Florida Keys, and were selected as critical habitat because of the extremely small size of the Dry Tortugas Recovery Unit.

LOGG-N-20 – Dry Tortugas, Monroe County: This unit contains nearshore reproductive habitat only. The unit boundary includes nearshore areas seaward to 1.6 km (one mile) from six islands where loggerhead sea turtle nesting has been documented within the Dry Tortugas. From west to east, these six islands are: Loggerhead Key, Garden Key, Bush Key, Long Key, Hospital

Key, and East Key. Nearby Dry Tortugas National Park is managed by the National Park Service. This unit was selected as critical habitat because of the extremely small size of the Dry Tortugas Recovery Unit.

LOGG-N-21 – Cape Sable, Monroe County: This unit contains nearshore reproductive habitat only. The boundaries of the unit are nearshore areas seaward to 1.6 km (one mile) from the north boundary of Cape Sable at 25.259242, -81.16687 to the south boundary of Cape Sable at 25.124681, -81.066827. Nearby Everglades National Park is managed by the National Park Service. This unit is adjacent to high density nesting by loggerhead sea turtles in the Southwestern Florida Region of the Peninsular Florida Recovery Unit.

LOGG-N-22 – Graveyard Creek — Shark Point, Monroe County: This unit contains nearshore reproductive habitat only. The boundaries of this unit are nearshore areas from Shark Point (25.387949, -81.149308) to Graveyard Creek Inlet seaward 1.6 km (one mile). Nearby Everglades National Park is managed by the National Park Service. This unit is adjacent to high density nesting by loggerhead sea turtles in the Southwestern Florida Region of the Peninsular Florida Recovery Unit.

LOGG-N-23 – Highland Beach, Monroe County: This unit contains nearshore reproductive habitat only. The boundaries of this unit are from First Bay to Rogers River Inlet and seaward 1.6 km (one mile). Nearby Everglades National Park is managed by the National Park Service. This unit supports expansion of nesting from an adjacent unit that has high density nesting by loggerhead sea turtles in the Southwestern Florida Region of the Peninsular Florida Recovery Unit.

LOGG-N-24 – Ten Thousand Islands North, Collier County: This unit contains nearshore reproductive habitat only. The unit boundary includes nearshore areas seaward 1.6 km (one mile) of nine keys where loggerhead sea turtle nesting has been documented within the northern part of the Ten Thousand Islands in Collier County in both the Ten Thousand Islands NWR and the Rookery Bay NERR. There are a few management authorities in close proximity. The Ten Thousand Islands NWR is managed by USFWS. The Rookery Bay NERR is managed by FDEP's Office of Coastal and Aquatic Managed Areas. This unit supports expansion of nesting from an adjacent unit that has high density nesting by loggerhead sea turtles in the Southwestern Florida Region of the Peninsular Florida Recovery Unit.

LOGG-N-25 – Cape Romano, Collier County: This unit contains nearshore reproductive habitat only. The boundaries of the unit are nearshore areas from Caxambas Pass to Gullivan Bay seaward 1.6 km (one mile). Nearby Rookery Bay NERR is owned by the State of Florida and managed by FDEP's Office of Coastal and Aquatic Managed Areas. This unit is adjacent to high density nesting by loggerhead sea turtles in the Southwestern Florida Region of the Peninsular Florida Recovery Unit.

LOGG-N-26 – Keewaydin Island and Sea Oat Island, Collier County: This unit contains nearshore reproductive habitat only. The boundaries of the unit are nearshore areas from Gordon Pass to Big Marco Pass and seaward 1.6 km (one mile). The State of Florida and National Audubon Society are management authorities in close proximity. The Rookery Bay NERR is managed by FDEP's Office of Coastal and Aquatic Managed Areas. This unit is adjacent to high density nesting by loggerhead sea turtles in the Southwestern Florida Region of the Peninsular Florida Recovery Unit.

LOGG-N-27 – Little Hickory Island, Lee and Collier Counties; Wiggins Pass — Clam Pass, Collier County; Clam Pass — Doctors Pass, Collier County: This unit contains nearshore reproductive habitat only. The boundaries of the unit are nearshore areas from Little Hickory Island to Doctors Pass seaward 1.6 km (one mile). The Collier County Parks and Recreation Department manages Vanderbilt Beach County Park and Barefoot Beach County Preserve Park. This unit supports expansion of nesting from an adjacent unit that has high density nesting by loggerhead sea turtles in the Southwestern Florida Region of the Peninsular Florida Recovery Unit.

LOGG-N-28 – Captiva Island, Lee County; Sanibel Island West, Lee County: This unit contains nearshore reproductive habitat only. The boundaries of the unit are nearshore areas from the north end of Captiva/Captiva Island Golf Club to Tarpon Bay Road seaward 1.6 km (one mile). The City of Sanibel Natural Resources Department manages Silver Key and Bowman's Beach Regional Park. This unit is adjacent to high density nesting and supports expansion of nesting from an adjacent unit that has high density nesting by loggerhead sea turtles in the Central Western Florida Region of the Peninsular Florida Recovery Unit.

LOGG-N-29 – Siesta and Casey Keys, Sarasota County; Venice Beaches and Manasota Key, Sarasota and Charlotte Counties; Knight, Don Pedro, and Little Gasparilla Islands, Charlotte County; Gasparilla Island, Charlotte and Lee Counties; Cayo Costa, Lee County: This unit contains nearshore reproductive habitat only. The boundaries of this unit are nearshore areas from South Sarasota to Pine Island Sound seaward 1.6 km (one mile). There are several management authorities in close proximity. Stump Pass Beach State Park, Don Pedro Island State Park, Cayo Costa State Park, and Gasparilla Island State Park are managed by FDEP. Sarasota County Parks and Recreation Department manages Turtle Beach County Park, Palmer Point County Park, Service Club Park, Brohard Beach, Paw Beach, Caspersen Beach County Park, and Blind Pass Park. This unit is adjacent to high density nesting and supports expansion of nesting from an adjacent unit that has high density nesting by loggerhead sea turtles in the Central Western Florida Region of the Peninsular Florida Recovery Unit.

LOGG-N-30 – Longboat Key, Manatee and Sarasota Counties: This unit contains nearshore reproductive habitat only. The boundaries of this unit are the north point of Longboat Key to New Pass and seaward 1.6 km (one mile). Management entities in proximity to this unit are Manatee and Sarasota Counties.

LOGG-N-31 – St. Joseph Peninsula, Gulf County; Eglin Air Force Base (Cape San Blas), Gulf County; Cape San Blas, Gulf County; St. Vincent Island, Franklin County; Little St. George Island, Franklin County; St. George Island, Franklin County; Dog Island, Franklin County: This unit contains nearshore reproductive habitat only. The boundaries of this unit are from St. Joseph Bay to St. George Sound and seaward 1.6 km (one mile). There are several management entities in close proximity. The USFWS manages the St. Vincent NWR. Jeff Lewis Wilderness Preserve is owned and managed by The Nature Conservancy. The State of

Florida manages the Dr. Julian G. Bruce St. George Island State Park, the Apalachicola NERR, the T.H. Stone Memorial, St. Joseph Peninsula State Park, and the St. Joseph Bay Aquatic Preserve. Salinas Park is managed by Gulf County Parks. This unit is adjacent to high density nesting by loggerhead sea turtles in the Florida portion of the Northern Gulf of Mexico Recovery Unit and this unit supports expansion of nesting from an adjacent unit that has high density nesting by loggerhead sea turtles in the Florida portion of the Northern Gulf of Mexico Recovery Unit.

LOGG-N-32 – Mexico Beach and St. Joe Beach, Bay and Gulf Counties: This unit contains nearshore reproductive habitat only. The boundaries of the unit are from the eastern boundary of Tyndall Air Force Base to Gulf County Canal in St. Joseph Bay and seaward 1.6 km (one mile). This unit supports expansion of nesting from an adjacent unit that has high density nesting by loggerhead sea turtles in the Florida portion of the Northern Gulf of Mexico Recovery Unit.

LOGG-N-33 – Gulf State Park — Perdido Pass, Baldwin County; Perdido Pass – FL/AL state line; Perdido Key to Pensacola Naval Air Station, Escambia County: This unit contains nearshore reproductive habitat only. The boundaries of the unit are nearshore areas seaward to 1.6 km (one mile) from the west boundary of Gulf State Park to the Pensacola Naval Air Station. The State of Alabama manages Gulf State Park. This unit is adjacent to high density nesting and supports expansion of nesting from an adjacent unit that has high density nesting by loggerhead sea turtles in Alabama.

LOGG-N-34 – Mobile Bay — Little Lagoon Pass, Baldwin County: This unit contains nearshore reproductive habitat only. The boundaries of the unit are nearshore areas seaward to 1.6 km (one mile) from Mobile Bay Inlet to Little Lagoon Pass. Nearby Bon Secour NWR and four Bureau of Land Management (BLM) parcels are managed by USFWS. This unit is adjacent to high density nesting by loggerhead sea turtles in Alabama.

LOGG-N-35 – Petit Bois Island, Jackson County: This unit contains nearshore reproductive habitat only. The boundaries of the unit are nearshore areas seaward to 1.6 km (one mile) from Horn Island Pass to Petit Bois Pass. Petit Bois Island is located in the Gulf Islands National Seashore, Mississippi District, which is managed by the National Park Service. This unit was selected as critical habitat to provide access to Horn Island, which has been documented as one of two islands in Mississippi with the greatest number of nests.

LOGG-N-36 – Horn Island, Jackson County: This unit contains nearshore reproductive habitat only. The boundaries of the unit are nearshore areas seaward to 1.6 km (one mile) from Dog Keys Pass to the eastern most point of the ocean facing island shore. Horn Island is located in the Gulf Islands National Seashore, Mississippi District, which is managed by the National Park Service. Nesting was confirmed by weekly aerial surveys prior to 2006. Although regular surveys have not been conducted since 2005, loggerhead nesting was documented in 2010 and 2011 during the Deepwater Horizon event response efforts. This unit was selected as critical habitat to provide access to Horn Island, which has been documented as one of two islands in Mississippi with the greatest number of nests.

VII.A.3. *Sargassum*

VII.A.3.a. *Sargassum* Habitat General Description

The geographical range occupied by the species includes a large area in which we know *Sargassum* habitat occurs. *Sargassum* habitat is ephemeral and the habitat features are not present at all times throughout the area. Therefore, NMFS identified the essential features of *Sargassum* critical habitat as U.S. waters south of 40° N. lat. in the Atlantic Ocean and Gulf of Mexico from 10 m (32.8 ft) depth contour to the outer boundary of the EEZ, where there are convergence zones, surface water downwelling and other features that support concentrated *Sargassum*, water temperatures warm enough to support *Sargassum* growth and loggerhead inhabitance, and *Sargassum* in concentrations that support adequate prey abundance and cover. NMFS decided to separate the large geographical area of *Sargassum* habitat into two components, the Gulf of Mexico and the U.S. Atlantic Ocean (Figure 37).

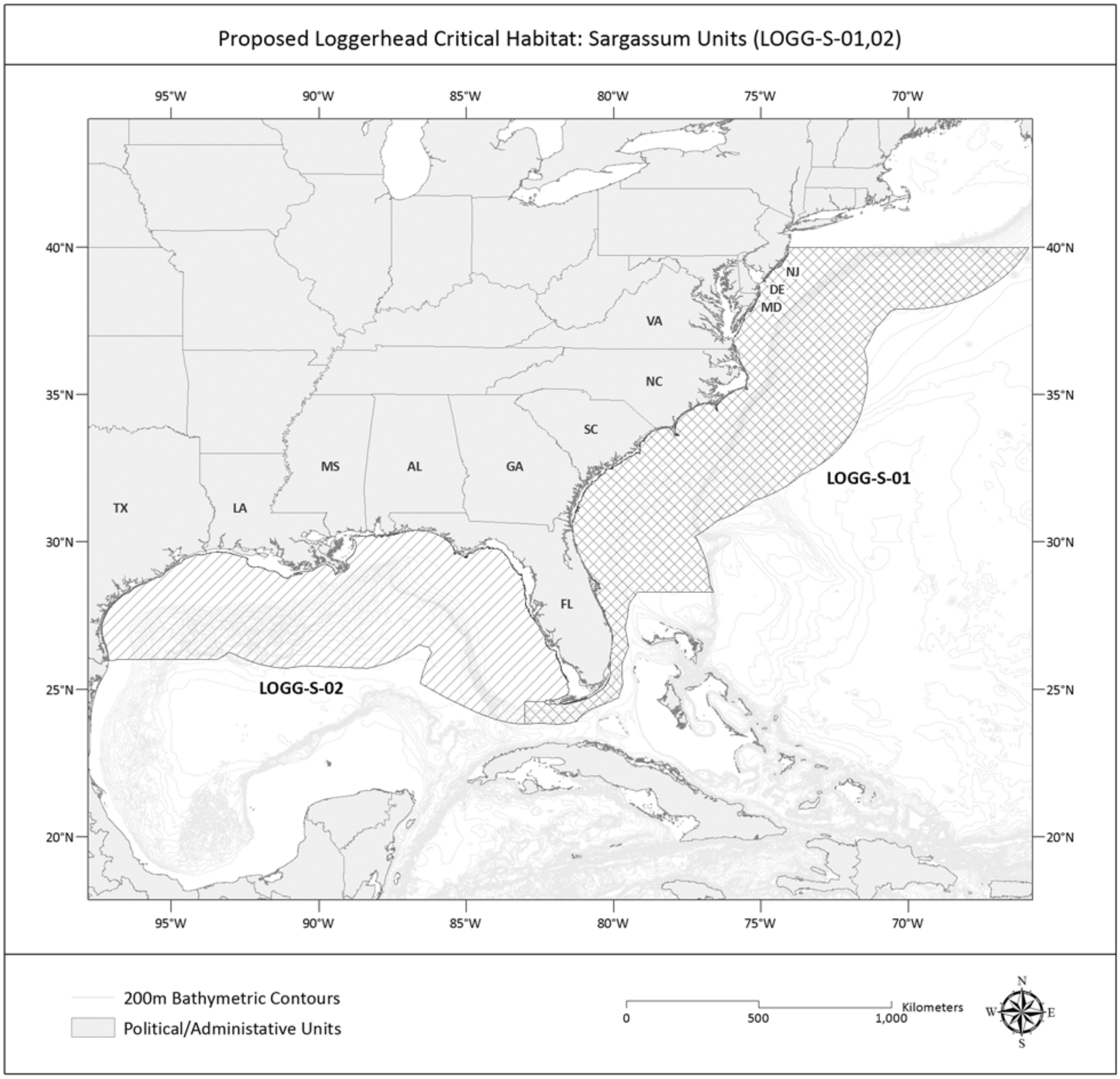

Figure 37. Sargassum Habitat (LOGG-S-01-02)

<u>VII.A.3.b. *Sargassum* Habitat Specific Unit Descriptions</u>

***LOGG-S-1* – Atlantic Ocean *Sargassum*:** U.S. waters south of 40° N. lat. in the Atlantic Ocean to the beginning of the Gulf of Mexico (the Gulf of Mexico begins at the intersection of the outer boundary of the U.S. EEZ and 83°W. long., and proceeds northward along that meridian to 24.58° N. lat. (near the Dry Tortugas Islands)) from the 10 m (32.8 ft) depth contour to the outer boundary of the EEZ, where there is *Sargassum* in concentrations that support adequate prey abundance and cover, and water temperatures warm enough to support *Sargassum* growth and loggerhead inhabitance.

***LOGG-S-2* – Gulf of Mexico *Sargassum*:** U.S. waters in the Gulf of Mexico (the Gulf of Mexico/Atlantic Ocean division begins at 83° W.long., and proceeds northward along that meridian to 24.58° 3N. lat. near the Dry Tortugas Islands)) from the 10 m (32.8 ft) depth contour to the outer boundary of the EEZ, where there is *Sargassum* in concentrations that support adequate prey abundance and cover, and water temperatures warm enough to support *Sargassum* growth and loggerhead inhabitance.

VII.A.4. Oceanic

The only oceanic habitat areas identified as critical habitat within the Northwest Atlantic are those that are included in the *Sargassum* Habitat described above.

VII.B. North Pacific Ocean DPS

NMFS did not identify any critical habitat within the U.S. EEZ in the Pacific for the North Pacific Ocean DPS because occupied habitat within the U.S. EEZ did not support suitable conditions in sufficient quantity and frequency to provide meaningful foraging, development, and/or transiting opportunities to the population in the North Pacific.

VIII: UNOCCUPIED AREAS

Section 3(5)(A)(ii) of the ESA authorizes designation of “specific areas outside the geographical areas occupied by the species at the time it is listed” if those areas are determined to be essential to the conservation of the species. Joint NMFS and USFWS regulations (50 CFR 424.12(e)) emphasize that the agency shall designate as critical habitat areas outside the geographical area presently occupied by a species only when a designation limited to its present range would be inadequate to ensure the conservation of the species. At the present time NMFS has not identified additional specific areas outside the geographic area occupied by loggerheads in the United States where loggerhead sea turtles once existed but no longer exist. For this reason, we did not identify any unoccupied areas.

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