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DEPARTMENT OF THE INTERIOR

United States Fish and Wildlife Service

50 CFR Part 17

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Parts 223 and 224

[Docket No. 100104003-1068-02]

RIN 0648–AY49

Endangered and Threatened Species; Determination of Nine Distinct Population Segments of Loggerhead Sea Turtles as Endangered or Threatened

AGENCIES: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce; United States Fish and Wildlife Service (USFWS), Interior.

ACTION: Final rule.

SUMMARY: We (NMFS and USFWS; also collectively referred to as the Services) have determined that the loggerhead sea turtle (Caretta caretta) is composed of nine distinct population segments (DPSs) that constitute "species" that may be listed as threatened or endangered under the Endangered Species Act (ESA). In this final rule, we are listing four DPSs as threatened and five as endangered under the ESA. We will propose to designate critical habitat for the two loggerhead sea turtle DPSs occurring within the United States in a future rulemaking. We encourage interested parties to provide any information related to the

identification of critical habitat and essential physical or biological features for this species, as well as economic or other relevant impacts of designation of critical habitat, to assist us with this effort.

DATES: This rule is effective on [Insert date 30 days after date of publication in the FEDERAL REGISTER].

ADDRESSES: This final rule and comments and materials received, as well as supporting documentation used in the preparation of this rule, are available on the Internet at http://www.regulations.gov and will be available for public inspection, by appointment, during normal business hours at: National Marine Fisheries Service, Office of Protected Resources, 1315 East West Highway, Room 13657, Silver Spring, MD 20910. You may submit information related to the identification of critical habitat for the loggerhead sea turtle by either of the following methods:

- Mail: NMFS National Sea Turtle Coordinator, Attn: Loggerhead Critical Habitat Information, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Room 13657, Silver Spring, MD 20910 or USFWS National Sea Turtle Coordinator, U.S. Fish and Wildlife Service, 7915 Baymeadows Way, Suite 200, Jacksonville, FL 32256.
- Fax: To the attention of NMFS National Sea Turtle Coordinator at 301–427–2522 or USFWS National Sea Turtle Coordinator at 904–731–3045.

Instructions: All information received will be a part of the public record. All personal identifying information (for example, name, address, etc.) voluntarily submitted by the public may be publicly accessible.

FOR FURTHER INFORMATION CONTACT: Barbara Schroeder, NMFS, at 301–427–8402; Sandy MacPherson, USFWS, at 904–731–3336; Marta Nammack, NMFS, at 301–427–8403mailto:; or Lorna Patrick, USFWS, at 850–769–0552 ext. 229. Persons who use a Telecommunications device for the deaf (TDD) may call the Federal Information Relay Service (FIRS) at 1–800–877–8339, 24 hours a day, 7 days a week.

SUPPLEMENTARY INFORMATION:

Background

We issued a final rule listing the loggerhead sea turtle as threatened throughout its worldwide range on July 28, 1978 (43 FR 32800). On July 12, 2007, we received a petition to list the "North Pacific populations of loggerhead sea turtle" as an endangered species under the ESA. NMFS published a notice in the Federal Register on November 16, 2007 (72 FR 64585), concluding that the petitioners (Center for Biological Diversity and Turtle Island Restoration Network) presented substantial scientific information indicating that the petitioned action may be warranted. Also, on November 15, 2007, we received a petition to list the "Western North Atlantic populations of loggerhead sea turtle" as an endangered species under the ESA. NMFS published a notice in the Federal Register on March 5, 2008 (73 FR 11849), concluding that the petitioners (Center for Biological Diversity and Oceana) presented substantial scientific information indicating that the petitioned action may be warranted.

In early 2008, NMFS assembled a Loggerhead Biological Review Team (BRT) to complete a status review of the loggerhead sea turtle. The BRT was composed of biologists from NMFS, USFWS, the Florida Fish and Wildlife Conservation Commission, and the North Carolina Wildlife Resources Commission. The BRT was charged with reviewing and evaluating all relevant scientific information relating to loggerhead population structure globally to determine if any population met the criteria to qualify as a DPS and, if so, to assess the extinction risk of each DPS. The findings of the BRT, which are detailed in the "Loggerhead Sea Turtle (Caretta caretta) 2009 Status Review under the U.S. Endangered Species Act" (Conant et al., 2009; hereinafter referred to as the Status Review), addressed DPS delineations, extinction risks to the species, and threats to the species. The Status Review underwent independent peer review by nine scientists with expertise in loggerhead sea turtle biology, genetics, and modeling. The Status Review is available electronically at http://www.nmfs.noaa.gov/pr/species/statusreviews.htm.

On March 12, 2009, the petitioners (Center for Biological Diversity, Turtle Island Restoration Network, and Oceana) sent a 60-day notice of intent to sue to the Services for failure to make 12-month findings on the petitions by the statutory deadlines (July 16, 2008, for the North Pacific petition and November 16, 2008, for the Northwest Atlantic petition). On May 28, 2009, the petitioners filed a Complaint for Declaratory and Injunctive Relief to compel the Services to complete the 12-month findings. On October 8, 2009, the petitioners and the Services reached a settlement in which the Services agreed to submit to the Federal Register a 12-month finding on the two petitions on or before February 19, 2010. On February 16, 2010, the United States District Court for the Northern District of California modified the February 19, 2010, deadline to March 8, 2010.

On March 16, 2010 (75 FR 12598), the Services published in the Federal Register combined 12-month findings on the petitions to list the North Pacific populations and the Northwest Atlantic populations of the loggerhead sea turtle as DPSs with endangered status, along with a proposed rule to designate nine loggerhead sea turtle DPSs worldwide and to list two of the DPSs as threatened and seven as endangered. The Federal Register notice also announced the opening of a 90-day public comment period on the proposed listing determination.

The Services subsequently received a request from the Maryland Department of Natural Resources for a public hearing to be held in Maryland. On June 2, 2010 (75 FR 30769), the Services published a notice in the Federal Register announcing our plans to hold a public hearing on the proposed actions on June 16, 2010. The Federal Register notice also announced a re-opening of the public comment period for an additional 90 days. The June 16, 2010, public hearing was held at the Ocean Pines Public Library in Berlin, Maryland.

On March 22, 2011 (76 FR 15932), the Services published in the Federal Register a notice announcing a 6-month extension of the deadline for a final listing decision to address substantial disagreement on the interpretation of data related to the status and trends for the Northwest Atlantic Ocean DPS of the loggerhead sea turtle and its relevance to the assessment of risk of extinction. At this time, we solicited new information or analyses from the public that would help clarify this issue. The public comment period was open for 20 days, and closed on April 11, 2011.

Policies for Delineating Species Under the ESA

Section 3 of the ESA defines “species” as including “any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.” The term “distinct population segment” is not recognized in the scientific literature, nor clarified in the ESA or its implementing regulations. Therefore, the

Services adopted a joint policy for recognizing DPSs under the ESA (DPS Policy; 61 FR 4722) on February 7, 1996. Congress has instructed the Secretary of the Interior or of Commerce to exercise this authority with regard to DPSs "…sparingly and only when the biological evidence indicates such action is warranted." The DPS Policy requires the consideration of two elements when evaluating whether a vertebrate population segment qualifies as a DPS under the ESA: (1) the discreteness of the population segment in relation to the remainder of the species or subspecies to which it belongs; and (2) the significance of the population segment to the species or subspecies to which it belongs.

A population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions: (1) it is markedly separated from other populations of the same taxon (an organism or group of organisms) as a consequence of physical, ecological, or behavioral factors. Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation; or (2) it is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the ESA (i.e., inadequate regulatory mechanisms).

If a population segment is found to be discrete under one or both of the above conditions, its biological and ecological significance to the taxon to which it belongs is evaluated. This consideration may include, but is not limited to: (1) persistence of the discrete population segment in an ecological setting unusual or unique for the taxon; (2) evidence that loss of the discrete population segment would result in a significant gap in the range of a taxon; (3) evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historical range; or (4) evidence that the discrete population segment differs markedly from other population segments of the species in its genetic characteristics.

Listing Determinations Under the ESA

The ESA defines an endangered species as one that is in danger of extinction throughout all or a significant portion of its range, and a threatened species as one that is likely to become endangered in the foreseeable future throughout all or a significant portion of its range (sections 3(6) and 3(20), respectively). The statute requires us to determine whether any species is endangered or threatened because of any of the following five factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; or (5) other natural or manmade factors affecting its continued existence (section 4(a)(1)(A-E)). We are to make this determination based solely on the best available scientific and commercial data after conducting a review of the status of the species and taking into account any efforts being made by States or foreign governments to protect the species.

Biology and Life History of Loggerhead Sea Turtles

A thorough account of loggerhead sea turtle biology and life history may be found in the Status Review, which is incorporated here by reference. The following is a summary of that information.

The loggerhead occurs 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, United States, and Masirah Island, Oman (Baldwin et al., 2003; Ehrhart et al., 2003; Kamezaki et al., 2003; Limpus and Limpus, 2003a; Margaritoulis et al., 2003). Nesting aggregations with 1,000 to 9,999 females nesting annually are 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). In contrast to determining population size on nesting beaches, determining population size in the marine environment has been very localized. A summary of information on distribution and habitat by ocean basin follows.

Pacific Ocean

Loggerheads can be found throughout tropical to temperate waters in the Pacific; however, their breeding grounds include a restricted number of sites in the North Pacific and South Pacific. Within the North Pacific, loggerhead nesting has been documented only in Japan (Kamezaki et al., 2003), although low level nesting may occur outside of Japan in areas surrounding the South China Sea (Chan et al., 2007). In the South Pacific, nesting beaches are restricted to eastern Australia and New Caledonia and, to a much lesser extent, Vanuatu and Tokelau (Limpus and Limpus, 2003a).

Based on tag-recapture studies from Japan, the East China Sea has been identified as the major habitat for post-nesting adult females (Iwamoto et al., 1985; Kamezaki et al., 1997; Balazs, 2006), while satellite tracking indicates the Kuroshio Extension Bifurcation Region to be an important pelagic foraging area for juvenile loggerheads (Polovina et al., 2006). Other important juvenile turtle foraging areas have been identified off the coast of Baja California Sur, Mexico (Pitman, 1990; Peckham and Nichols, 2006; Peckham et al., 2007).

Nesting females tagged on the coast of eastern Australia have been recorded foraging in New Caledonia; Queensland, northern New South Wales, and Northern Territory, Australia; Solomon Islands; Papua New Guinea; and Indonesia (Limpus and Limpus, 2003a; Limpus, 2009). Foraging Pacific loggerheads originating from nesting beaches in Australia are known to migrate to Chile and Peru (Alfaro-Shigueto et al., 2004, 2008a; Donoso and Dutton, 2006; Boyle et al., 2009).

Indian Ocean

In the North Indian Ocean, Oman hosts the vast majority of loggerhead nesting. The majority of the nesting in Oman occurs on Masirah Island, on the Al Halaniyat Islands, and on mainland beaches south of Masirah Island all the way to the Oman-Yemen border (IUCN - The World Conservation Union, 1989a, 1989b; Salm, 1991; Salm and Salm, 1991). In addition, nesting probably occurs on the mainland of Yemen on the Arabian Sea coast, and nesting has been confirmed on Socotra, an island off the coast of Yemen (Pilcher and Saad, 2000). Limited information exists on the foraging habitats of North Indian Ocean loggerheads; however, foraging individuals have been reported off the southern coastline of Oman (Salm et al., 1993). Satellite telemetry studies of post-nesting migrations of loggerheads nesting on Masirah Island, Oman, have revealed extensive use of the waters off the Arabian Peninsula, with the majority of telemetered turtles traveling southwest, following the shoreline of southern Oman and Yemen, and circling well offshore in nearby oceanic waters (Environment Society of Oman and Ministry of Environment and Climate Change, Oman, unpublished data). A minority traveled north as far as the western Persian Gulf or followed the shoreline of southern Oman and Yemen as far west as the Gulf of Aden and the Bab-el-Mandab.

The only verified nesting beaches for loggerheads on the Indian subcontinent are found in Sri Lanka. A small number of nesting females use the beaches of Sri Lanka every year (Deraniyagala, 1939; Kar and Bhaskar, 1982; Dodd, 1988); however, there are no records indicating that Sri Lanka has ever been a major nesting area for loggerheads (Kapurusinghe, 2006). No confirmed nesting occurs on the mainland of India (Tripathy, 2005; Kapurusinghe, 2006). The Gulf of Mannar provides foraging habitat for juvenile and post-nesting adult turtles (Tripathy, 2005; Kapurusinghe, 2006).

In the East Indian Ocean, Western Australia hosts all known loggerhead nesting (Dodd, 1988). Nesting distributions in Western Australia span from the Shark Bay World Heritage Area, including Dirk Hartog Island, and northward through the Ningaloo Marine Park coast to the North West Cape, including the Muiron Islands (Baldwin et al., 2003). Nesting individuals from Dirk Hartog Island have been recorded foraging within Shark Bay and Exmouth Gulf (Baldwin et al., 2003), and satellite tracking of individuals from Ningaloo has demonstrated that female turtles can disperse as far east as Torres Strait in Queensland.

In the Southwest Indian Ocean, loggerhead nesting occurs on the southeastern coast of Africa, from the Paradise Islands in Mozambique southward to St. Lucia in South Africa, and on the south and southwestern coasts of Madagascar (Baldwin et al., 2003). Foraging habitats are only known for post-nesting females from Tongaland, South Africa; tagging data show these loggerheads migrating eastward to Madagascar, northward to Mozambique, Tanzania, and Kenya, and southward to Cape Agulhas at the southernmost point of Africa (Baldwin et al., 2003; Luschi et al., 2006).

Atlantic Ocean

In the Northwest Atlantic, the majority of loggerhead nesting is concentrated along the coasts of the United States from southern Virginia through Alabama. Additional nesting beaches are found along the northern and western Gulf of Mexico, eastern Yucatan Peninsula, at Cay Sal Bank in the eastern Bahamas (Addison and Morford, 1996; Addison, 1997), on the southwestern coast of Cuba (F. Moncada-Gavilan, personal communication, cited in Ehrhart et al., 2003), and along the coasts of Central America, Colombia, Venezuela, and the eastern Caribbean Islands. In the Southwest Atlantic, loggerheads nest in significant numbers only in Brazil. In the eastern Atlantic, the largest nesting population of loggerheads is in the Cape Verde Islands (L.F. López-Jurado, personal communication, cited in Ehrhart et al., 2003), and some nesting occurs along the West African coast (Fretey, 2001).

As post-hatchlings, Northwest Atlantic loggerheads use the North Atlantic Gyre and enter Northeast Atlantic waters (Carr, 1987). They are also found in the Mediterranean Sea (Carreras et al., 2006; Eckert et al., 2008). In these areas, they overlap with animals originating from the Northeast Atlantic and the Mediterranean Sea (Laurent et al., 1993, 1998; Bolten et al., 1998; LaCasella et al., 2005; Carreras et al., 2006; Monzón-Argüello et al., 2006, 2010; Revelles et al., 2007; Eckert et al., 2008). 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 turtles appear to be moving through Madeiran waters (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, University of Florida, 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). Genetic information indicates the Grand Banks are foraging grounds for a mixture of loggerheads from all the North Atlantic rookeries (Bowen et al., 2005; LaCasella et al., 2005), and a large size range is represented (Watson et al., 2004, 2005).

After departing the oceanic zone, neritic juvenile loggerheads in the Northwest Atlantic inhabit continental shelf waters from Cape Cod Bay, Massachusetts, south through Florida, The Bahamas, Cuba, and the Gulf of Mexico (Musick and Limpus, 1997; Spotila et al., 1997; Hopkins-Murphy et al., 2003) (neritic refers to the inshore marine environment from the surface to the sea floor where water depths do not exceed 200 meters).

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, in the United States, 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 Chesapeake Bay in the U.S. mid-Atlantic, are also regularly used by juvenile loggerheads, as well as by adults primarily during warmer seasons (J. Musick, The Virginia Institute of Marine Science, personal communication, 2008). Shallow water habitats with large expanses of open ocean access, such as Florida Bay, provide year-round resident foraging areas for significant numbers of male and female adult loggerheads (Schroeder et al., 1998; Witherington et al., 2006a). 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). The southern edge of the Grand Bahama Bank is important habitat for loggerheads nesting on the Cay Sal Bank in The Bahamas, but nesting females are also resident in the bights of Eleuthera, Long Island, and Ragged Islands as well as Florida Bay in the United States, and the north coast of Cuba (A. Bolten and K. Bjorndal, University of Florida, unpublished data). Moncada et al. (2010) reported the recapture in Cuban waters of five adult female loggerheads originally flipper tagged in Quintana Roo, Mexico, indicating that Cuban shelf waters likely also provide foraging habitat for adult females that nest in Mexico.

In the Northeast Atlantic, satellite telemetry studies of post-nesting females from Cape Verde identified two distinct dispersal patterns; larger individuals migrated to benthic foraging areas off the northwest Africa coast and smaller individuals foraged primarily oceanically off the northwest Africa coast (Hawkes et al., 2006). Monzón-Argüello et al. (2009) conducted a mixed stock analysis of juvenile loggerheads sampled from foraging areas in the Canary Islands, Madeira, Azores, and Andalusia and concluded that while juvenile loggerheads from the Cape Verde population were distributed among these four sites, a large proportion of Cape Verde juvenile turtles appear to inhabit as yet unidentified foraging areas.

In the South Atlantic, recaptures of tagged juvenile turtles and nesting females have shown movement of animals up and down the coast of South America (Almeida et al., 2000, 2007; Marcovaldi et al., 2000; Laporta and Lopez, 2003). Juvenile loggerheads, presumably of Brazilian origin, have also been captured on the high seas of the South Atlantic (Kotas et al., 2004; Pinedo and Polacheck, 2004) and off the coast of Atlantic Africa (Petersen, 2005; Bal et al., 2007; Petersen et al., 2007) suggesting that loggerheads of the South Atlantic may undertake transoceanic developmental migrations (Bolten et al., 1998; Peckham et al., 2007). Marcovaldi et al. (2010) identified the northeastern coast of Brazil as important foraging habitat for post-nesting females from Bahia, Brazil.

Mediterranean Sea

Loggerhead sea turtles are widely distributed in the Mediterranean Sea. However, nesting is almost entirely confined to the eastern Mediterranean basin, with the main nesting concentrations in Cyprus, Greece, and Turkey (Margaritoulis et al., 2003; Casale and Margaritoulis, 2010). Preliminary surveys in Libya suggested nesting activity comparable to Greece and Turkey, although a better quantification is needed (Laurent et al., 1999). Minimal to moderate nesting also occurs in other countries throughout the Mediterranean including Egypt, Israel, Italy (southern coasts and islands), Lebanon, Syria, and Tunisia (Margaritoulis et al., 2003). Recently, isolated nesting events have been recorded in the western Mediterranean basin, namely in Spain, Corsica (France), and in the Tyrrhenian Sea (Italy) (Tomás et al., 2002; Delaugerre and Cesarini, 2004; Bentivegna et al., 2005).

Important neritic habitats have been suggested for the large continental shelves of: (1) Tunisia-Libya, (2) northern Adriatic Sea, (3) Egypt, and (4) Spain (Margaritoulis, 1988; Argano et al., 1992; Laurent and Lescure, 1994; Lazar et al., 2000; Gomez de Segura et al., 2006; Broderick et al., 2007; Casale et al., 2007a; Nada and Casale, 2008). At least the first three constitute shallow benthic habitats for adults (including post-nesting females). Some other neritic foraging areas include Amvrakikos Bay in western Greece, Lakonikos Bay in southern Greece, and southern Turkey. Oceanic foraging areas for small juvenile loggerheads have been identified in the south Adriatic Sea (Casale et al., 2005a), Ionian Sea (Deflorio et al., 2005), Sicily Strait (Casale et al., 2007a), and western Mediterranean (Spain) (e.g., Camiñas et al., 2006). In addition, tagged juvenile loggerheads have been recorded crossing the Mediterranean from the eastern to the western basin and vice versa, as well as in the Eastern Atlantic (Argano et al., 1992; Casale et al., 2007a).

Reproductive migrations have been confirmed by flipper tagging and satellite telemetry. Female loggerheads, after nesting in Greece, migrate primarily to the Gulf of Gabès and the northern Adriatic (Margaritoulis, 1988; Margaritoulis et al., 2003; Lazar et al., 2004; Zbinden et al., 2008). Loggerheads nesting in Cyprus migrate to Egypt and Libya, exhibiting fidelity in following the same migration route during subsequent nesting seasons (Broderick et al., 2007). In addition, directed movements of juvenile loggerheads have been confirmed through flipper tagging (Argano et al., 1992; Casale et al., 2007a) and satellite tracking (Rees and Margaritoulis, 2009).

Overview of Information Used to Identify DPSs

In the Status Review, the BRT considered a vast array of information to assess whether there were any loggerhead population segments that satisfy the DPS criteria of both discreteness and significance. First, the BRT examined whether there were any loggerhead population segments that were discrete. Data relevant to the discreteness question included physical, ecological, behavioral, and genetic data. Given the physical separation of ocean basins by continents, the BRT evaluated these data by ocean basin (Pacific Ocean, Indian Ocean, and Atlantic Ocean). This was not to preclude any larger or smaller DPS delineation, but to aid in data organization and assessment. The BRT then evaluated genetic information by ocean basin. The genetic data consisted of results from studies using maternally inherited mitochondrial DNA (mtDNA) and biparentally inherited nuclear DNA microsatellite markers. Next, tagging data (both flipper and Passive Integrated Transponder (PIT) tags) and telemetry data were reviewed. Additional information, such as potential differences in morphology, was also evaluated. Finally, the BRT considered whether the available information on loggerhead population segments was bounded by any oceanographic features (e.g., current systems) or geographic features (e.g., land masses).

In accordance with the DPS policy, the BRT also reviewed whether the population segments identified in the discreteness analysis were significant. If a population segment is considered discrete, its biological and ecological significance relative to the species or subspecies must then be considered. NMFS and USFWS must consider available scientific evidence of the discrete segment's importance to the taxon to which it belongs. Data relevant to the significance question include morphological, ecological, behavioral, and genetic data, as described above. The BRT considered the following factors, listed in the DPS policy, in determining whether the discrete population segments were significant: (a) persistence of the discrete segment in an ecological setting unusual or unique for the taxon; (b) evidence that loss of the discrete segment would result in a significant gap in the range of the taxon; (c) evidence that the discrete segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historical range; and (d) evidence that the discrete segment differs markedly from other populations of the species in its genetic characteristics. A discrete population segment needs to satisfy only one of these criteria to be considered significant. As described below, the BRT evaluated the available information and considered items (a), (b), and (d), as noted above, to be most applicable to loggerheads.

Discreteness Determination

As described in the Status Review, the loggerhead sea turtle is present in all tropical and temperate ocean basins, and has a life history that involves nesting on coastal beaches and foraging in neritic and oceanic habitats, as well as long-distance migrations between and within these areas. As with other globally distributed marine species, today's global loggerhead distribution has been shaped by a sequence of isolation events created by tectonic and oceanographic shifts over geologic time scales, the result of which is population substructuring in many areas (Bowen et al., 1994; Bowen, 2003). Globally, loggerhead sea turtles comprise a mosaic of populations, each with unique nesting sites and in many cases possessing disparate demographic features (e.g., mean body size, age at first reproduction) (Dodd, 1988). However, despite these differences, loggerheads from different nesting populations often mix in common foraging areas during certain life stages (Bolten and Witherington, 2003; Bowen and Karl, 2007), thus creating unique challenges when attempting to delineate distinct population segments for management or listing purposes.

Bowen et al. (1994) examined the mtDNA sequence diversity of loggerheads across their global distribution and found a separation of loggerheads in the Atlantic-Mediterranean basins from those in the Indo-Pacific basins since the Pleistocene period. The divergence between these two primary lineages corresponds to approximately three million years (2 percent divergence per million years; Dutton et al., 1996; Encalada et al., 1996). Geography and climate appear to have shaped the evolution of these two matriarchal lineages with the onset of glacial cycles, the appearance of the Panama Isthmus creating a land barrier between the Atlantic and eastern Pacific, and upwelling of cold water off southern Africa creating an oceanographic barrier between the Atlantic and Indian Oceans (Bowen, 2003). Recent warm temperatures during interglacial periods allowed bi-directional invasion by the temperate-adapted loggerheads into the respective basins (Bowen et al., 1994; J.S. Reece, Washington University, personal communication, 2008). Today, it appears that loggerheads within a basin are effectively isolated from populations in the other basin, but some dispersal from the Tongaland rookery in the Indian Ocean into feeding and developmental habitat in the South Atlantic is possible via the Agulhas Current (G.R. Hughes, unpublished data, cited in Bowen et al., 1994). In the Pacific, extensive mtDNA studies show that the northern loggerhead populations are isolated from the southern Pacific populations, and that juvenile loggerheads from these distinct genetic populations do not disperse across the equator (Bowen et al., 1994, 1995; Hatase et al., 2002a; Dutton, 2007, unpublished data; Boyle et al., 2009).

Mitochondrial DNA data indicate that regional turtle rookeries within an ocean basin have been strongly isolated from one another over ecological timescales (Bowen et al., 1994; Bowen and Karl, 2007). These same data indicate strong female natal homing and suggest that each regional nesting population is an independent demographic unit (Bowen et al., 2004, 2005; Bowen and Karl, 2007). It is difficult to determine the precise boundaries of these demographically independent populations in regions, such as the eastern U.S. coast, where rookeries are close to each other and range along large areas of a continental coastline. There appear to be varying levels of connectivity between proximate rookeries facilitated by imprecise natal homing and male mediated gene flow (Pearce, 2001; Bowen, 2003; Bowen et al., 2005). Regional genetic populations often are characterized by allelic frequency differences rather than fixed genetic differences (Bowen and Karl, 2007).

Through the evaluation of genetic data, tagging data, telemetry, and demography, the BRT determined that there are at least nine discrete population segments of loggerhead sea turtles globally. These discrete population segments are markedly separated from each other as a consequence of physical, ecological, behavioral, and oceanographic factors and, given the genetic evidence, the BRT concluded that each regional population identified is discrete from other populations of loggerheads. Information considered by the BRT in its delineation of discrete population segments is presented below by ocean basin.

Pacific Ocean

In the North Pacific Ocean, the primary loggerhead nesting areas are found along the southern Japanese coastline and Ryukyu Archipelago (Kamezaki et al., 2003), although low level nesting may occur outside Japan in areas surrounding the South China Sea (Chan et al., 2007). Loggerhead sea turtles hatching on Japanese beaches undertake extensive developmental migrations using the Kuroshio and North Pacific Currents (Balazs, 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., 2002c).

Despite these long-distance developmental movements of juvenile 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., 2002a; LeRoux and Dutton, 2006; Dutton, 2007, unpublished data; Boyle et al., 2009). This apparent, almost complete separation of two adjacent populations most likely results from: (1) the presence of two distinct Northern and Southern Gyre (current flow) systems in the Pacific (Briggs, 1974), (2) near-passive movements of post-hatchlings in these gyres that initially move them farther away from areas of potential mixing among the two populations along the equator, and (3) the nest-site fidelity of adult turtles that prevents turtles from returning to non-natal nesting areas.

Pacific loggerheads are further partitioned evolutionarily from other loggerheads throughout the world based on additional analyses of mtDNA. The haplotypes (a haplotype refers to the genetic signature, coded in mtDNA, of an individual) from both North and South Pacific loggerheads are distinguished by a minimum genetic distance (d) equal to 0.017 from other conspecifics, which indicates isolation of approximately one million years (Bowen, 2003).

Within the Pacific, Bowen et al. (1995) used mtDNA to identify two genetically distinct nesting populations in the Pacific – a northern hemisphere population nesting in Japan and a southern hemisphere population nesting primarily in Australia. This study also suggested that some loggerheads sampled as bycatch in the North Pacific might be from the Australian nesting population (Bowen et al., 1995). However, more extensive mtDNA data from rookeries in Japan (Hatase et al., 2002a) taken together with preliminary results from microsatellite (nuclear) analysis confirms that loggerheads inhabiting the North Pacific actually originate from nesting beaches in Japan (Watanabe et al., 2011; P. Dutton, NMFS, unpublished data).

Although these studies indicate genetic distinctness between loggerheads nesting in Japan versus those nesting in Australia, Bowen et al. (1995) did identify individuals with the common Australian haplotype at foraging areas in the North Pacific, based on a few individuals sampled as bycatch in the North Pacific. Bowen et al. (1995) indicated that this finding could be an artifact of sampling variance or that the Australian haplotype exists at low frequency in Japanese nesting aggregates but escaped detection in their study. More recently, Hatase et al. (2002a) and Watanabe et al. (2011) detected this common Australian haplotype at very low frequency at Japanese nesting beaches. However, the presence of the common Australian haplotype does not preclude the genetic distinctiveness of Japanese and Australian nesting populations, and is likely the result of rare gene flow events occurring over geologic time scales. Watanabe et al. (2011) found sub-structuring among the Japanese nesting sites based on mtDNA results, but homogeneity of nuclear DNA variation among the same Japanese nesting sites, indicating connectivity through male-mediated gene flow. These results taken together are consistent with the previous evidence supporting the genetic distinctiveness of the northern (Japanese) stocks from the southern Pacific nesting stocks.

The discrete status of loggerheads in the North Pacific is further supported by results from flipper tagging in the North Pacific. Flipper tagging of loggerheads has been widespread throughout this region, occurring on adults nesting in Japan and bycaught in the coastal pound net fishery (Y. Matsuzawa, Sea Turtle Association of Japan, personal communication, 2006), juvenile turtles reared and released in Japan (Uchida and Teruya, 1988; Hatase et al., 2002a), juvenile turtles foraging near Baja California, Mexico (Nichols, 2003; Seminoff et al., 2004), and juvenile and adult loggerheads captured in and tagged from commercial fisheries platforms in the North Pacific high seas (NMFS, unpublished data). To date, there have been at least three trans-Pacific tag recoveries showing east-west and west-east movements (Uchida and Teruya, 1988; Resendiz et al., 1998; W.J. Nichols, California Academy of Sciences, and H. Peckham, Pro Peninsula, unpublished data) and several recoveries of adults in the western Pacific (Iwamoto et al., 1985; Kamezaki et al., 1997). Tag returns show post-nesting females migrating into the East China Sea off South Korea, China, and the Philippines, and the nearby coastal waters of Japan (Iwamoto et al., 1985; Kamezaki et al., 1997, 2003). However, despite the more than 30,000 marked individuals, not a single tag recovery has been reported outside the North Pacific.

A lack of movements by loggerheads south across the equator has also been supported by extensive satellite telemetry. As with flipper tagging, satellite telemetry has been conducted widely in the North Pacific, with satellite transmitters being placed on adult turtles departing nesting beaches (Sakamoto et al., 1997; Japan Fisheries Resource Conservation Association, 1999; Hatase et al., 2002b, 2002c), on adult and juvenile turtles bycaught in pound nets off the coast of Japan (Sea Turtle Association of Japan, unpublished data), on captive-reared juvenile turtles released in Japan (Balazs, 2006), on juvenile and adult turtles bycaught in the eastern and central North Pacific (e.g., Kobayashi et al., 2008; Peckham, 2008), and on juvenile turtles foraging in the eastern Pacific (Nichols et al., 2000; Nichols, 2003; Peckham et al., 2007; Peckham, 2008; J. Seminoff, NMFS, unpublished data). Aerial surveys and satellite telemetry studies, which have documented juvenile foraging areas in the eastern Pacific, near Baja California, Mexico (Nichols, 2003; Seminoff et al., 2006; Peckham et al., 2007; H. Peckham, Pro

Peninsula, unpublished data) and Peru (Mangel et al., in press), similarly showed a complete lack of long distance north or south movements. Of the nearly 200 loggerheads tracked using satellite telemetry in the North Pacific, none have moved south of the equator.

Studies have demonstrated the strong association loggerheads show with oceanographic mesoscale features such as the Kuroshio Current Bifurcation Region and the Transition Zone Chlorophyll Front (Polovina et al., 2000, 2001, 2004, 2006; Etnoyer et al., 2006; Kobayashi et al., 2008). The Kuroshio Extension Current, lying west of the international date line, serves as the dominant physical and biological habitat in the North Pacific and is highly productive, likely due to unique features such as eddies and meanders that concentrate prey and support food webs. Juvenile loggerheads originating from nesting beaches in Japan exhibit high site fidelity to this area referred to as the Kuroshio Extension Bifurcation Region (Polovina et al., 2006). Juvenile turtles also were found to correlate strongly with the Transition Zone Chlorophyll Front, an area of surface chlorophyll a levels that also concentrates surface prey for loggerheads (Polovina et al., 2001; Parker et al., 2005; Kobayashi et al., 2008). Kobayashi et al. (2008) demonstrated that loggerheads strongly track these zones even as they shift in location, suggesting that strong habitat specificity during the oceanic stage also contributes to the lack of mixing. In summary, loggerheads inhabiting the North Pacific Ocean are derived primarily, if not entirely, from Japanese beaches, with the possible exception of rare waifs over evolutionary time scales. Further, nesting colonies of Japanese loggerheads are found to be genetically distinct based on mtDNA analyses, and when compared to much larger and more genetically diverse loggerhead populations in the Atlantic and Mediterranean, Pacific loggerheads have likely experienced critical bottlenecks (in Hatase et al., 2002a). This is the only known population of loggerheads to be found north of the equator in the Pacific Ocean, foraging in the eastern Pacific as far south as Baja California Sur, Mexico (Seminoff et al., 2004; Peckham et al., 2007) and in the western Pacific as far south as the Philippines (Limpus, 2009) and the mouth of Mekong River, Vietnam (Sadoyama et al., 1996; Hamann et al., 2006).

In the South Pacific Ocean, loggerhead sea turtles nest primarily in Queensland, Australia, and, to a lesser extent, New Caledonia and Vanuatu (Limpus and Limpus, 2003a; Limpus et al., 2006; Limpus, 2009). Loggerheads from these rookeries undertake an oceanic developmental migration, traveling to habitats in the central and southeastern Pacific Ocean where they may reside for several years prior to returning to the western Pacific for reproduction. Loggerheads in this early life history stage differ markedly from those originating from Western Australia beaches in that they undertake long west-to-east migrations, likely using specific areas of the pelagic environment of the South Pacific Ocean. An unknown portion of these loggerheads forage off Chile and Peru, and genetic information from foraging areas in the southeastern Pacific confirms that the haplotype frequencies among juvenile turtles in these areas closely match those found at nesting beaches in eastern Australia (Alfaro-Shigueto et al., 2004; Donoso and Dutton, 2006, 2007; Boyle et al., 2009). Large juvenile and adult loggerheads generally remain in the western South Pacific, inhabiting neritic and oceanic foraging sites during non-nesting periods (Limpus et al., 1994; Limpus, 2009).

Loggerheads from Australia and New Caledonia apparently do not travel north of the equator. Flipper tag recoveries from nesting females have been found throughout the western Pacific, including the southern Great Barrier Reef and Moreton Bay off the coast of Queensland, Australia, Indonesia (Irian Jaya), Papua New Guinea, Solomon Islands, the Torres Strait, and the

Gulf of Carpentaria (Limpus, 2009). Of approximately 1,000 (adult and juvenile; male and female) loggerheads that have been tagged in eastern Australian feeding areas over approximately 25 years, only two have been recorded nesting outside of Australia; both traveled to New Caledonia (Limpus and Limpus, 2003b; Limpus, 2009). Flipper tagging programs in Peru and Chile tagged approximately 500 loggerheads from 1999 to 2006, none of which have been reported from outside of the southeastern Pacific (Alfaro-Shigueto et al., 2008a; S. Kelez, Duke University Marine Laboratory, unpublished data; M. Donoso, ONG Pacifico Laud - Chile, unpublished data). Limited satellite telemetry data from 12 turtles in the southeastern Pacific area show a similar trend (Mangel et al., in press).

The spatial separation between the North Pacific and South Pacific loggerhead populations has contributed to substantial differences in the genetic profiles of the nesting populations in these two regions. Whereas the dominant mtDNA haplotypes among loggerheads nesting in Japan are CCP2 and CCP3 (equivalent to B and C respectively in Bowen et al., 1995 and Hatase et al., 2002a; LeRoux et al., 2008; P. Dutton, NMFS, unpublished data), loggerheads nesting in eastern Australia have a third haplotype (CCP1, previously A) which is dominant (98 percent of nesting females) (Bowen et al., 1994; FitzSimmons et al., 1996; Boyle et al., 2009). Further, preliminary genetic analysis using microsatellite markers (nuclear DNA) indicates genetic distinctiveness between nesting populations in the North versus South Pacific (P. Dutton, NMFS, personal communication, 2008).

The separateness between nesting populations in eastern Australia (in the South Pacific Ocean) and western Australia (in the East Indian Ocean) is less clear, although these too are considered to be genetically distinct from one another (Limpus, 2009). For example, mtDNA haplotype CCP1, which is the overwhelmingly dominant haplotype among eastern Australia nesting females (98 percent), is also found in western Australia, although at much lower frequency (33 percent) (FitzSimmons et al., 1996, 2003). The remaining haplotype for both regions was the CCP5 haplotype. Further, FitzSimmons (University of Canberra, unpublished data) found significant differences in nuclear DNA microsatellite loci from females nesting in these two regions. Estimates of gene flow between eastern and western Australian populations were an order of magnitude less than gene flow within regions. These preliminary results based on nuclear DNA indicate that male-mediated gene flow between eastern and western Australia may be insignificant, which, when considered in light of the substantial disparity in mtDNA haplotype frequencies between these two regions, provides further evidence of population separation. It is also important to note that there is no nesting by loggerheads recorded by either scientists or indigenous peoples for the thousands of kilometers of sandy beaches between the rookeries of Queensland and Western Australia (Chatto and Baker, 2008).

At present, there is no indication from genetic studies that the loggerhead sea turtles nesting in eastern Australia are distinct from those nesting in New Caledonia. Of 27 turtles sequenced from New Caledonia, 93 percent carried the CCP1 haplotype and the remaining had the CCP5 haplotype; similar to eastern Australia (Boyle et al., 2009).

The South Pacific population of loggerheads occupies an ecological setting distinct from other loggerheads, including the North Pacific population; however, less is known about the ecosystem on which South Pacific oceanic juvenile and adult loggerheads depend. Sea surface temperature and chlorophyll frontal zones in the South Pacific have been shown to dramatically affect the movements of green turtles, Chelonia mydas (Seminoff et al., 2008) and leatherback turtles, Dermochelys coriacea (Shillinger et al., 2008), and it is likely that loggerhead distributions are also affected by these mesoscale oceanographic features. However, unlike the North Pacific, there are no records of oceanic aggregations of loggerhead sea turtles.

Loggerheads in the South Pacific are substantially impacted by periodic environmental perturbations such as the El Niño Southern Oscillation (ENSO). This 3- to 6-year cycle within the coupled ocean-atmosphere system of the tropical Pacific brings increased surface water temperatures and lower primary productivity, both of which have profound biological consequences (Chavez et al., 1999; Saba et al., 2008). Loggerheads are presumably adversely impacted by the reduced food availability that often results from ENSO events, although data on this subject are lacking. Although ENSO may last for only short periods and thus not have a long-term effect on loggerheads in the region, recent studies by Chaloupka et al. (2008) suggested that long-term increases in sea surface temperature within the South Pacific may influence the ability of the Australian nesting population to recover from historical population declines.

Loggerheads originating from nesting beaches in the western South Pacific are the only population of loggerheads to be found south of the equator in the Pacific Ocean. As post-hatchlings, they are generally swept south by the East Australian Current (Limpus et al., 1994), spend a large portion of time foraging in the oceanic South Pacific Ocean, and some migrate to the southeastern Pacific Ocean off the coasts of Peru and Chile as juvenile turtles (Donoso et al., 2000; Alfaro-Shigueto et al., 2004, 2008a; Boyle et al., 2009). As large juveniles and adults, the foraging range of these loggerheads encompasses the eastern Arafura Sea, Gulf of Carpentaria, Torres Strait, Gulf of Papua, Coral Sea, and throughout the eastern coastline of Australia from north Queensland south to southern New South Wales, including the Great Barrier Reef, Hervey Bay, and Moreton Bay. The outer extent of this range includes the coastal waters off eastern Indonesia, northeastern Papua New Guinea, northeastern Solomon Islands, and New Caledonia (Limpus, 2009).

In summary, all loggerheads inhabiting the South Pacific Ocean are derived from beaches in eastern Australia and a lesser known number of beaches in southern New Caledonia, Vanuatu, and Tokelau (Limpus and Limpus, 2003a; Limpus, 2009). Furthermore, nesting colonies of the South Pacific population of loggerheads are found to be genetically distinct from loggerheads in the North Pacific and Indian Ocean.

Given the information presented above, the BRT concluded, and we concur, that two discrete population segments exist in the Pacific Ocean: (1) North Pacific Ocean and (2) South Pacific Ocean. These two population segments are markedly separated from each other and from population segments within the Indian Ocean and Atlantic Ocean basins as a consequence of physical, ecological, behavioral, and oceanographic factors. Information supporting this conclusion includes genetic analysis, flipper tag recoveries, and satellite telemetry, which indicate that individuals originating from Japan remain in the North Pacific for their entire life cycle, likely never crossing the equator or mixing with individuals from the South Pacific (Bowen et al., 1995; Hatase et al., 2002a; LeRoux and Dutton, 2006; Dutton, 2007, unpublished data; Boyle et al., 2009). This apparent, almost complete separation most likely results from: (1) the presence of two distinct Northern and Southern Gyre (current flow) systems in the Pacific (Briggs, 1974), (2) near-passive movements of post-hatchlings in these gyres that initially move them farther away from areas of potential mixing along the equator, and (3) the nest-site fidelity of adult turtles that prevents turtles from returning to non-natal nesting areas. The separation of the Pacific Ocean population segments from population segments within the Indian Ocean and Atlantic Ocean basins is believed to be the result of land barriers and oceanographic barriers. Based on mtDNA analysis, Bowen et al. (1994) found a separation of loggerheads in the Atlantic-Mediterranean basins from those in the Indo-Pacific basins since the Pleistocene period. Geography and climate appear to have shaped the evolution of these two matriarchal lineages with the onset of glacial cycles, the appearance of the Panama Isthmus creating a land barrier between the Atlantic and eastern Pacific, and upwelling of cold water off southern Africa creating an oceanographic barrier between the Atlantic and Indian Oceans (Bowen, 2003).

Indian Ocean

Similar to loggerheads in the Pacific and Atlantic, loggerheads in the Indian Ocean nest on coastal beaches, forage in neritic and oceanic habitats, and undertake long-distance migrations between and within these areas. The distribution of loggerheads in the Indian Ocean is limited by the Asian landmass to the north (approximately 30º N. lat.); distributions east and west are not restricted by landmasses south of approximately 38º S. latitude.

In the North Indian Ocean, Oman hosts the vast majority of loggerhead nesting. The largest nesting assemblage is at Masirah Island, Oman, in the northern tropics at 21º N. lat. (Baldwin et al., 2003). Other key nesting assemblages occur on the Al Halaniyat Islands, Oman (17º S. lat.) and on Oman's Persian Gulf mainland beaches south of Masirah Island to the Oman-Yemen border (17–20º S. lat.) (IUCN - The World Conservation Union, 1989a, 1989b; Salm, 1991; Salm and Salm, 1991; Baldwin et al., 2003). In addition, nesting probably occurs on the mainland of Yemen on the Arabian Sea coast, and nesting has been confirmed on Socotra, an island off the coast of Yemen (Pilcher and Saad, 2000).

Outside of Oman, loggerhead nesting is rare in the North Indian Ocean. The only verified nesting beaches for loggerheads on the Indian subcontinent are found in Sri Lanka (Deraniyagala, 1939; Kar and Bhaskar, 1982; Dodd, 1988; Kapurusinghe, 2006). Reports of regular loggerhead nesting on the Indian mainland are likely misidentifications of olive ridleys (Lepidochelys olivacea) (Tripathy, 2005; Kapurusinghe, 2006). Although loggerheads have been reported nesting in low numbers in Myanmar, these data may not be reliable because of misidentification of species (Thorbjarnarson et al., 2000).

Limited information exists on foraging locations of North Indian Ocean loggerheads. Foraging individuals have been reported off the southern coastline of Oman (Salm et al., 1993) and in the Gulf of Mannar, between Sri Lanka and India (Tripathy, 2005; Kapurusinghe, 2006). Satellite telemetry studies of post-nesting migrations of loggerheads nesting on Masirah Island, Oman, have revealed extensive use of the waters off the Arabian Peninsula, with the majority of telemetered turtles (15 of 20) traveling southwest, following the shoreline of southern Oman and Yemen, and circling well offshore in nearby oceanic waters (Environment Society of Oman and Ministry of Environment and Climate Change, Oman, unpublished data). A minority traveled north as far as the western Persian Gulf (3 of 20) or followed the shoreline of southern Oman and Yemen as far west as the Gulf of Aden and the Bab-el-Mandab (2 of 20). These preliminary data from Oman suggest that post-nesting migrations and adult female foraging areas are restricted to the Northwest Indian Ocean (Environment Society of Oman and Ministry of Environment and Climate Change, Oman, unpublished data). No tag returns or satellite tracks indicated that loggerheads nesting in Oman traveled south of the equator.

In the East Indian Ocean, Western Australia hosts all known loggerhead nesting (Dodd, 1988). Nesting distributions in Western Australia span from the Shark Bay World Heritage Area northward through the Ningaloo Marine Park coast to the North West Cape and to the nearby Muiron Islands (Baldwin et al., 2003). Nesting individuals from Dirk Hartog Island have been recorded foraging within Shark Bay and Exmouth Gulf, while other adults range into the Gulf of Carpentaria (Baldwin et al., 2003) as far east as Torres Strait. At the eastern extent of this apparent range, there is likely overlap with loggerheads that nest on Australia's Pacific coast (Limpus, 2009). However, despite extensive tagging and beach monitoring at principal nesting beaches on Australia's Indian Ocean and Pacific coasts, no exchange of females between nesting beaches has been observed (Limpus, 2009).

Loggerhead nesting in the Southwest Indian Ocean includes the southeastern coast of Africa from the Paradise Islands in Mozambique southward to St. Lucia in South Africa, and on the south and southwestern coasts of Madagascar (Baldwin et al., 2003). Foraging habitats are only known for the Tongaland, South Africa, adult female loggerheads. Returns of flipper tags describe a range that extends eastward to Madagascar, northward to Mozambique, Tanzania, and Kenya, and southward to Cape Agulhas at the southernmost point of Africa (Baldwin et al., 2003). Four post-nesting loggerheads satellite tracked by Luschi et al. (2006) migrated northward, hugging the Mozambique coast and remained in shallow shelf waters off Mozambique for more than 2 months. Only one post-nesting female from the Southwest Indian Ocean population (South Africa) has been documented migrating north of the equator (to southern Somalia) (Hughes and Bartholomew, 1996).

The available genetic information relates to connectivity and broad evolutionary relationships between ocean basins. There is a lack of genetic information on population structure among rookeries within the Indian Ocean. Bowen et al. (1994) described mtDNA sequence diversity among eight loggerhead nesting assemblages and found one of two principal branches in the Indo-Pacific basins. Using additional published and unpublished data, Bowen (2003) estimated divergence between these two lineages to be approximately three million years. Bowen pointed out evidence for more recent colonizations (12,000–250,000 years ago) between the Indian Ocean and the Atlantic-Mediterranean. For example, the sole mtDNA haplotype (among eight samples) identified by Bowen et al. (1994) at Masirah Island, Oman, is known from the Atlantic and suggests some exchange between oceans some 250,000 years ago. The other principal Indian Ocean haplotype reported by Bowen et al. (1994) was seen in all loggerheads sampled (n=15) from Natal, South Africa. Encalada et al. (1998) reported that this haplotype was common throughout the North Atlantic and Mediterranean, thus suggesting a similar exchange between the Atlantic and Indian Oceans as recently as 12,000 years ago (Bowen et al., 1994). Bowen (2003) speculated that Indian-Atlantic Ocean exchanges took place via the temperate waters south of South Africa and became rare as the ocean shifted to cold temperate conditions in this region.

To estimate loggerhead gene flow in and out of the Indian Ocean, J.S. Reece (Washington University, personal communication, 2008) examined 100 samples from Masirah Island, 249 from Atlantic rookeries (from Encalada et al., 1998), and 311 from Pacific rookeries (from Bowen et al., 1995 and Hatase et al., 2002a). Reece estimated that gene flow, expressed as number of effective migrants, or exchanges of breeding females between Indian Ocean rookeries and those from the Atlantic or Pacific occurred at the rate of less than 0.1 migrant per generation.

Reece estimated gene flow based on coalescence of combined mtDNA and nuclear DNA data to be approximately 0.5 migrants per generation. These unpublished results, while somewhat theoretical, may indicate that there is restricted gene flow into and out of the Indian Ocean. The low level of gene flow most likely reflects the historical connectivity over geological timescales rather than any contemporary migration, and is consistent with Bowen et al.'s (1994) hypothesis that exchange occurred most recently over 12,000–3,000,000 years ago during the Pleistocene, and has been restricted over recent ecological timescales.

The discrete status of three loggerhead populations in the Indian Ocean is primarily supported by observations of tag returns and satellite telemetry. The genetic information currently available based on mtDNA sequences does not allow for a comprehensive analysis of genetic population structure analysis for Indian Ocean rookeries, although Bowen et al. (1994) indicated the Oman and South African rookeries are genetically distinct, and, based on preliminary results, once sequencing studies are completed for these rookeries, it is likely that they will also be genetically distinct from the rookeries in Western Australia (P. Dutton, NMFS, unpublished data; N. FitzSimmons, University of Canberra, unpublished data; J. Reece, University of California at Santa Cruz, unpublished data). Based on multiple lines of evidence, discrete status is supported for the North Indian Ocean, Southeast Indo-Pacific Ocean, and Southwest Indian Ocean loggerhead populations. Although there is not a sufficiently clear picture of gene flow between these regions, significant vicariant barriers likely exist between these three Indian Ocean populations that would prevent migration of individuals on a time scale relative to management and conservation efforts. These biogeographical barriers are the oceanographic phenomena associated with Indian Ocean equatorial waters, and the large expanse between continents in the South Indian Ocean without suitable benthic foraging habitat.

Given the information presented above, the BRT concluded, and we concur, that three discrete population segments exist in the Indian Ocean: (1) North Indian Ocean, (2) Southeast Indo-Pacific Ocean, and (3) Southwest Indian Ocean. These three population segments are markedly separated from each other and from population segments within the Pacific Ocean and Atlantic Ocean basins as a consequence of physical, ecological, behavioral, and oceanographic factors. Information supporting this conclusion is primarily based on observations of tag returns and satellite telemetry. The genetic information currently available based on mtDNA sequences does not allow for a comprehensive analysis of genetic population structure for Indian Ocean rookeries; however, the Oman and South African rookeries are genetically distinct (Bowen et al., 1994), and, based on preliminary results, once sequencing studies are completed for these rookeries, it is likely that they will also be determined genetically distinct from the rookeries in Western Australia (P. Dutton, NMFS, unpublished data; N. FitzSimmons, University of Canberra, unpublished data; J. Reece, University of California at Santa Cruz, unpublished data). Furthermore, significant biogeographical barriers (i.e., oceanographic phenomena associated with Indian Ocean equatorial waters, and the large expanse between continents in the South Indian Ocean without suitable benthic foraging habitat) likely exist between these three Indian Ocean populations that would prevent migration of individuals on a time scale relative to management and conservation efforts. The separation of the Indian Ocean population segments from population segments within the Pacific Ocean and Atlantic Ocean basins is believed to be the result of land barriers and oceanographic barriers. Based on mtDNA analysis, Bowen et al. (1994) found a separation of loggerheads in the Atlantic-Mediterranean basins from those in the

Indo-Pacific basins since the Pleistocene period. Geography and climate appear to have shaped the evolution of these two matriarchal lineages with the onset of glacial cycles, the appearance of the Panama Isthmus creating a land barrier between the Atlantic and eastern Pacific, and upwelling of cold water off southern Africa creating an oceanographic barrier between the Atlantic and Indian Oceans (Bowen, 2003). In the East Indian Ocean, although there is possible overlap with loggerheads that nest on Australia's Indian Ocean and Pacific Ocean coasts, extensive tagging at the principal nesting beaches on both coasts has revealed no exchange of females between these nesting beaches (Limpus, 2009).

Atlantic Ocean and Mediterranean Sea

Within the Atlantic Ocean, loss and re-colonization of nesting beaches over evolutionary time scales has been influenced by climate, natal homing, and rare dispersal events (Encalada et al., 1998; Bowen and Karl, 2007). At times, temperate beaches were too cool to incubate eggs and embryonic development could have succeeded only on tropical beaches. Thus, the contemporary distribution of nesting is the product of colonization events from the tropical refugia during the last 12,000 years. Apparently, turtles from the Northwest Atlantic colonized the Mediterranean and at least two matrilines were involved (Schroth et al., 1996); however, Mediterranean rookeries became isolated from the Atlantic populations in the last 10,000 years following the end of the Wisconsin glacial period (Encalada et al., 1998). A similar colonization event appears to have populated the Northeast Atlantic (Monzón-Argüello et al., 2010).

Nesting in the western South Atlantic occurs primarily along the mainland coast of Brazil from Sergipe south to Rio de Janeiro, with peak concentrations in northern Bahia, Espírito Santo, and northern Rio de Janeiro (Marcovaldi and Chaloupka, 2007). In the eastern South Atlantic, diffuse nesting may occur along the mainland coast of Africa (Fretey, 2001), with more than 200 loggerhead nests reported for Rio Longa beach in central Angola in 2005 (Brian, 2007). However, other researchers have been unable to confirm nesting by loggerheads in the last decade anywhere along the south Atlantic coast of Africa, including Angola (Fretey, 2001; Weir et al., 2007). There is the possibility that reports of nesting loggerheads from Angola and Namibia (Márquez M., 1990; Brian, 2007) may have arisen from misidentified olive ridley turtles (Brongersma, 1982; Fretey, 2001). At the current time, it is not possible to confirm that regular, if any, nesting of loggerheads occurs along the Atlantic coast of Africa, south of the equator.

Genetic surveys of loggerheads have revealed that the Brazilian rookeries have a unique mtDNA haplotype (Encalada et al., 1998; Pearce, 2001). The Brazilian mtDNA haplotype, relative to North Atlantic haplotypes, indicates isolation of South Atlantic loggerheads from North Atlantic loggerheads on a scale of 250,000–500,000 years ago, and microsatellite DNA results show divergence on the same time scale (Bowen, 2003). Brazil's unique haplotype has been found only in low numbers in foraging populations of juvenile loggerheads of the North Atlantic (Bass et al., 2004). Other lines of evidence support a deep division between loggerheads from the South Atlantic and from the North Atlantic, including: (1) a nesting season in Brazil that peaks in the austral summer around December-January (Marcovaldi and Laurent, 1996), as opposed to the April-September nesting season in the southeastern United States in the northern hemisphere (Witherington et al., 2009); and (2) no observations of tagged loggerheads moving across the equator in the Atlantic, except a single case of a captive-reared animal that was released as a juvenile from Espírito Santo and was recaptured 3 years later in the Azores (Bolten et al., 1990). Post-nesting females from Espírito Santo, Brazil, moved either north or south along the coast, but remained between 10º S. lat. and 30º S. lat. (Marcovaldi et al., 2000; Lemke et al., 2006), while post-nesting females from Bahia, Brazil, all moved north (Marcovaldi et al., 2010).

Recaptures of tagged juvenile turtles and nesting females have shown movement of animals up and down the coast of South America (Almeida et al., 2000, 2007; Marcovaldi et al., 2000; Laporta and Lopez, 2003). Juvenile loggerheads, presumably of Brazilian origin, have also been captured on the high seas of the South Atlantic (Kotas et al., 2004; Pinedo and Polacheck, 2004) and off the coast of Atlantic Africa (Petersen, 2005; Petersen et al., 2007; Weir et al., 2007) suggesting that, like their North Pacific, South Pacific, and Northwest Atlantic counterparts, loggerheads of the South Atlantic may undertake transoceanic developmental migrations (Bowen et al., 1995; Bolten et al., 1998; Peckham et al., 2007; Boyle et al., 2009). Marcovaldi et al. (2010) equipped 10 loggerheads nesting in Brazil with satellite transmitters to study their internesting and postnesting movements. At the conclusion of their nesting season, all 10 turtles migrated to the northern coast of Brazil to individual foraging areas on the continental shelf. Females were also tracked during a second postnesting migration back to their foraging areas, showing a strong fidelity to foraging grounds.

Within the Northwest Atlantic, the majority of nesting activity occurs from April through September, with a peak in June and July (Williams-Walls et al., 1983; Dodd, 1988; Weishampel et al., 2006). Nesting occurs within the Northwest Atlantic along the coasts of North America, Central America, northern South America, the Antilles, and The Bahamas, but is concentrated in the southeastern United States and on the Yucatan Peninsula in Mexico (Sternberg, 1981; Ehrhart, 1989; Ehrhart et al., 2003; NMFS and USFWS, 2008). Five recovery units (management subunits of a listed species that are geographically or otherwise identifiable and essential to the recovery of the species) have been identified based on genetic differences and a combination of geographic distribution of nesting densities and geographic separation (NMFS and USFWS, 2008). These recovery units are: Northern Recovery Unit (Florida/Georgia border through southern Virginia), Peninsular Florida Recovery Unit (Florida/Georgia border through Pinellas County, Florida), Dry Tortugas Recovery Unit (islands located west of Key West, Florida), Northern Gulf of Mexico Recovery Unit (Franklin County, Florida, through Texas), and Greater Caribbean Recovery Unit (Mexico through French Guiana, The Bahamas, Lesser Antilles, and Greater Antilles) (NMFS and USFWS, 2008).

Loggerheads in the Northwest Atlantic have a complex population genetic structure. Based on mtDNA evidence, oceanic juveniles show no structure, neritic juveniles show moderate structure, and nesting colonies show strong structure (Bowen et al., 2005). In contrast, a study using microsatellite (nuclear DNA) markers showed no significant population structure among nesting populations (Bowen et al., 2005), indicating that while females exhibit strong philopatry, males may provide an avenue of gene flow between nesting colonies in this region. Nevertheless, Bowen et al. (2005) argued that male-mediated gene flow within the Northwest Atlantic does not detract from the classification of breeding areas as independent populations (e.g., management/recovery units) because the production of progeny depends on female nesting success. All Northwest Atlantic recovery units are reproductively isolated from populations within the Northeast Atlantic, South Atlantic, and Mediterranean Sea.

As oceanic juveniles, loggerheads from the Northwest Atlantic use the North Atlantic Gyre and often are associated with Sargassum communities (Carr, 1987). They also are found in the Mediterranean Sea. In these areas, they overlap with animals originating from the Northeast Atlantic and the Mediterranean Sea (Laurent et al., 1993, 1998; Bolten et al., 1998; Bowen et al., 2005; LaCasella et al., 2005; Carreras et al., 2006; Monzón-Argüello et al., 2006; Revelles et al., 2007). In the western Mediterranean, they tend to be associated with the waters off the northern African coast and the northeastern Balearic Archipelago, areas generally not inhabited by turtles of Mediterranean origin (Carreras et al., 2006; Revelles et al., 2007; Eckert et al., 2008). As larger neritic juveniles, they show more structure and tend to inhabit areas closer to their natal origins (Bowen et al., 2004), but some do move to and from oceanic foraging grounds throughout this life stage (McClellan and Read, 2007; Mansfield et al., 2009; McClellan et al., 2010), and some continue to use the Mediterranean Sea (Casale et al., 2008a; Eckert et al., 2008).

Adult populations are highly structured with no overlap in distribution among adult loggerheads from the Northwest Atlantic, Northeast Atlantic, South Atlantic, and Mediterranean. Carapace epibionts suggest the adult females of different subpopulations use different foraging habitats (Caine, 1986). In the Northwest Atlantic, based on satellite telemetry studies and flipper tag returns, non-nesting adult females from the Northern Recovery Unit reside primarily off the east coast of the United States; movement into the Bahamas or the Gulf of Mexico is rare (Bell and Richardson, 1978; Williams and Frick, 2001; Mansfield, 2006; Turtle Expert Working Group (TEWG), 2009). Adult females of the Peninsular Florida Recovery Unit are distributed throughout eastern Florida, The Bahamas, Greater Antilles, the Yucatan Peninsula of Mexico, and the Gulf of Mexico, as well as along the Atlantic seaboard of the United States (Meylan, 1982; Meylan et al., 1983; Foley et al., 2008; TEWG, 2009). Adult females from the Northern Gulf of Mexico Recovery Unit remained in the Gulf of Mexico, including off the Yucatan

Peninsula of Mexico, based on satellite telemetry and flipper tag returns (Foley et al., 2008; TEWG, 2009; M. Lamont, Florida Cooperative Fish and Wildlife Research Unit, personal communication, 2009; M. Nicholas, National Park Service, personal communication, 2009).

Nesting in the Northeast Atlantic is concentrated in the Cape Verde Archipelago, with some nesting occurring on most of the islands, and the highest concentration on the beaches of Boa Vista Island (López-Jurado et al., 2000; Varo Cruz et al., 2007; Loureiro, 2008; Monzón-Argüello et al., 2010). On mainland Africa, there is minor nesting on the coasts of Mauritania to Senegal (Brongersma, 1982; Arvy et al., 2000; Fretey, 2001). Earlier reports of loggerhead nesting in Morocco (Pasteur and Bons, 1960) have not been confirmed in recent years (Tiwari et al., 2001). Nesting has not been reported from Macaronesia (Azores, Madeira Archipelago, The Selvagens Islands, and the Canary Islands), other than in the Cape Verde Archipelago (Brongersma, 1982). In Cape Verde, nesting begins in mid-June and extends into October (Cejudo et al., 2000), which is somewhat later than when nesting occurs in the Northwest Atlantic.

Based on an analysis of mtDNA of nesting females from Boa Vista Island, the Cape Verde nesting assemblage is genetically distinct from other studied rookeries (Monzón-Argüello et al., 2009, 2010). The results also indicate that despite the close proximity of the Mediterranean, the Boa Vista rookery is most closely related to the rookeries of the Northwest Atlantic.

The distribution of juvenile loggerheads from the Northeast Atlantic is largely unknown but they have been found on the oceanic foraging grounds of the North Atlantic (A. Bolten, University of Florida, personal communication, 2008, based on Bolten et al., 1998 and LaCasella et al., 2005; Monzón-Argüello et al., 2009; M. Tiwari, NMFS, and A. Bolten, University of Florida, unpublished data) and in the western and central Mediterranean (A. Bolten, University of Florida, personal communication, 2008, based on Carreras et al., 2006), along with small juvenile loggerheads from the Northwest Atlantic. The size of nesting females in the Northeast Atlantic is comparable to those in the Mediterranean (average 72–80 cm straight carapace length (SCL); Margaritoulis et al., 2003) and smaller than those in the Northwest Atlantic or the South Atlantic; 91 percent of the nesting turtles are less than 86.5 cm curved carapace length (CCL) (Hawkes et al., 2006) and nesting females average 77.1 cm SCL (Cejudo et al., 2000). Satellite-tagged, post-nesting females from Cape Verde foraged in coastal waters along northwest Africa or foraged oceanically, mostly between Cape Verde and the African shelf from Mauritania to Guinea Bissau (Hawkes et al., 2006).

In the Mediterranean, nesting occurs throughout the central and eastern basins on the shores of Italy, Greece, Cyprus, Turkey, Syria, Lebanon, Israel, the Sinai, Egypt, Libya, and Tunisia (Sternberg, 1981; Margaritoulis et al., 2003; SWOT, 2007; Casale and Margaritoulis, 2010). Sporadic nesting also has been reported in the western Mediterranean on Corsica (Delaugerre and Cesarini, 2004), southwestern Italy (Bentivegna et al., 2005), and on the Spanish Mediterranean coast (Tomás et al., 2003, 2008). Nesting in the Mediterranean is concentrated between June and early August (Margaritoulis et al., 2003; Casale and Margaritoulis, 2010).

Within the Mediterranean, a recent study of mtDNA and nuclear DNA in nesting assemblages from Greece to Israel indicated genetic structuring, philopatry by both females and males, and limited gene flow between assemblages (Carreras et al., 2007). Genetic differentiation based on mtDNA indicated that there are at least four independent nesting assemblages within the Mediterranean and usually they are characterized by a single haplotype: (1) mainland Greece and the adjoining Ionian Islands, (2) eastern Turkey, (3) Israel, and (4) Cyprus. There is no evidence of adult female exchange among these four assemblages (Carreras et al., 2006). In studies of the foraging grounds in the western and central Mediterranean, seven of the 17 distinct haplotypes detected had not yet been described, indicating that nesting beach data to describe the natal origins of juveniles exploiting the western Mediterranean Sea are incomplete (Carreras et al., 2006; Casale et al., 2008a). Gene flow among the Mediterranean rookeries estimated from nuclear DNA was significantly higher than that calculated from mtDNA, consistent with the scenario of female philopatry maintaining isolation between rookeries, offset by male-mediated gene flow. Nevertheless, the nuclear data show there was a higher degree of substructuring among Mediterranean rookeries compared to those in the Northwest Atlantic (Bowen et al., 2005; Carreras et al., 2007).

Small oceanic juveniles from the Mediterranean Sea use the eastern basin (defined as inclusive of the central Mediterranean, Ionian, Adriatic, and Aegean Seas) and the western basin (defined as inclusive of the Tyrrhenian Sea) along the European coast (Laurent et al., 1998; Margaritoulis et al., 2003; Carreras et al., 2006; Revelles et al., 2007). Carreras et al. (2006) believe this genetic structuring is explained by the pattern of sea surface currents and water masses, with a limited exchange of juvenile loggerheads between water masses. Larger juveniles also use the eastern Atlantic and the eastern Mediterranean, especially the Tunisia-Libya shelf and the Adriatic Sea (Laurent et al., 1993; Margaritoulis et al., 2003; Monzón-Argüello et al., 2006; Revelles et al., 2007; Eckert et al., 2008). Adults appear to forage closer to the nesting beaches in the eastern basin; most tag recoveries from females nesting in Greece have occurred in the Adriatic Sea and off Tunisia (Margaritoulis et al., 2003; Lazar et al., 2004).

Loggerheads nesting in the Mediterranean were significantly smaller than loggerheads nesting in the Northwest Atlantic and the South Atlantic. Within the Mediterranean, carapace lengths ranged from 58 to 95 cm SCL (Margaritoulis et al., 2003). Greece's loggerheads averaged 77–80 cm SCL (Tiwari and Bjorndal, 2000; Margaritoulis et al., 2003), whereas Turkey's loggerheads averaged 72–73 cm SCL (Margaritoulis et al., 2003). The Greece turtles also produced larger clutches (relative to body size) than those produced by Florida or Brazil nesters (Tiwari and Bjorndal, 2000).

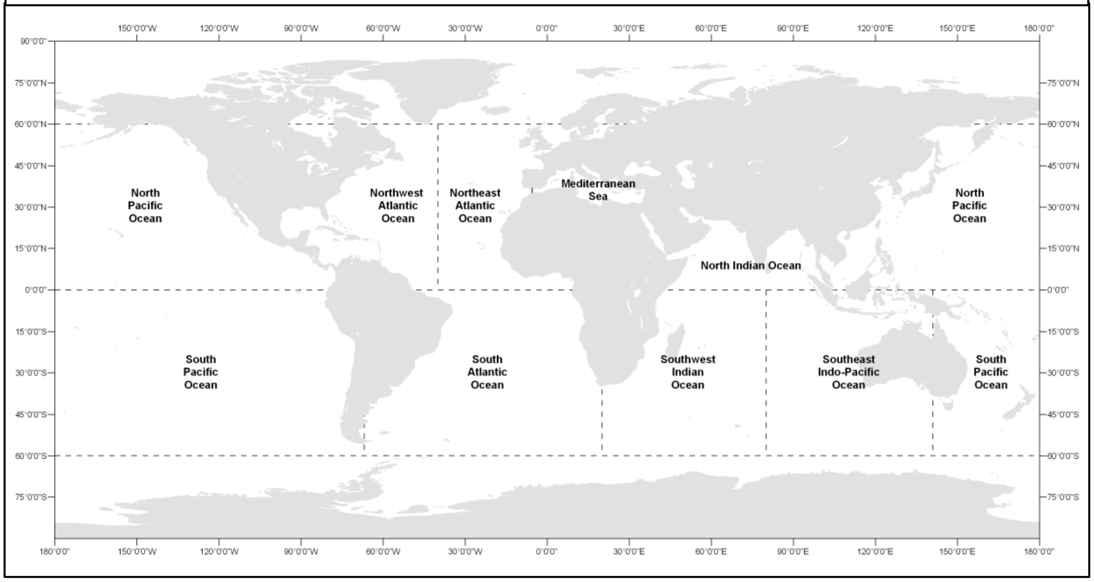
Given the information presented above, the BRT concluded, and we concur, that four discrete population segments exist in the Atlantic Ocean/Mediterranean: (1) Northwest Atlantic Ocean, (2) Northeast Atlantic Ocean, (3) South Atlantic Ocean, and (4) Mediterranean Sea. These four population segments are markedly separated from each other and from population segments within the Pacific Ocean and Indian Ocean basins as a consequence of physical, ecological, behavioral, and oceanographic factors. Information supporting this conclusion includes genetic analysis, flipper tag recoveries, and satellite telemetry. Genetic studies have shown that adult populations are highly structured with no overlap in distribution among adult loggerheads in these four population segments (Bowen et al., 1994; Encalada et al., 1998; Pearce, 2001; Carerras et al., 2007; Monzón-Argüello et al., 2009, 2010). Although loggerheads from the Northwest Atlantic, Northeast Atlantic, and Mediterranean Sea population segments may comingle on oceanic foraging grounds as juveniles, adults are apparently isolated from each other; they also differ demographically. Data from satellite telemetry studies and flipper tag returns have shown that nesting females from the Northwest Atlantic return to the same nesting areas; they reveal no evidence of movement of adults south of the equator or east of 40º W. longitude. Similarly, there is no evidence of movement of Northeast Atlantic adults south of the equator, west of 40º W. long., or east of the Strait of Gibraltar, a narrow strait that connects the Atlantic Ocean to the Mediterranean Sea. Also, there is no evidence of movement of adult Mediterranean Sea loggerheads west of the Strait of Gibraltar. With regard to South Atlantic loggerheads, there have been no observations of tagged loggerheads moving across the equator in the Atlantic, except a single case of a captive-reared animal that was released as a juvenile from Espírito Santo and was recaptured 3 years later in the Azores (Bolten et al., 1990). The separation of the Atlantic Ocean/Mediterranean Sea population segments from population segments within the Indian Ocean and Pacific Ocean basins is believed to be the result of land barriers and oceanographic barriers. Based on mtDNA analysis, Bowen et al. (1994) found a separation of loggerheads in the Atlantic-Mediterranean basins from those in the Indo-Pacific basins since the Pleistocene period. Geography and climate appear to have shaped the evolution of these two matriarchal lineages with the onset of glacial cycles, the appearance of the Panama Isthmus creating a land barrier between the Atlantic and eastern Pacific, and upwelling of cold water off southern Africa creating an oceanographic barrier between the Atlantic and Indian Oceans (Bowen, 2003).

Significance Determination

As stated in the preceding section, the BRT identified nine discrete population segments. As described below by ocean basin, the BRT found that each of the nine discrete population segments is biologically and ecologically significant. They each represent a large portion of the species' range, sometimes encompassing an entire hemispheric ocean basin. The range of each discrete population segment occurs within a unique ecosystem that has significantly influenced each population in physiology, morphology, and genetics. The loss of any individual discrete population segment would result in a significant gap in the loggerhead's range. Each discrete population segment is genetically distinct, often identified by unique mtDNA haplotypes, and the BRT suggested that this geographic partitioning of genetic variation could also indicate adaptive differences; the loss of any one discrete population segment would represent a significant loss of genetic diversity. Therefore, the BRT concluded, and we concur, that these nine population segments are both discrete from other conspecific population segments and significant to the species to which they belong, Caretta caretta.

The geographic delineations given below for each discrete population segment were determined primarily based on nesting beach locations, genetic evidence, oceanographic features, thermal tolerance, fishery bycatch data, and information on loggerhead distribution and migrations from satellite telemetry and flipper tagging studies (see Map of Loggerhead Sea Turtle DPS Boundaries). With rare exception, adults from discrete population segments remain within the delineated boundaries. In some cases, juvenile turtles from two or more discrete population segments may mix on foraging areas and, therefore, their distribution and migrations may extend beyond the geographic boundaries delineated below for each discrete population segment (e.g., juvenile turtles from the Northwest Atlantic Ocean, Northeast Atlantic Ocean, and Mediterranean Sea discrete population segments share foraging habitat in the western Mediterranean Sea).

Map of Loggerhead Sea Turtle DPS Boundaries



Pacific Ocean

The BRT considered 60º N. lat. and the equator as the north and south boundaries, respectively, of the North Pacific Ocean population segment based on oceanographic features, loggerhead sightings, thermal tolerance, fishery bycatch data, and information on loggerhead distribution from satellite telemetry and flipper tagging studies. The BRT determined that the North Pacific Ocean discrete population segment is biologically and ecologically significant because the loss of this population segment would result in a significant gap in the range of the taxon, and the population segment differs markedly from other population segments of the species in its genetic characteristics. The North Pacific Ocean population segment encompasses an entire hemispheric ocean basin and its loss would result in a significant gap in the range of the taxon. There is no evidence or reason to believe that female loggerheads from South Pacific nesting beaches would repopulate the North Pacific nesting beaches should those nesting assemblages be lost (Bowen et al., 1994; Bowen, 2003). Tagging studies show that the vast majority of nesting females return to the same nesting area. As summarized by Hatase et al. (2002a), of 2,219 tagged nesting females from Japan, only five females were subsequently documented nesting away (between 74 and 630 km) from where they were originally encountered. In addition, flipper tag and satellite telemetry research, as described in detail in the Discreteness Determination section above, has shown no evidence of north-south movement of loggerheads across the equator. This discrete population segment is genetically unique (see Discreteness Determination section above) and the BRT indicated that these unique haplotypes could represent adaptive differences; thus, the loss of this discrete population segment would represent a significant loss of genetic diversity. Based on this information, the BRT concluded, and we concur, that the North Pacific Ocean population segment is significant to the taxon to which it belongs, and, therefore, that it satisfies the significance element of the DPS policy.

The BRT considered the equator and 60º S. lat. as the north and south boundaries, respectively, and 67º W. long. and 141º E. long. as the east and west boundaries, respectively, of the South Pacific Ocean population segment based on oceanographic features, loggerhead sightings, thermal tolerance, fishery bycatch data, and information on loggerhead distribution from satellite telemetry and flipper tagging studies. The BRT determined that the South Pacific Ocean discrete population segment is biologically and ecologically significant because the loss of this population segment would result in a significant gap in the range of the taxon, and the population segment differs markedly from other population segments of the species in its genetic characteristics. The South Pacific Ocean population segment encompasses an entire hemispheric ocean basin, and its loss would result in a significant gap in the range of the taxon. The South Pacific Ocean population is the only population of loggerheads found south of the equator in the Pacific Ocean and there is no evidence or reason to believe that female loggerheads from North Pacific nesting beaches would repopulate the South Pacific nesting beaches should those nesting assemblages be lost (Bowen et al., 1994; Bowen, 2003). In addition, flipper tag and satellite telemetry research, as described in detail in the Discreteness Determination section above, has shown no evidence of north-south movement of loggerheads across the equator. The BRT also stated that it does not expect that recolonization from Indian Ocean loggerheads would occur in eastern Australia within ecological time frames. Despite evidence of foraging in the Gulf of Carpentaria by adult loggerheads from the nesting populations in eastern Australia (South Pacific Ocean population segment) and western Australia (Southeast Indo-Pacific Ocean population segment), the nesting females from these two regions are considered to be genetically distinct from one another (Limpus, 2009). In addition to a substantial disparity in mtDNA haplotype frequencies between these two populations, FitzSimmons (University of Canberra, unpublished data) found significant differences in nuclear DNA microsatellite loci between females nesting in these two regions, indicating separation between the South Pacific Ocean and the Southeast Indo-Pacific Ocean population segments. Long-term studies show a high degree of site fidelity by adult females in the South Pacific, with most females returning to the same beach within a nesting season and in successive nesting seasons (Limpus, 1985, 2009; Limpus et al., 1994). This has been documented as characteristic of loggerheads from various rookeries throughout the world (Schroeder et al., 2003). This discrete population segment is genetically unique and the BRT indicated that these unique haplotypes could represent adaptive differences. Thus, the loss of this discrete population segment would represent a significant loss of genetic diversity. Based on this information, the BRT concluded, and we concur, that the South Pacific Ocean population segment is significant to the taxon to which it belongs, and, therefore, that it satisfies the significance element of the DPS policy.

Indian Ocean

The BRT considered 30º N. lat. and the equator as the north and south boundaries, respectively, of the North Indian Ocean population segment based on oceanographic features, loggerhead sightings, thermal tolerance, fishery bycatch data, and information on loggerhead distribution from satellite telemetry and flipper tagging studies. The BRT determined that the North Indian Ocean discrete population segment is biologically and ecologically significant because the loss of this population segment would result in a significant gap in the range of the taxon, and the population segment differs markedly from other population segments of the species in its genetic characteristics. The North Indian Ocean population segment encompasses an entire hemispheric ocean basin, and its loss would result in a significant gap in the range of the taxon. Genetic information currently available for Indian Ocean populations indicates that the Oman rookery in the North Indian Ocean and the South African rookery in the Southwest Indian Ocean are genetically distinct (Bowen et al., 1994), and, based on preliminary results, once sequencing studies are completed for these rookeries, it is likely that they will also be determined to be genetically distinct from the Western Australia rookeries in the Southeast Indo-Pacific Ocean (P. Dutton, NMFS, unpublished data; N. FitzSimmons, University of Canberra, unpublished data; J. Reece, University of California at Santa Cruz, unpublished data). In addition, oceanographic phenomena associated with Indian Ocean equatorial waters exist between the North Indian Ocean population segment and the two population segments in the South Indian Ocean, which likely prevent migration of individuals across the equator on a time scale relative to management and conservation efforts (Conant et al., 2009). Therefore, there is no evidence or reason to believe that female loggerheads from the Southwest Indian Ocean or Southeast Indo-Pacific Ocean would repopulate the North Indian Ocean nesting beaches should those populations be lost (Bowen et al., 1994; Bowen, 2003). Based on this information, the BRT concluded, and we concur, that the North Indian Ocean population segment is significant to the taxon to which it belongs, and, therefore, that it satisfies the significance element of the DPS policy.

The BRT considered the equator and 60º S. lat. as the north and south boundaries, respectively, and 20º E. long. at Cape Agulhas on the southern tip of Africa and 80º E. long. as the east and west boundaries, respectively, of the Southwest Indian Ocean population segment based on oceanographic features, thermal tolerance, fishery bycatch data, and information on loggerhead distribution from satellite telemetry and flipper tagging studies. The BRT determined that the Southwest Indian Ocean discrete population segment is biologically and ecologically significant because the loss of this population segment would result in a significant gap in the range of the taxon, and the population segment differs markedly from other population segments of the species in its genetic characteristics. The Southwest Indian Ocean population segment encompasses half of a hemispheric ocean basin, and its loss would result in a significant gap in the range of the taxon. Genetic information currently available for Indian Ocean populations indicates that the Oman rookery in the North Indian Ocean and the South African rookery in the Southwest Indian Ocean are genetically distinct (Bowen et al., 1994), and, based on preliminary results, once sequencing studies are completed for these rookeries, it is likely that they will also be determined to be genetically distinct from the Western Australia rookeries in the Southeast Indo-Pacific Ocean (P. Dutton, NMFS, unpublished data; N. FitzSimmons, University of Canberra, unpublished data; J. Reece, University of California at Santa Cruz, unpublished data). In addition, biogeographical barriers (i.e., oceanographic phenomena associated with Indian Ocean equatorial waters, and the large expanse between continents in the South Indian Ocean without suitable benthic foraging habitat) likely exist between the three Indian Ocean populations that would prevent migration of individuals between populations on a time scale relative to management and conservation efforts (Conant et al., 2009). Therefore, there is no evidence or reason to believe that female loggerheads from the North Indian Ocean or Southeast Indo-Pacific Ocean would repopulate the Southwest Indian Ocean nesting beaches should those populations be lost (Bowen et al., 1994; Bowen, 2003). There is also no evidence of movement of adult Southwest Indian Ocean loggerheads west of 20º E. long. at Cape Agulhas, the southernmost point on the African continent, or east of 80º E. long. within the Indian Ocean. Based on this information, the BRT concluded, and we concur, that the Southwest Indian Ocean population segment is significant to the taxon to which it belongs, and, therefore, that it satisfies the significance element of the DPS policy.

The BRT considered the equator and 60º S. lat. as the north and south boundaries, respectively, and 141º E. long. and 80º E. long. as the east and west boundaries, respectively, of the Southeast Indo-Pacific Ocean population segment based on oceanographic features, thermal tolerance, fishery bycatch data, and information on loggerhead distribution from satellite telemetry and flipper tagging studies. The BRT determined that the Southeast Indo-Pacific Ocean discrete population segment is biologically and ecologically significant because the loss of this population segment would result in a significant gap in the range of the taxon, and the population segment differs markedly from other population segments of the species in its genetic characteristics. The Southeast Indo-Pacific Ocean population segment encompasses half of a hemispheric ocean basin, and its loss would result in a significant gap in the range of the taxon. Genetic information currently available for Indian Ocean populations indicates that the Oman rookery in the North Indian Ocean and the South African rookery in the Southwest Indian Ocean are genetically distinct (Bowen et al., 1994), and, based on preliminary results, once sequencing studies are completed for these rookeries, it is likely that they will also be determined to be genetically distinct from the Western Australia rookeries in the Southeast Indo-Pacific Ocean (P. Dutton, NMFS, unpublished data; N. FitzSimmons, University of Canberra, unpublished data; J.

Reece, University of California at Santa Cruz, unpublished data). In addition, biogeographical barriers (i.e., oceanographic phenomena associated with Indian Ocean equatorial waters, and the large expanse between continents in the South Indian Ocean without suitable benthic foraging habitat) likely exist between the three Indian Ocean populations that would likely prevent migration of individuals between populations on a time scale relative to management and conservation efforts (Conant et al., 2009). Therefore, there is no evidence or reason to believe that female loggerheads from the North Indian Ocean or Southwest Indian Ocean would repopulate the Southeast Indo-Pacific Ocean nesting beaches should those populations be lost (Bowen et al., 1994; Bowen, 2003). There is also no evidence of movement of adult Southeast Indo-Pacific Ocean loggerheads west of 80º E. long. within the Indian Ocean. Despite evidence of foraging in the Gulf of Carpentaria by adult loggerheads from the nesting populations in eastern Australia (South Pacific Ocean population segment) and western Australia (Southeast Indo-Pacific Ocean population segment), the nesting females from these two regions are considered to be genetically distinct from one another (Limpus, 2009). In addition to a substantial disparity in mtDNA haplotype frequencies between these two regions, FitzSimmons (University of Canberra, unpublished data) found significant differences in nuclear DNA microsatellite loci from females nesting in these two regions, indicating separation between the South Pacific Ocean population segment and the Southeast Indo-Pacific Ocean population segment. Based on this information, the BRT concluded, and we concur, that the Southeast Indo-Pacific Ocean population segment is significant to the taxon to which it belongs, and, therefore, it satisfies the significance element of the DPS policy.

Atlantic Ocean and Mediterranean Sea

The BRT considered 60º N. lat. and the equator as the north and south boundaries, respectively, and 40º W. long. as the eastern boundary of the Northwest Atlantic Ocean population segment based on oceanographic features, loggerhead sightings, thermal tolerance, fishery bycatch data, and information on loggerhead distribution from satellite telemetry and flipper tagging studies. The BRT determined that the Northwest Atlantic Ocean discrete population segment is biologically and ecologically significant because the loss of this population segment would result in a significant gap in the range of the taxon, and the population segment differs markedly from other population segments of the species in its genetic characteristics. The Northwest Atlantic Ocean population segment encompasses half of a hemispheric ocean basin, and its loss would result in a significant gap in the range of the taxon. Genetic studies have shown that adult populations are highly structured with no overlap in distribution among adult loggerheads from the Northwest Atlantic, Northeast Atlantic, South Atlantic, and Mediterranean Sea (Bowen et al., 1994; Encalada et al., 1998; Pearce, 2001; Carerras et al., 2007; Monzón-Argüello et al., 2009, 2010). There is no evidence or reason to believe that female loggerheads from the Northeast Atlantic, Mediterranean Sea, or South Atlantic nesting beaches would repopulate the Northwest Atlantic nesting beaches should these populations be lost (Bowen et al., 1994; Bowen, 2003). Data from satellite telemetry studies and flipper tag returns, as described in detail in the Discreteness Determination section above, have shown that the vast majority of nesting females from the Northwest Atlantic return to the same nesting area; they reveal no evidence of movement of adults south of the equator or east of 40º W. longitude. This discrete population segment is genetically distinct (see Discreteness Determination section above) possibly indicating adaptive differences as suggested by the BRT;

thus, the loss of this discrete population segment would represent a significant loss of genetic diversity. Based on this information, the BRT concluded, and we concur, that the Northwest Atlantic Ocean population segment is significant to the taxon to which it belongs, and, therefore, that it satisfies the significance element of the DPS policy.

The BRT considered 60º N. lat. and the equator as the north and south boundaries, respectively, and 40º W. long. as the west boundary of the Northeast Atlantic Ocean population segment. The BRT considered the boundary between the Northeast Atlantic Ocean and Mediterranean Sea population segments as 5º 36' W. long. (Strait of Gibraltar). These boundaries are based on oceanographic features, loggerhead sightings, thermal tolerance, fishery bycatch data, and information on loggerhead distribution from satellite telemetry and flipper tagging studies. The BRT determined that the Northeast Atlantic Ocean discrete population segment is biologically and ecologically significant because the loss of this population segment would result in a significant gap in the range of the taxon, and the population segment differs markedly from other population segments of the species in its genetic characteristics. The Northeast Atlantic Ocean population segment encompasses half of a hemispheric ocean basin, and its loss would result in a significant gap in the range of the taxon. Genetic studies have shown that adult populations are highly structured with no overlap in distribution among adult loggerheads from the Northwest Atlantic, Northeast Atlantic, South Atlantic, and Mediterranean Sea (Bowen et al., 1994; Encalada et al., 1998; Pearce, 2001; Carerras et al., 2007; Monzón-Argüello et al., 2009, 2010). There is no evidence or reason to believe that female loggerheads from the Northwest Atlantic, Mediterranean Sea, or South Atlantic nesting beaches would repopulate the Northeast Atlantic nesting beaches should these populations be lost (Bowen et al., 1994; Bowen, 2003). There is also no evidence of movement of Northeast Atlantic adults west of 40º W. long. or, in the vicinity of the Strait of Gibraltar (the boundary between the Northeast Atlantic Ocean and Mediterranean Sea population segments), no evidence of movement east of 5º 36' W. longitude. This discrete population segment is genetically unique (see Discreteness Determination section above) and the BRT indicated that these unique haplotypes could represent adaptive differences; thus, the loss of this discrete population segment would represent a significant loss of genetic diversity. Based on this information, the BRT concluded, and we concur, that the Northeast Atlantic Ocean population segment is significant to the taxon to which it belongs, and, therefore, that it satisfies the significance element of the DPS policy.

The BRT considered the Mediterranean Sea west to 5º 36' W. long. (Strait of Gibraltar) as the boundary of the Mediterranean Sea population segment based on oceanographic features, loggerhead sightings, thermal tolerance, fishery bycatch data, and information on loggerhead distribution from satellite telemetry and flipper tagging studies. The BRT determined that the Mediterranean Sea discrete population segment is biologically and ecologically significant because the loss of this population segment would result in a significant gap in the range of the taxon, and the population segment differs markedly from other population segments of the species in its genetic characteristics. The Mediterranean Sea population segment encompasses the entire Mediterranean Sea basin, and its loss would result in a significant gap in the range of the taxon. Genetic studies have shown that adult populations are highly structured with no overlap in distribution among adult loggerheads from the Northwest Atlantic, Northeast Atlantic, South Atlantic, and Mediterranean Sea (Bowen et al., 1994; Encalada et al., 1998; Pearce, 2001; Carerras et al., 2007; Monzón-Argüello et al., 2009, 2010). There is no evidence or reason to believe that female loggerheads from the Northwest Atlantic, Northeast Atlantic, or South Atlantic nesting beaches would repopulate the Mediterranean Sea nesting beaches should these populations be lost (Bowen et al., 1994; Bowen, 2003). As previously described, adults from the Mediterranean Sea population segment appear to forage closer to the nesting beaches in the eastern basin, and most flipper tag recoveries from females nesting in Greece have occurred in the Adriatic Sea and off Tunisia (Margaritoulis et al., 2003; Lazar et al., 2004). There is no evidence of movement of adult Mediterranean Sea loggerheads west of the Strait of Gibraltar (5º 36' W. long.). This discrete population segment is genetically unique (see Discreteness Determination section above) and the BRT indicated that these unique haplotypes could represent adaptive differences; thus, the loss of this discrete population segment would represent a significant loss of genetic diversity. Based on this information, the BRT concluded, and we concur, that the Mediterranean Sea population segment is significant to the taxon to which it belongs, and, therefore, that it satisfies the significance element of the DPS policy.

The BRT considered the equator and 60º S. lat. as the north and south boundaries, respectively, and 20º E. long. at Cape Agulhas on the southern tip of Africa and 67º W. long. as the east and west boundaries, respectively, of the South Atlantic Ocean population segment based on oceanographic features, loggerhead sightings, thermal tolerance, fishery bycatch data, and information on loggerhead distribution from satellite telemetry and flipper tagging studies. The BRT determined that the South Atlantic Ocean discrete population segment is biologically and ecologically significant because the loss of this population segment would result in a significant gap in the range of the taxon, and the population segment differs markedly from other population segments of the species in its genetic characteristics. The South Atlantic Ocean population segment encompasses an entire hemispheric ocean basin, and its loss would result in a significant gap in the range of the taxon. Genetic studies have shown that adult populations are highly structured with no overlap in distribution among adult loggerheads from the Northwest Atlantic, Northeast Atlantic, South Atlantic, and Mediterranean Sea (Bowen et al., 1994; Encalada et al., 1998; Pearce, 2001; Carerras et al., 2007; Monzón-Argüello et al., 2009, 2010). There is no evidence or reason to believe that female loggerheads from the Northwest Atlantic, Northeast Atlantic, or Mediterranean Sea nesting beaches would repopulate the South Atlantic nesting beaches should these populations be lost (Bowen et al., 1994; Bowen, 2003). This discrete population segment is genetically unique (see Discreteness Determination section above) and the BRT indicated that these unique haplotypes could represent adaptive differences; thus, the loss of this discrete population segment would represent a significant loss of genetic diversity. Based on this information, the BRT concluded, and we concur, that the South Atlantic Ocean population segment is significant to the taxon to which it belongs, and, therefore, that it satisfies the significance element of the DPS policy.

In summary, based on the information provided in the Discreteness Determination and Significance Determination sections above, the BRT identified nine loggerhead DPSs distributed globally: (1) North Pacific Ocean DPS, (2) South Pacific Ocean DPS, (3) North Indian Ocean DPS, (4) Southeast Indo-Pacific Ocean DPS, (5) Southwest Indian Ocean DPS, (6) Northwest Atlantic Ocean DPS, (7) Northeast Atlantic Ocean DPS, (8) Mediterranean Sea DPS, and (9) South Atlantic Ocean DPS. We concur with the findings and application of the DPS policy described by the BRT and herein delineate the nine DPSs identified by the BRT as DPSs (i.e., they are discrete and significant).

Significant Portion of the Range

We have determined that the range of each DPS contributes meaningfully to the conservation of the DPS and that populations that may contribute more or less to the conservation of each DPS throughout a portion of its range cannot be identified due to the highly migratory nature of the listed entity.

The loggerhead sea turtle is highly migratory and crosses multiple domestic and international geopolitical boundaries. Depending on the life stage, they may occur in oceanic waters or along the continental shelf of landmasses, or transit back and forth between oceanic and neritic habitats. Protection and management of both the terrestrial and marine environments is essential to recovering the listed entity. Management measures implemented by any State, foreign nation, or political subdivision likely would only affect individual sea turtles during certain stages and seasons of the life cycle. Management measures implemented by any State, foreign nation, or political subdivision may also affect individuals from multiple DPSs because juvenile turtles from disparate DPSs can overlap on foraging grounds or migratory corridors (e.g., Northwest Atlantic, Northeast Atlantic, and Mediterranean Sea DPSs). The term “significant portion of its range” is not defined by the statute. For the purposes of this rule, a portion of the species’ (species or distinct population segment) range is “significant” if its contribution to the viability of the species is so important that without that portion the species would be in danger of extinction. The BRT was unable to identify any particular portion of the range of any of the DPSs that was more significant to the DPS than another portion of the same range because of the species’ migratory nature, the varying threats that affect different life stages, and the varying benefits accruing from conservation efforts throughout the geographic range of each DPS. The next section describes our evaluation of the status of each DPS throughout its range.

Status and Trends of the Nine Loggerhead DPSs

Complete population abundance estimates do not exist for the nine DPSs. Within the global range of the species, and within each DPS, the primary data available are collected on nesting beaches, either as counts of nests or counts of nesting females, or a combination of both (either direct or extrapolated). Information on abundance and trends away from the nesting beaches is limited or non-existent, primarily because these data are, relative to nesting beach studies, logistically difficult and expensive to obtain. Therefore, the primary information source for directly evaluating status and trends of the nine DPSs is nesting beach data.

North Pacific Ocean DPS

In the North Pacific, loggerhead nesting is essentially restricted to Japan where monitoring of loggerhead nesting began in the 1950s on some beaches, and expanded to include most known nesting beaches since approximately 1990. Kamezaki et al. (2003) reviewed census data collected from most of the Japanese nesting beaches. Although most surveys were initiated in the 1980s and 1990s, some data collection efforts were initiated in the 1950s. Along the Japanese coast, nine major nesting beaches (greater than 100 nests per season) and six "submajor" beaches (10–100 nests per season) were identified. Census data from 12 of these 15 beaches provide composite information on longer-term trends in the Japanese nesting assemblage. Using information collected on these beaches, Kamezaki et al. (2003) concluded a substantial decline (50–90 percent) in the size of the annual loggerhead nesting population in Japan since the 1950s. Snover (2008) combined nesting data from the Sea Turtle Association of

Japan and data from Kamezaki et al. (2002) to analyze an 18-year time series of nesting data from 1990–2007. Nesting declined from an initial peak of approximately 6,638 nests in 1990–1991, followed by a steep decline to a low of 2,064 nests in 1997. During the past decade, nesting increased gradually to 5,167 nests in 2005, declined and then rose again to a high of just under 11,000 nests in 2008. Estimated nest numbers for 2009 were on the order of 7,000–8,000 nests. While nesting numbers have gradually increased in recent years and the number for 2009 was similar to the start of the time series in 1990, historical evidence from Kamouda Beach (census data dates back to the 1950s) indicates that there has been a substantial decline over the last half of the 20th century (Kamezaki et al., 2003) and that current nesting represents a fraction of historical nesting levels.

South Pacific Ocean DPS

In the South Pacific, loggerhead nesting is almost entirely restricted to eastern Australia (primarily Queensland) and New Caledonia, and the population has been well studied. The size of the annual breeding population (females only) has been monitored at numerous rookeries in Australia since 1968 (Limpus and Limpus, 2003a), and these data constitute the primary measure of the current status of the DPS. The total nesting population for Queensland was approximately 3,500 females in the 1976–1977 nesting season (Limpus, 1985; Limpus and Reimer, 1994). Little more than two decades later, Limpus and Limpus (2003a) estimated this nesting population at less than 500 females in the 1999–2000 nesting season. There has been a marked decline in the number of females breeding annually since the mid-1970s, with an estimated 50 to 80 percent decline in the number of breeding females at various Australian rookeries up to 1990 (Limpus and Reimer, 1994) and a decline of approximately 86 percent from 1976–1999 (Limpus and

Limpus, 2003a). However, since 2000, this long-term decline in the number of nesting females has reversed with increasing numbers of nesting females observed from 2000–2009 (Limpus, in press). More recent data for Mon Repos have shown increased nesting; 2009 nesting numbers were similar to nesting numbers recorded in the 1990s (M. Hamann, James Cook University, personal communication, 2010). However, comparable nesting surveys have not been conducted in New Caledonia. Information from a pilot study conducted in 2005 combined with oral history information collected suggest that there has been a decline in loggerhead nesting over recent decades (Limpus et al., 2006). Based on data from the pilot study, only 60 to 70 loggerheads nested on the four surveyed New Caledonia beaches during the 2004–2005 nesting season (Limpus et al., 2006).

Studies of eastern Australia loggerheads at their foraging areas provide some information on the status of non-breeding loggerheads of the South Pacific Ocean DPS. Chaloupka and Limpus (2001) determined that the resident loggerhead population on coral reefs of the southern Great Barrier Reef declined at 3 percent per year from 1985 to the late 1990s. The observed decline occurred in spite of constant high annual survivorship measured at this foraging habitat and was hypothesized to result from recruitment failure from fox predation of eggs at mainland rookeries during the 1960s and pelagic juvenile mortality from incidental capture in longline fisheries since the 1970s (Chaloupka and Limpus, 2001). Concurrently, a decline in new recruits was measured in these foraging areas (Limpus and Limpus, 2003a).

North Indian Ocean DPS

The North Indian Ocean hosts the largest nesting assemblage of loggerheads in the eastern hemisphere; the vast majority of these loggerheads nest in Oman (Baldwin et al., 2003).

Nesting occurs in greatest density on Masirah Island; the number of emergences ranges from 27–102 per km nightly (Ross, 1998). Nesting densities have complicated the implementation of standardized nesting beach surveys, and more precise nesting data have only been collected since 2008. Extrapolations resulting from partial surveys and tagging in 1977–1978 provided broad estimates of 19,000 to 60,000 females nesting annually at Masirah Island in 1977 and 28,000 to 35,000 in 1978. A more recent partial survey in 1991 provided an estimate of 23,000 nesting females at Masirah Island (Ross, 1979, 1998; Ross and Barwani, 1982; Baldwin, 1992). A reinterpretation of the 1977–1978 estimates, assuming 50 percent nesting success (as compared to 100 percent in the original estimates), resulted in an estimate of 20,000 to 40,000 females nesting annually (Baldwin et al., 2003). Reliable trends in nesting cannot be determined due to the lack of standardized surveys at Masirah Island prior to 2008. From 2008 through 2010, approximately 50,000, 67,600, and 62,400 nests, respectively, were estimated annually based on standardized daily surveys of the highest density nesting beaches and weekly surveys on all remaining island nesting beaches. Using an estimated clutch frequency of five nests per nesting female this would convert to 10,000, 13,520, and 12,480 nesting females annually (Conant et al., 2009). Even using the low end of the 1977–1978 estimates of 20,000 nesting females at Masirah, this suggests a significant decline in the size of the nesting population and is consistent with observations by long-term resident rangers that the population has declined substantially in the last three decades (E. Possardt, USFWS, personal communication, 2008).

In addition to the nesting beaches on Masirah Island, over 3,000 nests per year have been recorded in Oman on the Al-Halaniyat Islands and, along the Oman mainland of the Arabian Sea, approximately 2,000 nests are deposited annually (Salm, 1991; Salm et al., 1993). In

Yemen, on Socotra Island, 50–100 loggerheads were estimated to have nested in 1999 (Pilcher and Saad, 2000). A time series of nesting data based on standardized surveys is not available to determine trends for these nesting sites.

Loggerhead nesting is rare elsewhere in the northern Indian Ocean and in some cases is complicated by inaccurate species identification (Shanker, 2004; Tripathy, 2005). A small number of nesting females use the beaches of Sri Lanka every year; however, there are no records to suggest that Sri Lanka has ever been a major nesting area for loggerheads (Kapurusinghe, 2006). Loggerheads have been reported nesting in low numbers in Myanmar; however, these data may not be reliable because of misidentification of species (Thorbjarnarson et al., 2000).

Southeast Indo-Pacific Ocean DPS

In the eastern Indian Ocean, loggerhead nesting is restricted to Western Australia (Dodd, 1988), and this nesting population is the largest in Australia (Wirsing et al., unpublished data, cited in Natural Heritage Trust, 2005; Limpus, 2009).

Dirk Hartog Island hosts about 70–75 percent of nesting individuals in the eastern Indian Ocean (Baldwin et al., 2003). Surveys were conducted on the island for the duration of six nesting seasons between 1993/1994 and 1999/2000 (Baldwin et al., 2003) and continued until 2009 during which time 800–1,500 loggerheads were estimated to nest annually on Dirk Hartog Island beaches (Baldwin et al., 2003).

Fewer loggerheads (approximately 150–350 per season) are reported nesting on the Muiron Islands; however, more nesting loggerheads are reported here than on North West Cape (approximately 50–150 per season) (Baldwin et al., 2003). Although data are insufficient to determine trends, historical information suggests the nesting population in the Muiron Islands and North West Cape region was likely reduced from historical numbers, before recent beach monitoring programs began, as a result of bycatch in commercial fisheries (Nishemura and Nakahigashi, 1990; Poiner et al., 1990; Poiner and Harris, 1996).

Southwest Indian Ocean DPS

In the Southwest Indian Ocean, the highest concentration of nesting occurs on the coast of Tongaland, South Africa, where surveys and management practices were instituted in 1963 (Baldwin et al., 2003). A trend analysis of index nesting beach data from this region from 1965 to 2008 indicates an increasing nesting population between the first decade of surveys, which documented 500–800 nests annually, and the last 8 years, which documented 1,100–1,500 nests annually (Nel, 2008). These data represent approximately 50 percent of all nesting within South Africa and are believed to be representative of trends in the region. Loggerhead nesting occurs elsewhere in South Africa, but sampling is not consistent and no trend data are available. The total number of females nesting annually in South Africa is estimated between 500–2,000 turtles (Baldwin et al., 2003). In Mozambique, surveys have been instituted much more recently; likely less than 200 females nest annually and no trend data are available (Baldwin et al., 2003; Louro et al., 2006; Videira et al., 2008, 2010; Pereira et al., 2009). Similarly, in Madagascar, loggerheads have been documented nesting in low numbers, but no trend data are available (Rakotonirina, 2001).

Northwest Atlantic Ocean DPS

Nesting occurs within the Northwest Atlantic along the coasts of North America, Central America, northern South America, the Antilles, and The Bahamas, but is concentrated in the southeastern U.S. and on the Yucatan Peninsula in Mexico (Sternberg, 1981; Ehrhart, 1989; Ehrhart et al., 2003; NMFS and USFWS, 2008). Collectively, the Northwest Atlantic Ocean hosts the most significant nesting assemblage of loggerheads in the western hemisphere and is one of the two largest loggerhead nesting assemblages in the world. NMFS and USFWS (2008), Witherington et al. (2009), and TEWG (2009) provide comprehensive analyses of the status of the nesting assemblages within the Northwest Atlantic Ocean DPS using standardized data collected over survey periods ranging from 10 to 23 years. The results of these analyses, using different analytical approaches, were consistent in their findings – there had been a significant, overall nesting decline within this DPS. However, with the addition of nesting data from 2008 through 2010, which was not available at the time those analyses were conducted, the final result for the trend line changes. Nesting in 2008 showed a substantial increase compared to the low of 2007, and nesting in 2010 reached the highest level seen since 2000 (Florida Fish and Wildlife Conservation Commission Core Index Nesting Beach Database). The most current nesting trend for the Northwest Atlantic Ocean DPS, from 1989–2010, is very slightly negative, but the rate of decline is not statistically different from zero. Additionally, the range from the statistical analysis of the nesting trend includes both negative and positive growth (NMFS, unpublished data).

NMFS and USFWS (2008) identified five recovery units (nesting subpopulations) in the Northwest Atlantic Ocean: the Northern (Florida/Georgia border to southern Virginia); Peninsular Florida (Florida/Georgia border south through Pinellas County, excluding the islands west of Key West, Florida); Dry Tortugas (islands west of Key West, Florida); Northern Gulf of Mexico (Franklin County, Florida, west through Texas); and Greater Caribbean (Mexico through

French Guiana, The Bahamas, Lesser and Greater Antilles). At that time, declining trends in the annual number of nests were documented for all recovery units for which there were an adequate time series of nesting data.

The Peninsular Florida Recovery Unit represents approximately 87 percent of all nesting effort in the Northwest Atlantic Ocean DPS (Ehrhart et al., 2003). A significant declining trend had been documented for the Peninsular Florida Recovery Unit, where nesting declined 26 percent over the 20-year period from 1989–2008, and declined 41 percent over the period 1998–2008 (NMFS and USFWS, 2008; Witherington et al., 2009). As explained previously, with the addition of nesting data through 2010, the nesting trend for the Peninsular Florida Recovery Unit, and the Northwest Atlantic Ocean DPS, does not show a nesting decline statistically different from zero. The Northern Recovery Unit is the second largest recovery unit within the DPS and was declining significantly at 1.3 percent annually from 1983 to 2007 (NMFS and USFWS, 2008). Currently, nesting for that recovery unit is showing possible signs of stabilizing. In 2008, nesting in Georgia reached what was a new record at that time (1,646 nests), with a downturn in 2009, followed by yet another record in 2010 (1,760 nests). South Carolina had the two highest years of nesting in the 2000s in 2009 (2,183 nests) and 2010 (3,141 nests). The previous high for that 11-year span was 1,433 nests in 2003. North Carolina had 847 nests in 2010, which is above the average of 715. The Georgia, South Carolina, and North Carolina nesting data come from the seaturtle.org Sea Turtle Nest Monitoring System which is populated with data input by the State agencies. The Greater Caribbean Recovery Unit is the third largest recovery unit within the Northwest Atlantic Ocean DPS, with the majority of nesting at Quintana Roo, Mexico. TEWG (2009) reported a greater than 5 percent annual decline in loggerhead nesting from 1995–2006 at Quintana Roo. When nest counts up through 2010 are analyzed, however, the nesting trends from 1989 through 2010 are not significantly different from zero for all of the recovery units within the Northwest Atlantic Ocean DPS for which there are enough data to analyze (NMFS, unpublished data).

In an effort to evaluate loggerhead population status and trends beyond the nesting beach, NMFS and USFWS (2008) and TEWG (2009) reviewed data from in-water studies within the range of the Northwest Atlantic Ocean DPS. NMFS and USFWS (2008), in the Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle, summarized population trend data reported from nine in-water study sites where loggerheads were regularly captured and where efforts were made to provide local indices of abundance. These sites were located from Long Island Sound, New York, to Florida Bay, Florida. The study periods for these nine sites varied. The earliest began in 1987, and the most recent were initiated in 2000. Results reported from four of the studies indicated no discernible trend, two studies reported declining trends, and two studies reported increasing trends. Trends at one study site, Mosquito Lagoon, Florida, indicated either a declining trend (all data, 1977–2005) or no trend (more recent data, 1995–2005), depending on whether all sample years were used or only the more recent, and likely more comparable sample years, were used. TEWG (2009) used raw data from six of the aforementioned nine in-water study sites to conduct trend analyses. Results from three of the four sites located in the southeastern United States showed an increasing trend in the abundance of loggerheads, one showed no discernible trend, and the two sites located in the northeastern United States showed a decreasing trend in abundance of loggerheads.

Crouse et al. (1987) and Crowder et al. (1994) presented models, using data available from what is now the Northwest Atlantic Ocean DPS, suggesting that adults (males and females) are approximately 0.3 percent of the total population. These models assume that the population is density independent and growing exponentially; however, in the case of sea turtles, it is unlikely that either of these assumptions is met. The most recent point estimate of the number of adult females in the Northwest Atlantic Ocean DPS is 30,000 (Southeast Fisheries Science Center, 2009); assuming a 1:1 adult sex ratio results in 60,000 adults. If those individuals represent 0.3 percent of the total population size, then the total population size would be on the order of 20 million individuals. The vast majority of these individuals would be in the youngest life stages, where natural mortality is very high. This is the life history strategy of sea turtles; many individuals must be produced to contribute to the breeding population and to keep the population from declining. The most important point to understand regarding these models and subsequent calculations is that their main assumptions—the population has a stable age distribution, anthropogenic mortality is constant, sex ratios are equal, and the environment is constant—are likely not met.

A recent aerial survey from Cape Canaveral, Florida, to the mouth of the Gulf of St. Lawrence provided insight into loggerhead abundance in continental shelf waters of the U.S. Atlantic coast. In a preliminary report (Northeast Fisheries Science Center, 2011), the most conservative estimate, in which only sightings that were positively identified as loggerhead sea turtles were used, was that about 588,000 juvenile and adult loggerheads were present in the survey area (approximate inter-quartile range of 382,000–817,000 individuals). When a portion of the unidentified turtles were assigned as loggerheads, the estimate increased to 801,000 individuals (inter-quartile range of 521,000–1,111,000). The survey effort did not encompass waters south of Cape Canaveral on the Atlantic Coast or in the Gulf of Mexico (Northeast Fisheries Science Center, 2011).

Northeast Atlantic Ocean DPS

In the northeastern Atlantic, the Cape Verde Islands support the only large nesting population of loggerheads in the region (Fretey, 2001). Nesting occurs at some level on most of the islands in the archipelago with the largest nesting numbers reported from the island of Boa Vista where studies have been ongoing since 1998 (Lazar and Holcer, 1998; López-Jurado et al., 2000; Fretey, 2001; Varo Cruz et al., 2007; Loureiro, 2008; M. Tiwari, NMFS, personal communication, 2008). On Boa Vista Island, 833 and 1,917 nests were reported in 2001 and 2002 respectively from 3.1 km of beach (Varo Cruz et al., 2007) and between 1998 and 2002 the local project had tagged 2,856 females (Varo Cruz et al., 2007). In 2005, 5,396 nests and 3,121 females were reported from 9 km of beach on Boa Vista Island (López-Jurado et al., 2007). More recently, 12,028 nests in 2008, 20,102 nests in 2009, and 9,174 nests in 2010 were reported from approximately 68 km of beach on Boa Vista Island (Cabo Verde Natura 2000, 2010). On Sal Island, 344 nests were reported in 2008, 1,037 nests in 2009, and 566 nests in 2010 (SOS Tartarugas, 2009; J. Cozens, SOS Tartarugas, personal communication, 2011). From Santiago Island, 66 nests were reported from four beaches in 2007 and 53 nests from five beaches in 2008 (http://tartarugascaboverde.wordpress.com/santiago). Due to limited data available, a population trend cannot currently be determined for the Cape Verde population; however, available information on the directed killing of nesting females suggests that this nesting population is under severe pressure and likely significantly reduced from historical levels (Marco et al., 2010).

Loureiro (2008) reported a reduction in nesting from historical levels at Santiago Island, based on interviews with elders. Elsewhere in the northeastern Atlantic, loggerhead nesting is non-existent or occurs at very low levels. In Morocco, anecdotal reports indicated high numbers of nesting turtles in southern Morocco (Pasteur and Bons, 1960), but a few recent surveys of the Atlantic coastline have suggested a dramatic decline (Tiwari et al., 2001, 2006). A few nests have been reported from Mauritania (Arvy et al., 2000) and Sierra Leone (E. Aruna, Conservation Society of Sierra Leone, personal communication, 2008). Some loggerhead nesting in Senegal and elsewhere along the coast of West Africa has been reported; however, a more recent and reliable confirmation is needed (Fretey, 2001).

Mediterranean Sea DPS

Nesting occurs throughout the central and eastern Mediterranean in Italy, Greece, Cyprus, Turkey, Syria, Lebanon, Israel, Egypt, Libya, and Tunisia (Sternberg, 1981; Margaritoulis et al., 2003; SWOT, 2007; Casale and Margaritoulis, 2010). In addition, sporadic nesting has been reported from the western Mediterranean (Spain and France), but the vast majority of nesting occurs in Greece and Turkey (Margaritoulis et al., 2003). The documented annual nesting of loggerheads in the Mediterranean averages over 7,200 nests (Casale and Margaritoulis, 2010). There has been no discernible trend in nesting reported for the two longest monitoring projects in Greece, Laganas Bay (Margaritoulis, 2005) and southern Kyparissia Bay (Margaritoulis and Rees, 2001). However, the nesting trend at Rethymno Beach, which hosts approximately 7 percent of all documented loggerhead nesting in the Mediterranean, showed a highly significant declining trend from 1990 through 2004 (Margaritoulis et al., 2009). In Turkey, intermittent nesting surveys have been conducted since the 1970s with more consistent surveys conducted on some beaches only since the 1990s, making it difficult to assess trends in nesting. Ilgaz et al. (2007) reported a declining trend at Fethiye Beach from 1993–2004, this beach represents approximately 10 percent of loggerhead nesting in Turkey (Margaritoulis et al., 2003).

South Atlantic Ocean DPS

In the South Atlantic, nesting occurs primarily along the mainland coast of Brazil from Sergipe south to Rio de Janeiro, with peak concentrations in northern Bahia, Espírito Santo, and northern Rio de Janeiro with peak nesting along the coast of Bahia (Marcovaldi and Chaloupka, 2007). Prior to 1980, loggerhead nesting populations in Brazil were considered severely depleted. Recently, Marcovaldi and Chaloupka (2007) reported a long-term, sustained increasing trend in nesting abundance over a 16-year period from 1988 through 2003 on 22 surveyed beaches containing more than 75 percent of all loggerhead nesting in Brazil. A total of 4,837 nests were reported from these survey beaches for the 2003–2004 nesting season (Marcovaldi and Chaloupka, 2007). Loggerhead nesting has continued to increase with approximately 6,800 nests recorded during the 2008–2009 nesting season (dos Santos et al., 2011).

Summary of Comments

With the publication of the proposed listing determination for the nine loggerhead sea turtle DPSs on March 16, 2010 (75 FR 12598), we announced a 90-day comment period extending through June 14, 2010. On June 2, 2010 (75 FR 30769), we extended the public comment period for an additional 90 days through September 13, 2010, and announced our intention to hold a public hearing to provide an additional opportunity and format to receive public input. The public hearing was held in Berlin, Maryland, on June 16, 2010. On March 22, 2011 (76 FR 15932), we published in the Federal Register a notice announcing a 6-month extension of the deadline for a final listing decision to address substantial disagreement that existed on the interpretation of data related to the status and trends for the Northwest Atlantic Ocean DPS of the loggerhead sea turtle and its relevance to the assessment of risk of extinction. At this time, we announced an additional 20-day comment period for new information or analyses from the public that would help clarify this issue.

A joint NMFS/USFWS policy requires us to solicit independent expert review from at least three qualified specialists, concurrent with the public comment period (59 FR 34270; July 1, 1994). In December 2004, the Office of Management and Budget (OMB) issued a Final Information Quality Bulletin for Peer Review establishing minimum peer review standards, a transparent process for public disclosure, and opportunities for public input. The OMB Peer Review Bulletin, implemented under the Information Quality Act (Public Law 106–554), is intended to provide public oversight on the quality of agency information, analyses, and regulatory activities, and applies to information disseminated on or after June 16, 2005. We solicited technical review of the proposed listing determination from six independent experts, and received reviews from all six of these experts. The independent expert review under the joint NMFS/USFWS peer review policy collectively satisfies the requirements of the OMB Peer Review Bulletin and the joint NMFS/USFWS peer review policy. The peer reviewers provided additional information, clarifications, suggestions, and editorial comments to improve this final rule. Peer reviewer comments are addressed in the following summary and incorporated into this final rule as appropriate.

The Services received over 109,000 public comments on the proposed rule, of which over

104,000 were form letters sent as part of comment campaigns from environmental organizations. Approximately 5,000 unique individual comments received were generally supportive of the proposed rule. Comments were received from interested individuals, State and Federal agencies, fishing groups, environmental organizations, industry groups, and peer reviewers with scientific expertise.

The Services received many comments outside the scope of this rulemaking. These included comments on agency guidance on listing species, prohibitions on take, exceptions to the ESA prohibition on take (e.g., incidental take permits under section 10, incidental take statements under section 7), the difference between "take" as defined by the ESA and mortality, actions that may be taken as a result of changes to the ESA listing for loggerheads, management measures implemented via subsequent rulemakings, the findings of a National Research Council report on the assessment of sea turtle status and trends, and implementation of recovery plans. We do not respond to these comments in this final rule.

The summary of comments and our responses below are organized into six general categories: (1) peer review comments; (2) comments on the identification of DPSs; (3) comments on the identification and consideration of specific threats; (4) comments on the status and trends and extinction risk assessments of the DPSs; (5) comments on the status determinations for the DPSs; and (6) other comments.

Peer Review Comments

Comment 1: Two of the six peer reviewers requested clearer definitions for Endangered Species Act terminology used in the proposed rule. For instance, the proposed rule stated "The ESA defines an endangered species as one that is in danger of extinction throughout all or a significant portion of its range, and a threatened species as one that is likely to become endangered in the foreseeable future throughout all or a significant portion of its range..." These two reviewers asked about the time frame for "in danger of extinction" and whether the term extinction is referring to quasi-extinction or absolute extinction. One of these reviewers also asked what is meant by a "significant portion of its range" and "foreseeable future."

Response: The ESA defines an endangered species as a species that is "in danger of extinction throughout all or a significant portion of its range," and a threatened species as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The legislative history of the ESA indicates Congress did not provide any quantitative measures for the Services to apply when determining whether a species is "in danger of extinction." Rather, it left to the discretion of the Services the task of giving meaning to the terms through the process of case-specific analyses that necessarily depend on the Services' expertise to make the highly fact-specific decisions to list species as endangered or threatened. Although Congress did not seek to make any single factor controlling when drawing the distinction, Congress acknowledged that "there is a temporal element to the distinction between the categories." In Re Polar Bear Endangered Species Act Listing and § 4(d) Rule Litigation, Slip Opinion at 40 n. 24, 51, 51 n. 27. (D.D.C. June 30, 2011). Thus, in the context of the ESA, the Services interpret an "endangered species" to be one that is presently at risk of extinction. A "threatened species," on the other hand, is not currently at risk of extinction, but is likely to become so. In other words, a key statutory difference between a threatened and endangered species is the timing of when a species may be in danger of extinction, either now (endangered) or in the foreseeable future (threatened).

The term “significant portion of its range” is not defined by the statute. For the purposes of this rule, a portion of the species’ (species, subspecies, or distinct population segment) range is “significant” if its contribution to the viability of the species is so important that, without that portion, the species would be in danger of extinction. The definition of a “threatened species” is a species that is “likely to become an endangered species within the foreseeable future.” USFWS uses the term foreseeable future as interpreted by the U.S. Department of the Interior Office of the Solicitor (Bernhardt, 2009): “In summary, the foreseeable future describes the extent to which the Secretary (of Interior) can, in making determinations about the future conservation status of the species, reasonably rely on predictions about the future. Those predictions can be in the form of extrapolation of population or threat trends, analysis of how threats will affect the status of the species, or events that will have a significant new impact on the species. The Secretary's ability to rely on predictions may significantly vary with the amount and substance of available data.”

Comment 2: Three of the six peer reviewers agreed with the designation of the nine proposed DPSs. Two reviewers agreed with eight of the proposed DPSs, but disagreed with the proposed North Indian Ocean DPS and questioned the rationale for not breaking out this DPS into East and West components. One reviewer felt that the separation of the Indian Ocean into three DPSs was not sufficiently explained. Another reviewer found the evidence compelling to conclude that the North Pacific Ocean, South Pacific Ocean, and South Atlantic Ocean DPSs were discrete. However, he had questions about the discreteness of the Indian Ocean DPSs, and the northern Atlantic Ocean and Mediterranean Sea DPSs. While he did not question the discreteness findings of these DPSs, the full argument was not clear to him.

Response: Insufficient information was available to further separate the North Indian Ocean DPS into east and west segments. As for the comments indicating that sufficient information was not provided to justify the separation of some of the DPSs, the Services believe the information provided in the Discreteness Determination section of this final rule and the Discreteness Determination section of the Status Review (Conant et al., 2009), which is incorporated into this final rule by reference, meets agency policy for identifying DPSs.

Comment 3: In most cases, the peer reviewers either agreed with or did not oppose the proposed listing status for the nine DPSs. However, one reviewer stated that while he does not oppose the proposed status for any of the DPSs, he does not believe the proposed status for each DPS was adequately explained or justified. Another reviewer expressed similar concerns for the North Pacific Ocean DPS, South Pacific Ocean DPS, North Indian Ocean DPS, Southeast Indo-Pacific Ocean DPS, and the Northwest Atlantic Ocean DPS and stated that the status determinations needed to be more explicitly justified. One reviewer expressed concern about the restricted use of nesting data for the South Pacific Ocean DPS up until 1999 only and indicated that more recent data should be used. This reviewer indicated that the more recent data for Mon Repos, for example, have shown increased nesting with 2009 nesting levels back up to similar numbers as seen in the 1990s. Two reviewers did not believe sufficient data were presented to justify listing of the North Indian Ocean DPS as endangered, particularly in light of the large size of the nesting population, although one of them indicated he did not feel strongly about this. These same two reviewers also questioned the proposed endangered status for the Southeast Indo-Pacific Ocean DPS because the nesting population is protected, trends have been stable, and there do not appear to be major sources of mortality; however, one of the two reviewers indicated he did not feel strongly about this.

Response: With regard to the North Indian Ocean DPS, threats are substantial as identified in the five-factor review, and conservation efforts are embryonic relative to the known and suspected threats impacting the population. Given the information suggesting declines in the nesting population, the emergence of gillnet fisheries in close proximity to the nesting beaches, and the embryonic stage of conservation efforts in the region, the Services believe an endangered status is justified. In the case of the Southeast Indo-Pacific Ocean DPS, the nesting survey effort and methods have varied over the last 2 decades and currently there are no nesting population estimates available to suggest any positive trend in nesting populations. However, some of the fisheries bycatch impacts have been resolved through requirement of turtle excluder devices (TEDs) in shrimp trawlers, and longline fishery effort has declined due to fish stock decreases and economic reasons. Although a new fisheries effort has emerged for portunid crabs and is posing new threats to loggerheads, and longline fishing effort for tuna and billfish is also subject to increase if and when economics and fish populations improve, we are unable to quantify these threats. As a result, based primarily on peer reviewer comments regarding current threats and conservation efforts, the Services now believe a threatened status for the Southeast Indo-Pacific Ocean DPS is appropriate. With regard to the comment that the status determinations for several of the DPSs lacked sufficient justification, we have clarified the rationale for the status determinations in the Finding section in this final rule.

Comment 4: One peer reviewer commented that the information presented in the proposed rule appeared thorough, up-to-date, and convincing for the conclusions made, both with respect to DPS designation and listing status. However, he noted the Services could have readily arrived at these conclusions without the use of either the susceptibility to quasi-extinction (SQE) or the threat matrix analysis. He also noted that the relative novelty and thin track records of both methods may draw criticism that distracts from the real substance of the analysis of the available data. Another reviewer noted weaknesses with the extinction risk assessments, but was pleased to see these quantitative risk assessments included in the proposed rule and appreciated that they were considered hand-in-hand with the threats analysis. Specifically, he stated that the SQE approach looked at the risk of declining to 30 percent of the current population size, but it was not clear over what time frame this decline was examined or what risk of decline warranted listing. He also noted that the SQE method was largely retrospective, as it used past empirical trends to forecast future trends. He thought the matrix method was better at exploring the potential risk posed by future trends, so it was more forward-looking than the SQE method, but it only looked at deterministic risk, not stochastic risk. A third reviewer agreed with the threat based assessments, but he thought details were lacking in the SQE analysis. Specifically, he thought there should be more emphasis on the relationship between reduced population sizes and decreased resilience to cope with current and future impacts and felt this to be particularly relevant given the large time frames for maturity and the large spatial scales involved.

Response: The Services have clarified the text in the Extinction Risk Assessments section to more clearly state that the SQE and threat matrix analyses were only used to provide some additional insights into the status of the nine DPSs, but that ultimately the conclusions and determinations made were based on an assessment of population sizes and trends, current and anticipated threats (i.e., five-factor analysis), and conservation efforts for each DPS.

Comment 5: One peer reviewer stated that the threats assessments were not as future-focused as he would have liked. He thought they tended to rely on current or past status and trends, but he believes the ESA is forward-looking and is concerned about the future status of the species. He recognized that some evidence was presented about future trends, such as development pressures on beaches in various areas of the world, progress toward enforcing existing legislation, reduction of bycatch, and potential climate change impacts, but he still thought the final assessments could be more future-focused.

Response: Section 4 of the ESA and its implementing regulations (50 CFR part 424) set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. A species may be determined to be endangered or threatened due to one or more of the five factors described in section 4(a)(1) of the Act. The Services are required to use the best scientific and commercial information available at the time we are making our listing assessments. Thus, predicting potential future threats to a species is dependent on available data and the life history and ecology of the species, the nature of the threats, and the species' response to those threats. While the SQE analysis relied on nesting beach surveys and is retrospective, the threat matrix analyses look at the potential future directions given the known threats and loggerhead sea turtle biology. Although the SQE and threat matrix analyses provided some additional insights into the status of the nine DPSs, ultimately the conclusions and determinations made were primarily based on an assessment of population sizes and trends, current and anticipated threats, and conservation efforts for each DPS.

Comment 6: One peer reviewer said that for some populations (e.g., Northwest Atlantic Ocean DPS) there has been a great deal of study over the past few decades and there is a lot of information about many aspects of the life history of the population and its anthropogenic threats. For other populations, there are little data. As a result he was unclear how the quality of the empirical evidence affected the risk assessment and the status classification under the ESA. He questioned whether a more precautionary interpretation of the risk was taken when there was greater uncertainty or whether the greater amount of evidence in some places actually made it easier.

Response: We are to make status determinations based solely on the best available scientific and commercial data after conducting a review of the status of the species and taking into account any efforts being made by States or foreign governments to protect the species. In assessing the status of each identified DPS, we considered available information on status and trends, the five-factor analysis (see Summary of Factors Affecting the Nine Loggerhead DPSs section), and conservation efforts that have been implemented (see Conservation Efforts section). We considered this information in light of the ESA definitions of endangered and threatened (see Listing Determinations Under the ESA section).

Comment 7: One peer reviewer commented that the boundary of 139º E. long. in the Gulf of Carpentaria separating the South Pacific Ocean DPS and the Southeast Indo-Pacific Ocean DPS was too far west. He stated that satellite tracking showed a female from Western Australia moving into 141º E. long. and indicated there are reasonable numbers of loggerheads foraging in the Torres Strait for which genetic analyses have not yet been conducted.

Response: Based on the information provided by this peer reviewer, the Services have revised the boundary separating the South Pacific Ocean DPS and the Southeast Indo-Pacific Ocean DPS from 139º E. long. to 141º E. longitude.

Comments on the Identification of DPSs

Comment 8: Two commenters questioned the Services' application of the DPS policy. They noted that DPS designations should be used sparingly and only when biological evidence indicates that such action is warranted to meet Congressional intent. They stated that the separation must be marked, and DPS designations are only appropriate where scientific evidence is conclusive to justify such listing.

Response: The Services acknowledge in the Policies for Delineating Species Under the ESA section of this final rule that Congress has instructed the Secretaries of the Interior and Commerce to exercise the authority to designate DPSs "…sparingly and only when the biological evidence indicates such action is warranted." As a result, the Services adopted a joint policy for recognizing DPSs under the ESA (DPS Policy; 61 FR 4722) on February 7, 1996. This policy, described in the Policies for Delineating Species Under the ESA section, has been closely followed in determining loggerhead DPSs, and the Services believe it meets the Congressional intent.

Comment 9: One commenter did not believe additional benefits to the populations would occur if DPSs were designated (e.g., threatened turtles are already treated the same as endangered turtles under a 4(d) rule, critical habitat can be designated, and section 7 of the ESA applies). Another commenter believes the United States will diminish its role in international sea turtle conservation by only having an interest in the two DPSs (Northwest Atlantic Ocean and North Pacific Ocean) that occur in the United States.

Response: The Services were petitioned to list the Northwest Atlantic and North Pacific loggerhead sea turtle populations as DPSs and to change the listing status of turtles in those populations from threatened to endangered. The Services do not believe that identifying DPSs for the loggerhead will diminish the United States' role in international sea turtle conservation. Both Services have strong international programs for sea turtles, including implementation of the U.S. Marine Turtle Conservation Act of 2004, which was created to assist in the conservation of sea turtles and their nesting habitats in foreign countries.

Comment 10: The State of Florida supports the identification of nine DPSs. The States of Georgia and South Carolina support the designation of the Northwest Atlantic DPS. The State of Connecticut believes the listing of nine loggerhead DPSs is reasonable and will result in better targeted conservation for this species. The State of Maryland believes it is premature to consider listing DPSs without full disclosure of loggerhead population status. Numerous conservation organizations and individuals, including all the individuals that sent form letters, support designation of the nine proposed DPSs. Three fishing groups do not support the identification of loggerhead DPSs.

Response: The Services have considered the best available information on loggerhead population status and have summarized this information in the Status and Trends of the Nine Loggerhead DPSs section of this final rule.

Comment 11: The State of Alaska provided information that only two loggerheads have been observed in Alaska in the past 50 years and requested that Alaska waters be excluded from the North Pacific Ocean DPS.

Response: While the ESA authorizes the listing, delisting, or reclassification of a species, subspecies, or DPS of a vertebrate species, it does not authorize the exclusion of a subset or portion of a listed species, subspecies, or DPS from a listing decision. Although only two observations of loggerheads in Alaska waters have been reported, this indicates the species does at least occasionally occur there.

Comment 12: One commenter contended that the Services failed to conduct analyses (e.g., statistical analysis, gene flow, extent of DNA allele and haplotype differences, degree of DNA sequence divergence for mtDNA or nuclear DNA) necessary to determine if the data support a conclusion of marked separation with respect to genetics. The commenter noted that the proposed rule stated that it relied on genetic differences characterized by allele frequency differences rather than fixed genetic differences.

Response: The Services conducted a thorough review of the best available science and presented and discussed the body of published genetic studies in the scientific literature, including statistical analysis, gene flow, extent of DNA allele and haplotype differences, and degree of DNA sequence divergence for mtDNA and nuclear DNA. All of these studies consistently show evidence of deep evolutionary divergence between the proposed DPSs. Several of the DPSs are characterized by fixed genetic differences or endemic mtDNA haplotypes; however, fixation is not a requirement for marked genetic separation.

Comment 13: One commenter disagreed with the Services' determination that physical factors separate DPSs in different ocean basins, and further disagreed that water temperatures are a sufficient barrier to prevent turtles from moving between ocean basins. The commenter noted that dispersal from the Indian Ocean to the South Atlantic is possible via the Agulhas current and cited Bowen and Karl (2007), which documented at least two such transfers. The commenter disagreed with the rationale for dividing the Atlantic basin into North and South because a DNA haplotype unique to the Brazilian nesting assemblage has been found in foraging juveniles in the

North Atlantic, therefore contradicting that loggerheads in the North and South Atlantic are isolated from each other. The commenter also believes that loggerheads from the North Pacific and South Pacific mix during their trans-Pacific migrations, which results in gene flow across the equator. The commenter cited information presented in Hatase et al. (2002a) that the Australian haplotype (South Pacific Ocean DPS) was present in loggerheads nesting in Japan (North Pacific Ocean DPS) and in Bowen and Karl (2007) that turtles caught off Baja California have 5 percent of the Australian haplotype.

Response: There is substantial genetic evidence that is consistent with satellite telemetry and other lines of evidence to support the division between Ocean basins and between the North and South Atlantic and Pacific Oceans. The Services present a review of the available science and discuss the rationale in detail for each DPS, which are based on distribution of breeding populations (rookeries). The Services note that the distribution of and migration of juveniles may extend beyond the geographic boundaries of each DPS and that juveniles from different DPSs may share oceanic foraging habitat. The dispersal (in terms of expansion/exchange and establishment of breeding populations) between the Atlantic and Indian Oceans referred to by the commenter occurred on geological timescales, most recently during the Pleistocene 12,000–250,000 years ago. The separation between the North and South Atlantic is believed to be even deeper according to the published scientific literature detailed by the Services. The earlier speculation by Bowen et al. (2005) of an Australian haplotype present in the North Pacific (including Baja California foraging grounds) has been shown by more recent studies to be a sampling artifact (Bowen et al., 1994, 1995; Hatase et al., 2002a; Dutton, 2007, unpublished data; Boyle et al., 2009; Watanabe et al., 2011).

Comment 14: One commenter referred to the Status Review statement that unique DNA haplotypes could represent adaptive differences. The commenter contended that this is speculation with no supporting evidence and, therefore, that adaptation and selection should not be considered in the discreteness finding.

Response: Adaptation and selection were not explicitly used as criteria to evaluate discreteness, but are processes that are implicitly involved in the evolution of populations (e.g., the accumulation of geographically divergent genetic variation). The text has been revised to clarify this point.

Comment 15: One commenter believes the Services cannot limit genetic analysis to a subset of the DPS (adult females) because doing so would be listing below the DPS level and contrary to court findings and legislative history. The commenter cited various court cases including Modesto Irrigation District v. Gutierrez, Alsea Valley Alliance v. Evans, and Rock Creek Alliance v. United States Fish and Wildlife Service. The commenter believes that limiting genetic analyses to only mtDNA can yield misleading results because it only reflects female gene flow. Alternately, nuclear DNA reflects total gene flow.

Response: The Services followed the DPS Policy to determine the applicability of the policy for the loggerhead sea turtle. The DPS policy requires the consideration of two elements when evaluating whether a vertebrate population segment qualifies as a DPS under the ESA: (1) the discreteness of the population segment in relation to the remainder of the species or subspecies to which it belongs; and (2) the significance of the population segment to the species or subspecies to which it belongs. The loggerhead sea turtle's global distribution and natal site fidelity and migratory nature are integral to this determination. While the Services relied on the genetic analysis results of mitochondrial DNA (matriarchal), nuclear DNA analysis results, where available, were used to determine discreteness and significance of the DPSs. The Services presented a detailed rationale for identifying breeding populations as the population units given the complex life history of sea turtles. The geographic structure of maternal lineages is an appropriate measure that has been used extensively to delineate populations of sea turtles whose life history is characterized by natal homing (both of adult males and females).

Comment 16: One commenter disagreed that genetic separation exists for loggerheads in the Atlantic. The commenter believes that the data suggest the proposed DPSs in the Atlantic (Northwest Atlantic, Northeast Atlantic, South Atlantic, and Mediterranean) are not genetically distinct because they share mtDNA haplotypes and microsatellite DNA alleles. The commenter provided their own analysis of the Northwest Atlantic and South Atlantic that showed at least four migrants per generation between the Northwest Atlantic and South Atlantic; the commenter contended that migration of 1 to 10 animals between population groups per generation is sufficient to prevent genetic differentiation. Another commenter noted scientific agreement that male mediated gene flow is common among loggerheads, which leads the commenter to conclude that loggerheads are not "reproductively-isolated" on a global scale. This commenter believes that exchanges between ocean basins have occurred, are occurring now, and will likely occur in the future, while even subpopulations have been shown as genetically distinct within regions. One commenter questioned the Services' finding that the Northwest Atlantic Ocean DPS is reproductively isolated and therefore markedly separated based on male-mediated gene flow as well as nest site fidelity. The commenter cited studies that have documented individual adult females returning to nest at sites that were equal to or greater than distances between nesting colonies. This commenter further believes that by declaring female loggerheads are reproductively isolated because of “unique” nesting areas is to classify an entire species based on the characteristics of part of the proposed DPS (nesting adult females), which violates the ESA.

Response: Male mediated gene flow is one hypothesis explaining lack of differentiation with nuclear markers that have been found between proximate rookeries that have otherwise shown structure based on mtDNA. Follow up studies are necessary to further test the alternative hypothesis that the lack of differentiation was due to the lack of statistical power of the microsatellite markers used in early studies to resolve fine scale structure. These studies are ongoing and there is a suite of new microsatellite markers that has been developed to further this research. Published studies consistently indicate that gene flow between the DPSs identified by the Services occur over geological time scales and shared haplotypes are the result of shared common ancestry 12,000–3 million years ago and not ongoing radiation and colonization between DPSs.

Comment 17: One commenter questioned and disagreed with the Services’ finding that the Northwest Atlantic Ocean DPS is genetically separated from other DPSs, particularly the Northeast Atlantic Ocean and South Atlantic Ocean DPSs. As evidence of substantial mixing in the oceanic zone, the commenter cited data from bycaught loggerheads in the pelagic longline fishery operating off Atlantic Canada as well as fisheries off the Azores and Madeira. Relative to foraging grounds, another commenter believes that the documented mixing of males and females facilitates male mediated gene flow between different nesting assemblages and different ocean basins and results in mixing by male mediated gene flow. This commenter also believes that Northwest Atlantic loggerheads are not a legitimate DPS because they do not have private microsatellite alleles, share microsatellite alleles with other loggerheads, and do not have monophyletic DNA haplotypes within regions.

Response: There is no evidence that mating occurs on the distant foraging grounds. Indeed the body of genetic, behavioral, and telemetry research over the last 25 years is consistent with a paradigm of migration by adults, both male and female, to coastal areas near natal beaches where mating takes place at the beginning of the nesting season. There is no evidence that mixing of immature turtles at high seas foraging areas where pelagic fisheries also interact facilitates male mediated gene flow. Bowen et al. (2005) also showed tendency toward natal homing by immature loggerheads in the Northwest Atlantic as they move into the nearshore neritic habitat.

Comment 18: One commenter provided an analysis comparing mtDNA haplotypes directly (i.e., not transforming them to Fst) for the proposed DPSs in the Northwest Atlantic and Mediterranean. The commenter concluded that actual genetic data show that the Northwest Atlantic, Northeast Atlantic, and Mediterranean populations are genetically similar, with shared mtDNA haplotypes with similar frequencies in some nesting populations. The commenter believes these observations of genetic patterns within and between regions indicate the proposed DPSs (Northwest Atlantic, Northeast Atlantic, and Mediterranean) are not genetically distinct or markedly separated. The commenter noted that after the Services concluded genetic separation between the proposed Northwest and Northeast Atlantic Ocean DPSs, the Services admitted that nesting females of the Boa Vista rookery in the Northeast Atlantic, despite their proximity to other Northeast Atlantic rookeries and to the Mediterranean, are "most closely related to the rookeries of the Northwest Atlantic." Thus, the commenter believes the Services' admit no marked genetic separation between these two proposed DPSs. The commenter further recalled that the proposed rule admitted loggerheads from the Northwest Atlantic colonized the Northeast Atlantic and Mediterranean. Additionally, the commenter believes this same rationale applies to other DPSs. An Australian haplotype (South Pacific Ocean) is found in Japanese nesting populations (North Pacific Ocean) indicating comingling of these groups. Similarly, the proposed South Pacific Ocean DPS (eastern Australia) does not appear to be markedly different from nesting assemblages in Western Australia in the proposed Southeast Indo-Pacific Ocean DPS because the two groups share two mtDNA haplotypes. Turtles caught off Baja California included 95 percent of the haplotypes that are common to Japanese nesting areas and 5 percent of Australian haplotypes; the Status Review admitted gene flow between these populations. As noted by Bowen and Karl (2007) "there appears to be sufficient leakage [of genes] between ocean basins to prevent long-term isolation and allopatric specification."

Response: Standard population genetic analysis published in the peer-reviewed scientific literature indicates significant population structure. Recent studies (Monzón-Argüello et al., 2010) reinforce this and identify haplotypes that are common in the Northeast Atlantic but absent in the Northwest Atlantic rookeries. Furthermore, Monzón-Argüello et al. (2010) show that haplotypes that were the same based on relatively short (~380bp) sequences were actually different when longer sequence fragments (~760bp) were analyzed. They identified four new variants of the base haplotype and showed fixed differences between a Northwest Atlantic rookery and Northeast Atlantic rookery, suggesting that previous studies have underestimated the level of differentiation between these DPSs. Research is currently underway using longer sequence data to comprehensively reanalyze Atlantic and Mediterranean rookery structure that is expected to provide greater power to detect differentiation. Also, see the response to Comment 17.

<u>Comment 19:</u> One commenter believes there is an error in the proposed rule, which notes that loggerheads at Brazilian rookeries have a "unique mtDNA haplotype...." but then notes the haplotype is not "unique" because it has been found "in foraging populations of juvenile loggerheads of the North Atlantic...." The commenter believes that if the haplotype is found throughout the Atlantic it is not "unique" and instead indicates common recent ancestry and male mediated gene flow throughout the Atlantic basin. Additionally, the commenter believes that mtDNA obtained from 11 animals from one site in Brazil is too small a sample and limited geographically to properly assess the presence of haplotypes in North and South Atlantic populations.

<u>Response:</u> The commenter has confused the presence of haplotype in juvenile foraging populations with absence of this haplotype in North Atlantic rookeries. Furthermore the commenter overstates the frequency of occurrence of the Brazilian haplotype in the North Atlantic juvenile foraging aggregations, and since mtDNA is maternally inherited, the claim that this is evidence of male mediated gene flow is erroneous.

<u>Comment 20:</u> One commenter disagreed that there are ecological differences for adult females in the Atlantic basin because multiple populations mix on foraging grounds. The commenter also feels that ecological differences cannot be used as justification for delineating a Northwest Atlantic Ocean DPS because foraging behavior of adult males and other life stages are not included. Therefore, DPS designation is based only on a subset of the population and not the entire DPS. To further illustrate this point, the commenter cited a 2001 Atlantic Highly

Migratory Species Fishery Management Plan that noted adult females comprise only 1 percent of the total turtle population and a National Research Council report that concluded adults comprise less than 5 percent of the non-hatchling population.

Response: See response to comment 15. Also, in general, adult females occupy neritic foraging habitat, and mixing of adults from different DPSs on foraging grounds is unlikely.

Comment 21: One commenter disagreed that behavioral differences (i.e., nesting season) justify discreteness. The commenter noted that nesting occurs in the summer months in both the South Atlantic and the Northwest Atlantic; the months that nesting occurs are not the same because of the earth's rotation and have nothing to do with turtle behavior. The commenter contended that the behavior patterns of turtles are the same in both regions, thus if nesting season is used as the justification, it argues against separating the Northwest Atlantic from the Northeast Atlantic and the Mediterranean.

Response: Marked differences in nesting season between northern and southern hemispheres is one of several characteristics that help support distinction. The Services do not use nesting season per se as a diagnostic criterion to justify DPS designation, but rather consider it as one of several supporting factors.

Comment 22: One commenter believes the Services reached conclusions on the discreteness factors without analysis or explanation.

Response: The Services disagree. The Discreteness Determination section of the proposed rule clearly presented the information we considered in determining the discreteness of populations.

Comment 23: One commenter noted that the proposed rule addressed size issues only in the Atlantic and neglected the other ocean basins. Also with respect to size, the commenter did not agree that mean size of reproductive female loggerheads should be used to support splitting the Northwest Atlantic Ocean and South Atlantic Ocean DPSs because the proposed rule noted that SCL in Brazil is comparable to that in the Northwest Atlantic. Further, the commenter does not believe that size differences are justification for separate DPSs as these differences could be attributed to various ages, sexes, nutrition, and water temperature, which would greatly affect growth rates and corresponding size.

Response: The Services did not use nesting female size per se as a diagnostic criterion to justify DPS designation, but rather considered it as one of several supporting factors.

Comment 24: One commenter does not believe the "significance" standard is met in the proposed rule. The commenter believes that being located in different geographic areas does not make each area unique for loggerheads such that each area is significant.

Response: The Services disagree with the comment. Each of the nine populations represents a large portion of the species' range and each represents a unique ecosystem that is significant to the taxon as a whole, influenced by local ecological and physical factors. The loss of any individual population would result in a significant gap in the loggerhead's range. Each population segment is genetically unique, often identified by unique mtDNA haplotypes, and the loss of any one population segment would represent a significant loss of genetic diversity.

Comments on the Identification and Consideration of Specific Threats

Comment 25: Three commenters believe climate change should be determined as a significant threat to the persistence of all of the DPSs. The commenters provided detailed information on sea level rise impacts on nesting beaches and nesting success, increasing sand temperatures resulting in skewed sex ratios and higher egg mortality, impacts of storm activity on nesting beaches and nesting success, warmer ocean temperatures and changes in circulation effects on all age classes, and ocean acidification impacts on nesting beaches and food resources. Another commenter believes that global climate change should not be considered in the listing decision for the North Pacific Ocean DPS because its effects on loggerheads and the ecosystem are too complex and speculative, and they could adapt to changing conditions.

Response: The Services have identified climate change impacts as potentially having profound long-term impacts on nesting populations, but also continue to believe it is not possible to quantify the potential impacts at this time. Impacts from climate change, especially due to global warming, are likely to become more apparent in future years (Intergovernmental Panel on Climate Change, 2007). The global mean temperature has risen 0.76 degrees Celsius over the last 150 years, and the linear trend over the last 50 years is nearly twice that for the last 100 years (Intergovernmental Panel on Climate Change, 2007). One of the most certain consequences of climate change is sea level rise (Titus and Narayanan, 1995), which will result in increased erosion rates along nesting beaches. On undeveloped and unarmored beaches with no landward infrastructure, shoreline migration may have limited effects on the suitability of nesting habitat. Bruun (1962) hypothesized that during sea level rise a typical beach profile will maintain its configuration but will be translated landward and upward. However, along developed coastlines, and especially in areas where erosion control structures have been constructed to limit shoreline movement, rising sea levels are likely to cause severe effects on nesting females and their eggs (Hawkes et al., 2009; Poloczanska et al., 2009).

Comment 26: One commenter believes that terrestrial threats documented in the proposed rule should be irrelevant because the North Pacific Ocean DPS nesting beach counts have increased despite these threats during the same time period. While these threats may have some as yet unquantified impact on the population, they are most certainly not driving the population to extinction.

Response: The Services believe that increased impacts in the terrestrial zone, such as beach armoring and human traffic, serve to decrease nesting success, hatching success, and hatchling survivorship. Thus, although terrestrial threats may not impact loggerheads through direct mortality, the indirect effects hamper the reproductive output of the population, on which the effects will be manifested for decades to come.

Comment 27: One commenter believes the listing factor analysis for the North Pacific Ocean DPS does not appropriately weigh the adequacy of existing regulatory mechanisms (e.g., regulatory measures that address egg harvest and drift netting).

Response: The Services believe that the illegal, unidentified, and unregulated industrial longline and driftnet fleets operating in the North Pacific have a major adverse effect on loggerhead sea turtles. Thus, the existing regulatory mechanisms are currently insufficient to address these fishing impacts. It is likely that the existing regulatory mechanisms mandating fishing strategies in U.S.-based fleets are approaching adequate, yet loggerheads remain vulnerable to impacts from foreign fleets.

Comment 28: One commenter believes the impacts of U.S. commercial fisheries on North Pacific loggerheads are extremely small and not currently (or foreseeably) a significant source of injury or mortality. The commenter noted that peer-reviewed scientific literature demonstrated that severe restrictions placed on the shallow-set fishery ostensibly to protect turtles, actually resulted in substantially more takes on the high seas by foreign fleets filling market demand not being met by Hawaii-based longline fisheries. While foreign high seas fisheries interact with North Pacific loggerheads, the commenter noted the impact of this take is uncertain and unquantified. The commenter believes that known data demonstrate that the North Pacific population has increased and remained stable since the 1990s, which suggests that high seas bycatch is not driving the population to extinction; this is contrary to the language in the proposed rule on foreign high seas fisheries' effects on the population.

Response: The Services agree that efforts by Hawaii-based longline fisheries to minimize loggerhead takes have been substantial and effective. However, to focus on loggerhead population trends since 1990 only tells part of the story. Empirical data clearly show that by 1990 the annual nesting population was substantially reduced relative to historical levels. Thus, loggerheads in the North Pacific remain a depleted population that continues to be vulnerable to fisheries bycatch.

Comment 29: One commenter did not agree that bycatch in Japanese coastal pound net and other fisheries is causing population declines of the North Pacific Ocean DPS and requested detailed bycatch data/information that supports the Services' conclusion.

Response: The loggerhead Status Review concludes that impacts from fisheries bycatch represent a substantial threat to loggerhead sea turtles. Coastal pound-net fisheries in Japan have been shown to present a problem to loggerhead sea turtles in Japan and, when taken in context of all the other fisheries impacts ongoing at present, it is clear that no single fishery (coastal pound nets included) constitutes the only threat to loggerheads.

Comment 30: One commenter noted that for listing Factor A (The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range), the Status Review listed threats as low and very low for Northwest Atlantic loggerheads. The commenter believes that low or very low threats do not provide a legally sound basis to designate the Northwest Atlantic Ocean DPS as endangered. The commenter believes the proposed rule is inadequate in its assessment of listing Factor A and does not believe this factor justifies an endangered finding. The commenter listed several threats for which effects were not quantified (e.g., number of individuals or amount of habitat affected) or evaluated for impacts to Northwest Atlantic loggerheads: nesting beach erosion, erosion control devices (beach armoring), beach washout, jetty construction, light pollution, vehicular traffic, fishing effects on loggerhead diet, sediment dredging for port navigation, and climate change effects on trophic changes. Further, the commenter noted that the proposed rule does not explain how impacts from armoring or dredging are offset by beach nourishment programs that increase loggerhead nesting. Another commenter also provided comments for listing Factor A and believes the discussion of trends in addressing these threats is missing in the proposed rule (e.g., artificial lighting in Florida, beach driving in North Carolina, Magnuson-Stevens Fishery Conservation and Management Act and Atlantic States Marine Fisheries Commission management measures, etc.).

Response: For a number of reasons, discussed in the Finding section, the Services are listing the Northwest Atlantic Ocean DPS as threatened. While a listing could proceed based on one of the five factors, determinations of any listing decision are generally based on an examination of all five factors and how they impact the entity in total and not by examining or relying on only one factor in isolation. Habitat modification or destruction impacts are considered to the extent they are known based on the best available information. Quantification of such impacts is typically very difficult as a result of lack of available information. Regarding armoring or dredging impacts being offset by beach nourishment programs, we cannot quantify what the trade-off in effects would be. However, while nourishment can provide nesting habitat where either it had been destroyed previously or to augment impacts from other coastal measures, it at best helps reduce the impacts, but does not provide new benefits to the turtles. The Services agree that many efforts have been made to reduce threats on the nesting beaches. However, in many cases past policies have resulted in permanent detrimental impacts to nesting beaches. As coastal development increases, additional pressure on beach systems will occur, and are occurring now. In many areas breakwaters, jetties, seawalls, and other erosion control structures designed to protect public and private property continue to be permitted and built. Additional residential and commercial properties near beaches also continue to be permitted and built. While measures (e.g., lighting ordinances, construction setbacks) to mitigate these pressures to some degree provide important protections, threats remain a serious concern.

Comment 31: One commenter noted that for listing Factor B (Overutilization for Commercial, Recreational, Scientific, or Educational Purposes), the Status Review lists threats as low or very low for Northwest Atlantic loggerheads. The commenter believes that low or very low threats do not provide a legally sound basis to designate the Northwest Atlantic Ocean DPS as endangered. The commenter also questioned how a harvest of close to zero threatens loggerheads with extinction in the Northwest Atlantic, citing the TEWG assessment of harvest in the Caribbean and the proposed rule.

Response: For a number of reasons, discussed in the Finding section, the Services are listing the Northwest Atlantic Ocean DPS as threatened. While a listing could proceed based on one of the five factors, determinations of any listing decision are generally based on an examination of all five factors and how they impact the listed entity in total and not by examining or relying on only one factor in isolation.

Comment 32: One commenter noted that for listing Factor C (Disease or Predation), the Status Review lists threats as low or very low for Northwest Atlantic loggerheads. The commenter believes that low or very low threats do not provide a legally sound basis to designate the Northwest Atlantic Ocean DPS as endangered. The commenter also asserted the proposed rule does not claim that threat from disease and predation actually exists, only that it may be an issue for Northwest Atlantic loggerheads. Further, the commenter believes the Services failed to indicate the nature or extent of the threat or how many loggerheads may be affected.

Response: For a number of reasons, discussed in the Finding section, the Services are listing the Northwest Atlantic Ocean DPS as threatened. While a listing could proceed based on one of the five factors, determinations of any listing decision are generally based on an examination of all five factors and how they impact the entity in total and not by examining or relying on only one factor in isolation. There are little data to assess the extent of disease and predation threats, thus a more qualitative discussion on the factor is presented. That some degree of disease and predation occurs is known, though it is not expected to be significant by itself. That is the reason it was considered to be a low to very low threat.

Comment 33: One commenter presented an argument that the declines in Northwest Atlantic loggerhead nesting can best be explained by an epizootic event that specifically impacted loggerheads, and not fishery interactions. The commenter also claimed that the epizootic ended some years ago and populations are in recovery.

Response: The Services do not find there is enough evidence to support the epizootic hypothesis at this time. While epizootic events may play a factor in the population trajectory, a much stronger case would need to be made. Witherington et al. (2009) published a very compelling analysis of loggerhead nesting trends and demonstrated that fisheries impacts appear to account for a significant proportion of the trend.

Comment 34: One commenter believes listing Factor D (Inadequacy of Existing Regulatory Mechanisms) is not at issue and cannot be used to justify an endangered designation for the Northwest Atlantic Ocean DPS because the Status Review noted that it is "not considered to be reducing survival rates directly." Additionally, the commenter believes the Services never discussed what mechanisms are believed to be inadequate nor identified any indirect impacts.

Response: For a number of reasons, discussed in the Finding section, the Services are listing the Northwest Atlantic Ocean DPS as threatened. While a listing could proceed based on one of the five factors, determinations of any listing decision are generally based on an examination of all five factors and how they impact the entity in total and not by examining or relying on only one factor in isolation. Our review of regulatory mechanisms for this DPS described below in the Summary of Factors Affecting the Nine Loggerhead DPSs demonstrates that regulatory mechanisms are in place that should address direct and incidental take for this DPS. While the regulatory mechanisms contained within international instruments are inconsistent and likely insufficient, the mechanisms of existing national legislation and protection enacted under existing regulatory mechanisms, primarily the ESA, Magnuson-Stevens Fishery Conservation and Management Act, and State regulations, are much more adequate.

However, it remains to be determined if national measures are being implemented effectively to fully address the needs of loggerheads as many of the most significant measures have come within the last generation of loggerheads, and thus the benefits may not yet be seen in the nesting trends. In addition, even with the existing regulatory mechanisms there is still a potential threat from both national and international fishery bycatch and coastal development, beachfront lighting, and coastal armoring and other erosion control structures on nesting beaches in the United States. More work needs to be done under the existing national regulatory mechanisms, as well as continuing to advance the development and effectiveness of international instruments, to ensure the persistence of this DPS. Therefore, we have determined that the threat from the inadequacy of existing regulatory mechanisms is significant relative to the persistence of this DPS.

Comment 35: One commenter agrees with the Services that although regulatory mechanisms are in place that should address direct and incidental take in Northwest Atlantic loggerheads, these regulatory mechanisms are insufficient or are not being implemented effectively to address the needs of loggerheads.

Response: More work needs to be done under the existing national regulatory mechanisms, as well as continuing to advance the development and effectiveness of international instruments, to ensure the persistence of this DPS. See the response to Comment 34 for additional information.

Comment 36: One commenter believes that the Services' assessment of existing regulatory measures for loggerheads in the Northwest Atlantic Ocean DPS was confounded by the Services' failure to implement existing mechanisms. The commenter believes it is difficult to argue that the existing regulatory mechanisms are inadequate for the Northwest Atlantic Ocean DPS. The commenter noted that many conservation measures have been enacted, but given the species' prolonged age to maturity, coupled with transitory dynamics, it is likely too early to begin measuring effects of past actions on nesting activity; this is further complicated by multiple measures, implemented at different times, affecting different life stages.

Response: The Services agree that nationally, significant measures have been enacted under existing regulatory mechanisms and that is not yet possible to determine whether the measures are sufficiently effective as many of the most significant measures have come within the last generation of loggerheads, and thus the benefits may not yet be seen in the nesting trends. However, we have determined that additional work needs to be done under the existing national regulatory mechanisms, as well as continuing to advance the development and effectiveness of international instruments, to ensure the persistence of this DPS.

Comment 37: One commenter is concerned about apparent low survival rates of adult females from the Peninsular Florida Recovery Unit within the Northwest Atlantic Ocean DPS, but suggested this is better addressed through more effective implementation of existing regulatory measures.

Response: The apparent low survival rate of adult females from the Peninsular Florida Recovery Unit has also been a concern for the Services. There is a need to continue researching the issue to better understand what the actual survival rates are for adult females and all age classes. The Services agree that continued, and more effective, implementation of measures under the existing regulatory mechanisms is needed.

Comment 38: One commenter disagreed that existing regulatory mechanisms have failed to adequately address threats to Northwest Atlantic loggerheads from incidental take and that no mechanism has effectively eliminated or sufficiently reduced mortality from fishing. Similarly, another commenter stated that the claims that NMFS faces “limitations on implementing demonstrated effective conservation measures” and that domestic “regulatory mechanisms are insufficient or are not being implemented effectively to address the needs of loggerheads” of the Northwest Atlantic is contrary to the commenters’ beliefs. This commenter noted that while no regulatory measure is perfect, the mechanisms in the United States (and increasingly internationally) are strong and subject to constant improvement and enforcement. The law virtually assures that identified gaps in protection are filled. Further, this commenter states that the current system for enforcing sea turtle protective measures is comprehensive and effective and took issue with the Services’ characterization of “limitations on enforcement capacity.” However, several commenters disagreed that NMFS has an adequate number of officers to enforce existing regulations.

Response: The Services agree that substantial measures have been taken to reduce sea turtle mortality from fishery bycatch, and NMFS is committed to reducing bycatch and bycatch mortality further. However, in many fisheries high interaction levels and mortalities still occur, both nationally and internationally. While the Federal law does require that gaps in protection under U.S. jurisdiction are addressed, many gaps remain, and many of the measures enacted provide benefits to the species, but impacts still remain significant. NMFS disagrees with the assertion that there are not substantial limitations on enforcement capacity, as the geographic scope and variety of fisheries, inshore, coastal, and on the high seas that are known to, or potentially, impact sea turtles make effective enforcement difficult with limited resources at both the State and Federal levels.

Comment 39: One commenter questioned what the Services meant by "lack of availability of comprehensive bycatch reduction technologies" under Factor D (Inadequacy of Existing Regulatory Mechanisms) for the Northwest Atlantic Ocean DPS.

Response: While TEDs stand as the model for sea turtle bycatch reduction technology, many gear types do not lend themselves to technological fixes that can reach a similarly high level of effectiveness when properly used. Even for some trawl fisheries, further development is needed to devise TED designs that effectively exclude sea turtles while maintaining sufficient target catch. Longline measures such as circle hooks and release gear requirements are valuable, but partial, solutions. Take levels in longline fisheries, both pelagic and bottom, can still result in significant impacts. For many other gear types, effective technological solutions are not so readily available, and much work remains to determine what gear changes, if any, will result in significant reductions in interactions and mortalities.

Comment 40: One commenter believes that "limitations on implementing demonstrated conservation measures" is a fallacious rationale to justify a change in status. The commenters again cited longline and shrimp trawl as well as scallop dredge gear modifications as leading to increasing protection for sea turtles at all life stages.

Response: While important measures have been enacted to address sea turtle interactions in some fisheries, there are still substantial levels of interactions in those and other fisheries. Limitations in applicability, resources, and industry acceptance and compliance in many cases present very real limitations on implementing demonstrated conservation measures in an effective manner.

<u>Comment 41:</u> One commenter noted that Federal negligence to design and execute appropriate loggerhead recovery efforts is a routinely overlooked threat to loggerhead survival. However, the commenter believes these failures can simply be corrected by harmonizing the conservation recommendations of ESA mandates with permitted incidental take. The commenter suggested better integration of three integral agency actions – mandatory species recovery plans, ESA section 7 Biological Consultations, and incidental take (both Incidental Take Permits for State and private actions and Incidental Take Statements for Federal agency actions) – to facilitate the recovery of the loggerhead sea turtle. Specifically, the commenter stated the belief that crucial recommendations in recovery plans are routinely ignored during section 7 consultations and incidental take authorizations and urged NMFS to reassess its internal recovery management strategy (e.g., reinitiating section 7 consultation when necessary not just when authorized take limits are exceeded) to meet the recovery needs of loggerheads.

<u>Response:</u> Although the commenter is referring to actions taken subsequent to the listing, the Services point out that the "three integral agency actions" cited by the commenter are and will continue to be integrated. The "ESA section 7 biological consultations" and incidental take are both part of the same action for a Federal agency action. Incidental take is authorized by section 7 Biological Opinions, which are formal ESA consultations that occur when take is anticipated from a Federal action. Section 10(a)(1)(B) provides a mechanism when an action is being undertaken by a non-Federal entity that results in incidental take of a species; section 10(a)(1)(A) provides a mechanism for exempting directed take for scientific purposes. Recovery plans are important tools in the species conservation and recovery and provide

recommendations at a broader scale and are used as guidelines but are not regulatory. Reasonable and Prudent Measures and Terms and Conditions, in Biological Opinions are project specific and are intended to minimize the effects of the incidental take on a species. Reinitiation of section 7 consultations takes place when: the amount or extent of take specified in the incidental take statement is exceeded; new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; and a new species is listed or critical habitat designated that may be affected by the identified action.

Comment 42: One commenter believes that permitting incidental take in the face of uncertainties in baseline loggerhead life history parameters and population estimates suggests existing regulatory mechanisms are inadequate. Specifically, the commenter stated the belief that data for both sexes of loggerheads at all life stages (growth rate, size, dispersal, etc.) are either nonexistent or inadequate, significantly curtailing their value for modeling.

Response: The Services agree that there remain substantial gaps in knowledge regarding loggerhead life history parameters; however, the ESA requires us to use the best scientific data available when making a listing determination. Although significant measures have been enacted nationally under existing regulatory mechanisms, it is not yet possible to determine whether the measures are sufficiently effective as many of the most significant measures have come within the last generation of loggerheads, and thus the benefits may not yet be seen in the nesting trends. We have determined that additional work needs to be done under the existing national regulatory mechanisms, as well as continuing to advance the development and effectiveness of international instruments, to ensure the persistence of this DPS.

Comment 43: One commenter questioned the analysis of loggerhead survival rates in the Status Review. The commenter noted that the natural survival rate for neritic adults (i.e., large prebreeding and breeding males and females) is stated to be 95 percent in all DPSs. The Status Review also stated that anthropogenic mortalities for neritic juveniles and adults in the proposed Northwest Atlantic Ocean DPS are between 13 percent and 50 percent of the 95 percent of loggerheads left after natural mortality is subtracted. In other words, using the high end of the anthropogenic mortality estimate in the Status Review, approximately 52.5 percent of the proposed Northwest Atlantic Ocean DPS neritic juvenile and adult population dies annually. The TEWG estimated the neritic juvenile and adult population of the proposed Northwest Atlantic Ocean DPS to be 230,000. Given that, the Status Review asserted that 120,750 neritic juveniles and adults from this population die annually, almost entirely because of anthropogenic mortality. Yet the Status Review admitted that the largest source of mortality in the proposed Northwest Atlantic Ocean DPS, fishery bycatch, totals only 3,743 turtles annually.

Response: The Status Review document prepared by the BRT was only one of many sources of information considered by the Services to make the listing status determination. The mortality estimate used for that particular threat analysis was based upon a majority opinion of experts comprising the BRT, but it was not a consensus opinion. Another study estimated that total annual mortality (natural and anthropogenic) for the neritic juveniles was 17 percent, with a range of 11–26 percent (Braun-McNeill et al., 2007). However, another preliminary study determined that adult female survivorship from the Northwest Atlantic Ocean DPS may be a significant concern. That study estimated annual survivorship of adult females to be as low as

0.41 (0.20–0.65, 95 percent confidence intervals), and at best 0.60 (0.40–0.78, 95 percent confidence intervals) (NMFS, unpublished data). Additional research to better understand survival rates for the various life stages is a high priority for the Services.

Comment 44: One commenter believes the justification for listing the Northwest Atlantic Ocean DPS as endangered by evaluating other natural or manmade factors is missing. The commenter noted several threats for which effects were not quantified adequately or inappropriately assessed, such as vessel strikes, changing weather (e.g., hurricanes and cold stun events), habitat change, saltwater cooling, and bycatch. Specific to bycatch in the shrimp fishery, the commenter provided a population calculation for Northwest Atlantic loggerheads based on annual bycatch in all fisheries and questioned how take of 0.17 percent of the population is likely to result in an endangered listing.

Response: The Services disagree that an evaluation of other natural or manmade factors was missing. In many cases, there are substantial data limitations that prevent in-depth, quantitative analysis of threats, including those listed by the commenter. The five-factor analysis for listing determinations is based on consideration of all of the factors, using the best data available.

Comment 45: The State of Florida referenced the Witherington et al. (2009) analysis of the Index Nesting Beach Survey data set that concluded the causal factor that best fit the nesting decline was fisheries bycatch. The State judged the magnitude, timing, and ongoing nature of fisheries threats to be consistent with the steep decline in nesting following 1998. The State believes the full scope of threats and impacts remain poorly understood as evidenced by the recent discovery of unexpectedly high mortality rates of sea turtles in the Gulf of Mexico reef fish bottom longline fishery. The State does not believe the threat posed by fisheries bycatch is likely to abate significantly in the foreseeable future.

Response: Inclusion of nesting data up through 2010 results in the nesting trend line being slightly negative, but not significantly different from zero. The Services agree that fisheries bycatch is one factor that best fits the nesting decline seen in the past. However, various fishery bycatch reduction measures have occurred within the last generation time for loggerhead sea turtles, and the benefits of those actions may only now be starting to become evident on the nesting beaches. The agencies are committed to reducing fisheries bycatch further.

Comment 46: The North Carolina Division of Marine Fisheries and the State of South Carolina suggested that instead of reclassifying Northwest Atlantic loggerheads as endangered, existing measures (e.g., TEDs, circle hooks, time/area closures) should be broadened or modified to apply to problem gears or areas. Additionally, the North Carolina Division of Marine Fisheries believes that annual catch limits and accountability measures under the Magnuson-Stevens Fishery Conservation and Management Act will result in lower harvest levels, reduced fishing effort, closed areas, and shorter seasons, all of which will decrease potential for sea turtle bycatch.

Response: A variety of conservation measures for fisheries and non-fishery activities have been enacted in many areas, including in the Northwest Atlantic, and many within the past generation of loggerhead sea turtles. Additionally, many fisheries, especially the shrimp trawl fisheries in the Northwest Atlantic Ocean and Gulf of Mexico, have experienced substantial declines, thus potentially reducing impacts to sea turtles. The benefits of those fishery reductions, if permanent, combined with conservation actions, if sufficiently effective, may only now, or may soon, begin to become evident on the nesting beaches. The agencies are committed to reducing fisheries bycatch further regardless of the listing status.

Comment 47: Two commenters noted that loggerheads are at risk from fisheries using longlines, trawls, gillnets, hooks and lines, dredges, and assorted other types of gear, citing mortality estimates in the 2008 Recovery Plan for Northwest Atlantic loggerheads. Additionally, the commenters noted that an unknown number of animals also sustain serious and moderate injuries in other fisheries. The commenters referenced Wallace et al. (2008), which concluded that turtles killed in U.S. waters are larger and more valuable to the population; therefore, the failure of NMFS to reduce fishery interactions is significantly undermining the survival of Northwest Atlantic loggerheads. Further, the commenters noted the 2008 Biological Opinion on the Gulf of Mexico reef fish fishery, which states that the population "is likely to continue to decline until large mortality reductions in all fisheries and other sources of mortality (including impacts outside U.S. jurisdiction) are achieved."

Response: The Services agree that fishery bycatch is a significant threat to sea turtles, including Northwest Atlantic loggerheads, and that substantial gaps remain in our understanding of take and mortality levels for many fisheries. Various fishery bycatch reduction measures have occurred within the most recent generation of loggerhead sea turtles, including technological measures, time/area closures, and effort reductions. Additionally, some U.S. fisheries that incidentally capture loggerhead turtles have experienced effort declines within that time. The benefits of those actions may only now be starting to become evident on the nesting beaches. NMFS is committed to reducing fisheries bycatch further to conserve loggerhead sea turtles, regardless of the listing status of the Northwest Atlantic Ocean DPS.

Comment 48: Three commenters referenced recent data showing 1,451 loggerhead mortalities in the Southeast U.S. and Gulf of Mexico shrimp trawl fleets, indicating this fishery is the leading cause of mortality for Northwest Atlantic loggerheads.

Response: The Services agree that taking measures to limit sea turtle interactions with fisheries, including the U.S. shrimp trawl fishery, is a top priority for sea turtle conservation. NMFS is currently working on a new consultation for the shrimp trawl fishery, a rule to require TEDs in certain mid-Atlantic trawl fisheries, and a rule to require TEDs in skimmer trawl fisheries. NMFS continues to work with the coastal States to improve TED enforcement.

Comment 49: Two commenters highlighted the bycatch of hundreds of loggerheads in the Gulf of Mexico reef fish bottom longline fishery, citing NMFS 2005 and 2009 biological opinions. The commenters noted the particularly lethal nature of takes in this fishery because turtles become hooked while too deep and cannot reach the surface to breathe. Additionally, the commenters stated that gillnet interactions represent the greatest unknown for turtles because there is no estimate of the total numbers of interactions occurring or the mortality sustained by loggerheads in gillnets as observer coverage in many fisheries is so low and State fisheries are often not observed or regulated. The commenters further noted that as observer coverage increases, actual take levels and authorizations are regularly revised upward. However, another commenter disagreed with the Services' statement that "gillnets, longlines, and trawl gear collectively result in tens of thousands of Northwest Atlantic loggerhead deaths annually throughout their range" especially with regard to the pelagic longline fleet. Additionally, yet another commenter stated that measures, particularly shrimp TEDs, modifications to longline gear and practices, and gillnet reductions, have progressively reduced the threat facing juvenile and adult loggerheads by orders of magnitudes and weigh strongly against a change in listing status.

Response: NMFS has enacted various efforts over the years to reduce bycatch and mortality rates in domestic fisheries, and has engaged other nations bilaterally and through larger international organizations in efforts to reduce sea turtle bycatch overseas. Such efforts continue to be a top priority for the agency. This includes reductions in take, and mortality rates, for the Gulf of Mexico reef fish bottom longline fishery enacted in 2009. However, the effect of those measures are yet to be determined as many of the most significant measures have come within the last generation of loggerheads, and thus the benefits may not yet be seen in the nesting trends. The Services are committed to enacting additional measures to reduce anthropogenic impacts. NMFS also continues to undertake efforts to increase the understanding of interaction levels and impacts of the many Federal and State fisheries through means such as the 2007 ESA Sea Turtle Observer Rule (72 FR 43176; August 3, 2007).

The level of take authorized under the ESA is based upon an analysis of the anticipated take from the proposed action. Upward revisions of take occur when new data indicate that take levels are higher than previously anticipated. That new expected take level is then analyzed to determine if it would jeopardize the continued existence of the species, and often additional terms and conditions are required as part of the new biological opinion that could result in additional or different limitations or gear restrictions for the fishing industry.

Comment 50: The State of Maryland provided information on loggerhead strandings documented from May to November from 1991–2009 along the Chesapeake Bay and Atlantic

Coast. Of the 378 dead loggerhead strandings, less than 3 percent of strandings with evidence of human interaction exhibited signs of fishery interaction. The Maryland Department of Natural Resources conducts fishery-dependent and independent surveys each year and rarely finds turtles associated with either of these surveys.

Response: The Services are aware that there is variability, both geographically and temporally, in the instances of fishery interactions with loggerheads in coastal waters. Evidence of human interaction in stranded turtles is difficult to ascertain, especially if the examination is limted to externally observable anomalies. Bycatch mortality due to drowning is not apparent through external examination, and turtles captured in gear, such as trawls or gillnets, are most often removed from the gear and, as such, do not strand with gear attached. This makes it difficult to use the referenced stranding data to ascertain rates of fisheries interactions. The Services believe that fisheries bycatch is the leading source of anthropogenic mortality in U.S. waters.

Comment 51: Five commenters cited information on the threat of direct and indirect effects of oil, as well as the actions to contain, remove, and disperse oil, on sea turtles. Two of these commenters noted that while the preamble of the proposed rule discusses the threat posed by oil spills, it was published prior to the Deepwater Horizon oil spill in the Gulf of Mexico. Additionally, three of the commenters noted that the total number of loggerhead sea turtles harmed by the spill is likely higher than observed numbers. Another commenter provided information on the impacts of the 2010 Deepwater Horizon oil spills on loggerheads.

Response: The full scope and effects of the 2010 Deepwater Horizon (Mississippi Canyon 252) oil well blowout and uncontrolled oil release on sea turtles in the Gulf of Mexico, including Northwest Atlantic Ocean DPS loggerheads, is not yet determined.

Comment 52: Three commenters believe that plastic ingestion poses immediate threats and risks to Northwest Atlantic loggerheads. The commenters provided detailed information to support this.

Response: The Services agree that plastic ingestion is a threat to Northwest Atlantic Ocean DPS loggerheads as well as other DPSs and species. Discussion of this threat was added to the "Other Manmade and Natural Impacts" section under the analysis for Factor E (Other Natural or Manmade Factors Affecting its Continued Existence) in the five-factor analysis.

Comment 53: One commenter questioned why "geopolitical complexities" contribute to a listing determination given that all populations are within the U.S. and subject to the Convention on International Trade in Endangered Species of Wildlife Fauna and Flora (CITES), the International Commission for the Conservation of Atlantic Tunas (ICCAT), etc.

Response: Although the majority of Northwest Atlantic Ocean DPS nesting is within the United States, and a significant portion of adult and sub-adult stages are spent in U.S. waters, the wide-ranging habits of the species still results in significant exposure to pressures outside of U.S. jurisdiction. The existence of various international conventions (e.g., CITES) and organizations (e.g., ICCAT) are valuable tools, as pointed out by the commenter. However, advances made in reducing bycatch in foreign nations via these instruments are still limited, in need of strengthening and expansion, and in many cases tenuous as a result of political uncertainties.

Comments on the Status and Trends and Extinction Risk Assessments of the DPSs

Comment 54: One commenter believes that neither of the methodologies used in the 2009 Status Review provided the necessary "convincing evidence" of near-term extinction of loggerheads, either globally or in the Northwest Atlantic Ocean DPS. The commenter believes that neither of the two models employed were geared toward the legally relevant factors, and thus do nothing to further the inquiry as to the imminence of loggerhead extinction. The commenter believes that the models used do not meet the ESA standard that the Services use the best available scientific and commercial data. Thus, as a legal matter, the commenter believes that a change in listing status is not warranted by the best scientific and commercial data available. Another commenter believes that models are an inappropriate tool to measure fluctuating population trends and predict extinction.

Response: The Services have clarified the text in the Extinction Risk Assessments section to more clearly state that the SQE and threat matrix analyses were only used to provide some additional insights into the status of the nine DPSs, but that ultimately the conclusions and determinations made were primarily based on an assessment of population sizes and trends, current and anticipated threats, and conservation efforts for each DPS. However, for a number of reasons, discussed in the Finding section, the Services are listing the Northwest Atlantic Ocean DPS as threatened.

Comment 55: Given the species' life history, one commenter expressed concern that any positive trends in the adult segment of the Northwest Atlantic population as a result of conservation efforts over the last 15 years would not be apparent until 2020 and beyond. The North Carolina Division of Marine Fisheries also stated that conservation measures (e.g., TEDs) from the 1980s should have positive effects on the segment of the population that is just now becoming sexually mature; therefore, it would be prudent to allow enough time to evaluate whether those conservation measures have worked before taking further action. Similarly, a third commenter stated that the most recent and effective management measures have and will continue to have beneficial impacts that will not be seen on beaches for decades.

Response: The Services agree that the effects of most conservation measures will not be apparent for many years given the loggerhead's prolonged age to maturity. Although individual conservation measures should have a positive effect on a population, in many cases it would be difficult to clearly determine the effect of any individual conservation activity due to the many different conservation efforts being undertaken simultaneously. Collectively, however, conservation efforts should result in a positive effect on a population as long as the key threats have been sufficiently targeted. For a number of reasons, discussed in the Finding section, the Services are listing the Northwest Atlantic Ocean DPS as threatened. However, the Services do not believe it would be prudent to wait to see the results of conservation efforts that have been implemented before taking any additional actions to protect the species given the species life history. Further, under the ESA, the Services are required to make determinations based on the best available scientific and commercial data, and not wait to determine whether measures already implemented are effective at ameliorating threats.

Comment 56: The Services received several comments relative to in-water abundance and population size. One commenter questioned why the Status Review did not consider existing in-water survey data, which show an increase in loggerhead populations, as reported in the 2009 TEWG Report. Another commenter noted that both Epperly et al. (2007) and the SEAMAP survey show an increase in juvenile loggerheads. Both of these commenters stated that the Services should not proceed until a major survey of in-water abundance is undertaken, and that the Services should wait to make a final decision until additional data were available.

Response: It would not be appropriate for the Services to wait for additional in-water data to become available before proceeding with this final rule. Under the ESA, the Services must base each listing determination solely on the best available scientific and commercial data after conducting a review of the status of the species and taking into account any efforts being made by States or foreign governments to protect the species. The Services were petitioned to list the North Pacific and Northwest Atlantic populations as DPSs under the ESA. The Services must respond to petitions within statutory deadlines. We do not have the latitude to defer listing decisions until additional information becomes available.

Although the Services did consider available data from in-water studies within the range of the Northwest Atlantic Ocean DPS in its assessment of population status, extrapolation of these localized in-water trends to the broader population, and relating localized trends at neritic sites to population trends at nesting beaches, is a problem of scale and requires the integration of many representative foraging grounds throughout the population range (Bjorndal et al., 2005). NMFS and USFWS (2008) summarized trend data available from nine in-water sampling programs along the U.S. Atlantic coast. Four studies indicated no discernible trend, two studies reported declining trends, and two studies reported increasing trends. Trends at one study site indicated either a declining trend or no trend depending on whether all sample years were used or only the more recent, and likely more comparable, sample years were used. TEWG (2009) used raw data from six of the aforementioned nine in-water study sites to conduct trend analyses and found three with positive trends, two with a negative trend, and one with no trend. The TEWG did not provide a shared agreement about the weighting of these data, nor did they establish how representative these programs were of the larger population. As a result, caution must be exercised in evaluating results from all of the above referenced studies, given the relative short-term duration of most of the studies, noted difficulties in comparisons of trend data across disparate sampling periods, changes in sampling methodologies and equipment, small study areas, and uncontrolled variables such as weather, sea-state, migration patterns, and possible shifts in loggerhead distributions.

Comment 57: One commenter referenced Northeast Fisheries Science Center (2011) (Preliminary Summer 2010 Regional Abundance Estimate of Loggerhead Turtles (Caretta caretta) in Northwestern Atlantic Ocean Continental Shelf Waters) and suggested that the Services incorporate this new information into the final rule.

Response: The Services agree and have incorporated this information into the Status and Trends of the Nine Loggerhead DPSs section of this final rule.

Comment 58: One commenter stated that the Status Review never assessed the status of the proposed Northwest Atlantic Ocean DPS as a whole; rather the analysis focused solely on specific indices. Thus, the commenter stated the opinion that no finding was ever made as to whether the proposed DPS is in danger of extinction. The commenter also stated there was no analysis of the timeframe in which extinction is likely to occur, which is the primary factor distinguishing a threatened from an endangered species under the ESA. Therefore, the commenter recommends that the appropriate response would be to find that there is not sufficient evidence to justify reclassifying Northwest Atlantic loggerheads as endangered.

Response: Both modeling approaches assessed the Northwest Atlantic Ocean DPS as a whole; the indices used were based on the population. The commenter is correct in saying that the models did not find that the proposed DPS was in danger of extinction. The models also did not find that the DPS was increasing. The Status Review simply stated that the model outputs indicated that the DPS may be declining without us detecting the decline. However, for a number of reasons, discussed in the Finding section, the Services are listing the Northwest Atlantic Ocean DPS as threatened.

Comment 59: One commenter stated that she does not believe that a proportional decline in the population is the appropriate definition of extinction when other information exists. Specifically, the commenter did not agree that listing decisions should depend solely on whether the population will decline to 50 percent, 30 percent, or 10 percent of its current or historical population size, but should instead be based on more quantitative listing criteria whenever possible. The commenter further noted that stochastic population models have indicated that population size and trend are the best focus in determining listing status and provided several references.

Response: Stochastic population models are useful when we have information on the magnitude of stochasticity. We incorporated the uncertainty in the threat matrix analyses. Because of the late maturity of the species, only small additional mortality can be tolerated for a population of loggerhead sea turtles. Because of the large uncertainties in additional mortalities from a wide variety of threats, a population of loggerheads can be increasing or decreasing rapidly. The observed trend at nesting beaches may not reflect what happens at sea.

Comment 60: One commenter questioned whether a decline to 30 percent by itself warrants listing any species under the ESA regardless of the population size when at 30 percent. In the case of the Northwest Atlantic Ocean DPS, in 2007 (the lowest nesting activity in the series) the adult population size of all recovery units combined was approximately 30,000 adult females (TEWG, 2009). Thus, a quasi-extinction threshold (QET) of 0.3 of that number translates to a decline to, or below, 10,000 nesting females (or 20,000 adult females and males combined) within 100 years, if the model was initialized with the 2007 numbers, not the 1998 numbers, which were greater. The commenter asked whether a population of 10,000 adult females 100 years later warrants endangered or threatened status.

Response: The Services believe that population size is just one piece of information to be taken into consideration when considering the status of a species. Although the SQE and threat matrix analyses provided some additional insights into the status of the nine DPSs, ultimately the conclusions and determinations made were primarily based on an assessment of population sizes and trends, current and anticipated threats, and conservation efforts for each DPS.

Comment 61: One commenter believes the SQE analysis used outdated, qualitative estimates of risk factors that fail to incorporate significant changes in fishing effort and management measures that have drastically reduced take and mortality.

Response: The SQE analysis did not use risk factors. Fishing effort or management measures were not relevant to the SQE analysis.

Comment 62: One commenter believes that because the SQE analysis relies exclusively on nesting beach surveys, it is retrospective and considers only mature females thereby failing to capture important indicators of current abundance.

Response: The Services agree that because the SQE analysis relied on nesting beach surveys, it is retrospective and considers only mature females. That is why the BRT also conducted the threat matrix analyses to provide insight into the future outlook for each DPS, given the known threats and loggerhead sea turtle biology.

Comment 63: One commenter recommended that the Services update the model to include nesting data through 2008 for the Northwest Atlantic Ocean DPS, Peninsula Florida Recovery Unit, and the North Pacific Ocean DPS and through 2008–2009 for the Indian Ocean DPS as data were provided by an independent reviewer of the Status Review. The commenter stated the belief that including these data will change the model's results. Another commenter also requested that the Services update the model to include 2008 nesting data. A third commenter noted that nesting beach abundance data for the North Pacific Ocean DPS exhibit a long-term increasing trend. Additionally, this commenter noted that in the Snover model, the North Pacific population ranked 0.3 on the SQE index, thus indicating that it is at risk (i.e., "threatened"). The model used a single composite time series of nesting counts for 1990–2007, which likely underestimates a strong recovery trend because it does not include 2008 and 2009 nesting data. A fourth commenter also noted that most major nesting beaches for which pre-1990 nest count data are available show a consistent lower trend in the latter half of the 1980s compared to the early 1990s, raising the question of whether 1990 may have been an anomalous year with high nesting activity.

Response: The Services have included the most recent nesting data available for each DPS in the Status and Trends of the Nine Loggerhead DPSs section. For the Northwest Atlantic Ocean DPS, the nesting data for 2008–2010 were incorporated into the nesting trend analyses, and the result indicated that the nesting trend for this DPS from 1989–2010 is slightly negative but not statistically different from zero. Available data for the North Pacific Ocean DPS suggest this DPS has declined up to 90 percent from its recorded historical population size of about 50 years ago. The 2010 estimate of the number of nests suggests the abundance of nesting females has returned to earlier levels (ca. 1990); however, this level is still low relative to the historical population.

Comment 64: One commenter noted that the Status Review model used a constant parameter for the number of nests laid per female per season for the next 100 years. The commenter stated that this was inappropriate because older females produce more nests per season than new nesters. Therefore, the commenter stated the belief that the model fails to account for the large number of females that are about to be added to the breeding population and the possibility of a naturally fluctuating decrease that may follow.

Response: Because the models were not age-specific, the BRT did not incorporate age-specific demographic parameters. Such an exercise is important for demographic studies but not for determining effects of possible threats to a population, as those uncertainties would be overwhelmed with much greater uncertainty in threat measures. The parameters of the base model in the threat matrix analyses were derived from the basic biology of loggerhead sea turtles, rather than what may happen in the future.

Comment 65: One commenter stated that the application of the diffusion approximation model was so flawed as to make the results unusable and provided a detailed analysis of these flaws. The commenter questioned why the Services did not specify a population threshold or range that below which the population could not survive. The commenter also contended that the Services did not provide direct probability estimates of extinction; instead the Services provided susceptibility to quasi-extinction.

Response: The Services agree that the diffusion approximation approach has limitations as do any other approaches used to estimate possible extinctions of a population. That is why we also conducted the threat matrix analyses to provide insight into the future outlook for each DPS, given the known threats and loggerhead sea turtle biology. The Services have clarified the text in the Extinction Risk Assessments section to more clearly state that the SQE and threat matrix analyses were only used to provide some additional insights into the status of the nine DPSs, but that ultimately the conclusions and determinations made were based on an assessment of population sizes and trends, current and anticipated threats (i.e., five-factor analysis), and conservation efforts for each DPS.

Comment 66: One commenter stated that neither the Status Review nor the Services dealt with the actual abundance of loggerhead sea turtles or bothered to develop a numeric value to define "quasi-extinction" based on known biological characteristics of loggerheads. Rather, the Status Review included relative estimates of potential decline in its SQE analysis. Further, the analysis relied solely on nesting data as the only empirical input. Because sea turtles are both long-lived and late maturing, this analysis completely ignored the myriad efforts implemented over the past 20 to 30 years to reduce anthropogenic mortality and increase survival, of which the benefits to conservation of juvenile loggerheads have yet to influence adult numbers. This math-rich, but data-poor approach does not address relevant legal criteria.

Response: The BRT included all available information in the threat matrix analysis approach and used mathematics as a tool to explain how these data are related to the results provided in the Status Review rather than treating them as separate entities. The BRT also considered the time-lag effects of the long-lived and late maturing nature of the species through the matrix modeling approach.

Comment 67: One commenter disagreed with using 100 years in the diffusion approximation model given that scientists who support this concept recommend limiting the number of years to 2.5 times the number of years for which nesting survey data are available (i.e., 50 years based on the 20 years or less of nesting data in the Status Review). The commenter stated that, using the current model, the population size of the Peninsula Florida Recovery Unit within the Northwest Atlantic Ocean DPS in 100 years would still approach 1 million loggerheads, which does not suggest an immediate risk of extinction.

Response: Because loggerhead sea turtles are likely to mature at greater than 30 years of age, the BRT used the time period of 100 years to compute QETs, which is consistent with the IUCN Red List Criteria for estimating extinction risk (3 generations or 100 years, whichever is shorter). To incorporate the uncertainty of parameter estimates in determining SQE, the BRT used 95 percent confidence limits of the arithmetic mean of the log population growth rate and the variance of the log population growth rate, which accounts for sources of variability, including environmental and demographic stochasticity, and observation error.

Comment 68: One commenter stated that the diffusion approximation model produced results outside appropriate and acceptable boundaries and contended that the Services did not evaluate the model assumptions to determine whether the results were within appropriate boundaries.

Response: The Services believe the assumptions made for the diffusion approximation model were appropriate for the modeling exercise conducted by the BRT. For further information on the assumptions for the diffusion approximation model, see Conant et al. 2009, section 4. The Services have clarified the text in the Extinction Risk Assessments section to more clearly state that the SQE and threat matrix analyses were only used to provide some additional insights into the status of the nine DPSs, but that ultimately the conclusions and determinations made were primarily based on an assessment of population sizes and trends, current and anticipated threats, and conservation efforts for each DPS.

Comment 69: One commenter noted that there is no universal definition or numerical value of the QET, but it is generally defined as a small population that is doomed to eventual extinction. The commenter provided specific information from Morris and Doak (2002) on the range of QET values, starting at 1 (extremely low), including 20 and 50, and continuing to a much larger value of 100 breeders and noted that typically QET values are less than 500 individuals, breeders, or females. The commenter suggested that the Services make informed decisions about the QET for sea turtles and use population size. The commenter provided an example of susceptibility of quasi-extinction for Kemp's ridley sea turtles to support this point. The commenter recommended using a QET of 1,000 (or lesser value) adult female loggerhead population size. The commenter provided a new analysis of various SQE values using QET levels ranging from 10,000 to 50 adult females. The Peninsular Florida Recovery Unit is the largest in the Northwest Atlantic Ocean DPS (80 percent of nesting occurs in this recovery unit) and it drives the dynamics of the DPS. Based on the revised SQE analysis, the commenter expressed the opinion that there is little risk (SQE<0.3) that the Peninsular Florida Recovery Unit, and therefore the Northwest Atlantic Ocean DPS, will fall to or below the threshold of 1,000 adult females in 100 years. Similarly, the commenter stated the South Atlantic Ocean DPS is not at risk of dropping below 1,000 adult females, whereas the North Pacific Ocean DPS and the South Pacific Ocean DPS are at risk. The commenter stated that the conclusions are the same when QET is set at 500 and 250 adult females, but begin to differ when QET is 100 or less (fewer DPSs are at risk).

Response: The SQE analyses only provided information on what has happened and what may happen if the same trend continues in the future. Consequently, the Services do not rely solely on the SQE analysis in the decision-making process. The Services have clarified the text in the Extinction Risk Assessments section to more clearly state that the SQE and threat matrix analyses were only used to provide some additional insights into the status of the nine DPSs, but that ultimately the conclusions and determinations made were primarily based on an assessment of population sizes and trends, current and anticipated threats, and conservation efforts for each DPS.

Comment 70: One commenter noted that when the impact of the scallop fishery on loggerhead sea turtles was last assessed, NMFS undertook an analysis that looked at the probability of extinction in terms of the time to quasi-extinction. This report was conducted in the context of an ESA section 7 consultation to determine whether the fishery could lead to "jeopardy." The basic findings, utilizing the same nesting trends and similar modeling techniques as relied upon by the 2009 Status Review and very conservative (i.e., precautionary high) estimates of takes by the scallop fishery, were that the likelihood of quasi-extinction over a 75-year period was zero, and the likelihood at 100 years was only 0.01. The commenter noted that neither the BRT nor the Services made a comparable quantitative finding of the likelihood of near-term extinction with respect to loggerheads as a global species or as a species within any of the newly proposed DPSs.

Response: The Services believe the analyses conducted were appropriate and tailored to the best available information (see section 4 of the 2009 Status Review (Conant et al. 2009)). The Services have clarified the text in the Extinction Risk Assessments section to more clearly state that the SQE and threat matrix analyses were only used to provide some additional insights into the status of the nine DPSs, but that ultimately the conclusions and determinations made were primarily based on an assessment of population sizes and trends, current and anticipated threats, and conservation efforts for each DPS.

Comment 71: Comments were provided with respect to survey methods and how the resulting data are used in the listing process for the North Pacific Ocean DPS. One commenter stated that the proposed rule is internally inconsistent and unjustifiably relies on questionable long-term data. For example, the Kamouda Beach 1955–1992 data only covers 500 m of beach, is unreliable, and does not outweigh standardized data collection from 1990 to present. Another commenter stated that individual beach level data should be used to ameliorate the distorting effects of inconsistent survey methods, which likely skew results when combining Japanese nesting beach data into a single time series. This commenter suggested the Services revise the Status Review and extinction analysis using individual nesting beach data for longer time periods, which would likely produce different, more positive results. The proposed rule recognizes the positive nesting trend, but states "nesting beach count data for the North Pacific Ocean DPS indicated a decline of loggerhead nesting in the last 20 years.

Response: The Services used the best available information in assessing population trends for the North Pacific Ocean DPS. Population size trends for this DPS rely on nesting beach counts at a number of nesting beaches in Japan. Overall counts in the early 1990s approached 7,000 nests, declined to a low point in the mid-1990s (just over 2,000 nests), and between 2008 and 2010 have ranged from approximately 7,000 to 11,000 nests. A long-term dataset available from a single beach (Kamouda, Japan) documents turtle emergences from 1954 to at least 2004. While these emergence counts include both nesting emergences and non-nesting emergences (false crawls), they have a relationship to the number of nests, and thereby to nesting females. As such, it is the longest continual index of adult females in the North Pacific population, and these data suggest a decline of approximately 90 percent in turtle emergences at the site over the 50-year period. Given historical records overall, during the last half of the 20th century, over fewer than three generations, the size of the nesting population in Japan has declined between 50–90 percent.

Comment 72: Four commenters stated that they did not agree with the expert opinions used in the Status Review threat matrix model. One of the commenters questioned the validity of this approach and cited one of the Status Review peer reviewer's comments to support their opinion as well as a National Research Council report noting that models are a "heuristic exercise with little or no real power for prediction." Further, this commenter contended that the experts arbitrarily assigned threat rankings that were inconsistent with actual data. Another of these commenters noted that despite disagreeing on values for anthropogenic mortality in the Northwest Atlantic Ocean DPS, the analysis on extinction risk using population growth rate showed that this DPS cannot withstand much anthropogenic mortality. Yet another of these commenters also stated that the model skewed estimates of anthropogenic mortalities high (e.g., for the scallop fishery, trawl fisheries), leading to a false sense of urgency, primarily because it over-relied on the subjective opinions of experts. In addition, one of the four commenters asserted that threat rankings were arbitrarily assigned mortality values that do not correlate with actual data. Three different commenters indicated that a paper by Dulvy et al. (2004) noted that the available approaches have been subject to considerable debate, but this suggests that deference to the scientific expertise of those knowledgeable about loggerhead sea turtles, such as the BRT, is required. These three commenters noted that general criticisms, such as the fact that loggerhead sea turtles may be numerous, are not sufficient to undermine the BRT's report and are not based on the best available science. For example, Dulvy et al. (2004) stated that the decline of an abundant species may represent a massive biomass loss that may be of greater concern than the loss of a small number of individuals of a rare species because it may compromise the ecosystem's functionality, stability, or resilience. These three commenters stressed that scientists with intimate knowledge both of loggerhead sea turtles and their ecosystem must be able to use their scientific opinions to analyze the status of the species.

Response: As stated in the Status Review, known anthropogenic threats to each life stage of a DPS, measured as additional annual mortality, were quantified using both available data and experts' opinions, where the stage-specific additional annual mortality was summarized in a matrix format (threat matrix). The BRT loggerhead sea turtle experts estimated threat levels based on the best information available. Justifications and references for each threat were provided in the Status Review and in the online threat matrix spreadsheets [http://www.nmfs.noaa.gov/pr/species/statusreviews.htm].

The threat matrix analysis was not used to predict the population trends. The National Research Council (2010) review is correct in that the threats matrix analysis was used as a heuristic exercise to show that the current knowledge about loggerhead sea turtle biology and anthropogenic mortalities is not sufficient to make precise conclusions about the future. In the

Status Review, the BRT stated "…these indices were used to measure the negative effects of known anthropogenic mortalities on the overall health of each DPS and not to estimate the actual population growth rates of these DPSs."

Comment 73: One commenter stated the belief that the BRT incorporated the most pessimistic and conservative assumptions in its analyses. For example, with respect to the assumptions made in the threat matrix analysis, the BRT stated that "we used the precautionary principle for characterizing the threat level." For the SQE analysis, the commenter stated that the BRT ignored the model developers' use of 0.4 as the critical value, which was found to balance the risk of making both Type I and Type II errors, opting to reduce that value to 0.3. This had the effect of increasing the chances of finding risk where none exists. The commenter stated that all assumptions incorporated in the models were skewed toward findings of endangerment. The commenter noted this approach could be suitable, and perhaps even required, in the context of a section 7 consultation, where the question is whether a Federal action is or is not likely to result in jeopardy to a listed species. However, the commenter argued that it is legally inappropriate in the context of a listing decision. The commenter noted that the Services are required to use the best scientific and commercial data available, not data skewed toward a particular result. In the present case, the commenter stated that the BRT failed to utilize both basic biological and population dynamics expertise. Further, the commenter noted that contrary information, such as the TEWG's findings with respect to the increase in juvenile abundance and the newer nest numbers, was ignored.

Response: The BRT clearly explained its rationale for using the SQE value of 0.3 as follows: "Using simulations, Snover and Heppell (2009) demonstrated that SQE values greater than 0.4 indicated a population has >0.9 probability of quasi-extinction. At this critical value (SQE = 0.40), Type I and Type II errors are minimized simultaneously at approximately 10%. Reducing the critical value to 0.3 lessens the 'Type I' error rate but increases the 'Type II' error rate (Snover and Heppell, 2009). The choice of 0.9 as the cut-off probability was arbitrary, and values other than 0.9 could be used. However, new critical values other than 0.4 needed to be established for different values of the cut-off probability. Qualitatively, the results would not differ if a value other than 0.9 was used (Snover and Heppell, 2009). In this assessment, we used the cut-off probability of 0.9 as in Snover and Heppell (2009) and a critical value for the SQE of 0.30, which reduced the 'Type I' error (a DPS is considered to be not at risk when in fact it is). SQE values greater than 0.30, therefore, indicate the DPS is at risk." The Services agree with this approach taken by the BRT.

Comments on the Status Determinations for the DPSs

Comment 74: All individuals that sent form letters, as well as 18 organizations or individuals that sent non-form letters, supported the proposed endangered listing status for seven of the DPSs.

Response: While general support or non-support of a listing is not, in itself, a substantive comment that we take into consideration as part of our five-factor analysis, we appreciate the support of these commenters. Support is important to the conservation of species.

Comment 75: Several commenters noted that in the NMFS and USFWS 5-year review for the loggerhead sea turtle (NMFS and USFWS, 2007), the agencies concluded that they do not believe the loggerhead sea turtle should be reclassified; therefore, the 2009 Status Review presents no new information to justify a new "endangered" finding.

Response: In the 5-year review for the loggerhead sea turtle, NMFS and USFWS concluded that, based on the best available information, we did not believe the entire species, as listed worldwide, should be delisted or reclassified. However, we stated that we had information indicating that an analysis and review of the species should be conducted to determine the application of the DPS policy to the loggerhead sea turtle. Subsequently, the BRT reviewed and evaluated all relevant scientific information relating to loggerhead population structure globally to determine whether DPSs exist and, if so, to assess the status of each DPS. The findings of the BRT informed this rulemaking.

Comment 76: One commenter provided an analysis of the distinction between "threatened" and "endangered" under the ESA, referencing a memorandum written by Dan Ashe, USFWS (Ashe Memo). The commenter stated that the key difference is the timing for when the species is in danger of extinction – threatened means may be in danger of extinction in the foreseeable future and endangered means in danger now and on the brink of extinction. The commenter referenced four basic categories included in the Ashe Memo and provided information relative to loggerhead sea turtles as follows: "(1) Species facing a catastrophic threat from which the risk of extinction is imminent and certain. Unlike snail darters, loggerhead sea turtles are found throughout the world making it neither uniquely dependent on a single, vulnerable area nor subject to any impending, catastrophic threat. (2) Narrowly restricted endemics that, as a result of their limited range or population size, are vulnerable to extinction from elevated threats. Conservation efforts for loggerheads in the U.S. and internationally have greatly minimized anthropogenic threats and these threats have been significantly reduced over recent decades. (3) Species formerly more widespread that have been reduced to such critically low numbers or restricted ranges that they are at a high risk of extinction due to threats that would not otherwise imperil the species. Loggerheads do not meet these particular criteria, for many of the same reasons already discussed. Additionally, in the Northwest Atlantic alone, this species numbers in the millions at all life stages. Furthermore, such as in the Tongaland example, local loggerhead subpopulations have shown the ability to recover from levels of only a couple hundred mature females. (4) Species with still relatively widespread distribution that have nevertheless suffered ongoing major reductions in its numbers, range, or both, as a result of factors that have not abated." The commenter noted that protective measures in the form of ever improving TEDs, protective longline gear and practices, time/area closures, and nesting beach improvements and ordinances have gone a long way toward abating threats to loggerhead sea turtles and that the current trend in loggerhead abundance in the Northwest Atlantic is increasing.

The commenter further referenced the Ashe Memo, which says "threatened species typically have some of the characteristics of the fourth category above, in that they too have generally suffered some recent declines in numbers, range or both, but to a less severe extent than endangered species." The Ashe Memo goes on to distinguish between a species that is endangered and one that is threatened and "depends on the life history and ecology of the species, the nature of the threats, and population numbers and trends." The trends for loggerheads, both in terms of increased nesting and reduced threats, not to mention the geographic diversity of nesting habitat, the species' extensive distribution, and the sheer numbers of individuals in the population, all point toward, at most, a "threatened" status.

<u>Response:</u> The Services agree that numerous protective measures have been implemented to protect loggerhead sea turtles in the Northwest Atlantic Ocean. However,

compliance levels with TEDs, high interaction levels and mortalities in many domestic and international fisheries, continued loss of nesting beach habitat, and inadequate development and enforcement of lighting ordinances, to name a few, suggest that many threats are still impacting Northwest Atlantic loggerhead sea turtles and need to be further addressed. With regard to the commenter's assertion that the current trend in loggerhead abundance in the Northwest Atlantic is increasing, inclusion of nesting data up through 2010 results in the nesting trend line being slightly negative, but not significantly different from zero. Regardless, for a number of reasons, discussed in the Finding section, the Services are listing the Northwest Atlantic Ocean DPS as threatened.

Comment 77: Three commenters noted that best available science suggests that focusing solely on biological extinction, or imminent extinction, is not useful from an ecological, management, or ecosystem perspective because even after population declines of more than 95 percent, many marine fishes would still number in the hundreds of thousands or millions of individuals and, therefore, not be considered to be at an increased risk of extinction. The commenters argued that scientists do not understand "how the multitude of factors that influence the extinction probability for a given population or species interact with one another under specific physical and biological environments." They contended that the ESA, by requiring NMFS and USFWS to consider five statutory listing criteria, anticipates the interactions of many factors and provides inherent flexibility in determining whether a species warrants protection as endangered. The commenters stated that requiring that the species face imminent extinction or that the species be on the brink of extinction is neither legally justifiable nor scientifically possible given the current published literature on extinction risk in marine species. The commenters urged the Services to be open to scientists' assessments of extinction risk because these are important to convey that a species' extinction probability has increased and that its probability of recovery is low.

Response: The Services agree that even species that have suffered fairly substantial declines in numbers or range are sometimes listed as threatened rather than endangered, based on the species' resilience and resistance to threats making the species currently less vulnerable to threats. Whether a species is ultimately protected as an endangered species or a threatened species depends on the specific life history and ecology of the species, the nature of the threats, the species' response to those threats, and population numbers and trends.

Comment 78: Two commenters stated that they did not support the proposed endangered listing for North Pacific loggerheads. One of these commenters stated the proposed endangered listing is contrary to established listing practices for other species in similar situations with North Pacific loggerheads (e.g., crested caracara, ribbon seal, northern spotted owl, slickspot peppergrass, chirichua leopard frog, delta green ground beetle, California red-legged frog, southeastern beach mouse, Anastasia Island beach mouse, and Waccamaw silverside minnow). This commenter argued that even though a species may be at risk from significant past and projected habitat destruction, population declines, or elimination from a portion of its range, the Services regularly list a species as threatened when the population declines are not steep and when the threat to the species' ongoing survival is not imminent.

Response: An endangered species is any species which is in danger of extinction throughout all or a significant portion of its range. A threatened species is any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Thus, a species may be listed as threatened if it is likely to become in danger of extinction within the foreseeable future. Threatened species typically have some of the same characteristics as endangered species with relatively widespread distribution that have suffered ongoing major reductions in numbers, range, or both, as a result of factors that have not been abated, in that they too have generally suffered some recent decline in numbers, range, or both, but to a less severe extent than endangered species. Whether a species is ultimately protected as an endangered species or a threatened species depends on the specific life history and ecology of the species, the nature of the threats, the species' response to those threats, and population numbers and trends.

Comment 79: One commenter stated that there is a lack of evidence to support the endangered designation for the North Pacific Ocean DPS. The commenter stated that recent nesting increases are clear evidence that the North Pacific Ocean DPS is increasing, which is inconsistent with the proposed endangered status.

Response: The Services agree there has been an encouraging trend in the annual nesting abundance of loggerheads in Japan. However, relative to historical levels, the annual nesting abundance is very low. The agencies believe the substantial depletion of this population, despite the aforementioned increases, coupled with ongoing threats to loggerheads in the North Pacific, warrants endangered status for the North Pacific Ocean DPS.

Comment 80: Two commenters stated that they do not support listing the Southwest Indian Ocean DPS as threatened and suggested it should be listed as endangered. The commenters noted that although this population is increasing, it remains small and vulnerable. The commenters noted that while the majority of nesting habitat is protected in South Africa and

Mozambique, loggerheads are at risk from direct exploitation, especially in Madagascar, and incidental capture has not yet been quantified. Additionally, dramatic increases in regional longline fishing for tuna are expected to increase loggerhead bycatch.

Response: A trend analysis of index nesting beach data from this region from 1965 to 2008 indicates an increasing nesting population. Although the Services agree that fisheries bycatch is a concern, the extent of this threat is not well understood. In light of the protected status of the majority of nesting beaches and the increasing nesting trend, the Services believe a threatened status is appropriate for the Southwest Indian Ocean DPS.

Comment 81: Thousands of commenters stated that they strongly supported listing the Northwest Atlantic Ocean DPS as endangered, particularly noting that Northwest Atlantic loggerheads are more in need of endangered status to ensure their survival after the recent oil spill in the Gulf of Mexico. Many commenters noted that the majority of Northwest Atlantic loggerheads nest in the United States and represent the second largest nesting assemblage in the world, which makes their survival critical to the future of the species. The States of Florida, Georgia, and Virginia support an endangered status for the Northwest Atlantic Ocean DPS. The North Carolina Department of Marine Fisheries stated that it opposes an endangered listing because appropriate information is lacking. Specifically, the agency stated that it opposes the listing because counts of nests or females are not an assessment of the population. Three other commenters also stated that they oppose listing the Northwest Atlantic Ocean DPS as endangered, arguing that the case for a change in listing status has not been established and the proposed rule should be rejected, particularly for the Northwest Atlantic Ocean DPS.

Response: The Services agree on the importance of the Northwest Atlantic Ocean DPS.

The predominance of nesting in the United States and the extensive use of U.S. coastal and Exclusive Economic Zone (EEZ) waters by adults and large neritic juveniles from this DPS provides us the ability to better control anthropogenic threats to individuals of those highly valuable life stages compared to other DPSs which originate in, and inhabit waters of, other nations over which we have no control. Based on additional review and discussions within the Services on status and trends, threats, and conservation efforts, we do not believe the Northwest Atlantic Ocean DPS is currently “in danger of extinction throughout all or a portion of its range,” and determined that a “threatened” listing under the ESA is more appropriate.

Comment 82: The North Carolina Division of Marine Fisheries stated that there is no accurate way to determine the status of the Northwest Atlantic Ocean DPS because there is no benchmark assessment of the DPS and periodic updates. It suggested conducting an assessment similar to the 2009 bottlenose dolphin stock assessment.

Response: The Services agree that gaps remain in what is known about the population dynamics of the Northwest Atlantic Ocean DPS. The Services continue to evaluate ways to improve population assessments for sea turtles. The Services used the best available data and the most appropriate analyses in assessing the status of the Northwest Atlantic Ocean DPS and making our final determination.

Comment 83: Three commenters stated the belief that the Northwest Atlantic Ocean DPS is “in danger of extinction throughout all or a portion of its range” and therefore must be listed as endangered. The commenters noted that the definition of an endangered species is necessarily forward-looking, as a species “in danger” of extinction is not currently extinct. Rather it is a species facing a risk of extinction in the future. The Northwest Atlantic Ocean

DPS, facing a high probability of quasi-extinction, cannot be merely threatened, because the threatened category is only for species that are not currently in danger of extinction but instead likely to become so in the future.

Response: Based on additional review and discussions within the Services on status and trends, threats, and conservation efforts, we do not believe the Northwest Atlantic Ocean DPS is currently "in danger of extinction throughout all or a portion of its range," and determined that a "threatened" listing under the ESA is more appropriate. Quasi-extinction analyses support the fact that the Northwest Atlantic Ocean DPS is not currently in danger of extinction throughout all or a portion of its range. In one such analysis, a Dennis-Holmes demographic population viability analysis (PVA) was conducted using nesting data through 2009. Quasi-extinction was defined as 1,000 remaining adults (which is higher than is typically used in most PVAs) within 100 years. For a population of 35,000 turtles (approximately the current estimated number of adult females), the risk of reaching that QET was 0.0017, less than two-tenths of a percent (NMFS, unpublished data). A revision of the SQE analysis done in the Status Report written by the BRT had similar results. Including nesting data through 2009 instead of just 2007, and redoing the analysis to use a range of adult female abundance estimates as QETs, it was determined that there was little risk (SQE<0.3) of the Peninsular Florida Recovery Unit (comprising approximately 80 percent of the Northwest Atlantic Ocean DPS) reaching 1,000 or fewer females in 100 years.

Comment 84: Three commenters referenced Center for Biological Diversity v. Lohn, where the court found that uncertainty regarding data used in an ESA section 4 listing determination did not justify failing to list the species, citing Conner v. Burford. The commenters noted that, while data gaps exist for loggerhead sea turtles, this is true for many if not all marine species and cannot excuse the lack of agency action under the ESA to protect loggerhead sea turtles. The commenters noted that with a threatened listing for over 30 years, Northwest Atlantic loggerheads continue to decline; therefore, the Services must grant additional protections to recover the species.

Response: The Services agree and understand that data gaps do not justify failing to list a species under the ESA. Despite the gaps in knowledge, loggerhead sea turtles in the Northwest Atlantic have been, and will continue to be, listed as a threatened species under the ESA. We disagree that there has been a "lack of agency action under the ESA to protect loggerhead sea turtles." Numerous protective regulations and measures have been adopted since the original listing of the loggerhead sea turtle, both on the nesting beaches and in the marine environment. The effectiveness of many of those measures may not yet be observed on the nesting beaches because of the recent enactment relative to the life history and age to maturity of loggerhead sea turtles. However, additional measures continue to be undertaken to reduce anthropogenic impacts, as required by the ESA. Analysis of nesting trends from 1989–2010 results in a trend line that is slightly negative, but not significantly different from zero.

Comment 85: Three commenters reiterated that the Services' determinations concerning listing species or DPSs and changing the status of a listed species or DPS must be made "solely on the basis of the best scientific and commercial data available." The commenters noted that the Services may not cater to political influences in conducting a purely scientific evaluation. The commenters noted that their petitions, prior comments, the 2009 Status Review, and the best available science support the Services' proposed DPS designations and changing the status of the

Northwest Atlantic Ocean DPS from threatened to endangered. The commenters argued that the Services' alleged substantial disagreement on the interpretation of the existing data, which prompted a 6-month extension on the final determination, suggests political and not scientific differences of opinion.

Response: The Services agree that such determinations must be made solely on the basis of the best scientific and commercial data available. The final determination was based upon all available information, as well as information and comments provided in response to the proposed rule, including information provided during the public comment extension periods. The Services then determined that the Northwest Atlantic Ocean DPS should be listed as threatened. A discussion of that information and basis for the listing status is contained in the final determination for the DPS, below.

Comment 86: One commenter questioned why the Services reasoned that current circumstances warrant an endangered listing for the Northwest Atlantic Ocean DPS instead of a threatened listing. The commenter noted that at the time of the original listing in 1978, adult loggerhead population sizes were not well known. For example, the Final EIS associated with the original listing of the species in 1978 identified the Florida population with a total of 41,524 adults of both sexes and Georgia with 551 females nesting annually. Assuming a 3-year remigration interval and a 1:1 sex ratio, the Georgia estimate equates to approximately 3,306 adults, and combined with the Florida estimate, yields an adult population size of 44,830 turtles for the region. The regional population was thought to be declining. The most recent adult population point estimate for the Northwest Atlantic Ocean DPS is 30,050 adult females or approximately 60,100 adult males and females, and that number is believed to be declining.

Thus, while the number of nests in the DPS [at the largest rookery] in the Northwest Atlantic increased for 2 decades after being listed, it since has declined, and now the population size of adults (extrapolated from the number of nests) is comparable to or slightly greater than the number that existed when the species was listed as threatened. Another commenter also questioned the size of the loggerhead population against which impacts are measured and provided an estimate of between 1,230,000 and at least 3,300,000 animals in the Northwest Atlantic Ocean DPS.

Response: Based on additional review and discussions within the Services on status and trends, threats, and conservation efforts, we do not believe the Northwest Atlantic Ocean DPS is currently "in danger of extinction throughout all or a portion of its range," and have determined that a "threatened" listing under the ESA is more appropriate.

Comment 87: One commenter questioned whether nesting declines are truly valid evidence that the Northwest Atlantic Ocean DPS is headed for extinction. The commenter expressed the belief that the Services should have delved more rigorously into all existing abundance data to determine whether trends in nesting actually reflect trends in the population. The commenter cited the following text from the TEWG (2000) report: "nesting trends alone may give an incomplete picture of population status."

Response: The Services agree with the TEWG (2000) report's statement that nesting trends alone may give an incomplete picture of population status. However, at this time it is the strongest indicator, and most thorough and consistent data set available for such determinations. The limited in-water data are also given consideration when making determinations of population status. Note that subsequent to the publication of the proposed rule, nesting data for

2008–2010 was incorporated into the nesting trend analyses, and the result indicated that the nesting trend for the Northwest Atlantic Ocean DPS from 1989–2010 is slightly negative but not statistically different from zero.

Comment 88: The State of Florida provided data on loggerhead nesting activity on Florida beaches collected by the Florida Fish and Wildlife Conservation Commission through June 2010. The analysis of these data shows a marked decline in nest counts since 1989 when extensive index beach monitoring began. The recent analysis reveals that the decline in nest counts from 1989 to 2009 was 23.9 percent and from 1998 to 2009 was 38.4 percent, which corresponds to a decline of 1.42 percent and 4.84 percent per year, respectively. The State of Florida noted that nesting declines correspond with declines of adult female loggerheads. The State acknowledged that nest counts vary with reproductive output as well as adult female abundance and that this source of variation could contribute to either an under- or over-estimate of females from nests in a given year. As such, declines in adult females may be lower or greater than nest counts indicate, but the declining trend is not in dispute. The State of Florida recognized data from other data sets representing younger life stages within the Northwest Atlantic Ocean DPS that come from in-water captures where capture effort was recorded. The trends in catch per unit effort vary by location with some showing a statistically significant increasing trend in immature loggerheads. The State of Florida explained that there are important differences between nest count data and catch per unit effort data that apply to how accurately each data set represents actual population changes. Florida nest count data have a time series of 21 years collected via a standardized protocol, are spatially detailed, and are collected over the majority of the principal nesting range of the Northwest Atlantic Ocean DPS.

In contrast, catch per unit effort data, even when a composite data set, do not come close to the spatial detail and population range as the nest count data. The State of Florida acknowledged the importance of catch per unit effort trends assessment, but cautioned that the inherent sampling bias of catch per unit effort techniques introduces uncertainty into any conclusions drawn from those data.

Response: The Services acknowledge the nesting decline reported by the State of Florida for the period 1989–2009; however, analysis of the data through 2010 (2010 data were not available at the time of the proposed rule) results in a trend line that is slightly negative, but not statistically different from zero. Nesting in 2009 on the Core Index Nesting Beaches was relatively low at 32,717. However, in 2008, nesting numbers exceeded 38,000, the second highest total since 2002. In 2010, the nest count was 47,880, the highest since 2000, and the ninth highest in the 22 years in the data set. The Services agree that available in-water abundance information must be used with caution due to inherent sampling biases; however, we believe these data are an important piece of information that can be used to help assess the status of this DPS.

Comment 89: Five commenters referenced Witherington et al. (2009) and the decline of nesting in Florida. The commenters noted that if the trend continues the nesting population will decline by 80 percent by 2017 (using 1989–2007 data); such a drastic decline over just 19 years, less than half a loggerhead's generation time, would warrant IUCN Critically Endangered status. Witherington et al. 2009 noted that fisheries bycatch is the factor that best fits the nesting decline.

Response: Inclusion of nesting data up through 2010 results in the nesting trend line being slightly negative, but not significantly different from zero. The Services agree that fisheries bycatch is one factor that best fits the nesting decline seen in the past. However, various fishery bycatch reduction measures have occurred within the last generation time for loggerhead sea turtles, and the benefits of those actions may only now be starting to become evident on the nesting beaches. The agencies are committed to reducing fisheries bycatch further.

Comment 90: The State of Georgia provided data on loggerhead nesting in Georgia. The State noted that loggerhead nest counts in Georgia show a stable nesting population for the corresponding time period used in Witherington et al. (2009). However, the State acknowledged that nesting in Georgia represents a small fraction (less than 2 percent) of the nesting by loggerheads in the Northwest Atlantic Ocean DPS and, therefore, has little effect on the overall nesting trend for the Northwest Atlantic Ocean DPS.

Response: The Services agree that Georgia loggerhead nesting indicates a stable nesting population. Additionally, nesting in South Carolina and North Carolina has also been relatively stable over the past decade, with record or near record nesting since 2008 in some cases. Nesting in these three States constitute most of the Northern Recovery Unit of the Northwest Atlantic Ocean DPS. While small in comparison to the Peninsular Florida Recovery Unit, it is the second largest recovery unit in the DPS and an important source of gene flow within the Northwest Atlantic Ocean DPS.

Comment 91: One commenter provided a critique of the methods used in the loggerhead Status Review written by the BRT. In more than one instance, the commenter made reference to the Status Review making an “endangered” determination or recommendation.

Response: The Services would like to clarify that the role of the BRT and the Status Review was not to make a determination or recommendation of listing status under the ESA. The BRT was to provide an analysis of loggerhead status, which was then used in conjunction with numerous other sources of information by the Services to make a final listing determination. Confusion occurred for many readers of the Status Review because of the convergence of language used in the BRT report and the legal language used in the ESA. The BRT did not make conclusions as to ESA listing status.

Comment 92: Two commenters stated that they did not support listing the South Atlantic Ocean DPS as threatened and suggested it should be listed as endangered. The commenters noted that although this population is increasing, it remains small and vulnerable. The commenters further noted that the South Atlantic Ocean DPS in Brazil is subject to various threats on both important nesting beaches and in-water habitat, particularly climate change and ocean acidification.

Response: The Services determined that a threatened status is appropriate for the South Atlantic Ocean DPS. A long-term, sustained increasing trend in nesting abundance was observed from 1988 through 2003, and loggerhead nesting has continued to increase through the 2008–2009 nesting season. Conservation efforts on nesting beaches have been largely successful although coastal development in the main nesting areas continues to be a concern. The Services agree that fisheries bycatch remains a concern; however, there are efforts underway within Brazilian waters and elsewhere in their range to address these threats.

Other Comments

Comment 93: The North Carolina Division of Marine Fisheries and one other commenter noted that the proposed rule contained limited discussion of mitigating non-fisheries threats (e.g., oil spills, vessel strikes, entanglement in marine debris, and indirect anthropogenic factors that affect reproductive success such as alteration/loss of nesting habitat, light pollution, etc.) for the Northwest Atlantic Ocean DPS.

Response: The Services appreciate the significance and importance of non-fisheries threats on sea turtle populations, including the Northwest Atlantic Ocean DPS. Discussion of these threats does occur within the preamble language of the listing rule. However, as a result of the greater specific information available for known fishery impacts and the general understanding that fishery impacts constitute what is likely the largest category of impact on sea turtle populations, a greater volume of text is dedicated to that discussion.

Comment 94: Three commenters argued the 6-month extension was unjustified and unlawful and requested the Services withdraw the extension and complete the final rule immediately.

Response: The Services disagree that the 6-month extension was unjustified and unlawful. Section 4(b)(6) of the ESA allows for 6-month extensions of final determinations when "there is substantial disagreement regarding the sufficiency or accuracy of the available data relevant to the determination… for purposes of soliciting additional data." The Services proposed to list the Northwest Atlantic Ocean DPS of the loggerhead sea turtle as endangered. However, in preparing the final rule, there was substantial disagreement regarding the interpretation of the existing data on status and trends and its relevance to the assessment of extinction risk to the Northwest Atlantic Ocean DPS. There was also considerable disagreement regarding the magnitude and immediacy of the fisheries bycatch threat and measures to reduce this threat to the Northwest Atlantic Ocean DPS. As part of the 6-month extension notice, the Services solicited new information or analyses to help clarify these issues and used this time to fully evaluate and assess the best scientific and commercial data available and ensure consistent interpretation of data and application of statutory standards for all of the nine proposed DPSs.

Comment 95: Several individuals provided comments on critical habitat designations for the Northwest Atlantic Ocean and North Pacific Ocean DPSs.

Response: The Services have not designated critical habitat for the loggerhead sea turtle. Critical habitat is not determinable at this time, but will be proposed in a separate rulemaking.

Summary of Factors Affecting the Nine Loggerhead DPSs

Section 4 of the ESA (16 U.S.C. 1533) and implementing regulations at 50 CFR part 424 set forth procedures for adding species to the Federal List of Endangered and Threatened Species. Under section 4(a) of the ESA, we must determine if a species is threatened or endangered because of any of the following five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence.

We have described the effects of various factors leading to the decline of the loggerhead sea turtle in the original listing determination (43 FR 32800; July 28, 1978) and other documents (NMFS and USFWS, 1998, 2007, 2008). In making this finding, information regarding the status of each of the nine loggerhead DPSs is considered in relation to the five factors provided in section 4(a)(1) of the ESA. The reader is directed to section 5 of the Status Review for a more detailed discussion of the factors affecting the nine identified loggerhead DPSs. In section 5.1, a general description of the threats that occur for all DPSs is presented under the relevant section 4(a)(1) factor. In section 5.2, threats that are specific to a particular DPS are presented by DPS under each section 4(a)(1) factor. That information is incorporated here by reference; the following is a summary of that information by DPS.

North Pacific Ocean DPS

A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Terrestrial Zone

Destruction and modification of loggerhead nesting habitat in the North Pacific result from coastal development and construction, placement of erosion control structures and other barriers to nesting, beachfront lighting, vehicular and pedestrian traffic, sand extraction, beach erosion, beach sand placement, beach pollution, removal of native vegetation, planting of non-native vegetation (NMFS and USFWS, 1998), and climate change. Beaches in Japan where loggerheads nest are extensively eroded due to dredging and dams constructed upstream, and are obstructed by seawalls as well. Unfortunately, no quantitative studies have been conducted to determine the impact to the loggerhead nesting populations (Kamezaki et al., 2003). However, it is clear that loggerhead nesting habitat has been impacted by erosion and extensive beach use by tourists, both of which have contributed to unusually high mortality of eggs and pre-emergent hatchlings at many Japanese rookeries (Matsuzawa, 2006). While the Services cannot predict the exact impacts of climate change, sea level rise may present a more immediate challenge for this DPS because of the proportion of beaches with shoreline armoring that prevents or interferes with the ability of nesting females to access to suitable nesting habitat.

Maehama Beach and Inakahama Beach on Yakushima in Kagoshima Prefecture account for approximately 30 percent of loggerhead nesting in Japan (Kamezaki et al., 2003), making Yakushima an important area for nesting beach protection. However, the beaches suffer from beach erosion and light pollution, especially from passing cars, as well as from tourists encroaching on the nesting beaches (Matsuzawa, 2006). Burgeoning numbers of visitors to beaches may cause sand compaction and nest trampling. Egg and pre-emergent hatchling mortality in Yakushima has been shown to be higher in areas where public access is not restricted and is mostly attributed to human foot traffic on nests (Kudo et al., 2003). Fences have been constructed around areas where the highest densities of nests are laid; however, there are still lower survival rates of eggs and pre-emergent hatchlings due to excessive foot traffic (Ohmuta, 2006).

Loggerhead nesting habitat also has been lost at important rookeries in Miyazaki due in part to port construction that involved development of a groin of 1 kilometer from the coast into the sea, a yacht harbor with breakwaters and artificial beach, and an airport, causing erosion of beaches on both sides of the construction zone. This once excellent nesting habitat for loggerheads is now seriously threatened by erosion (Takeshita, 2006).

Minabe-Senri beach, Wakayama Prefecture is a “submajor” nesting beach (in Kamezaki et al., 2003), but is one of the most important rookeries on the main island of Japan (Honshu). Based on unpublished data, Matsuzawa (2006) reported hatching success of unwashed-out clutches at Minabe-Senri beach to be 24 percent in 1996, 50 percent in 1997, 53 percent in 1998, 48 percent in 1999, 62 percent in 2000, 41 percent in 2001, and 34 percent in 2002.

Neritic/Oceanic Zones

Threats to habitat in the loggerhead neritic and oceanic zones in the North Pacific Ocean include fishing practices, channel dredging, sand extraction, marine pollution, and climate change. Fishing methods not only incidentally capture loggerheads, but also deplete invertebrate and fish populations and thus alter ecosystem dynamics. In many cases loggerhead foraging areas coincide with fishing zones. For example, using aerial surveys and satellite telemetry, juvenile foraging hotspots have recently been identified off the coast of Baja California, Mexico; these hotspots overlap with intensive small-scale fisheries (Peckham and Nichols, 2006; Peckham et al., 2007, 2008). Comprehensive data currently are unavailable to fully understand how intense harvesting of fish resources changes neritic and oceanic ecosystems. Climate change also may result in future trophic changes, thus impacting loggerhead prey abundance and distribution.

In summary, we find that the North Pacific Ocean DPS of the loggerhead sea turtle is negatively affected by ongoing changes in both its terrestrial and marine habitats as a result of land and water use practices as considered above in Factor A. Within Factor A, we find that coastal development and coastal armoring on nesting beaches in Japan are significant threats to the persistence of this DPS.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

In Japan, the use of loggerhead meat for food was historically popular in local communities such as Kochi and Wakayama prefectures. In addition, egg collection was common in the coastal areas during times of hunger and later by those who valued loggerhead eggs as revitalizers or aphrodisiacs and acquired them on the black market (in Kamezaki et al., 2003; Takeshita, 2006). Currently, due in large part to research and conservation efforts throughout the country, egg harvesting no longer represents a problem in Japan (Kamezaki et al., 2003; Ohmuta, 2006; Takeshita, 2006). Laws were enacted in 1973 to prohibit egg collection on Yakushima, and in 1988, the laws were extended to the entire Kagoshima Prefecture, where two of the most important loggerhead nesting beaches are protected (Matsuzawa, 2006).

Despite national laws, in many other countries where loggerheads are found migrating through or foraging, the hunting of adult and juvenile turtles is still a problem, as seen in Baja California Sur, Mexico (Koch et al., 2006; Mancini and Koch, 2009). Sea turtles have been protected in Mexico since 1990, when a Federal law decreed the prohibition of the "extraction, capture and pursuit of all species of sea turtle in federal waters or from beaches within national territory ... [and a requirement that] ... any species of sea turtle incidentally captured during the operations of any commercial fishery shall be returned to the sea, independently of its physical state, dead or alive" (in Garcia-Martinez and Nichols, 2000). Despite the ban, studies have shown that sea turtles continue to be caught, both indirectly in fisheries and by a directed harvest of juvenile turtles. Turtles are principally hunted using nets, longlines, and harpoons. While some are killed immediately, others are kept alive in pens and transported to market. The market for sea turtles consists of two types: the local market (consumed locally) and the export market (sold to restaurants in Mexico cities such as Tijuana, Ensenada, and Mexicali, and U.S. cities such as San Diego and Tucson). Consumption is highest during holidays such as Easter and Christmas (Wildcoast/Grupo Tortuguero de las Californias, 2003).

Based on a combination of analyses of stranding data, beach and sea surveys, tag-recapture studies, and extensive interviews, all carried out between June 1994 and January 1999, Nichols (2003) conservatively estimated the annual take of sea turtles by various fisheries and through direct harvest in the Baja California, Mexico, region. Sea turtle mortality data collected between 1994 and 1999 indicated that over 90 percent of sea turtles recorded dead were either green turtles (30 percent of total) or loggerheads (61 percent of total), and signs of human consumption were evident in over half of the specimens. These studies resulted in an estimated 1,950 loggerheads killed annually, affecting primarily juvenile size classes. The primary causes for mortality were the incidental take in a variety of fishing gears and direct harvest for consumption and [illegal] trade (Gardner and Nichols, 2001; Nichols, 2003).

From April 2000 to July 2003 throughout the Bahia Magdalena region (including local beaches and towns), researchers found 1,945 sea turtle carcasses, 44.1 percent of which were loggerheads. Of the sea turtle carcasses found, slaughter for human consumption was the primary cause of death for all species (63 percent for loggerheads). Over 90 percent of all turtles found were juvenile turtles (Koch et al., 2006). As the population of green turtles has declined in Baja California Sur waters, poachers have switched to loggerheads (H. Peckham, Pro Peninsula, personal communication, 2006).

In summary, overutilization for commercial purposes in both Japan and Mexico likely was a factor that contributed to the historical declines of this DPS. Current illegal harvest of loggerheads in Baja California for human consumption continues as a significant threat to the persistence of this DPS.

C. Disease or Predation

The potential exists for diseases and endoparasites to impact loggerheads found in the North Pacific Ocean. As in other nesting locations, egg predation also exists in Japan, particularly by raccoon dogs (Nyctereutes procyonoides) and weasels (Mustela itatsi); however, quantitative data do not exist to evaluate the impact on loggerhead populations (Kamezaki et al., 2003). Loggerheads in the North Pacific Ocean also may be impacted by harmful algal blooms.

In summary, although nest predation in Japan is known to occur, quantitative data are not sufficient to assess the degree of impact of nest predation on the persistence of this DPS.

D. Inadequacy of Existing Regulatory Mechanisms

International Instruments

The BRT identified several regulatory mechanisms that apply to loggerhead sea turtles globally and within the North Pacific Ocean. The reader is directed to sections 5.1.4. and 5.2.1.4. of the Status Review for a discussion of these regulatory mechanisms. Hykle (2002) and Tiwari (2002) have reviewed the effectiveness of some of these international instruments. The problems with existing international treaties are often that they have not realized their full potential, do not include some key countries, do not specifically address sea turtle conservation, and are handicapped by the lack of a sovereign authority to enforce environmental regulations. The ineffectiveness of international treaties and national legislation is oftentimes due to the lack of motivation or obligation by countries to implement and enforce them. A thorough discussion of this topic is available in a special 2002 issue of the Journal of International Wildlife Law and Policy: International Instruments and Marine Turtle Conservation (Hykle, 2002).

National Legislation and Protection

Fishery bycatch that occurs throughout the North Pacific Ocean is substantial (see Factor E). Although national and international governmental and non-governmental entities on both sides of the North Pacific are currently working toward reducing loggerhead bycatch, and some positive actions have been implemented, it is unlikely that this source of mortality can be sufficiently reduced in the near future due to the challenges of mitigating illegal, unregulated, and unreported fisheries, the lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies.

In addition to fishery bycatch, coastal development and coastal armoring on nesting beaches in Japan continues as a substantial threat (see Factor A). Coastal armoring, if left unaddressed, will become an even more substantial threat as sea level rises. Recently, the Japan Ministry of Environment has supported the local non-governmental organization conducting turtle surveys and conservation on Yakushima in establishing guidelines for surveys and minimizing impacts by humans encroaching on the nesting beaches. As of the 2009 nesting season, humans accessing Inakahama, Maehama, and Yotsuse beaches at night must comply with the established rules (Y. Matsuzawa, Sea Turtle Association of Japan, personal communication, 2009).

In summary, our review of regulatory mechanisms under Factor D demonstrates that although regulatory mechanisms are in place that should address direct and incidental take of North Pacific Ocean loggerheads, these regulatory mechanisms are insufficient or are not being implemented effectively to address the needs of loggerheads. We find that the threats from the inadequacy of existing regulatory mechanisms for fishery bycatch (Factor E) and coastal development and coastal armoring (Factor A) are significant relative to the persistence of this DPS.

E. Other Natural or Manmade Factors Affecting its Continued Existence

Incidental Bycatch in Fishing Gear

Incidental capture in artisanal and commercial fisheries is a significant threat to the survival of loggerheads in the North Pacific. (Artisanal fisheries are typically small scale-commercial or subsistence fisheries.) Sea turtles may be caught in pelagic and demersal longlines, drift and set gillnets, bottom and mid-water trawling, fishing dredges, pound nets and weirs, haul and purse seines, pots and traps, and hook and line gear.

Based on turtle sightings and capture rates reported in an April 1988 through March 1989 survey of fisheries research and training vessels and extrapolated to total longline fleet effort by the Japanese fleet in 1978, Nishemura and Nakahigashi (1990) estimated that 21,200 turtles, including greens, leatherbacks, loggerheads, olive ridleys, and hawksbills, were captured annually by Japanese tuna longliners in the western Pacific and South China Sea, with a reported mortality of approximately 12,300 turtles per year. Using commercial tuna longline logbooks, research vessel data, and questionnaires, Nishemura and Nakahigashi (1990) estimated that for every 10,000 hooks in the western Pacific and South China Sea, one turtle is captured, with a mortality rate of 42 percent. Although species-specific information on the bycatch is not available, vessels reported that 36 percent of the sightings of turtles in locations that overlap with these commercial fishing grounds were loggerheads.

Caution should be used in interpreting the results of Nishemura and Nakahigashi (1990), including estimates of sea turtle take rate (per number of hooks) and resultant mortality rate, and estimates of annual take by the fishery, for the following reasons: (1) the data collected were based on observations by training and research vessels, logbooks, and a questionnaire (i.e., hypothetical), and do not represent actual, substantiated logged or observed catch of sea turtles by the fishery; (2) the authors assumed that turtles were distributed homogeneously; and (3) the authors used only one year (1978) to estimate total effort and distribution of the Japanese tuna longline fleet. Although the data and analyses provided by Nishemura and Nakahigashi (1990) are conjectural, longliners fishing in the Pacific have significantly impacted and, with the current level of effort, probably will continue to have significant impacts on sea turtle populations.

Foreign high-seas driftnet fishing in the North Pacific Ocean for squid, tuna, and billfish ended with a United Nations moratorium in December 1992. Except for observer data collected in 1990–1991, there is virtually no information on the incidental take of sea turtle species by the driftnet fisheries prior to the moratorium. The high-seas squid driftnet fishery in the North Pacific was observed in Japan, Korea, and Taiwan, while the large-mesh fisheries targeting tuna and billfish were observed in the Japanese fleet (1990–1991) and the Taiwanese fleet (1990). A combination of observer data and fleet effort statistics indicate that 2,986 loggerhead sea turtles were entangled by the combined fleets of Japan, Korea, and Taiwan from June 1990 through May 1991, when all fleets were monitored. Of these incidental entanglements, an estimated 805 loggerheads were killed (27 percent mortality rate) (Wetherall, 1997). Data on size composition of the turtles caught in the high-seas driftnet fisheries also were collected by observers. The majority of loggerheads measured by observers were juvenile (Wetherall, 1997). The cessation of high-seas driftnet fishing in 1992 should have reduced the incidental take of marine turtles. However, nations involved in driftnet fishing may have shifted to other gear types (e.g., pelagic or demersal longlines, coastal gillnets); this shift in gear types could have resulted in either similar or increased turtle bycatch and associated mortality.

These rough mortality estimates for a single fishing season provide only a narrow glimpse of the impacts of the driftnet fishery on sea turtles, and a full assessment of impacts would consider the turtle mortality generated by the driftnet fleets over their entire range. Unfortunately, comprehensive data are lacking, but the observer data do indicate the possible magnitude of turtle mortality given the best information available. Wetherall et al. (1993) speculate that the actual mortality of sea turtles may have been between 2,500 and 9,000 per year, with most of the mortalities being loggerheads taken in the Japanese and Taiwanese large-mesh fisheries.

While a comprehensive, quantitative assessment of the impacts of the North Pacific driftnet fishery on turtles is impossible without a better understanding of turtle population abundance, genetic identities, exploitation history, and population dynamics, it is likely that the mortality inflicted by the driftnet fisheries in 1990 and in prior years was significant (Wetherall et al., 1993), and the effects may still be evident in sea turtle populations today. The high mortality of juvenile turtles and reproductive adults in the high-seas driftnet fishery has probably altered the current age structure (especially if certain age groups were more vulnerable to driftnet fisheries) and therefore diminished or limited the future reproductive potential of affected sea turtle populations.

Extensive ongoing studies regarding loggerhead mortality and bycatch have been administered off the coast of Baja California Sur, Mexico. The location and timing of loggerhead strandings documented in 2003–2005 along a 43-kilometer beach (Playa San Lazaro) indicated bycatch in local small-scale fisheries. In order to corroborate this, in 2005, researchers observed two small-scale fleets operating closest to an area identified as a high-use area for loggerheads. One fleet, based out of Puerto López-Mateos, fished primarily for halibut using bottom set gillnets, soaking from 20 to 48 hours. This fleet consisted of up to 75 boats in 2005, and, on a given day, 9 to 40 vessels fished the deep area (32–45 meter depths). During a 2-month period, 11 loggerheads were observed taken in 73 gillnet day-trips, with eight of those loggerheads landed dead (observed mortality rate of 73 percent). The other fleet, based in Santa Rosa, fished primarily for demersal sharks using bottom-set longlines baited with tuna or mackerel and left to soak for 20 to 48 hours. In 2005, the fleet numbered only five to six vessels. During the seven day-long bottom-set longline trips observed, 26 loggerheads were caught; 24 of them were dead when the longlines were retrieved (observed mortality rate of 92 percent). Based on these observations, researchers estimated that in 2005 at least 299 loggerheads died in the bottom-set gillnet fishery and at least 680 loggerheads died in the bottom-set longline fishery. This annual bycatch estimate of approximately 1,000 loggerheads is considered a minimum and is also supported by shoreline mortality surveys and informal interviews (Peckham et al., 2007). These results suggest that incidental capture at Baja California Sur is one of the most significant sources of mortality identified for the North Pacific loggerhead population and underscores the importance of reducing bycatch in small-scale fisheries.

Peckham et al. (2008) assessed anthropogenic mortality of loggerhead sea turtles in the coastal waters of Baja California Sur through the synthesis of three sources: (1) intensive surveys of an index shoreline from 2003–2007, (2) bimonthly surveys of additional shorelines and towns for stranded and consumed carcasses from 2006–2007, and (3) bycatch observations of two small-scale fishing fleets. They estimated that 1,500–2,950 loggerhead sea turtles died per year from 2005–2006 due to bycatch in the two observed fleets. Actual mortality may have been considerably higher due to bycatch in other fisheries, directed hunting for black market trade, and natural factors including predation and disease. From 2003–2007, 2,719 loggerhead carcasses were encountered on shorelines and in and around towns of Baja California Sur. Along the 43-km Playa San Lázaro, thousands of loggerheads stranded during the summer fishing months over 5 years, which is among the highest reported stranding rates worldwide. This stranding rate corroborates similarly high observed bycatch rates for local small-scale longline (29 loggerheads per 1,000 hooks) and gillnet (1.0 loggerhead per km of net) fisheries. A significant increase in mean length of 2,636 carcasses measured at Baja California Sur occurred from 1995–2007. Due to the decades-long maturation time of loggerheads, this increasing trend in turtle size may reflect both long term declines in nesting described from Japan (Kamezaki et al., 2003) and also historically high bycatch of juvenile loggerheads in both high seas driftnet (Wetherall et al., 1993) and longline fisheries (Lewison et al., 2004). The decreasing proportion of smaller juveniles at Baja California Sur especially from 2000–2007 could be related to sharp declines in nesting observed across all Japanese rookeries in the 1990s (Peckham et al., 2008).

In the U.S. Pacific, longline fisheries targeting swordfish and tuna and drift gillnet fisheries targeting swordfish have been identified as the primary fisheries of concern for loggerheads. Bycatch of loggerhead sea turtles in these fisheries has been significantly reduced as a result of time-area closures, required gear modifications, and hard caps imposed on turtle bycatch, with 100 percent observer coverage in certain areas.

The California/Oregon (CA/OR) drift gillnet fishery targets swordfish and thresher shark off the west coast of the United States. The fishery has been observed by NMFS since July 1990 and currently averages 20 percent observer coverage. From July 1990 to January 2000, the CA/OR drift gillnet fishery was observed to incidentally capture 17 loggerheads (12 released alive, 1 injured, and 4 killed). Based on a worst-case scenario, NMFS estimated that a maximum of 33 loggerheads in a given year could be incidentally taken by the CA/OR drift gillnet fleet. Sea turtle mortality rates for hard-shelled species were estimated to be 32 percent (NMFS, 2000). In 2000, analyses conducted under the mandates of the ESA showed that the CA/OR drift gillnet fishery was taking excessive numbers of sea turtles, such that the fishery "jeopardized the continued existence of" loggerheads and leatherbacks. In this case, the consulting agency (NMFS) was required to provide a reasonable and prudent alternative to the action (i.e., the fishery). In order to reduce the likelihood of interactions with loggerhead sea turtles, NMFS has regulations in place to close areas to drift gillnet fishing off southern California during forecasted or occurring El Niño events from June 1 through August 31, when loggerheads are likely to move into the area from the Pacific coast of Baja California following a preferred prey species, pelagic red crabs.

Prior to 2000, the Hawaii-based longline fishery targeted highly migratory species north of Hawaii using gear largely used by fleets around the world. From 1994–1999, the fishery was estimated to take between 369 and 501 loggerheads per year, with between 64 and 88 mortalities per year (NMFS, 2000). Currently, the Hawaii-based shallow longline fishery targeting swordfish is strictly regulated such that an annual take of 17 loggerheads is authorized for the fishery, beginning in 2004, when the fishery was re-opened after being closed for several years. In 2004 and 2005, the fishing year was completed without reaching the turtle take levels (1 and 10 loggerheads were captured, respectively, with fleets operating with 100 percent observer coverage). However, in 2006, 17 loggerheads were taken, resulting in early closure of the fishery. From 2007 through 2010, 15, 0, 3, and 5 loggerheads were taken, respectively, by the fishery. Most loggerheads were released alive (NMFS-Pacific Islands Regional Office, Observer Database Public Website, 2011, http://www.fpir.noaa.gov/OBS/obs_qrtrly_annual_rprts.html).

Recent investigations off the coast of Japan, particularly focused off the main islands of Honshu, Shikoku, and Kyushu, have revealed a major threat to the more mature stage classes of loggerheads (approximately 70–80 cm SCL) due to pound net fisheries set offshore of the nesting beaches and in the coastal foraging areas (T. Ishihara, Sea Turtle Association of Japan, personal communication, 2007). While pound nets constitute the third largest fishery in terms of metric tons of fish caught in Japan, they account for the majority of loggerhead bycatch by Japanese fisheries (Ishihara, 2007, 2009). Open-type pound nets studied in an area off Shikoku were shown to take loggerheads as the most prevalent sea turtle species caught but had lower mortality rates (less than 15 percent), primarily because turtles could reach the surface to breathe. Middle layer and bottom-type pound nets in particular have high rates of mortality (nearly 100 percent), because the nets are submerged and sea turtles are unable to reach the surface. Estimates of loggerhead mortality in one area studied between April 2006 and September 2007 were on the order of 100 individuals. While the fishing industry has an interest in changing its gear to open-type, it is very expensive, and the support from the Japanese government is limited (T. Ishihara, Sea Turtle Association of Japan, personal communication, 2007). Nonetheless, the BRT recognized that coastal pound net fisheries off Japan may pose a significant threat to the North Pacific population of loggerheads.

Quantifying the magnitude of the threat of fisheries in the North Pacific Ocean on loggerhead sea turtles is very difficult given the low level of observer coverage or investigations into bycatch conducted by countries that have large fishing fleets. Efforts have been made to quantify the effect of pelagic longline fishing on loggerheads, and annual estimates of bycatch were on the order of over 10,000 sea turtles, with as many as 2,600 individual loggerheads killed annually through immediate or delayed mortality as a result of interacting with the gear (Lewison et al., 2004).

Other Manmade and Natural Impacts

Similar to other areas of the world, climate change and sea level rise have the potential to impact loggerheads in the North Pacific Ocean. This includes beach erosion and loss from rising sea levels, skewed hatchling sex ratios from rising beach incubation temperatures, and abrupt disruption of ocean currents used for natural dispersal during the complex life cycle (Hawkes et al., 2009; Poloczanska et al., 2009). Because the majority of Japanese beaches are armored, loggerheads nesting on Japan beaches are likely to be left with increasingly limited nesting habitat when they undergo the vertical and poleward shifts in nesting habitat selection necessitated by sea level rise (S.H. Peckham, Grupo Tortuguero de las Californias, personal communication, 2010). Matsuzawa et al. (2002) found heat-related mortality of pre-emergent hatchlings in Minabe Senri Beach and concluded that this population is vulnerable to even small temperature increases resulting from global warming because sand temperatures already exceed the optimal thermal range for incubation. Recently, Chaloupka et al. (2008) used generalized additive regression modeling and autoregressive-prewhitened cross-correlation analysis to consider whether changes in regional ocean temperatures affect long-term nesting population dynamics for Pacific loggerheads from primary nesting assemblages in Japan and Australia. Researchers chose four nesting sites with a generally long time series to model, two in Japan (Kamouda rookery, declining population, and Yakushima rookery, generally increasing in the last 20 years), and two in Australia (Woongarra rookery, generally declining through early 1990s and beginning to recover, and Wreck Island rookery, which is generally declining). Analysis of 51 years of mean annual sea surface temperatures around two core foraging areas off Japan and eastern Australia, showed a general warming of the oceans in these regions. In general, nesting abundance for all four rookeries was inversely related to sea surface temperatures; that is, higher sea surface temperatures during the previous year in the core foraging area resulted in lower summer season nesting at all rookeries. Given that cooler ocean temperatures are generally associated with increased productivity and that female sea turtles generally require at least 1 year to acquire sufficient fat stores for vitellogenesis to be completed, as well as the necessary somatic energy reserves required for the breeding season, any lag in productivity due to warmer temperatures has physiological basis. Over the long term, warming ocean temperatures could therefore lead to lower productivity and prey abundance, and thus reduced nesting and recruitment by Pacific loggerheads (Chaloupka et al., 2008).

Other anthropogenic impacts include boat strikes, ingestion of and entanglement in marine debris, and entrainment in coastal power plants.

Natural environmental events, such as cyclones, hurricanes, and tsunamis, may affect loggerheads in the North Pacific Ocean. Typhoons also have been shown to cause severe beach erosion and negatively affect hatching success at many loggerhead nesting beaches in Japan, especially in areas already prone to erosion. For example, during the 2004 season, the Japanese archipelago suffered a record number of typhoons and many nests were drowned or washed out. Extreme sand temperatures at nesting beaches also create highly skewed female sex ratios of hatchlings or threaten the health of hatchlings. Without human intervention to protect clutches against some of these natural threats, many of these nests would be lost (Matsuzawa, 2006).

In summary, we find that the North Pacific Ocean DPS of the loggerhead sea turtle is negatively affected by both natural and manmade impacts as described above in Factor E. Within Factor E, we find that fishery bycatch that occurs throughout the North Pacific Ocean, including the coastal pound net fisheries off Japan, coastal fisheries impacting juvenile foraging populations off Baja California, Mexico, and undescribed fisheries likely affecting loggerheads in the South China Sea and the North Pacific Ocean, is a significant threat to the persistence of this DPS.

South Pacific Ocean DPS

A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Terrestrial Zone

In the South Pacific Ocean, loggerhead sea turtles nest primarily in Queensland, Australia, and, to a lesser extent, New Caledonia and Vanuatu (Limpus and Limpus, 2003a; Limpus et al., 2006; Limpus, 2009). Over 80 percent of all loggerhead nesting in Queensland occurs within the protected habitat of Conservation Parks and National Parks (Limpus, 2009). However, destruction and modification of loggerhead nesting habitat outside the protected areas in Queensland result from coastal development and construction, beach erosion, placement of erosion control structures, and beachfront lighting (Limpus et al., 2006; Limpus, 2009).

Removal or destruction of native dune vegetation, which enhances beach stability and acts as an integral buffer zone between land and sea, results in erosion of nesting habitat. Preliminary studies on nesting beaches in New Caledonia include local oral histories that attribute the decrease in loggerhead nesting to the removal of vegetation for construction purposes and subsequent beach erosion (Limpus et al., 2006).

Beach armoring presents a barrier to nesting in New Caledonia. On the primary nesting beach in New Caledonia, a rock wall was constructed to prevent coastal erosion, and sea turtle nesting attempts have been unsuccessful. Local residents are seeking authorization to extend the wall further down the beach (Limpus et al., 2006).

Beachfront lighting has been identified as a problem in some areas of Queensland. Hatchling disorientations have been regularly documented on the small nesting beaches adjacent to Mon Repos (Burnett Heads, Neilson Park, Bargara) and at Heron Island (Limpus, 1985; EPA Queensland Turtle Conservation Project unpublished data cited in Limpus, 2009). However, efforts have been made to reduce hatchling disorientations on Burnett Heads beach with the installation of low pressure sodium vapor lighting. Lighting has not been controlled at other beaches (Neilson Park, Bargara, Kellys Beach), and eggs are relocated to nearby dark beaches to protect emerging hatchlings (Limpus, 2009). Hatchling disorientations have been reduced along the Woongarra Coast to a few clutches annually as a result of altered light horizons (Limpus, 2009).

Neritic/Oceanic Zones

Threats to habitat in the loggerhead neritic and oceanic zones in the South Pacific Ocean include fishing practices, channel dredging, sand extraction, marine pollution, and climate change, though they appear to be minor. However, climate change may result in future trophic changes, thus impacting loggerhead prey abundance and distribution.

In summary, we find that the South Pacific Ocean DPS of the loggerhead sea turtle is negatively affected by ongoing changes in both its terrestrial and marine habitats as a result of land and water use practices as considered above in Factor A. However, the majority of nesting is located within protected parks in Queensland, and current threats in both the terrestrial and marine environments appear to be low and are not believed to be significant threats to the persistence of this DPS.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The Australian Native Title Legislation (Native Title Act 1993) allows the harvesting of loggerheads and their eggs by indigenous peoples (Environment Australia, 2003). However, egg consumption in Australia is virtually nil and very few loggerheads are taken for food by indigenous Australians (M. Hamann, James Cook University, personal communication, 2010). Outside of Australia, despite national laws, in many areas the poaching of eggs and hunting of adult and juvenile turtles is still a problem, and Limpus (2009) suggests that the harvest rate of loggerheads by indigenous hunters (including the legal take in Australia and the illegal take in neighboring countries) is on the order of 40 turtles per year. Preliminary studies suggest that local harvesting in New Caledonia constitutes about 5 percent of the nesting population (Limpus et al., 2006). Loggerheads also are consumed after being captured incidentally in high-seas fisheries of the southeastern Pacific (Alfaro-Shigueto et al., 2006), and occasionally may be the product of illegal trade throughout the region.

In summary, current legal and illegal harvest of loggerheads in Australia and New Caledonia for human consumption, as well as the consumption of loggerheads incidentally taken in high-seas fisheries, continues to affect the South Pacific Ocean DPS. However, current threats in both the terrestrial and marine environments appears to be minor to moderate and are not believed to be a significant threat to the persistence of this DPS.

C. Disease or Predation

There are no reports of diseases causing significant loggerhead mortality in the South Pacific (Limpus, 2009). The prevalence of fibropapillomatosis is thought to be small and occurs at low frequency among loggerheads in Moreton Bay and the southern Great Barrier Reef (Limpus and Miller, 1994; Limpus, 2009). Limpus et al. (1994) reported 14 of 320 loggerheads (4.4 percent) captured in Moreton Bay, Australia, during 1990–1992 as exhibiting the disease. According to Limpus (2009), there is no evidence this disease is having a significant impact on the population. Predation on nests and hatchlings by terrestrial vertebrates is a major problem at loggerhead rookeries in the South Pacific. At mainland rookeries in eastern Australia, for example, the introduced fox (Vulpes vulpes) has been the most significant predator on loggerhead eggs (Limpus, 1985, 2009). Although this has been minimized in recent years (to less than 5 percent; Limpus, 2009), researchers believe the earlier egg loss will greatly impact recruitment to this nesting population in the early 21st century (Limpus and Reimer, 1994). Predation on hatchlings by crabs and diurnal birds is also a threat (Limpus, 2009). In New Caledonia, feral dogs pose a predation threat to nesting loggerheads, and thus far no management has been implemented (Limpus et al., 2006).

In summary, nest and hatchling predation likely was a factor that contributed to the historical decline of this DPS. Current fox predation levels in eastern Australia are greatly reduced from historical levels, although predation by other species still occurs, and predation by feral dogs in New Caledonia has not been addressed and continues to affect the South Pacific Ocean DPS. In addition, a low incidence of the fibropapillomatosis disease exists in Moreton Bay and the southern Great Barrier Reef. However, these threats appear to be minor and are not believed to be a significant threat to the persistence of this DPS.

D. Inadequacy of Existing Regulatory Mechanisms

International Instruments

The BRT identified several regulatory mechanisms that apply to loggerhead sea turtles globally and within the South Pacific Ocean. The reader is directed to sections 5.1.4. and 5.2.2.4. of the Status Review for a discussion of these regulatory mechanisms. Hykle (2002) and Tiwari (2002) have reviewed the effectiveness of some of these international instruments. The problems with existing international treaties are often that they have not realized their full potential, do not include some key countries, do not specifically address sea turtle conservation, and are handicapped by the lack of a sovereign authority to enforce environmental regulations.

The ineffectiveness of international treaties and national legislation is oftentimes due to the lack of motivation or obligation by countries to implement and enforce them. A thorough discussion of this topic is available in a special 2002 issue of the Journal of International Wildlife Law and Policy: International Instruments and Marine Turtle Conservation (Hykle, 2002).

National Legislation and Protection

A large part of the Great Barrier Reef off the coast of Queensland, Australia, is protected as part of the Great Barrier Reef Marine Park, which helps limit human use impacts such as fishing and tourism. Over 80 percent of all loggerhead nesting in Queensland occurs within the protected ownership (Limpus, 2009). In 1981, in recognition of its rich faunal diversity, the Great Barrier Reef was inscribed on the United Nations Educational, Scientific and Cultural Organization's World Heritage List. One of the key reasons for its listing as the Great Barrier Reef World Heritage Area (GBRWHA) was the presence of internationally significant foraging and nesting populations of sea turtles, including loggerheads. Since its listing, protection of habitats within the GBRWHA has increased, with the current zone-based management plan enacted in 2004 (Dryden et al., 2008). Nesting habitat protection has also increased with the addition of indigenous co-management plans and ecotourism regulations at Mon Repos (M. Hamann, James Cook University, personal communication, 2010). However, destruction and modification of loggerhead nesting habitat outside the protected areas in Queensland result from coastal development and construction, beach erosion, placement of erosion control structures, and beachfront lighting, (Limpus et al., 2006; Limpus, 2009).

Fishery bycatch that occurs throughout the South Pacific Ocean is substantial (see Factor E). Although national and international governmental and non-governmental entities on both sides of the South Pacific are currently working toward reducing loggerhead bycatch, and some positive actions have been implemented (e.g., TED requirements in certain trawl fisheries in Australia), it is unlikely that this cumulative bycatch mortality can be sufficiently reduced in the near future due to the challenges of mitigating illegal, unregulated, and unreported fisheries, the continued expansion of artisanal fleets in the southeastern Pacific, the lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies.

In summary, our review of regulatory mechanisms under Factor D demonstrates that although regulatory mechanisms are in place that should address direct and incidental take of South Pacific Ocean loggerheads, these regulatory mechanisms are insufficient or are not being implemented effectively to address the needs of loggerheads. We find that the threat from the inadequacy of existing regulatory mechanisms for fishery bycatch across the range of the DPS (Factor E) is significant relative to the persistence of this DPS.

E. Other Natural or Manmade Factors Affecting its Continued Existence

Incidental Bycatch in Fishing Gear

Incidental capture in artisanal and commercial fisheries and shark control programs are a significant threat to the survival of loggerheads throughout the South Pacific. The primary gear types involved in these interactions include longlines, driftnets, set nets, and trawl fisheries. These are employed by both artisanal and industrial fleets, and target a wide variety of species including tunas, sharks, sardines, swordfish, and mahi mahi.

In the southwestern Pacific, bottom trawling gear has been a contributing factor to the decline in the eastern Australian loggerhead population (Limpus and Reimer, 1994). The northern Australian prawn fishery (NPF) is made up of both a banana prawn fishery and a tiger prawn fishery, and extends from Cape York, Queensland (142º E) to Cape Londonberry, Western Australia (127º E). The fishery is one of the most valuable in all of Australia and in 2000 comprised 121 vessels fishing approximately 16,000 fishing days (Robins et al., 2002a). In 2000, the use of TEDs in the NPF was made mandatory, due in part to several factors: (1) objectives of the Draft Australian Recovery Plan for Marine Turtles, (2) requirement of the Australian Environment Protection and Biodiversity Conservation Act for Commonwealth fisheries to become ecologically sustainable, and (3) the 1996 U.S. import embargo on wild-caught prawns taken in a fishery without adequate turtle bycatch management practices (Robins et al., 2002a). Data primarily were collected by volunteer fishers who were trained extensively in the collection of scientific data on sea turtles caught as bycatch in their fishery. Prior to the use of TEDs in this fishery, the NPF annually took between 5,000 and 6,000 sea turtles as bycatch, with a mortality rate of an estimated 40 percent due to drowning, injuries, or being returned to the water comatose (Poiner and Harris, 1996). Since the mandatory use of TEDs has been in effect, the annual bycatch of sea turtles in the NPF has dropped to less than 200 sea turtles per year, with a mortality rate of approximately 22 percent (based on recent years). This lower mortality rate also may be based on better sea turtle handling techniques adopted by the fleet. In general, loggerheads were the third most common sea turtle taken in this fishery. In the East Coast otter trawl fishery, Robins (1995) suggests that upwards of 340 turtle mortalities may potentially occur each year, with loggerheads comprising the bulk of the interactions. Despite encouraging signs of reduced impacts to turtles from these and other fisheries operating on the East Coast due to rezoning of the Great Barrier Reef World Heritage site, there remain fisheries threats in nearshore areas that have yet to be abated and that may continue to impact loggerhead sea turtles (Dryden et al., 2008).

Loggerheads also are taken by longline fisheries operating out of Australia (Limpus, 2009). For example, Robins et al. (2002b) estimate that approximately 400 turtles are killed annually in Australian pelagic longline fishery operations. Of this annual estimate, leatherbacks accounted for over 60 percent of this total, while unidentified hardshelled turtles accounted for the remaining species. Therefore, the effect of this longline fishery on loggerheads is unknown.

Loggerheads also have been the most common turtle species captured in shark control programs in Australia (Kidston et al., 1992; Limpus, 2009). From 1998–2002, a total of 232 loggerheads was captured with 195 taken on drum lines and 37 taken in nets, both with a low level of direct mortality (Limpus, 2009).

In the southeastern Pacific, significant bycatch has been reported in artisanal gillnet and longline shark and mahi mahi fisheries operating out of Peru (Kelez et al., 2003; Alfaro-Shigueto et al., 2006, 2010) and, to a lesser extent, Chile (Donoso and Dutton, 2010). The fishing industry in Peru is the second largest economic activity in the country, and, over the past few years, the longline fishery has rapidly increased. Currently, nearly 600 longline vessels fish in the winter and over 1,300 vessels fish in the summer. During an observer program in 2003/2004, 588 sets were observed during 60 trips, and 154 sea turtles were taken as bycatch. Loggerheads were the species most often caught (73.4 percent). Of the loggerheads taken, 68 percent were entangled and 32 percent were hooked. Of the two fisheries, sea turtle bycatch was highest during the mahi

mahi season, with 0.597 turtles/1,000 hooks, while the shark fishery caught 0.356 turtles/1,000 hooks (Alfaro-Shigueto et al., 2008b). A separate study by Kelez et al. (2003) reported that approximately 30 percent of all turtles bycaught in Peru were loggerheads. In many cases, loggerheads are kept on board for human consumption; therefore, the mortality rate in this artisanal longline fishery is likely high because sea turtles are retained for future consumption or sale.

Data on loggerhead bycatch in Chile are limited to the industrial swordfish fleet (Donoso and Dutton, 2010). Since 1990, fleet size has ranged from 7 to 23 vessels with a mean of approximately 14 vessels per year. These vessels fish up to and over 1,000 nautical miles along the Chilean coast with mechanized sets numbering approximately 1,300 to 2,000 hooks (M. Donoso, ONG Pacifico Laud - Chile, personal communication, 2007; Donoso and Dutton, 2010). Loggerhead bycatch is present in Chilean fleets; however, the catch rate is substantially lower than that reported for Peru (Alfaro-Shigueto et al., 2008b, 2010; Donoso and Dutton, 2010).

Other Manmade and Natural Impacts

Other threats such as marine debris ingestion, boat strikes, port dredging, and oil and gas development also impact loggerheads in the South Pacific (Limpus, 2009; M. Hamann, James Cook University, personal communication, 2010). Loggerhead mortality resulting from dredging of channels in Queensland is a persistent, albeit minor problem. From 1999–2002, the average annual reported mortality was 1.7 turtles per year (range = 1–3) from port dredging operations (Limpus, 2009).

Similar to other areas of the world, climate change and sea level rise have the potential to impact loggerheads in the South Pacific Ocean. This includes beach erosion and loss from rising sea levels, skewed hatchling sex ratios from rising beach incubation temperatures, and abrupt disruption of ocean currents used for natural dispersal during the complex life cycle (Hawkes et al., 2009; Poloczanska et al., 2009). Climate change studies for the northern Great Barrier Reef green turtle population indicate that increased sand temperatures will result in the sex ratio of hatchlings produced by this population skewing toward females, as well as lethal incubation temperatures; up to 34 percent of available nesting habitat used by this population may be inundated as a result of sea level rise; and changes in nesting beach sedimentology may result in changes in nesting success, hatchling emerging success, and reduced optimal nesting habitat (Fuentes et al., 2009, 2010a, 2010b, 2010c, 2011). Thus, climate change and sea level rise have the potential to also impact loggerheads in the South Pacific Ocean; however, the impact of these threats for loggerheads has not been quantified (Hamann et al., 2007).

Natural environmental events, such as cyclones or hurricanes, may affect loggerheads in the South Pacific Ocean. These types of events may disrupt loggerhead nesting activity, albeit on a temporary scale. Chaloupka et al. (2008) demonstrated that nesting abundance of loggerheads in Australia was inversely related to sea surface temperatures, and suggested that a long-term warming trend in the South Pacific may be adversely impacting the recovery potential of this population.

In summary, we find that the South Pacific Ocean DPS of the loggerhead sea turtle is negatively affected by both natural and manmade impacts as described above in Factor E. Within Factor E, we find that the cumulative fishery bycatch of loggerheads that occurs throughout the South Pacific Ocean is a significant threat to the persistence of this DPS.

North Indian Ocean DPS

A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Terrestrial Zone

Destruction and modification of loggerhead nesting habitat in the North Indian Ocean result from coastal development and construction, beachfront lighting, vehicular and pedestrian traffic, beach pollution, removal of native vegetation, and planting of non-native vegetation (E. Possardt, USFWS, personal observation, 2008).

The primary loggerhead nesting beaches of this DPS are at Masirah Island, Oman, and are still relatively undeveloped but now facing increasing development pressures. Newly paved roads closely paralleling most of the Masirah Island coast are bringing newly constructed highway lights (E. Possardt, USFWS, personal observation, 2008) and greater access to nesting beaches by the public. Light pollution from the military installation at Masirah Island also is evident at the most densely nested northern end of the island and is a likely cause of hatchling disorientation and nesting female disturbance (E. Possardt, USFWS, personal observation, 2008). Beach driving occurs on most of the major beaches outside the military installation. This vehicular traffic creates ruts that obstruct hatchling movements (Mann, 1977; Hosier et al., 1981; Baldwin, 1992; Cox et al., 1994), tramples nests, and destroys vegetation and dune formation processes, which exacerbates light pollution effects. Free ranging camels, sheep, and goats overgraze beach vegetation, which impedes natural dune formation (E. Possardt, USFWS, personal observation, 2008). A new hotel on a major loggerhead nesting beach at Masirah Island was recently completed and, although not yet approved, there are plans for a major resort at an important loggerhead nesting beach on one of the Halaniyat Islands. Armoring structures common to many developed beaches throughout the world are not yet evident on the major loggerhead nesting beaches of this DPS.

Neritic/Oceanic Zones

Threats to habitat in the loggerhead neritic and oceanic zones in the North Indian Ocean include fishing practices, channel dredging, sand extraction, marine pollution, and climate change. Fishing methods not only incidentally capture loggerheads, but also deplete invertebrate and fish populations and thus alter ecosystem dynamics. In many cases loggerhead foraging areas coincide with fishing zones. There has been an apparent growth in artisanal and commercial fisheries in waters surrounding Masirah Island (Baldwin, 1992). Climate change also may result in future trophic changes, thus impacting loggerhead prey abundance and distribution.

In summary, we find that the North Indian Ocean DPS of the loggerhead sea turtle is negatively affected by ongoing changes in both its terrestrial and marine habitats as a result of land and water use practices as considered above in Factor A. Within Factor A, we find that coastal development, beachfront lighting, and vehicular beach driving on nesting beaches in Oman are significant threats to the persistence of this DPS.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The use of loggerhead meat for food in Oman is not legal or popular. However, routine egg collection on Masirah Island does occur (Baldwin, 1992). The extent of egg collection as estimated by Masirah rangers and local residents is approximately 2,000 clutches per year (less than 10 percent).

In summary, although the collection of eggs for human consumption is known to occur, it does not appear to be a significant threat to the persistence of this DPS.

C. Disease or Predation

The potential exists for diseases and endoparasites to impact loggerheads found in the North Indian Ocean. Natural egg predation on Oman loggerhead nesting beaches undoubtedly occurs, but is not well documented or believed to be significant. Predation on hatchlings by Arabian red fox (Vulpes vulpes arabica), ghost crabs (Ocypode saratan), night herons (Nycticorax nycticorax), and gulls (Larus spp.) likely occurs. While quantitative data do not exist to evaluate these impacts on the North Indian Ocean loggerhead population, they are not likely to be significant.

In summary, nest predation is known to occur and hatchling predation is likely. The best available data suggest predation is potentially affecting the persistence of this DPS; however, quantitative data are not sufficient to assess the degree of impact of nest predation on the persistence of this DPS.

D. Inadequacy of Existing Regulatory Mechanisms

International Instruments

The BRT identified several regulatory mechanisms that apply to loggerhead sea turtles globally and within the North Indian Ocean. The reader is directed to sections 5.1.4. and 5.2.3.4. of the Status Review for a discussion of these regulatory mechanisms. Hykle (2002) and Tiwari (2002) have reviewed the effectiveness of some of these international instruments. The problems with existing international treaties are often that they have not realized their full potential, do not include some key countries, do not specifically address sea turtle conservation, and are handicapped by the lack of a sovereign authority to enforce environmental regulations. The ineffectiveness of international treaties and national legislation is oftentimes due to the lack of motivation or obligation by countries to implement and enforce them. A thorough discussion of this topic is available in a special 2002 issue of the Journal of International Wildlife Law and Policy: International Instruments and Marine Turtle Conservation (Hykle, 2002).

National Legislation and Protection

Oman Royal Decree No. 6/2003 (The Law of Nature Conservation and Wildlife) prohibits harm to all species of sea turtles or the collecting of their eggs. Royal Decrees also exist to protect habitat for important green turtle nesting beaches (Ras al Hadd Turtle Reserve) and hawksbills (Damaniyat Nature Reserve). No such protection exists in Oman for the important nesting beaches at Masirah Island and Halaniyat Islands, although a proposed protected area is being developed and considered for Masirah Island for the loggerhead nesting beaches and other endangered wildlife.

Impacts to loggerheads and loggerhead nesting habitat from coastal development, beachfront lighting, and vehicular beach driving on nesting beaches in Oman is substantial (see Factor A). In addition, fishery bycatch that occurs throughout the North Indian Ocean, although not quantified, is likely substantial (see Factor E). Threats to nesting beaches are likely to increase, which would require additional and widespread nesting beach protection efforts (Factor A). Little is currently being done to monitor and reduce mortality from neritic and oceanic fisheries in the range of the North Indian Ocean DPS; this mortality is likely to continue and increase with expected additional fishing effort from commercial and artisanal fisheries (Factor E). Reduction of mortality would be difficult due to a lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies.

In summary, our review of regulatory mechanisms under Factor D indicates that existing regulatory mechanisms may be insufficient or may not be sufficiently implemented to address the needs of loggerheads. The best available data suggest that insufficient or insufficiently implemented regulatory mechanisms in both the terrestrial and marine environments are potentially affecting the persistence of this DPS; however, sufficient data are not available to assess the adequacy of existing regulatory mechanisms on the persistence of this DPS.

E. Other Natural or Manmade Factors Affecting its Continued Existence

Incidental Bycatch in Fishing Gear

The magnitude of the threat of incidental capture of sea turtles in artisanal and commercial fisheries in the North Indian Ocean is difficult to assess. A bycatch survey administered off the coast of Sri Lanka between September 1999 and November 2000 reported 5,241 total turtle entanglements, of which 1,310 were loggerheads, between Kalpitiya and Kirinda (Kapurusinghe and Saman, 2001; Kapurusinghe and Cooray, 2002). Sea turtle bycatch has been reported in driftnet and set gillnets, longlines, trawls, and hook and line gear (Kapurusinghe and Saman, 2001; Kapurusinghe and Cooray, 2002; Lewison et al., 2004).

Quantifying the magnitude of the threat of fisheries on loggerheads in the North Indian Ocean is difficult given the low level of observer coverage or investigations into bycatch conducted by countries that have large fishing fleets. Efforts have been made to quantify the effects of pelagic longline fishing on loggerheads globally (Lewison et al., 2004; Wallace et al., 2010). While there were no turtle bycatch data available from the North Indian Ocean to use in their assessment, extrapolations that considered bycatch data for the Pacific and Atlantic basins gave a conservative estimate of 6,000 loggerheads captured in the Indian Ocean in the year 2000 (Lewison et al., 2004). Interviews with rangers at Masirah Island reveal that shark gillnets capture many loggerheads off nesting beaches during the nesting season. As many as 60 boats are involved in this fishery with up to 6 km of gillnets being fished daily from June through October along the Masirah Island coast. Quantitative estimates of bycatch are not available due to lack of observer coverage; however, rangers reported that loggerhead bycatch is a common occurrence (E. Possardt, USFWS, personal communication, 2008).

Other Manmade and Natural Impacts

Other anthropogenic impacts, such as boat strikes and ingestion or entanglement in marine debris, as well as entrainment in coastal power plants, likely apply to loggerheads in the North Indian Ocean. Similar to other areas of the world, climate change and sea level rise have the potential to impact loggerheads in the North Indian Ocean. This includes beach erosion and loss from rising sea levels, skewed hatchling sex ratios from rising beach incubation temperatures, and abrupt disruption of ocean currents used for natural dispersal during the complex life cycle (Hawkes et al., 2009; Poloczanska et al., 2009). Climate change impacts could have profound long-term impacts on nesting populations in the North Indian Ocean, but it is not possible to quantify the potential impacts at this point in time.

Natural environmental events, such as cyclones, tsunamis, and hurricanes, affect loggerheads in the North Indian Ocean. For example, during the 2007 season, Oman suffered a rare typhoon. In general, however, severe storm events are episodic and, although they may affect loggerhead hatchling production, the results are generally localized and they rarely result in whole-scale losses over multiple nesting seasons.

In summary, we find that the North Indian Ocean DPS of the loggerhead sea turtle is negatively affected by both natural and manmade impacts as described above in Factor E. Within Factor E, we find that fishery bycatch that occurs throughout the North Indian Ocean, although not quantified, is likely a significant threat to the persistence of this DPS.

Southeast Indo-Pacific Ocean DPS

A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Terrestrial Zone

The primary loggerhead nesting beaches for this DPS occur in Australia on Dirk Hartog Island and Murion Islands (Baldwin et al., 2003), which are undeveloped. Dirk Hartog Island and the Murion Islands recently became part of the Western Australian Protected Area System.

On the mainland, loggerhead nesting habitat is not well protected within the Australian conservation reserve system (Limpus, 2009). Nesting habitat on the Ningaloo Coast is almost entirely contained within the Ningaloo Marine Park; however, management of nesting habitat on this coast is primarily driven by management related to the adjacent pastoral leases. South of the Ningaloo Marine Park, other mainland nesting habitat mostly occurs within pastoral leases (Limpus, 2009). The Gnaraloo section of the coast is a private leasehold, but there are concerns about future coastal development (M. Hamann, James Cook University, personal communication, 2010). The Ningaloo Coast (including Gnaraloo) is currently being considered for World Heritage listing (Commonwealth of Australia, 2010).

Neritic/Oceanic Zones

Threats to habitat in the loggerhead neritic and oceanic zones in the Southeast Indo-Pacific Ocean include fishing practices, channel dredging, oil and gas development, sand extraction, marine pollution, and climate change. Fishing methods not only incidentally capture loggerheads, but also deplete invertebrate and fish populations and thus alter ecosystem dynamics. In many cases, loggerhead foraging areas coincide with fishing zones. Climate change also may result in future trophic changes, thus impacting loggerhead prey abundance and distribution.

In summary, we find that the Southeast Indo-Pacific Ocean DPS of the loggerhead sea turtle is negatively affected by ongoing changes in its marine habitats. The best available data suggest that threats to neritic and oceanic habitats are potentially affecting the persistence of this DPS; however, sufficient data are not available to assess the degree of impact of these threats on the persistence of this DPS.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The Australian Native Title Legislation (Native Title Act 1993) allows the harvesting of loggerheads and their eggs by indigenous peoples (Environment Australia, 2003). However, egg consumption in Australia is virtually nil, and very few loggerheads are taken for food by indigenous Australians (M. Hamann, James Cook University, personal communication, 2010). Dirk Hartog Island and Murion Islands are largely uninhabited, and poaching of eggs and turtles is likely negligible.

In summary, harvest of eggs and turtles is believed to be negligible and does not appear to be a threat to the persistence of this DPS.

C. Disease or Predation

The potential exists for diseases and endoparasites to impact loggerheads found in the Southeast Indo-Pacific Ocean. On the North West Cape and the beaches of the Ningaloo coast of mainland Australia, a long established feral European red fox (Vulpes vulpes) population preyed heavily on eggs and is thought to be responsible for the lower numbers of nesting turtles on the mainland beaches (Baldwin et al., 2003).

The fox populations have been eradicated on Dirk Hartog Island and Murion Islands (Baldwin et al., 2003), and fox eradication projects currently occur at Gnaraloo and Ningaloo in Western Australia. However, fox predation is still a significant issue on these mainland beaches (Limpus, 2009; Butcher, 2010; Hattingh et al., 2010), but these are minor nesting sites (M. Hamann, James Cook University, personal communication, 2010).

In summary, nest predation likely was a factor that contributed to the historical decline of this DPS. However, foxes have been eradicated on Dirk Hartog Island and Murion Islands, and current fox predation levels on mainland beaches in Western Australia are greatly reduced from historical levels. Therefore, predation no longer appears to be a significant threat to the persistence of this DPS.

D. Inadequacy of Existing Regulatory Mechanisms

International Instruments

The BRT identified several regulatory mechanisms that apply to loggerhead sea turtles globally and within the Southeast Indo-Pacific Ocean. The reader is directed to sections 5.1.4. and 5.2.4.4. of the Status Review for a discussion of these regulatory mechanisms. Hykle (2002) and Tiwari (2002) have reviewed the effectiveness of some of these international instruments. The problems with existing international treaties are often that they have not realized their full potential, do not include some key countries, do not specifically address sea turtle conservation, and are handicapped by the lack of a sovereign authority to enforce environmental regulations. The ineffectiveness of international treaties and national legislation is oftentimes due to the lack of motivation or obligation by countries to implement and enforce them. A thorough discussion of this topic is available in a special 2002 issue of the Journal of International Wildlife Law and Policy: International Instruments and Marine Turtle Conservation (Hykle, 2002).

National Legislation and Protection

Fishery bycatch that occurs throughout the Southeast Indo-Pacific Ocean, although not quantified, is likely substantial (see Factor E). With the exception of efforts to reduce loggerhead bycatch in the northern Australian prawn fishery, little is currently being done to monitor and reduce mortality from neritic and oceanic fisheries in the range of the Southeast Indo-Pacific Ocean DPS. This mortality is likely to continue and increase with expected additional fishing effort from commercial and artisanal fisheries (Factor E). Although national and international governmental and non-governmental entities are currently working toward reducing loggerhead bycatch, and some positive actions have been implemented, it is unlikely that this source of mortality can be sufficiently reduced in the near future due to the challenges of mitigating illegal, unregulated, and unreported fisheries, the continued expansion of artisanal fleets, the lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies.

Loggerheads are listed as Endangered under Australia's Environment Protection and Biodiversity Conservation Act of 1999. As described under Factor A, the primary nesting beaches for this DPS occur in Australia on Dirk Hartog Island and Murion Islands (Baldwin et al., 2003). These islands are undeveloped and recently became part of the Western Australian Protected Area System. On the mainland, loggerhead nesting habitat is not well protected within the Australian conservation reserve system (Limpus, 2009), although the Ningaloo Coast (including Gnaraloo) is currently being considered for World Heritage listing (Commonwealth of Australia, 2010). At this time, loggerhead nesting habitat on the Ningaloo Coast is almost entirely contained within the Ningaloo Marine Park, but the Gnaraloo section of the coast is a private leasehold and there are concerns about future coastal development (M. Hamann, James Cook University, personal communication, 2010).

In summary, our review of regulatory mechanisms under Factor D demonstrates that although regulatory mechanisms are in place that should address direct and incidental take of Southeast Indo-Pacific Ocean loggerheads, these regulatory mechanisms are insufficient or are not being implemented effectively to address the needs of loggerheads. We find that the threat from the inadequacy of existing regulatory mechanisms for fishery bycatch (Factor E) is significant relative to the persistence of this DPS.

E. Other Natural or Manmade Factors Affecting its Continued Existence

Incidental Bycatch in Fishing Gear

The extent of the threat of incidental capture of sea turtles in artisanal and commercial fisheries in the Southeast Indo-Pacific Ocean is unknown. Sea turtles are caught in pelagic and demersal longlines, gillnets, trawls, seines, and pots and traps (Environment Australia, 2003).

There is evidence of significant historical bycatch from prawn fisheries, which may have depleted nesting populations long before nesting surveys were initiated in the 1990s (Baldwin et al., 2003).

Quantifying the magnitude of the threat of fisheries on loggerheads in the Southeast Indo-Pacific Ocean is very difficult given the low level of observer coverage or investigations into bycatch conducted by countries that have large fishing fleets. Efforts have been made to quantify the effects of pelagic longline fishing on loggerheads globally (Lewison et al., 2004). While there were no turtle bycatch data available from the Southeast Indo-Pacific Ocean to use in their assessment, extrapolations that considered bycatch data for the Pacific and Atlantic basins gave a conservative estimate of 6,000 loggerheads captured in the Indian Ocean in the year 2000. Loggerheads are known to be taken by Japanese longline fisheries operating off of Western Australia (Limpus, 2009).

The northern Australian prawn fishery (NPF) is made up of both a banana prawn fishery and a tiger prawn fishery, and extends from Cape York, Queensland (142º E) to Cape Londonberry, Western Australia (127º E). The fishery is one of the most valuable in all of Australia and in 2000 comprised 121 vessels fishing approximately 16,000 fishing days (Robins et al., 2002a). In 2000, the use of TEDs in the NPF was made mandatory, due in part to several factors: (1) objectives of the Draft Australian Recovery Plan for Marine Turtles, (2) requirement of the Australian Environment Protection and Biodiversity Conservation Act for Commonwealth fisheries to become ecologically sustainable, and (3) the 1996 U.S. import embargo on wild-caught prawns taken in a fishery without adequate turtle bycatch management practices (Robins et al., 2002a). Data primarily were collected by volunteer fishers who were trained extensively in the collection of scientific data on sea turtles caught as bycatch in their fishery. Prior to the use of TEDs in this fishery, the NPF annually took between 5,000 and 6,000 sea turtles as bycatch, with a mortality rate of an estimated 40 percent, due to drowning, injuries, or being returned to the water comatose (Poiner and Harris, 1996). Since the mandatory use of TEDs has been in effect, the annual bycatch of sea turtles in the NPF has dropped to less than 200 sea turtles per year, with a mortality rate of approximately 22 percent (based on recent years). This lower mortality rate also may be based on better sea turtle handling techniques adopted by the fleet. In general, loggerheads were the third most common sea turtle taken in this fishery.

Loggerheads also have been the most common turtle species captured in shark control programs in Pacific Australia (Kidston et al., 1992; Limpus, 2009); however, the Western Australian demersal longline fishery for sharks has no recorded interaction with loggerheads. An emerging and expanding fishery for portunid crabs has started up in Western Australia and is known to kill loggerheads as bycatch (R. Prince, Department of Environment and Conservation, Western Australia, personal communication, 2011).

Other Manmade and Natural Impacts

Other anthropogenic impacts, such as boat strikes, oil and gas development, and ingestion or entanglement in marine debris, likely apply to loggerheads in the Southeast Indo-Pacific Ocean. Similar to other areas of the world, climate change and sea level rise have the potential to impact loggerheads in the Southeast Indo-Pacific Ocean. This includes beach erosion and loss from rising sea levels, skewed hatchling sex ratios from rising beach incubation temperatures, and abrupt disruption of ocean currents used for natural dispersal during the complex life cycle (Hawkes et al., 2009; Poloczanska et al., 2009). Climate change impacts could have profound long-term impacts on nesting populations in the Southeast Indo-Pacific Ocean, but it is not possible to quantify the potential impacts at this point in time.

Natural environmental events, such as cyclones and hurricanes, may affect loggerheads in the Southeast Indo-Pacific Ocean. In general, however, severe storm events are episodic and, although they may affect loggerhead hatchling production, the results are generally localized and they rarely result in whole-scale losses over multiple nesting seasons.

In summary, we find that the Southeast Indo-Pacific Ocean DPS of the loggerhead sea turtle is negatively affected by both natural and manmade impacts as described above in Factor E; however, many of these threats have not been quantified. Within Factor E, we find that fishery bycatch, particularly from the northern Australian prawn fishery, was a factor that contributed to the historical decline of this DPS. Although loggerhead bycatch has been greatly reduced in the northern Australian prawn fishery, bycatch that occurs elsewhere in the Southeast Indo-Pacific Ocean has not been fully quantified, and there is a new fishery for portunid crabs with known but unquantified bycatch. The best available data suggest the effects of pelagic longline fishing on loggerheads in the Southeast Indo-Pacific are likely substantial when considering the number of industrial and artisanal vessels operating out of nations lining the Indo-Pacific region (FAO Fisheries Statistics [http://www.fao.org/fishery/statistics/en], accessed online June 2011). Within Factor E, we find that fishery bycatch that occurs throughout the Southeast Indo-Pacific Ocean, although not quantified, is likely a significant threat to the persistence of this DPS.

Southwest Indian Ocean DPS

A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Terrestrial Zone

Limited information is available on threats in the terrestrial zone. All nesting beaches within South Africa are within protected areas (Baldwin et al., 2003). In Mozambique, nesting beaches in the Maputo Special Reserve (approximately 60 km of nesting beach) and in the Paradise Islands are within protected areas (Baldwin et al., 2003; Costa et al., 2007).

Neritic/Oceanic Zones

Threats to habitat from fishing practices, channel dredging, sand extraction, and marine pollution likely apply to loggerhead neritic and oceanic zones in the Southwest Indian Ocean DPS. Fishing methods not only incidentally capture loggerheads, but also deplete invertebrate and fish populations and thus alter ecosystem dynamics. In many cases, loggerhead foraging areas coincide with fishing zones. Climate change also may result in future trophic changes, thus impacting loggerhead prey abundance and distribution.

In summary, we find that the Southwest Indian Ocean DPS of the loggerhead sea turtle is likely negatively affected by ongoing changes in its marine habitats as a result of land and water use practices as considered above in Factor A. The best available data suggest that threats to neritic and oceanic habitats are potentially affecting the persistence of this DPS; however, sufficient data are not available to assess the significance of these threats to the persistence of this DPS.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

In the Southwest Indian Ocean, on the east coast of Africa, subsistence hunting by local people is a continued threat to loggerheads (Baldwin et al., 2003). Illegal hunting of marine turtles and egg harvesting remains a threat in Mozambique as well (Louro et al., 2006).

In summary, harvest of loggerheads and eggs for human consumption on the east coast of Africa, although not quantified, is likely a significant threat to the persistence of this DPS.

C. Disease or Predation

The potential exists for diseases and endoparasites to impact loggerheads found in the Southwest Indian Ocean. Side striped jackals (Canis adustus) and honey badgers (Melivora capensis) are known to depredate nests (Baldwin et al., 2003).

In summary, nest predation is known to occur. The best available data suggest predation is potentially affecting the persistence of this DPS; however, quantitative data are not sufficient to assess the degree of impact of nest predation on the persistence of this DPS.

D. Inadequacy of Existing Regulatory Mechanisms

International Instruments

The BRT identified several regulatory mechanisms that apply to loggerhead sea turtles globally and within the Southwest Indian Ocean. The reader is directed to sections 5.1.4. and 5.2.5.4. of the Status Review for a discussion of these regulatory mechanisms. Hykle (2002) and Tiwari (2002) have reviewed the effectiveness of some of these international instruments. The problems with existing international treaties are often that they have not realized their full potential, do not include some key countries, do not specifically address sea turtle conservation, and are handicapped by the lack of a sovereign authority to enforce environmental regulations. The ineffectiveness of international treaties and national legislation is oftentimes due to the lack of motivation or obligation by countries to implement and enforce them. A thorough discussion of this topic is available in a special 2002 issue of the Journal of International Wildlife Law and Policy: International Instruments and Marine Turtle Conservation (Hykle, 2002).

National Legislation and Protection

Fishery bycatch that occurs throughout the Southwest Indian Ocean, although not broadly quantified, is likely substantial (see Factor E). This mortality is likely to continue and may increase with expected additional fishing effort from commercial and artisanal fisheries. Reduction of mortality would be difficult due to a lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies.

As described under Factor A, all loggerhead nesting beaches within South Africa are within protected areas (Baldwin et al., 2003). In Mozambique, nesting beaches in the Maputo Special Reserve (approximately 60 km of nesting beach) and in the Paradise Islands are within protected areas (Baldwin et al., 2003; Costa et al., 2007).

In summary, our review of regulatory mechanisms under Factor D indicates that existing regulatory mechanisms may be insufficient or may not be sufficiently implemented to address the needs of loggerheads. The best available data suggest that insufficient or insufficiently implemented regulatory mechanisms in the marine environment are potentially affecting the persistence of this DPS; however, sufficient data are not available to assess the adequacy of existing regulatory mechanisms on the persistence of this DPS.

E. Other Natural or Manmade Factors Affecting its Continued Existence

Incidental Bycatch in Fishing Gear

The full extent of the threat of incidental capture of sea turtles in artisanal and commercial fisheries in the Southwest Indian Ocean is unknown. Sea turtles are caught in demersal and pelagic longlines, trawls, gillnets, and seines (Petersen, 2005; Louro et al., 2006; Costa et al., 2007; Fennessy and Isaksen, 2007; Petersen et al., 2007, 2009). There is evidence of significant historical bycatch from prawn fisheries, which may have depleted nesting populations long before nesting surveys were initiated in the 1990s (Baldwin et al., 2003).

Quantifying the magnitude of the threat of fisheries on loggerheads in the Southwest Indian Ocean is very difficult given the low level of observer coverage or investigations into bycatch conducted by countries that have large fishing fleets. Efforts have been made to quantify the effects of pelagic longline fishing on loggerheads globally (Lewison et al., 2004). While there were no turtle bycatch data available from the Southwest Indian Ocean to use in their assessment, extrapolations that considered bycatch data for the Pacific and Atlantic basins gave a conservative estimate of 6,000 loggerheads captured in the Indian Ocean in the year 2000. The effect of the longline fishery on loggerheads in the Indian Ocean is largely unknown (Lewison et al., 2004).

Other Manmade and Natural Impacts

Other anthropogenic impacts, such as boat strikes and ingestion or entanglement in marine debris, likely apply to loggerheads in the Southwest Indian Ocean. Similar to other areas of the world, climate change and sea level rise have the potential to impact loggerheads in the Southwest Indian Ocean. This includes beach erosion and loss from rising sea levels, skewed hatchling sex ratios from rising beach incubation temperatures, and abrupt disruption of ocean currents used for natural dispersal during the complex life cycle (Hawkes et al., 2009; Poloczanska et al., 2009). Climate change impacts could have profound long-term impacts on nesting populations in the Southwest Indian Ocean, but it is not possible at this time to predict how and the extent to which climate change will impact this DPS.

Natural environmental events, such as cyclones, tsunamis and hurricanes, may affect loggerheads in the Southwest Indian Ocean. In general, however, severe storm events are episodic and, although they may affect loggerhead hatchling production, the results are generally localized and they rarely result in whole-scale losses over multiple nesting seasons.

In summary, we find that the Southwest Indian Ocean DPS of the loggerhead sea turtle is negatively affected by both natural and manmade impacts as described above in Factor E. Within Factor E, we find that fishery bycatch that occurs throughout the Southwest Indian Ocean, although not quantified, is likely a significant threat to the persistence of this DPS.

Northwest Atlantic Ocean DPS

A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Terrestrial Zone

Destruction and modification of loggerhead nesting habitat in the Northwest Atlantic results from coastal development and construction, placement of erosion control structures and other barriers to nesting, placement of nearshore shoreline stabilization structures, beachfront lighting, vehicular and pedestrian traffic, beach erosion, beach sand placement, removal of native vegetation, and planting of non-native vegetation (NMFS and USFWS, 2008).

Numerous beaches in the southeastern United States are eroding due to both natural (e.g., storms, sea level changes, waves, shoreline geology) and anthropogenic (e.g., construction of armoring structures, groins, and jetties; coastal development; inlet dredging) factors. Such shoreline erosion leads to a loss of nesting habitat for sea turtles.

In the southeastern United States, numerous erosion control structures (e.g., bulkheads, seawalls, soil retaining walls, rock revetments, sandbags, geotextile tubes) that create barriers to nesting have been constructed. The proportion of coastline that is armored is approximately 18 percent (239 km) in Florida (Clark, 1992; Schroeder and Mosier, 2000; Witherington et al., 2006b), 9 percent (14 km) in Georgia (M. Dodd, Georgia Department of Natural Resources, personal communication, 2009), 12 percent (29 km) in South Carolina (D. Griffin, South Carolina Department of Natural Resources, personal communication, 2009), and 3 percent (9 km) in North Carolina (M. Godfrey, North Carolina Wildlife Resources Commission, 2009). These estimates of armoring extent do not include structures that are also barriers to sea turtle nesting but do not fit the definition of armoring, such as dune crossovers, cabanas, sand fences, and recreational equipment. Jetties have been placed at many ocean inlets along the U.S. Atlantic coast to keep transported sand from closing the inlet channel. Witherington et al. (2005) found a significant negative relationship between loggerhead nesting density and distance from the nearest of 17 ocean inlets on the Atlantic coast of Florida. The effect of inlets in lowering nesting density was observed both updrift and downdrift of the inlets, leading researchers to propose that beach instability from both erosion and accretion may discourage loggerhead nesting.

Stormwater and other water source runoff from coastal development, including beachfront parking lots, building rooftops, roads, decks, and draining swimming pools adjacent to the beach, is frequently discharged directly onto Northwest Atlantic beaches and dunes either by sheet flow, through stormwater collection system outfalls, or through small diameter pipes. These outfalls create localized erosion channels, prevent natural dune establishment, and wash out sea turtle nests (Florida Fish and Wildlife Conservation Commission, unpublished data). Contaminants contained in stormwater, such as oils, grease, antifreeze, gasoline, metals, pesticides, chlorine, and nutrients, are also discharged onto the beach and have the potential to affect sea turtle nests and emergent hatchlings. The effects of these contaminants on loggerheads are not yet understood. As a result of natural and anthropogenic factors, beach nourishment is a frequent activity, and many beaches are on a periodic nourishment schedule. On severely eroded sections of beach, where little or no suitable nesting habitat previously existed, beach nourishment has been found to result in increased nesting (Ernest and Martin, 1999). However, on most beaches in the southeastern United States, nesting success typically declines for the first year or two following construction, even though more nesting habitat is available for turtles (Trindell et al., 1998; Ernest and Martin, 1999; Herren, 1999).

Coastal development also contributes to habitat degradation by increasing light pollution. Both nesting and hatchling sea turtles are adversely affected by the presence of artificial lighting on or near the beach (Witherington and Martin, 1996). Experimental studies have shown that artificial lighting deters adult female turtles from emerging from the ocean to nest (Witherington, 1992). Witherington (1986) also noted that loggerheads aborted nesting attempts at a greater frequency in lighted areas. Because adult females rely on visual brightness cues to find their way back to the ocean after nesting, those turtles that nest on lighted beaches may become disoriented by artificial lighting and have difficulty finding their way back to the ocean. In some cases, misdirected nesting females have crawled onto coastal highways and have been struck and killed by vehicles (Florida Fish and Wildlife Conservation Commission, unpublished data).

Reports of hatchling disorientation events in Florida alone describe several hundred nests each year and are likely to involve tens of thousands of hatchlings (Nelson et al., 2002); however, this number calculated is likely a vast underestimate. Independent of these reports, Witherington et al. (1996) surveyed hatchling orientation at nests located at 23 representative beaches in six counties around Florida in 1993 and 1994 and found that, by county, approximately 10 to 30 percent of nests showed evidence of hatchlings disoriented by lighting. From this survey and from measures of hatchling production (Florida Fish and Wildlife Conservation Commission, unpublished data), the number of hatchlings disoriented by lighting in Florida is calculated in the range of hundreds of thousands per year. Mortality of disoriented clutches is likely very high (NMFS and USFWS, 2008 - see Appendix 2).

In the United States, vehicular driving is allowed on certain beaches in northeast Florida (Nassau, Duval, St. Johns, and Volusia Counties), northwest Florida (Walton and Gulf Counties), Georgia (Cumberland, Little Cumberland, and Sapelo Islands), North Carolina (Fort Fisher State Recreation Area, Carolina Beach, Freeman Park, Onslow Beach, Emerald Isle, Indian Beach/Salter Path, Pine Knoll Shores, Atlantic Beach, Cape Lookout National Seashore, Cape Hatteras National Seashore, Nag's Head, Kill Devil Hills, Town of Duck, and Currituck Banks), Virginia (Chincoteague NWR and Wallops Island), and Texas (the majority of beaches except for a highly developed section of South Padre Island and Padre Island National Seashore, San Jose Island, Matagorda Island, and Matagorda Peninsula where driving is not allowed or is limited to agency personnel, land owners, and researchers). Beach driving has been found to reduce the quality of loggerhead nesting habitat in several ways. In the southeastern U.S., vehicle ruts on the beach have been found to prevent or impede hatchlings from reaching the ocean following emergence from the nest (Mann, 1977; Hosier et al., 1981; Cox et al., 1994; Hughes and Caine, 1994). Sand compaction by vehicles has been found to hinder nest construction and hatchling emergence from nests (Mann, 1977). Vehicle lights and vehicle movement on the beach after dark results in reduced habitat suitability, which can deter females from nesting and disorient hatchlings. Additionally, vehicle traffic on nesting beaches contributes to erosion, especially during high tides or on narrow beaches where driving is concentrated on the high beach and foredune.

Neritic/Oceanic Zones

Threats to habitat in the loggerhead neritic and oceanic zones in the Northwest Atlantic Ocean include fishing practices, channel dredging, sand extraction, oil exploration and development, marine pollution, and climate change. Fishing methods not only incidentally capture loggerheads, but also deplete invertebrate and fish populations and thus alter ecosystem dynamics. Although anthropogenic disruptions of natural ecological interactions have been difficult to discern, a few studies have been focused on the effects of these disruptions on loggerheads. For instance, Youngkin (2001) analyzed gut contents from hundreds of loggerheads stranded in Georgia over a 20-year period. His findings point to the probability of major effects on loggerhead diet from activities such as shrimp trawling and dredging. Lutcavage and Musick (1985) found that horseshoe crabs strongly dominated the diet of loggerheads in Chesapeake Bay in 1980–1981. Subsequently, fishermen began to harvest horseshoe crabs, primarily for use as bait in the eel and whelk pot fisheries, using several gear types. Atlantic coast horseshoe crab landings increased by an order of magnitude (0.5 to 6.0 million pounds) between 1980 and 1997, and in 1998 the Atlantic States Marine Fisheries

Commission implemented a horseshoe crab fishery management plan to curtail catches (Atlantic States Marine Fisheries Commission, 1998). The decline in horseshoe crab availability has apparently caused a diet shift in juvenile loggerheads, from predominantly horseshoe crabs in the early to mid-1980s to blue crabs in the late 1980s and early 1990s, to mostly finfish in the late 1990s and early 2000s (Seney, 2003; Seney and Musick, 2007). These data suggest that turtles are foraging in greater numbers in or around fishing gears and on discarded bycatch (Seney, 2003). However, Wallace et al. (2009) and McClellan et al. (2010) reported that neritic crabs (blue crabs, in particular) and whelk comprised the most important dietary items for juvenile loggerheads in neritic areas in North Carolina, indicating that the trend reported by Seney and Musick (2007) might be regional.

Periodic dredging of sediments from navigational channels is carried out at large ports to provide for the passage of large commercial and military vessels. In addition, sand mining (dredging) for beach renourishment and construction projects occurs in the Northwest Atlantic along the U.S., Mexico, Central American, Colombia, and Venezuela coasts. Although directed studies have not been conducted, dredging activities, which occur regularly in the Northwest Atlantic, have the potential to destroy or degrade benthic habitats used by loggerheads. Channelization of inshore and nearshore habitat and the subsequent disposal of dredged material in the marine environment can destroy or disrupt resting or foraging grounds (including grass beds and coral reefs) and may affect nesting distribution by altering physical features in the marine environment (Hopkins and Murphy, 1980). Oil exploration and development on live bottom areas may disrupt foraging grounds by smothering benthic organisms with sediments and drilling muds (Coston-Clements and Hoss, 1983). The effects of benthic habitat alteration on loggerhead prey abundance and distribution, and the effects of these potential changes on loggerhead populations, have not been determined but are of concern. Climate change also may result in trophic changes, thus impacting loggerhead prey abundance and distribution.

In summary, we find that the Northwest Atlantic Ocean DPS of the loggerhead sea turtle is negatively affected by ongoing changes in both its terrestrial and marine habitats as a result of land and water use practices as considered above in Factor A. Within Factor A, we find that coastal development, beachfront lighting, and coastal armoring and other erosion control structures on nesting beaches in the United States are significant threats to the persistence of this DPS. We also find that anthropogenic disruptions of natural ecological interactions as a result of fishing practices, channel dredging, and oil exploration and development are likely a significant threat to the persistence of this DPS. However, compared to many of the other loggerhead DPSs and sea turtle species, the United States has the ability to control a very large proportion of the anthropogenic threats to nesting and foraging habitats used by neritic juveniles and adults. While not minimizing the role of the Caribbean rookeries, the vast majority of nesting is on U.S. beaches, and a great number of large neritic juveniles and adults, the most reproductively valuable age classes, from all rookeries spend a large portion of their time in U.S. waters.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Deliberate hunting of loggerheads for their meat, shells, and eggs is reduced from previous exploitation levels, but still exists. In the Caribbean, 12 of 29 (41 percent) countries/territories allow the harvest of loggerheads (NMFS and USFWS, 2008 - see Appendix 3; A. Bolten, University of Florida, personal communication, 2009); this takes into account the September 2009 ban on the harvest of sea turtles in The Bahamas. Loggerhead harvest in the

Caribbean is generally restricted to the non-nesting season with the exception of St. Kitts and Nevis, where turtle harvest is allowed annually from March 1 through September 30, and the Turks and Caicos Islands, where turtle harvest is allowed year-round. Most countries/territories that allow harvest have regulations that favor the harvest of large juvenile and adult turtles, the most reproductively valuable members of the population. Exceptions include the Cayman Islands, which mandates maximum size limits, and Haiti and Trinidad and Tobago, which have no size restrictions. All North, Central, and South American countries in the Northwest Atlantic have enacted laws that mandate complete protection of loggerheads from harvest in their territorial waters with the exception of Guyana. Despite national laws, in many countries the poaching of eggs and hunting of adult and juvenile turtles still occurs at varying levels (NMFS and USFWS, 2008 - see Appendix 3). Although unquantified, the extent of legal and illegal take in most locations is believed to be low and occur in locations where loggerhead density is low (NMFS and USFWS, 2008 - see Appendix 2; TEWG, 2009). However, take in Cuba, despite the national ban, is thought to be rather extensive (F. Moncada-Gavilan, Cuba Fisheries Research Centre, personal communication, 2009).

In summary, overutilization for commercial purposes likely was a factor that contributed to the historical decline of this DPS. Legal and illegal harvest of loggerheads in the Caribbean for human consumption continues, and the best available data suggest this harvest is potentially affecting the persistence of this DPS; however, quantitative data are not sufficient to assess the degree of impact of overutilization on the persistence of this DPS.

C. Disease or Predation

The potential exists for diseases and endoparasites to impact loggerheads found in the Northwest Atlantic. Viral diseases have not been documented in free-ranging loggerheads, with the possible exception of sea turtle fibropapillomatosis, which may have a viral etiology (Herbst and Jacobson, 1995; George, 1997). Although fibropapillomatosis reaches epidemic proportions in some wild green turtle populations, the prevalence of this disease in most loggerhead populations is thought to be small. An exception is Florida Bay where approximately 9.5 percent of the loggerheads captured exhibit fibropapilloma-like external lesions (B. Schroeder, NMFS, personal communication, 2006). Mortality levels and population-level effects associated with the disease are still unknown. Heavy infestations of endoparasites may cause or contribute to debilitation or mortality in loggerhead sea turtles. Trematode eggs and adult trematodes were recorded in a variety of tissues including the spinal cord and brain of debilitated loggerheads during an epizootic in South Florida, USA, during late 2000 and early 2001. These endoparasites were implicated as a possible cause of the epizootic (Jacobson et al., 2006). Although many health problems have been described in wild populations through the necropsy of stranded turtles, the significance of diseases on the ecology of wild loggerhead populations is not known (Herbst and Jacobson, 1995).

Predation of eggs and hatchlings by native and introduced species occurs on almost all nesting beaches throughout the Northwest Atlantic. The most common predators at the primary nesting beaches in the southeastern United States are ghost crabs (Ocypode quadrata), raccoons (Procyon lotor), feral hogs (Sus scrofa), foxes (Urocyon cinereoargenteus and Vulpes vulpes), coyotes (Canis latrans), armadillos (Dasypus novemcinctus), and red fire ants (Solenopsis invicta) (Stancyk, 1982; Dodd, 1988). In the absence of well managed nest protection programs, predators may take significant numbers of eggs; however, nest protection programs are in place at most of the major nesting beaches in the Northwest Atlantic.

Non-native vegetation has invaded many coastal areas and often outcompetes native plant species. Exotic vegetation may form impenetrable root mats that can invade and desiccate eggs, as well as trap hatchlings. The Australian pine (Casuarina equisetifolia) is particularly harmful to sea turtles. Dense stands have taken over many coastal areas throughout central and south Florida. Australian pines cause excessive shading of the beach that would not otherwise occur. Studies in Florida suggest that nests laid in shaded areas are subjected to lower incubation temperatures, which may alter the natural hatchling sex ratio (Marcus and Maley, 1987; Schmelz and Mezich, 1988; Hanson et al., 1998). Fallen Australian pines limit access to suitable nest sites and can entrap nesting females (Austin, 1978; Reardon and Mansfield, 1997). The shallow root network of these pines can interfere with nest construction (Schmelz and Mezich, 1988). Davis and Whiting (1977) reported that nesting activity declined in Everglades National Park where dense stands of Australian pine took over native dune vegetation on a remote nesting beach. Beach vitex (Vitex rotundifolia) is native to countries in the western Pacific and was introduced to the horticulture trade in the southeastern United States in the mid-1980s and is often sold as a "dune stabilizer." Its presence on North Carolina and South Carolina beaches has a negative effect on sea turtle nesting as its dense mats interfere with sea turtle nesting and hatchling emergence from nests (Brabson, 2006). This exotic plant is crowding out the native species, such as sea oats and bitter panicum, and can colonize large areas in just a few years. Sisal, or century plant, (Agave americana) is native to arid regions of Mexico. The plant was widely grown in sandy soils around Florida in order to provide fiber for cordage. It has escaped cultivation in Florida and has been purposely planted on dunes. Although the effects of sisal on sea turtle nesting are uncertain, thickets with impenetrable sharp spines are occasionally found on developed beaches.

Harmful algal blooms, such as a red tide, also affect loggerheads in the Northwest Atlantic. In Florida, the species that causes most red tides is Karenia brevis, a dinoflagellate that produces a toxin (Florida Marine Research Institute, 2003) and can cause mortality in birds, marine mammals, and sea turtles. During four red tide events along the west coast of Florida, sea turtle stranding trends indicated that these events were acting as a mortality factor (Redlow et al., 2003). Furthermore, brevetoxin concentrations supportive of intoxication were detected in biological samples from dead and moribund sea turtles during a mortality event in 2005 and in subsequent events (Fauquier et al., 2007). The population level effects of these events are not yet known.

In summary, nest and hatchling predation likely was a factor that contributed to the historical decline of this DPS. Although current predation levels in the United States are greatly reduced from historical levels, predation still occurs in the United States, as well as in Mexico, and could be significant in the absence of the current well managed protection efforts. Although diseases and parasites are known to impact loggerheads in this DPS, the significance of these threats is not known. Overall, however, current threats in both the terrestrial and marine environments are not believed to be a significant threat to the persistence of this DPS.

D. Inadequacy of Existing Regulatory Mechanisms

International Instruments

The BRT identified several regulatory mechanisms that apply to loggerhead sea turtles globally and within the Northwest Atlantic Ocean (Conant et al., 2009). Hykle (2002) and Tiwari (2002) have reviewed the effectiveness of some of these international instruments. The problems with existing international treaties are often that they have not realized their full potential, do not include some key countries, do not specifically address sea turtle conservation, and are handicapped by the lack of a sovereign authority to enforce environmental regulations. The ineffectiveness of international treaties and national legislation is oftentimes due to the lack of motivation or obligation by countries to implement and enforce them. A thorough discussion of this topic is available in a special 2002 issue of the Journal of International Wildlife Law and Policy: International Instruments and Marine Turtle Conservation (Hykle, 2002). However, efforts continue to establish international instruments for sea turtle protection and to incorporate sea turtle protection into existing instruments. In November 2010, ICCAT approved a proposal to require data reporting on the capture of sea turtles in the Atlantic Ocean and mandated the use of hook-removal and fishing line disentanglement gear.

National Legislation and Protection

Fishery bycatch that occurs throughout the North Atlantic Ocean is substantial (see Factor E). National and international governmental and non-governmental entities on both sides of the North Atlantic are currently working toward reducing loggerhead bycatch. Some positive actions have been implemented in addition to effort reductions occurring in some fisheries as a result of economics and reductions in target species. However, it is still unclear to what degree this source of mortality can be reduced across the range of the DPS in the near future because of the diversity and magnitude of the fisheries operating in the North Atlantic, the lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies. National legislation and protective measures have been implemented in the past, and in many cases it is yet too early to determine the effectiveness of those actions stemming from the available regulatory mechanisms. With a long age to maturity and transitory dynamics in the populations, the effects of actions taken over 20 years ago may just now be expected to be observed on the nesting beaches. The existing regulatory framework uses the authority of the ESA, as well as that of the Magnuson-Stevens Fishery Conservation and Management Act, as the primary means of providing protection from fishery interactions. Further explanation of specific protective actions taken under these Acts to reduce fishery bycatch are detailed in the discussion of incidental bycatch in fishing gear under Factor E as well as under the Conservation Efforts section. A comprehensive review of the framework for all U.S. fisheries in which turtle (as well as mammal and seabird) bycatch occurs is provided by Moore et al. (2009).

Coastal development, coupled with critical beach erosion, has led to the placement of structures (e.g., armoring, sand fences, and other erosion control structures to protect upland property), which have destroyed or degraded nesting habitat. While some States have regulations prohibiting coastal armoring, other State regulations are insufficient to protect nesting habitat. State regulations related to the placement and design of new coastal structures need to be reviewed and revised as appropriate to reduce the need for coastal armoring. Where lighting ordinances have been adopted and adequately enforced, hatchling disorientation has been managed at acceptable levels; however, not all coastal counties or municipalities have adopted or fully enforced effective lighting ordinances and thus additional work is needed to ensure more consistent protective measures.

In summary, our review of regulatory mechanisms under Factor D demonstrates that regulatory mechanisms are in place that should address direct and incidental take of Northwest Atlantic Ocean loggerheads. While the regulatory mechanisms contained within international instruments are inconsistent and likely insufficient, the mechanisms of existing national legislation and protection are much more adequate. However, it remains to be determined if national measures are being implemented effectively to fully address the needs of loggerheads. The potential strength of the existing national regulatory mechanisms provides a likely advantage to the Northwest Atlantic Ocean DPS compared to other loggerhead DPSs and other sea turtle species, as a very large proportion of the adult and large juvenile stages occur in waters under our national jurisdiction. However, we find that even with the existing regulatory mechanisms there is still a potential threat from both national and international fishery bycatch (Factor E) and coastal development, beachfront lighting, and coastal armoring and other erosion control structures on nesting beaches in the United States (Factor A). More work needs to be done under the existing national regulatory mechanisms, as well as continuing to advance the development and effectiveness of international instruments, to ensure the persistence of this DPS. Therefore, we find that the threat from the inadequacy of existing regulatory mechanisms is significant relative to the persistence of this DPS.

E. Other Natural or Manmade Factors Affecting its Continued Existence

<u>Incidental Bycatch in Fishing Gear</u>

Bycatch of loggerheads in commercial and recreational fisheries in the Northwest Atlantic is a significant threat facing the species in this region. A variety of fishing gears that incidentally capture loggerhead sea turtles are employed including gillnets, trawls, hook and line, longlines, seines, dredges, pound nets, and various types of pots/traps. Among these, gillnets, longlines, and trawl gear contribute to the vast majority of bycatch mortality of loggerheads annually throughout their range in the Atlantic Ocean and Gulf of Mexico with shrimp trawls likely accounting for the majority of bycatch mortality (Epperly et al., 1995; NMFS, 2002, 2004, 2007, 2008; Lewison et al., 2003, 2004; Richards, 2007; Moore et al., 2009; NMFS, unpublished data). Considerable effort has been expended since the 1980s to document and address fishery bycatch, especially in the United States and Mexico. Observer programs have been implemented in some fisheries to collect turtle bycatch data, and efforts to reduce bycatch and mortality of loggerheads in certain fishing operations have been undertaken and implemented or partially implemented. These efforts include developing gear solutions to prevent or reduce captures or to allow turtles to escape without harm (e.g., TEDs, circle hooks and bait combinations), implementing time and area closures to prevent interactions from occurring (e.g., prohibitions on gillnet fishing along the mid-Atlantic coast during the critical time of northward migration of loggerheads), implementation of careful release protocols (e.g., requirements for careful release of turtles captured in longline fisheries), prohibitions of gillnetting in some U.S. State waters, and modifying gear (e.g., requirements to reduce mesh size in the leaders of pound nets in certain U.S. coastal waters to prevent entanglement).

The primary bycatch reduction focus in the Northwest Atlantic, since the 1978 ESA listing of the loggerhead, has been on bycatch reduction in shrimp trawls. The United States has required the use of TEDs throughout the year since the mid-1990s, with modifications required and implemented as necessary (52 FR 24244; June 29, 1987; 57 FR 57348; December 4, 1992; Epperly, 2003). Most notably, in 2003, NMFS implemented new requirements for TEDs in the shrimp trawl fishery to ensure that large loggerheads could escape through TED openings (68 FR 8456; February 21, 2003). Significant effort has been expended to transfer this technology to other shrimping fleets in the Northwest Atlantic; however, not all nations where loggerheads occur require the device be used. Enforcement of TED regulations is difficult and compliance is not believed to be complete in any of the nations requiring TED use, including the United States. Even if compliance was complete, TEDs are not 100 percent effective, as it is estimated that as much as 3 percent of turtles may still be retained and possibly drown in a trawl with a properly installed TED. Therefore, a significant number of loggerheads are estimated to still be killed annually in shrimp trawls throughout the Northwest Atlantic. For the U.S. Southeast food shrimp trawl fishery, NMFS previously estimated the annual mortality of loggerheads in the Gulf of Mexico and southeastern U.S. Atlantic Ocean as 3,948 individuals (95 percent confidence intervals, 1,221–8,498) based upon 2001 effort data (NMFS, 2002). However, shrimping effort by otter trawls in the southeastern United States has significantly declined in both the Gulf of Mexico (2009 effort was 39 percent of 2001 effort) and the South Atlantic (2009 effort was 62 percent of 2001 effort) (NMFS, unpublished data). In 2011 a revised estimate of annual loggerhead mortality for the Southeast food shrimp trawl fishery was calculated using 2009 data (the latest available at the time). It estimated annual mortality to be 778 individuals in the Gulf of Mexico and 673 in the South Atlantic (NMFS, unpublished data).

Other trawl fisheries operating in Northwest Atlantic waters that are known or expected to capture sea turtles include, but are not limited to, summer flounder, calico scallop, sea scallop, blue crab, whelk, cannonball jellyfish, horseshoe crab, and mid-Atlantic directed finfish trawl fisheries and the Sargassum fishery. In the United States, the summer flounder fishery is the only trawl fishery (other than the shrimp fishery) with federally mandated TED use (in certain areas). Loggerhead annual bycatch estimates in 2004 and 2005 in U.S. mid-Atlantic scallop trawl gear ranged from 81 to 191 turtles, depending on the estimation methodology used (Murray, 2007). Estimated average annual bycatch of loggerheads in other mid-Atlantic federally managed bottom otter trawl fisheries during 1996–2004 was 616 turtles (Murray, 2006). A more recent study estimated that between the years 2005–2008, an average of 352 loggerheads were caught annually by the U.S. Mid-Atlantic fish and scallop bottom otter trawl fisheries (Warden, 2011). The harvest of Sargassum by trawlers can result in incidental capture of post-hatchlings and habitat destruction (Schwartz, 1988; Witherington, 2002); however, this fishery is not currently active. Likewise, the calico scallop fishery was a periodic fishery that did not occur on a regular basis and has not been prosecuted for years: no commercial landings of calico scallop have been reported from the East Coast of Florida since 2003 (NMFS commercial fisheries landings database), and the processing facilities that previously supported these fisheries have been closed, hampering the rapid resumption of a large-scale fishery.

Dredge fishing gear is the predominant gear used to harvest sea scallops off the mid- and northeastern United States Atlantic coast. Turtles can be struck and injured or killed by the dredge frame or captured in the bag where they may drown or be further injured or killed when the catch and heavy gear are dumped on the vessel deck. Total estimated bycatch of loggerhead sea turtles in the U.S. sea scallop dredge fishery operating in the mid-Atlantic region (New York to North Carolina) from June through November is on the order of several hundred turtles per year (Murray, 2004, 2005, 2007). The impact of the sea scallop dredge fishery on loggerheads in U.S. waters of the Northwest Atlantic remains a serious concern.

Incidental take of oceanic-stage loggerheads in pelagic longline fisheries has recently received significant attention (Balazs and Pooley, 1994; Bolten et al., 1994, 2000; Aguilar et al., 1995; Laurent et al., 1998; Long and Schroeder, 2004; Watson et al., 2005). Large-scale commercial longline fisheries operate throughout the pelagic range of the Northwest Atlantic loggerhead, including the western Mediterranean. The largest size classes in the oceanic stage are the size classes impacted by the swordfish longline fishery in the Azores (Bolten, 2003) and on the Scotian Shelf, Georges Bank, and Grand Banks in Canadian waters (Watson et al., 2005; Brazner and McMillan, 2008), and this is likely the case for other nation's fleets operating in the region, including but not limited to, the European Union, United States, Japan, and Taiwan. The demographic consequences relative to population recovery of the increased mortality of these size classes have been discussed (Crouse et al., 1987; Heppell et al., 2003; Chaloupka, 2003; Wallace et al., 2008). Estimates derived from data recorded by the international observer program suggest that thousands of mostly juvenile loggerheads have been captured in the Canadian pelagic longline fishery in the western North Atlantic since 1999 (Brazner and McMillan, 2008). NMFS (2004) estimates that 635 loggerheads (143 lethal) will be taken annually in the U.S. pelagic longline fishery.

Incidental capture of neritic-stage loggerheads in demersal longline fishing gear has also been documented. Richards (2007) estimated total annual bycatch of loggerheads in the

Southeast U.S. Atlantic and U.S. Gulf of Mexico commercial directed shark bottom longline fishery from 2003–2005 as follows: 2003: 302–1,620 (CV 0.45); 2004: 95–591 (CV 0.49); and 2005: 139–778 (CV 0.46). NMFS (2009) estimated the total number of captures of hardshell turtles in the U.S. Gulf of Mexico reef fish fishery (demersal longline fishery) from July 2006–December 2008 as 861 turtles (95 percent confidence intervals, 383–1934). Based on the 2009 biological opinion for the Gulf of Mexico reef fish fishery, estimated takes by the demersal longline portion of the fishery following new regulations on gear restrictions and post-hooking gear removal was determined to be 623 every 3 years, with a mortality of 378 over that time span. This represents a reduction compared to the recent historical take cited above. These estimates are not comprehensive across this gear type (i.e., pelagic and demersal longline) throughout the Northwest Atlantic Ocean. Cumulatively, the bycatch and mortality of Northwest Atlantic loggerheads in longline fisheries is significant.

Gillnet fisheries may be the most ubiquitous of fisheries operating in the neritic range of the Northwest Atlantic loggerhead. Comprehensive estimates of bycatch in gillnet fisheries do not yet exist and, while this precludes a quantitative analysis of their impacts on loggerhead populations, the cumulative mortality of loggerheads in gillnet fisheries is likely high. In the U.S. mid-Atlantic, the average annual estimated bycatch of loggerheads from 1995–2006 was 350 turtles (CV= 0.20., 95 percent confidence intervals over the 12-year period: 234 to 504) (Murray, 2009). From 2007–2009, the U.S. pelagic shark gillnet fishery had a total of three observed loggerhead takes (all in 2007), but insufficient data exist to extrapolate a total estimated take for the fishery (NMFS, unpublished report). In the United States, some States (e.g., South Carolina, Georgia, Florida, Louisiana, and Texas) have prohibited gillnets in their waters, but there remain active gillnet fisheries in other U.S. States, in U.S. Federal waters, Mexico waters, Central and South America waters, and the Northeast Atlantic.

Pound nets are fixed gear with a long mesh leader that can be suspended from the surface by a series of stringers or vertical lines or a mesh supported along its length supported by stakes; both end in a "heart" that funnels animals into an impoundment for trapping fish at the terminal point of the gear. Sea turtles incidentally captured in the open top pound are usually safe from injury and can be released when the fishermen pull the nets (Mansfield et al., 2002; Epperly et al., 2007). However, sea turtle mortalities have been documented in the leader of certain pound nets. Large mesh leaders (greater than 12-inch stretched mesh) may act as a gillnet, entangling sea turtles by the head or foreflippers (Bellmund et al., 1987) or may act as a barrier against which turtles may be impinged (NMFS, unpublished data). Nets with small mesh leaders (less than 8 inches stretched mesh) usually do not present a mortality threat to loggerheads, but some mortality has been reported (Morreale and Standora, 1998; Epperly et al., 2000, 2007; Mansfield et al., 2002). In 2002, the United States prohibited, in certain areas within the Chesapeake Bay and at certain times, pound net leaders having mesh greater than or equal to 12 inches and leaders with stringers (67 FR 41196; June 17, 2002). Subsequent regulations have further restricted the use of certain pound net leaders in certain geographic areas and established pound net leader gear modifications (69 FR 24997; May 5, 2004; 71 FR 36024; June 23, 2006).

Pots/traps are commonly used to target crabs, lobsters, whelk, and reef fishes. These traps vary in size and configuration, but all are attached to a surface float by means of a vertical line leading to the trap. Entanglement and mortality of loggerheads has been documented in various pot/trap fisheries in the U.S. Atlantic and Gulf of Mexico. Data from the U.S. Sea Turtle

Stranding and Salvage Network indicate that 82 loggerheads (dead and rescued alive) were documented by the stranding network in various pot/trap gear from 1996–2005, of these approximately 30–40 percent were adults and the remainder juvenile turtles (NMFS, unpublished data). Without intervention it is likely that the majority of the live, entangled turtles would die. Additionally, documented strandings represent only a portion of total interactions and mortality. Recently, a small number of loggerhead entanglements also have been recorded in whelk pot bridles in the U.S. Mid-Atlantic (M. Fagan, Virginia Institute of Marine Science, personal communication, 2008). However, no dedicated observer programs exist to provide estimates of take and mortality from pot/trap fisheries; therefore, comprehensive estimates of loggerhead interactions with pot/trap gear are not available, but the gear is widely used throughout the range of the DPS, and poses a continuing threat.

Other Manmade and Natural Impacts

Propeller and collision injuries from boats and ships are becoming more common in sea turtles. In the U.S. Atlantic, from 1997 to 2005, 14.9 percent of all stranded loggerheads were documented as having sustained some type of propeller or collision injuries (NMFS, unpublished data). The incidence of propeller wounds observed in sea turtles stranded in the United States has risen from approximately 10 percent in the late 1980s to a record high of 20.5 percent in 2004, followed by annual rates of 15.2, 15.6, and 16.5 percent from 2005 to 2007, respectively (NMFS, unpublished data). In the United States, propeller wounds are greatest in Southeast Florida; during some years, as many as 60 percent of the loggerhead strandings found in these areas had propeller wounds (Florida Fish and Wildlife Conservation Commission, unpublished data). However, it is still unclear what proportion of those received the wounds postmortem. As the number of vessels increases, in concert with increased coastal development, and possibly increasing numbers of juvenile sea turtles, especially in nearshore waters, propeller and vessel collision injuries are also expected to rise.

Marine pollution impacts, especially the ingestion of or entanglement in plastic, is another significant anthropogenic impact to loggerhead sea turtles. Studies have shown that approximately 15 percent of post-hatchling loggerheads that emerge from Florida beaches ingest plastics as they forage during their first few weeks in the pelagic environment. Even in small quantities, plastics can kill sea turtles due to obstruction of the esophagus or perforation of the bowel, as well as potentially reducing normal food intake.

Several activities associated with offshore oil and gas production, including oil spills, water quality (operational discharge), seismic surveys, explosive platform removal, platform lighting, and noise from drillships and production activities, are known to impact loggerheads (National Research Council, 1996; Minerals Management Service, 2000; Gregg Gitschlag, NMFS, personal communication, 2007; Viada et al., 2008). Currently, there are 3,443 federally regulated offshore platforms in the Gulf of Mexico dedicated to natural gas and oil production. Additional State-regulated platforms are located in State waters (Texas and Louisiana). There are currently no active leases off the Atlantic coast.

Oil spills also threaten loggerheads in the Northwest Atlantic. Two oil spills that occurred near loggerhead nesting beaches in Florida were observed to affect eggs, hatchlings, and nesting females. Approximately 350,000 gallons of fuel oil spilled in Tampa Bay in August 1993 and was carried onto nesting beaches in Pinellas County. Observed mortalities included 31 hatchlings and 176 oil-covered nests; an additional 2,177 eggs and hatchlings were either exposed to oil or disturbed by response activities (Florida Department of Environmental Protection et al., 1997). Another spill near the beaches of Broward County in August 2000 involved approximately 15,000 gallons of oil and tar (National Oceanic and Atmospheric Administration and Florida Department of Environmental Protection, 2002). Models estimated that approximately 1,500 to 2,000 hatchlings and 0 to 1 adult were injured or killed. Annually about 1 percent of all sea turtle strandings along the U.S. east coast have been associated with oil, but higher rates of 3 to 6 percent have been observed in South Florida and Texas (Rabalais and Rabalais, 1980; Plotkin and Amos, 1990; Teas, 1994). It is not yet clear what the immediate and long-term impacts of the 2010 Deepwater Horizon (Mississippi Canyon 252) oil well blowout and uncontrolled release has had, and will have, on sea turtles in the Gulf of Mexico, including Northwest Atlantic Ocean DPS loggerheads.

In addition to the destruction or degradation of habitat, periodic dredging of sediments from navigational channels can also result in incidental mortality of sea turtles. Direct injury or mortality of loggerheads by dredges has been well documented in the southeastern and mid-Atlantic United States (National Research Council, 1990). Solutions, including modification of dredges and time/area closures, have been successfully implemented to reduce mortalities and injuries in the United States (NMFS, 1991, 1995, 1997; Nelson and Shafer, 1996).

The entrainment and entrapment of loggerheads in saltwater cooling intake systems of coastal power plants has been documented in New Jersey, North Carolina, Florida, and Texas (Eggers, 1989; National Research Council, 1990; Carolina Power and Light Company, 2003; Progress Energy Florida, Inc., 2003; Florida Power and Light Company and Quantum Resources, Inc., 2005). Average annual incidental capture rates for most coastal plants from which captures have been reported amount to several turtles per plant per year. One notable exception is the St. Lucie Nuclear Power Plant located on Hutchinson Island, Florida. During the first 15 years of operation (1977–1991), an average of 128 loggerheads per year was captured in the intake canal with a mortality rate of 6.4 percent. During 1991–2005, loggerhead captures more than doubled (average of 308 per year), while mortality rates decreased to 0.3 percent per year (Florida Power and Light Company and Quantum Resources, Inc., 2005). From 2005–2009, numbers fluctuated in the 200+ to 400+ range (Florida Power and Light Company and Quantum Resources, Inc. take database). Epperly et al. (2007) and TEWG (2009) used this dataset, among others, to demonstrate that an examination of all in-water research sites in the United States with data suitable for trend analysis was showing a similar increase. This suggests a possible juvenile population increase.

Although not a major source of mortality, cold stunning of loggerheads has been reported at several locations in the United States, including Cape Cod Bay, Massachusetts (Still et al., 2002); Long Island Sound, New York (Meylan and Sadove, 1986; Morreale et al., 1992); the Indian River system, Florida (Mendonça and Ehrhart, 1982; Witherington and Ehrhart, 1989); and Texas inshore waters (Hildebrand, 1982; Shaver, 1990). Cold stunning is a phenomenon during which turtles become incapacitated as a result of rapidly dropping water temperatures (Witherington and Ehrhart, 1989; Morreale et al., 1992). As temperatures fall below 8–10^{o} C, turtles may lose their ability to swim and dive, often floating to the surface. The rate of cooling that precipitates cold stunning appears to be the primary threat, rather than the water temperature itself (Milton and Lutz, 2003). Sea turtles that overwinter in inshore waters are most susceptible to cold stunning, because temperature changes are most rapid in shallow water (Witherington and Ehrhart, 1989). More recent large-scale cold-stunning events have occurred in January 2010, and December 2010/January 2011. Although the vast majority of the sea turtles were green turtles, some loggerheads were also impacted (Florida Fish and Wildlife Conservation Commission data).

Another natural factor that has the potential to affect recovery of loggerhead sea turtles is aperiodic hurricanes. In general, these events are episodic and, although they may affect loggerhead hatchling production, the results are generally localized and they rarely result in whole-scale losses over multiple nesting seasons. The negative effects of hurricanes on low-lying and developed shorelines may be longer-lasting and a greater threat overall.

Similar to other areas of the world, climate change and sea level rise have the potential to impact loggerheads in the Northwest Atlantic. These potential impacts include beach erosion from rising sea levels, repeated inundation of nests, skewed hatchling sex ratios from rising incubation temperatures, and abrupt disruption of ocean currents used for natural dispersal during the complex life cycle (Fish et al., 2005, 2008; Hawkes et al., 2009; Poloczanska et al., 2009). Climate change impacts could have profound long-term impacts on nesting populations in the Northwest Atlantic Ocean, but it is not possible to predict the impacts at this point in time.

In summary, we find that the Northwest Atlantic Ocean DPS of the loggerhead sea turtle is negatively affected by both natural and manmade impacts as described above in Factor E. Within Factor E, we find that fishery bycatch that occurs throughout the North Atlantic Ocean, particularly bycatch mortality of loggerheads from gillnet, longline, and trawl fisheries throughout their range in the Atlantic Ocean and Gulf of Mexico, is a significant threat to the persistence of this DPS. In addition, boat strikes are becoming more common, possibly as a result of increased boat traffic, increased juvenile populations, or some combination of both, and are possibly a significant threat to the persistence of this DPS.

Northeast Atlantic Ocean DPS

A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Terrestrial Zone

Destruction and modification of loggerhead nesting habitat in the Northeast Atlantic result from coastal development and construction, placement of erosion control structures and other barriers to nesting, beachfront lighting, vehicular and pedestrian traffic, sand extraction, beach erosion, and beach pollution (Formia et al., 2003; Loureiro, 2008).

In the Northeast Atlantic, the only loggerhead nesting of note occurs in the Cape Verde Islands. The Cape Verde government's plans to develop Boa Vista Island, the location of the main nesting beaches, could increase the terrestrial threats to loggerheads (van Bogaert, 2006). Sand extraction on Santiago Island, Cape Verde, may be responsible for the apparent decrease in nesting there (Loureiro, 2008). Both sand extraction and beachfront lighting have been identified as serious threats to the continued existence of a nesting population on Santiago Island (Loureiro, 2008). Scattered and infrequent nesting occurs in western Africa, where much industrialization is located on the coast and population growth rates fluctuate between 0.8 percent (Cape Verde) and 3.8 percent (Côte D'Ivoire) (Abe et al., 2004; Tayaa et al., 2005). Land mines on some of the beaches of mainland Africa, within the reported historical range of nesting by loggerheads (e.g., the Western Sahara region), would be detrimental to nesters and are an impediment to scientific surveys of the region (Tiwari et al., 2001). Tiwari et al. (2001) noted a high level of human use of many of the beaches in Morocco – enough that any evidence of nesting activity would be quickly erased. Garbage litters many developed beaches (Formia et al., 2003). Erosion is a problem along the long stretches of high energy ocean shoreline of Africa and is further exacerbated by sand mining and harbor building (Formia et al., 2003); crumbling buildings claimed by the sea may present obstructions to nesting females.

Neritic/Oceanic Zones

Threats to habitat in the loggerhead neritic and oceanic zones in the Northeast Atlantic Ocean include fishing practices, marine pollution and climate change. Ecosystem alterations have occurred due to the tremendous human pressure on the environment in the region. Turtles, including loggerheads, usually are included in ecosystem models of the region (see Palomares and Pauly, 2004). In the Canary Current Large Marine Ecosystem (LME), the area is characterized by the Global International Waters Assessment as severely impacted in the area of modification or loss of ecosystems or ecotones and health impacts, but these impacts are decreasing (http://www.lme.noaa.gov). The Celtic-Biscay Shelf LME is affected by alterations to the seabed, agriculture, and sewage (Valdés and Lavin, 2002). The Gulf of Guinea has been characterized as severely impacted in the area of solid wastes by the Global International Waters Assessment; this and other pollution indicators are increasing (http://www.lme.noaa.gov). Marine pollution, such as oil and debris, has been shown to negatively impact loggerheads and represent a degradation of the habitat (Orós et al., 2005, 2009; Calabuig Miranda and Liria Loza, 2007). Climate change also may result in future trophic changes, thus impacting loggerhead prey abundance and distribution.

Additionally, fishing is a major source of ecosystem alteration of the neritic and oceanic habitats of loggerhead sea turtles in the region. Fishing effort off the western African coast is increasing and record low biomass has been recorded for exploited resources, representing a decline in fish biomass by a factor of 13 since 1960 (see Palomares and Pauly, 2004). Throughout the North Atlantic, fishery landings fell by 90 percent during the 20th century, foreboding a trophic cascade and a change in food-web competition (Pauly et al., 1998; Christensen et al., 2003). For a description of the exploited marine resources in the region, see Lamboeuf (1997). The Celtic-Biscay Shelf LME, the Iberian Coastal Ecosystem LME, the Canary Current LME, and the Guinea Current LME all are severely overfished, and effort now is turning to a focus on pelagic fisheries, whereas historically there were demersal fisheries. The impacts continue to increase in the Guinea Current LME despite efforts throughout the region to reduce fishing pressure (http://www.lme.noaa.gov).

The threats to bottom habitat for loggerheads include modification of the habitat through bottom trawling. Trawling occurs off the European coast and the area off Northwest Africa is one of the most intensively trawled areas in the world (Zeeberg et al., 2006). Trawling has been banned in the Azores, Madeira, and Canary Islands to protect cold-water corals (Lutter, 2005). Although illegal, trawling also occurs in the Cape Verde Islands (López-Jurado et al., 2003). The use of destructive fishing practices, such as explosives and toxic chemicals, has been reported in the Canary Current area, causing serious damage to both the resources and the habitat (Tayaa et al., 2005).

In summary, we find that the Northeast Atlantic Ocean DPS of the loggerhead sea turtle is negatively affected by ongoing changes in both its terrestrial and marine habitats as a result of land and water use practices as considered above in Factor A. Within Factor A, we find that sand extraction and beachfront lighting on nesting beaches are significant threats to the persistence of this DPS. We also find that anthropogenic disruptions of natural ecological interactions as a result of fishing practices and marine pollution are likely a significant threat to the persistence of this DPS.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Deliberate hunting of loggerheads for their meat, shells, and eggs still exists and remains the most serious threat facing nesting turtles in the Northeast Atlantic. Historical records indicate turtles were harvested throughout Macaronesia (see López-Jurado, 2007). Intensive exploitation has been cited for the extirpation of the loggerhead nesting colony in the Canary Islands (López-Jurado, 2007), and heavy human predation on nesting and foraging animals occurred on Santiago Island, Cape Verde, the first in the Archipelago to be settled (Loureiro, 2008), as well as on Sal and Sao Vicente islands (López-Jurado, 2007). Nesting loggerheads and eggs are still harvested at Boa Vista, Cape Verde (Cabrera et al., 2000; López-Jurado et al., 2003). In 2007, over 1,100 (36 percent) of the nesting turtles were hunted, which is about 15 percent of the estimated adult female population (Marco et al., 2010). In 2008, the military protected one of the major nesting beaches on Boa Vista where in 2007 55 percent of the mortality had occurred; with the additional protection, only 17 percent of the turtles on that beach were slaughtered (Roder et al., in press). On Sal Island, 11.5 percent of the emergences on unprotected beaches ended with mortality, whereas mortality was 3 percent of the emergences on protected beaches (Cozens et al., in press). The slaughter of nesting turtles is a problem wherever turtles nest in the Cape Verde Islands and may approach 100 percent in some places (C. Roder, Turtle Foundation, Münsing, Germany, personal communication, 2009; Cozens, in press). The meat and eggs are consumed locally as well as traded among the archipelago (C.

Roder, Turtle Foundation, Münsing, Germany, personal communication, 2009). Hatchlings are collected on Sal Island, but this activity appears to be rare on other islands of the archipelago (J. Cozens, SOS Tartarugas, Santa Maria, Sal Island, Cape Verde, personal communication, 2009). Additionally, free divers target turtles for consumption of meat, often selectively taking large males (López-Jurado et al., 2003). Turtles are harvested along the African coast and, in some areas, are considered a significant source of food and income due to the poverty of many residents along the African coast (Formia et al., 2003). Loggerhead carapaces are sold in markets in Morocco and Western Sahara (Fretey, 2001; Tiwari et al., 2001; Benhardouze et al., 2004).

In summary, overutilization for human consumption likely was a factor that contributed to the historical decline of this DPS. Current harvest of loggerhead sea turtles and eggs for human consumption in both Cape Verde and along the African coast, as well as the sale of loggerhead carapaces in markets in Africa, are a significant threat to the persistence of this DPS.

C. Disease or Predation

The potential exists for diseases and endoparasites to impact loggerheads found in the Northeast Atlantic Ocean. Spontaneous diseases documented in the Northeast Atlantic include pneumonia, hepatitis, meningitis, septicemic processes, and neoplasia (Orós et al., 2005). Pneumonia could result from the aspiration of water from forced submergence in fishing gear. The authors also reported nephritis, esophagitis, nematode infestation, and eye lesions. Fibropapillomatosis does not appear to be an issue in the Northeast Atlantic.

Nest depredation by ghost crabs (Ocypode cursor) occurs in Cape Verde (López-Jurado et al., 2000). The ghost crabs feed on both eggs and hatchlings. Arvy et al. (2000) reported predation of loggerhead eggs in two nests in Mauritania by golden jackals (Canis aureus); a loggerhead sea turtle creating a third nest also had been killed, with meat and eggs eaten, but the predator was not identified.

Loggerheads in the Northeast Atlantic also may be impacted by harmful algal blooms, which have been reported infrequently in the Canary Islands and the Iberian Coastal LME (Ramos et al., 2005; Akin-Oriola et al., 2006; Amorim and Dale, 2006; Moita et al., 2006; http://www.lme.noaa.gov).

In summary, disease and predation are known to occur. The best available data suggest these threats are potentially affecting the persistence of this DPS; however, quantitative data are not sufficient to assess the degree of impact of these threats on the persistence of this DPS.

D. Inadequacy of Existing Regulatory Mechanisms

International Instruments

The BRT identified several regulatory mechanisms that apply to loggerhead sea turtles globally and within the Northeast Atlantic Ocean. The reader is directed to sections 5.1.4. and 5.2.7.4. of the Status Review for a discussion of these regulatory mechanisms. Hykle (2002) and Tiwari (2002) have reviewed the effectiveness of some of these international instruments. The problems with existing international treaties are often that they have not realized their full potential, do not include some key countries, do not specifically address sea turtle conservation, and are handicapped by the lack of a sovereign authority to enforce environmental regulations. The ineffectiveness of international treaties and national legislation is oftentimes due to the lack of motivation or obligation by countries to implement and enforce them. A thorough discussion of this topic is available in a special 2002 issue of the Journal of International Wildlife Law and Policy: International Instruments and Marine Turtle Conservation (Hykle, 2002).

National Legislation and Protection

Ongoing directed lethal take of nesting females and eggs (Factor B), low hatching and emergence success (Factors A, B, and C), and mortality of juvenile and adult turtles from fishery bycatch (Factor E) that occurs throughout the Northeast Atlantic Ocean is substantial. Currently, conservation efforts to protect nesting females are growing, and a reduction in this source of mortality is likely to continue in the near future. Although national and international governmental and non-governmental entities in the Northeast Atlantic are currently working toward reducing loggerhead bycatch, and some positive actions have been implemented, it is unlikely that this source of mortality can be sufficiently reduced across the range of the DPS in the near future because of the lack of bycatch reduction in high seas fisheries operating within the range of this DPS, lack of bycatch reduction in coastal fisheries in Africa, the lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies.

In summary, our review of regulatory mechanisms under Factor D demonstrates that although regulatory mechanisms are in place that should address direct and incidental take of Northeast Atlantic Ocean loggerheads, these regulatory mechanisms are insufficient or are not being implemented effectively to address the needs of loggerheads. We find that the threat from the inadequacy of existing regulatory mechanisms for harvest of turtles and eggs for human consumption (Factor B), fishery bycatch (Factor E), and sand extraction and beachfront lighting on nesting beaches (Factor A) is significant relative to the persistence of this DPS.

E. Other Natural or Manmade Factors Affecting its Continued Existence

Incidental Bycatch in Fishing Gear

Loggerhead sea turtles strand throughout the Northeast Atlantic (Fretey, 2001; Tiwari et al., 2001; Duguy et al., 2004, 2005; Witt et al., 2007), and there are indications that the turtles become entangled in nets and monofilament and swallow hooks in the region (Orós et al., 2005; Calabuig Miranda and Liria Loza, 2007). On the European coasts, most stranded loggerheads are small (mean of less than 30 cm SCL), but a few are greater than 60 cm SCL (Witt et al., 2007). Similarly, Tiwari et al. (2001) and Benhardouze et al. (2004) indicated that the animals they viewed in Morocco and Western Sahara were small juveniles and preliminary genetic analyses of stranded turtles indicate that they are of western Atlantic origin (M. Tiwari, NMFS, and A. Bolten, University of Florida, unpublished data), whereas Fretey (2001) reported that loggerheads captured and stranded in Mauritania were both juvenile and adult-sized animals.

Incidental capture of sea turtles in artisanal and commercial fisheries is a threat to the survival of loggerheads in the Northeast Atlantic. Sea turtles may be caught in a multitude of gears deployed in the region: pelagic and demersal longlines, drift and set gillnets, bottom and mid-water trawling, weirs, haul and purse seines, pots and traps, cast nets, and hook and line gear (see Pascoe and Gréboval, 2003; Bayliff et al., 2005; Tayaa et al., 2005; Dossa et al., 2007). Fishing effort off the western African coast has been increasing (see Palomares and Pauly, 2004). Impacts continue to increase in the Guinea Current LME, but, in contrast, the impacts are reported to be decreasing in the Canary Current LME (http://www.lme.noaa.gov). Throughout the region, fish stocks are depleted and management authorities are striving to reduce the fishing pressure.

In the Northeast Atlantic, loggerheads, particularly the largest size classes in the oceanic environment (most of which are small juveniles), are captured in surface longline fisheries targeting swordfish (Ziphias gladius) and tuna (Thunnus spp.) (Ferreira et al., 2001; Bolten, 2003). Bottom longlines in Madeira Island targeting black-scabbard (Aphanopus carbo) capture and kill small juvenile loggerhead sea turtles as the fishing depth does not allow hooked turtles to surface (Dellinger and Encarnaçâo, 2000; Delgado et al., in press).

In United Kingdom and Irish waters, loggerhead bycatch is uncommon but has been noted in pelagic driftnet fisheries (Pierpoint, 2000; Rogan and Mackey, 2007). Loggerheads have not been captured in pelagic trawls, demersal trawls, or gillnets in United Kingdom and Irish waters (Pierpoint, 2000), but have been captured in nets off France (Duguy et al., 2004, 2005).

International fleets of trawl fisheries operate in Mauritania and have been documented to capture sea turtles, including loggerheads (Zeeberg et al., 2006). Despite being illegal, trawling occurs in the Cape Verde Islands and has the potential to capture and kill loggerhead sea turtles; one piece of abandoned trawl net washed ashore with eight live and two dead loggerheads (López-Jurado et al., 2003). Longlines, seines, and hook and line have been documented to capture loggerheads 35–73 cm SCL off the northwestern Moroccan coast (Benhardouze, 2004).

Other Manmade and Natural Impacts

Other anthropogenic impacts, such as boat strikes and ingestion or entanglement in marine debris, also apply to loggerheads in the Northeast Atlantic. Propeller and boat strike injuries have been documented in the Northeast Atlantic (Orós et al., 2005; Calabuig Miranda and Liria Loza, 2007). Exposure to crude oil is also of concern. Loggerhead strandings in the Canary Islands have shown evidence of hydrocarbon exposure as well as ingestion of marine debris, such as plastic and monofilament (Orós et al., 2005; Calabuig Miranda and Liria Loza, 2007), and in the Azores and elsewhere plastic debris is found both on the beaches and floating in the waters (Barrerios and Barcelos, 2001; Tiwari et al., 2001). Pollution from heavy metals is a concern for the seas around the Iberian Peninsula (European Environmental Agency, 1998) and in the Guinea Current LME (Abe et al., 2004). Bioaccumulation of metals in loggerheads has been measured in the Canary Islands and along the French Atlantic Coast (Caurant et al., 1999; Torrent et al., 2004). However, the consequences of long-term exposure to heavy metals are unknown (Torrent et al., 2004).

Natural environmental events, such as climate change, could affect loggerheads in the Northeast Atlantic. Similar to other areas of the world, climate change and sea level rise have the potential to impact loggerheads in the Northeast Atlantic, and the changes may be further exacerbated by the burning of fossil fuels and deforestation. This includes beach erosion and loss from rising sea levels, skewed hatchling sex ratios from rising beach incubation temperatures, and abrupt disruption of ocean currents used for natural dispersal during the complex life cycle (Hawkes et al., 2009; Poloczanska et al., 2009). Climate change impacts could have profound long-term impacts on nesting populations in the Northeast Atlantic Ocean, but it is not possible to quantify the potential impacts at this point in time. Tropical and sub-tropical storms occasionally strike the area and could have a negative impact on nesting, although such an impact would be of limited duration.

In summary, we find that the Northeast Atlantic Ocean DPS of the loggerhead sea turtle is negatively affected by both natural and manmade impacts as described above in Factor E. Within Factor E, we find that fishery bycatch that occurs throughout the Northeast Atlantic Ocean, particularly bycatch mortality of loggerheads from longline and trawl fisheries, is a significant threat to the persistence of this DPS.

Mediterranean Sea DPS

A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Terrestrial Zone

In the Mediterranean, some areas known to host nesting activity in the past have been lost to turtles (e.g., Malta) or severely degraded (e.g., Israel) (Margaritoulis et al., 2003). Destruction and modification of loggerhead nesting habitat in the Mediterranean result from coastal development and construction, placement of erosion control structures and other barriers to nesting, beachfront lighting, vehicular and pedestrian traffic, sand extraction, beach erosion, beach sand placement, beach pollution, removal of native vegetation, and planting of non-native vegetation (Baldwin, 1992; Margaritoulis et al., 2003). These activities may directly impact the nesting success of loggerheads and survivability of eggs and hatchlings. Nesting in the Mediterranean almost exclusively occurs in the Eastern basin, with the main concentrations found in Cyprus, Greece, Turkey, and Libya (Margaritoulis et al., 2003; Laurent et al., 1999); therefore, the following threats to the nesting habitat are concentrated in these areas.

The Mediterranean experiences a large influx of tourists during the summer months, coinciding with the nesting season. Margaritoulis et al. (2003) stated that extensive urbanization of the coastline, largely a result of tourism and recreation, is likely the most serious threat to loggerhead nesting areas. The large numbers of tourists that use Mediterranean beaches result in an increase in umbrellas, chairs, garbage, and towels, as well as related hotels, restaurants, and stationary (e.g., street lights, hotels) and moving (e.g., cars) lighting, all which can impact sea turtle nesting success (Demetropoulos, 2000). Further, the eastern Mediterranean is exposed to high levels of pollution and marine debris, in particular the nesting beaches of Cyprus, Turkey, and Egypt (Camiñas, 2004).

Construction and infrastructure development also have the potential to alter nesting beaches and subsequently impact nesting success. The construction of new buildings on or near nesting beaches has been a problem in Greece and Turkey (Camiñas, 2004). The construction of a jetty and waterworks around Mersin, Turkey, has contributed significantly to the continuous loss of adjacent beach (Camiñas, 2004).

Beach erosion and sand extraction also pose a problem for sea turtle nesting sites. The noted decline of the nesting population at Rethymno, Island of Crete, Greece, is partly attributed to beach erosion caused by construction on the high beach and at sea (e.g., groins) (Margaritoulis et al., 2009). A 2001 survey of Lebanese nesting beaches found severe erosion on beaches where previous nesting had been reported, and in some cases the beaches had disappeared completely (Venizelos et al., 2005). Definitive causes of this erosion were found to be sand extraction, offshore sand dredging, and sediment removal from river beds for construction and military purposes. Beach erosion also may occur from natural changes, with the same deleterious effects to loggerhead nesting. On Patara, Turkey, beach erosion and subsequent inundation by waves and shifting sand dunes are responsible for about half of all loggerhead nest losses (Camiñas, 2004). Erosion can further be exacerbated when native dune vegetation, which enhances beach stability and acts as an integral buffer zone between land and sea, is degraded or destroyed. This in turn often leaves insufficient nesting opportunities above the high tide line, and nests may be washed out. In contrast, the planting or invasion of less stabilizing, non-native plants can lead to increased erosion and degradation of suitable nesting habitat. Finally, sand extraction has been a serious problem on Mediterranean nesting beaches, especially in Turkey (Türkozan and Baran, 1996), Cyprus (Demetropoulos and Hadjichristophorou, 1989; Godley et al., 1996), and Israel (Levy, 2003).

While the most obvious effect of nesting beach destruction and modification may be to the existence of the actual nests, hatchlings are also threatened by habitat alteration. In the Mediterranean, disorientation of hatchlings due to artificial lighting has been recorded mainly in Greece (Rees, 2005; Margaritoulis et al., 2007, 2009), Turkey (Türkozan and Baran, 1996), and Lebanon (Newbury et al., 2002). Additionally, vehicle traffic on nesting beaches may disrupt the natural beach environment and contribute to erosion, especially during high tides or on narrow beaches where driving is concentrated on the high beach and foredune. On Zakynthos Island in Greece, Venizelos et al. (2006) reported that vehicles drove along the beach and sand dunes throughout the tourist season on East Laganas and Kalamaki beaches, leaving deep ruts in the sand, disturbing sea turtles trying to nest, and impacting hatchlings trying to reach the sea.

Neritic/Oceanic Zones

Threats to habitat in the loggerhead neritic and oceanic zones in the Mediterranean Sea include fishing practices, channel dredging, sand extraction, marine pollution, and climate change. Trawling occurs throughout the Mediterranean, most notably in areas off Albania, Algeria, Croatia, Egypt, France, Greece, Italy, Libya, Morocco, Slovenia, Spain, Tunisia, and

Turkey (Gerosa and Casale, 1999; Camiñas, 2004; Casale, 2008). This fishing practice has the potential to destroy bottom habitat in these areas. Fishing methods affect neritic zones by not only impacting bottom habitat and incidentally capturing loggerheads but also depleting fish populations, and thus altering ecosystem dynamics. For example, depleted fish stocks in Zakynthos, Greece, likely contributed to predation of adult loggerheads by monk seals (Monachus monachus) (Margaritoulis et al., 1996). Further, by depleting fish populations, the trophic dynamics will be altered, which may then in turn affect the ability of loggerheads to find prey resources. If loggerheads are not able to forage on the necessary prey resources, their long-term survivability may be impacted. Climate change also may result in future trophic changes, thus impacting loggerhead prey abundance and distribution.

Marine pollution, including direct contamination and structural habitat degradation, can affect loggerhead neritic and oceanic habitat. As the Mediterranean is an enclosed sea, organic and inorganic wastes, toxic effluents, and other pollutants rapidly affect the ecosystem (Camiñas, 2004). The Mediterranean has been declared a "special area" by the MARPOL Convention, in which deliberate petroleum discharges from vessels are banned, but numerous repeated offenses are still thought to occur (Pavlakis et al., 1996). Some estimates of the amount of oil released into the region are as high as 1,200,000 metric tons (Alpers, 1993). Direct oil spill events also occur as happened in Lebanon in 2006 when 10,000 to 15,000 tons of heavy fuel oil spilled into the eastern Mediterranean (United Nations Environment Programme, 2007).

Destruction and modification of loggerhead habitat also may occur as a result of other activities. For example, underwater explosives have been identified as a key threat to loggerhead habitat in internesting areas in the Mediterranean (Margaritoulis et al., 2003). Further, the

Mediterranean is a site of intense tourist activity, and corresponding boat anchoring also may impact loggerhead habitat in the neritic environment.

In summary, we find that the Mediterranean Sea DPS of the loggerhead sea turtle is negatively affected by ongoing changes in both its terrestrial and marine habitats as a result of land and water use practices as considered above in Factor A. Within Factor A, we find that coastal development, placement of barriers to nesting, beachfront lighting, and erosion resulting from sand extraction, offshore sand dredging, and sediment removal from river beds are significant threats to the persistence of this DPS.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Mediterranean turtle populations were subject to severe exploitation until the mid-1960s (Margaritoulis et al., 2003). Deliberate hunting of loggerheads for their meat, shells, and eggs is reduced from previous exploitation levels, but still exists. For example, Nada and Casale (2008) found that egg collection (for individual consumption) still occurs in Egypt. In some areas of the Mediterranean, like on the Greek Island of Zakynthos, nesting beaches are protected (Panagopoulou et al., 2008), so egg harvest by humans in those areas is likely negligible.

Exploitation of juveniles and adults still occurs in some Mediterranean areas. In Tunisia, clandestine trade for local consumption is still recorded, despite prohibition of the sale of turtles in fish markets in 1989 (Laurent et al., 1996). In Egypt, turtles are sold in fish markets despite prohibitive laws; of 71 turtles observed at fish markets in 1995 and 1996, 68 percent were loggerheads (Laurent et al., 1996). Nada (2001) reported 135 turtles (of which 85 percent were loggerheads) slaughtered at the fish market of Alexandria in 6 months (December 1998–May 1999). Based on observed sea turtle slaughters in 1995 and 1996, Laurent et al. (1996) estimated that several thousand sea turtles were probably killed each year in Egypt. More recently, a study found that the open selling of sea turtles in Egypt generally has been curtailed due to enforcement efforts, but a high level of intentional killing for the black market or for direct personal consumption still exists (Nada and Casale, 2008). Given the high numbers of turtles caught in this area, several hundred turtles are currently estimated to be slaughtered each year in Egypt (Nada and Casale, 2008). This estimate likely includes both juvenile and adult loggerheads, as Egyptian fish markets have been documented selling different sized sea turtles. While the mean sea turtle size was 65.7 cm CCL (range 38–86.3 cm CCL; n=48), 37.5 percent of observed loggerhead samples were greater than 70 cm CCL (Laurent et al., 1996).

In summary, overutilization for commercial purposes likely was a factor that contributed to the historical declines of this DPS. Current illegal harvest of loggerheads in Egypt for human consumption continues as a significant threat to the persistence of this DPS.

C. Disease or Predation

The potential exists for diseases and endoparasites to impact loggerheads found in the Mediterranean. Endoparasites in loggerheads have been studied in the western Mediterranean. While the composition of the gastrointestinal community of sea turtles is expected to include digeneans, nematodes, and aspidogastreans, loggerheads in the Mediterranean were found to harbor only four digenean species typical of marine turtles (Aznar et al., 1998). There have been no records of fibropapillomatosis in the Mediterranean. While there is the potential for disease in this area, information on the prevalence of such disease is lacking.

In the Mediterranean Sea, loggerhead hatchlings and eggs are subject to depredation by wild canids (i.e., foxes (Vulpes vulpes), golden jackals (Canis aureus)), feral/domestic dogs, and ghost crabs (Ocypode cursor) (Margaritoulis et al., 2003). Predators have caused the loss of 48.4 percent of loggerhead clutches at Kyparissia Bay, Greece (Margaritoulis, 1988), 70–80 percent at Dalyan Beach, Turkey (Erk'akan, 1993), 36 percent (includes green turtle clutches) in Cyprus (Broderick and Godley, 1996), and 44.8 percent in Libya (Laurent et al., 1995). A survey of the Syrian coast in 1999 found 100 percent nest predation, mostly due to stray dogs and humans (Venizelos et al., 2005). Loggerhead eggs are also depredated by insect larvae in Cyprus (McGowan et al., 2001), Turkey (Özdemir et al., 2004), and Greece (Lazou and Rees, 2006). Ghost crabs have been reported preying on loggerhead hatchlings in northern Cyprus and Egypt, suggesting 66 percent of emerging hatchlings succumb to this mortality source (Simms et al., 2002). Predation also has been influenced by anthropogenic sources. On Zakynthos, Greece, a landfill site next to loggerhead nesting beaches has resulted in an artificially high level of seagulls (Larus spp.), which results in increased predation pressure on hatchlings (Panagopoulou et al., 2008). Planting of non-native plants also can have a detrimental effect on nests in the form of roots invading eggs (e.g., tamarisk tree (Tamarix spp.) roots invading eggs in Zakynthos, Greece) (Margaritoulis et al., 2007).

Predation on adult and juvenile loggerheads has also been documented in the Mediterranean. Predation of nesting loggerheads by golden jackals has been recorded in Turkey (Peters et al., 1994). During a 1995 survey of loggerhead nesting in Libya, two nesting females were found killed by carnivores, probably jackals (Laurent et al., 1997). Off the sea turtle nesting beach of Zakynthos, Greece, adult loggerheads were found being predated upon by Mediterranean monk seals (Monachus monachus). Of the eight predated turtles observed or reported, 62.5 percent were adult males (Margaritoulis et al., 1996). Further, stomach contents were examined from 24 Mediterranean white sharks (Carcharodon carcharias), and 17 percent contained remains of marine turtles, including two loggerheads, one green, and one unidentifiable turtle (Fergusson et al., 2000). One of the loggerhead sea turtles ingested was a juvenile with a carapace length of approximately 60 cm (length not reported as either SCL or CCL). Fergusson et al. (2000) report that white shark interactions with sea turtles are likely rare east of the Ionian Sea, and while the impact of shark predation on turtle populations is unknown, it is probably small compared to other sources of mortality.

The Mediterranean is a low-productivity body of water, with high water clarity as a result. However, harmful algal blooms do occur in this area (e.g., off Algeria in 2002), and the problem is particularly acute in enclosed ocean basins such as the Mediterranean. In the northern Adriatic Sea, fish kills have occurred as a result of noxious phytoplankton blooms and anoxic conditions (Mediterranean Sea LME). While fish may be more susceptible to these harmful algal blooms, loggerheads in the Mediterranean also may be impacted by such noxious or toxic phytoplankton to some extent.

In summary, nest and hatchling predation likely was a factor that contributed to the historical decline of this DPS. The best available data suggest that current nest and hatchling predation on several Mediterranean nesting beaches is a significant threat to the persistence of this DPS.

D. Inadequacy of Existing Regulatory Mechanisms

International Instruments

The BRT identified several regulatory mechanisms that apply to loggerhead sea turtles globally and within the Mediterranean Sea. The reader is directed to sections 5.1.4. and 5.2.8.4.

of the Status Review for a discussion of these regulatory mechanisms. Hykle (2002) and Tiwari (2002) have reviewed the effectiveness of some of these international instruments. The problems with existing international treaties are often that they have not realized their full potential, do not include some key countries, do not specifically address sea turtle conservation, and are handicapped by the lack of a sovereign authority to enforce environmental regulations. The ineffectiveness of international treaties and national legislation is oftentimes due to the lack of motivation or obligation by countries to implement and enforce them. A thorough discussion of this topic is available in a special 2002 issue of the Journal of International Wildlife Law and Policy: International Instruments and Marine Turtle Conservation (Hykle, 2002).

National Legislation and Protection

Fishery bycatch that occurs throughout the Mediterranean Sea (see Factor E), as well as anthropogenic threats to nesting beaches (Factor A) and eggs/hatchlings (Factors A, B, C, and E), is substantial. Although conservation efforts to protect some nesting beaches are underway, more widespread and consistent protection is needed. Although national and international governmental and non-governmental entities in the Mediterranean Sea are currently working toward reducing loggerhead bycatch, it is unlikely that this source of mortality can be sufficiently reduced across the range of the DPS in the near future because of the lack of bycatch reduction in commercial and artisanal fisheries operating within the range of this DPS, the lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies.

In summary, our review of regulatory mechanisms under Factor D demonstrates that although regulatory mechanisms are in place that should address direct and incidental take of Mediterranean Sea loggerheads, these regulatory mechanisms are insufficient or are not being implemented effectively to address the needs of loggerheads. We find that the threat from the inadequacy of existing regulatory mechanisms for fishery bycatch (Factor E) and impacts to nesting beach habitat (Factor A) is significant relative to the persistence of this DPS.

E. Other Natural or Manmade Factors Affecting its Continued Existence

Other anthropogenic and natural factors affecting loggerhead survival include incidental bycatch in fisheries, vessel collisions, marine pollution, climate change, and cyclonic storm events. Fishing practices alone have been estimated to result in over 150,000 sea turtle captures per year, with approximately 50,000 mortalities (Casale, 2008; Lucchetti and Sala, 2009), and sea turtle bycatch in multiple gears in the Mediterranean is considered among the most urgent conservation priorities globally (Wallace et al., 2010).

The only estimation of loggerhead survival probabilities in the Mediterranean was calculated by using capture-mark-recapture techniques from 1981–2003 (Casale et al., 2007b). Of the 3,254 loggerheads tagged, 134 were recaptured at different sites throughout the Mediterranean. Most recaptured animals were juveniles (mean 54.4 cm CCL; range 25–88 cm CCL), but the study did not delineate between juvenile life stages. This research estimated a loggerhead annual survival probability of 0.73 (95 percent confidence intervals; 0.67–0.78), recognizing that there are methodological limitations of the technique used. Nonetheless, Casale et al. (2007c) stated that assuming a natural survivorship no higher than 0.95 and a tag loss rate of 0.1, a range of 0.1–0.2 appears reasonable for the additional human induced mortality (from all sources).

Incidental Bycatch in Fishing Gear

Incidental capture of sea turtles in artisanal and commercial fisheries is a significant threat to the survivability of loggerheads in the Mediterranean. Sea turtles may be caught in pelagic and demersal longlines, drift gillnets, set gillnets and trammel nets, bottom and mid-water trawls, seines, dredges, traps/pots, and hook and line gear. In a 2004 FAO Fisheries Report, Camiñas (2004) stated that the main fisheries affecting sea turtles in the Mediterranean Sea (at that time) were Spanish and Italian longline, North Adriatic Italian, Tunisian, and Turkish trawl, and Moroccan and Italian driftnet. Available information on sea turtle bycatch by gear type is discussed below. There is growing evidence that artisanal/small vessel fisheries (set gillnet, bottom longline, and part of the pelagic longline fishery) may be responsible for a comparable or higher number of captures with higher mortality rates than the commercial/large vessel fisheries (Casale, 2008) as previously suggested by indirect clues (Casale et al., 2005b).

Mediterranean fish landings have increased steadily since the 1950s, but the FAO 10-year capture trend from 1990–1999 shows stable landings (Mediterranean LME, http://www.lme.noaa.gov). However, stable fish landings may result from stable fishing effort at the same catch rates, or higher fishing effort at lower catch rates. As fish stocks in the Mediterranean are being depleted (P. Casale, MTSG-IUCN Italy, personal communication, 2009), fishing effort in some areas may be increasing to catch the available fish. This trend has not yet been verified throughout the Mediterranean, but fishing pressures may be increasing even though landings appear stable.

Longline Fisheries

In the Mediterranean, pelagic longline fisheries targeting swordfish (Ziphias gladius) and albacore (Thunnus alalunga) may be the primary source of loggerhead bycatch. It appears that most of the incidental captures occur in the western and central portions of the area (Demetropoulos and Hadjichristophorou, 1995). The most severe bycatch in the Mediterranean occurs around the Balearic Islands where 1,950–35,000 juveniles are caught annually in the surface longline fishery (Mayol and Castelló Mas, 1983; Camiñas, 1988, 1997; Aguilar et al., 1995). Specifically, the following regions have reported annual estimates of total turtle bycatch from pelagic longlines: Spain – 17,000 to 35,000 turtles (Aguilar et al., 1995; Camiñas et al., 2003); Italy (Ionian Sea) – 1,084 to 4,447 turtles (Deflorio et al., 2005); Morocco – 3,000 turtles (Laurent, 1990); Greece – 280 to 3,310 turtles (Panou et al., 1999; Kapantagakis and Lioudakis, 2006); Italy (Lampedusa) – 2,100 turtles (Casale et al., 2007c); Malta – 1,500 to 2,500 turtles (Gramentz, 1989); South Tunisia (Gulf of Gabès) – 486 turtles (Jribi et al., 2008); and Algeria – 300 turtles (Laurent, 1990).

For the entire Mediterranean pelagic longline fishery, an extrapolation resulted in a bycatch estimate of 60,000 to 80,000 loggerheads in 2000 (Lewison et al., 2004). Further, a more recent paper used the best available information to estimate that Spain, Morocco, and Italy have the highest level of sea turtle bycatch, with over 10,000 turtle captures per year for each country, and Greece, Malta, Libya, and Tunisia each catch 1,000 to 3,000 turtles per year (Casale, 2008). Available data suggest the annual number of loggerhead sea turtle captures by all Mediterranean pelagic longline fisheries may be greater than 50,000 (Casale, 2008). Note that these are not necessarily individual turtles, as the same sea turtle can be captured more than once.

Mortality estimates in the pelagic longline fishery at gear retrieval appear to be lower than in some other types of gear (e.g., set gillnet). Although limited to observations of direct mortality at gear retrieval, Carreras et al. (2004) found mortality to be low (0–7.7 percent) in the longline fishery off the Balearic Islands, and Jribi et al. (2008) reported 0 percent direct mortality in the southern Tunisia surface longline fishery. These estimates are consistent with those found in other areas; direct mortality was estimated at 4.3 percent in Greece (n=23), 0 percent in Italy (n=214), and 2.6 percent in Spain (n=676) (Laurent et al., 2001). However, considering injured turtles and those released with hooks, the potential for mortality is likely much higher. Based upon observations of hooked loggerhead sea turtles in captivity, Aguilar et al. (1995) estimated 20–30 percent of animals caught in longline gear may eventually die. More recently, Casale et al. (2008b) reported, given variations in hook position affecting survivability, the mortality rate of turtles caught by pelagic longlines could be higher than previously thought (17–42 percent; Lewison et al., 2004). Considering direct and post-release mortality, Casale (2008) used a conservative approach to arrive at 40 percent for the average mortality from Mediterranean pelagic longlines. The result is an estimated 20,000 turtles killed per year by pelagic longlines (Casale, 2008).

In general, most of the turtles captured in the Mediterranean surface longline fisheries are juvenile animals (Aguilar et al., 1995; Panou et al., 1999; Camiñas et al., 2003; Casale et al., 2007c; Jribi et al., 2008), but some adult loggerhead bycatch is also reported. Considering data from many Mediterranean areas and research studies, the average size of turtles caught by pelagic longlines was 48.9 cm CCL (range 20.5–79.2 cm CCL; n=1868) (Casale, 2008). Specifically, in the Spanish surface longline fishery, 13 percent of estimated carapace sizes (n=455) ranged from 75.36 to 107 cm CCL, considered to be adult animals (Camiñas et al., 2003), and in the Ionian Sea, 15 percent of a total 157 loggerhead sea turtles captured in swordfish longlines were adult animals (estimated size at greater than or equal to 75 cm) (Panou et al., 1999).

Bottom longlines are also fished in the Mediterranean, but specific capture rates for loggerheads are largely unknown for many areas. The countries with the highest number of documented captures (in the thousands per year) are Tunisia, Libya, Greece, Turkey, Egypt, Morocco, and Italy (Casale, 2008). Available data suggest the annual number of loggerhead sea turtle captures (not necessarily individual turtles) by all Mediterranean demersal longliners may be greater than 35,000 (Casale, 2008). Given available information and using a conservative approach, mortality from bottom longlines may be at least equal to pelagic longline mortality (40 percent; Casale, 2008). The result is an estimated 14,000 turtles killed per year in Mediterranean bottom longlines (Casale, 2008). It is likely that these animals represent mostly juvenile loggerheads, Casale (2008) reported an average turtle size of 51.8 cm CCL (n=35) in bottom longlines based on available data throughout the Mediterranean.

Artisanal longline fisheries also have the potential to take sea turtles. A survey of 54 small boat (4–10 meter length) artisanal fishermen in Cyprus and Turkey resulted in an estimated minimum bycatch of over 2,000 turtles per year, with an estimated 10 percent mortality rate (Godley et al., 1998a). These small boats fished with a combination of longlines and trammel/gillnets. However, note that it is likely that a proportion (perhaps a large proportion) of the turtle bycatch estimated in this study are green turtles.

Set Net (Gillnet) Fisheries

As in other areas, sea turtles have the potential to interact with set nets (gillnets or trammel nets) in the Mediterranean. Mediterranean set nets refer to gillnets (a single layer of net) and trammel nets, which consist of three layers of net with different mesh size. Casale (2008) estimated that the countries with the highest number of loggerhead captures (in the thousands per year) are Tunisia, Libya, Greece, Turkey, Cyprus, and Croatia. Italy, Morocco, Egypt, and France likely have high capture rates as well. Available information suggests the annual number of loggerhead captures by Mediterranean set nets may be greater than 30,000 (Casale, 2008).

Due to the nature of the gear and fishing practices (e.g., relatively long soak times), incidental capture in gillnets is among the highest source of direct sea turtle mortality. An evaluation of turtles tagged then recaptured in gillnets along the Italian coast found 14 of 19 loggerheads (73.7 percent) to be dead (Argano et al., 1992). Gillnets off France were observed to capture six loggerheads with a 50 percent mortality rate (Laurent, 1991). Six loggerheads were recovered in gillnets off Croatia between 1993 and 1996; 83 percent were found dead (Lazar et al., 2000). Off the Balearic Islands, 196 sea turtles were estimated to be captured in lobster trammel nets in 2001, with a CPUE of 0.17 turtles per vessel (Carreras et al., 2004). Mortality estimates for this artisanal lobster trammel net fishery ranged from 78 to 100 percent. Given this mortality rate and the number of turtles reported in lobster trammel nets, Carreras et al. (2004) estimate that a few thousand loggerhead sea turtles are killed annually by lobster trammel nets in the whole western Mediterranean. Considering data throughout the entire Mediterranean, as well as a conservative approach, Casale (2008) considered mortality by set nets to be 60 percent, with a resulting estimate of 16,000 turtles killed per year. Most of these animals are likely juveniles; Casale (2008) evaluated available set net catch data throughout the Mediterranean and found an average size of 45.4 cm CCL (n=74).

As noted above, artisanal set net fisheries also may capture numerous sea turtles, as observed off Cyprus and Turkey (Godley et al., 1998a).

Driftnet Fisheries

Historically, driftnet fishing in the Mediterranean caught large numbers of sea turtles. An estimated 16,000 turtles were captured annually in the Ionian Sea driftnet fishery in the 1980s (De Metrio and Megalofonou, 1988). The United Nations established a worldwide moratorium on driftnet fishing effective in 1992, but unregulated driftnetting continued to occur in the Mediterranean. For instance, a bycatch estimate of 236 loggerhead sea turtles was developed for the Spanish swordfish driftnet fishery in 1994 (Silvani et al., 1999). While the Spanish fleet curtailed activity in 1994, the Moroccan, Turkish, French, and Italian driftnet fleets continued to operate. Tudela et al. (2005) presented bycatch rates for driftnet fisheries in the Alboran Sea and off Italy. The Moroccan Alboran Sea driftnet fleet bycatch rate ranged from 0.21 to 0.78 loggerheads per haul, whereas the Italian driftnet fleet had a lower bycatch rate of 0.046 to 0.057 loggerheads per haul (Di Natale, 1995; Camiñas, 1997; Silvani et al., 1999). The use of driftnets in the Mediterranean continues to be illegal: the General Fisheries Commission for the Mediterranean prohibited driftnet fishing in 1997; a total ban on driftnet fishing by the European Union fleet in the Mediterranean went into effect in 2002; and ICCAT banned driftnets in 2003. Nevertheless, there are an estimated 600 illegal driftnet vessels operating in the Mediterranean, including fleets based in Algeria, France, Italy, Morocco, and Turkey (Environmental Justice Foundation, 2007). In particular, the Moroccan fleet, operating in the Alboran Sea and Straits of

Gibraltar, comprises the bulk of Mediterranean driftnetting, and has been found responsible for high bycatch, including loggerhead sea turtles (Environmental Justice Foundation, 2007; Aksissou et al., 2010). Driftnet fishing in the Mediterranean, and accompanying threats to loggerhead sea turtles, continues to occur.

Trawl Fisheries

Sea turtles are known to be incidentally captured in trawls in Albania, Algeria, Croatia, Egypt, France, Greece, Italy, Libya, Morocco, Slovenia, Spain, Tunisia, and Turkey (Gerosa and Casale, 1999; Camiñas, 2004; Casale, 2008). Laurent et al. (1996) estimated that approximately 10,000 to 15,000 sea turtles (most of which are loggerheads) are captured by bottom trawling in the entire Mediterranean. More recently, Casale (2008) compiled available trawl bycatch data throughout the Mediterranean and reported that Italy and Tunisia have the highest level of sea turtle bycatch, potentially over 20,000 captures per year combined, and Croatia, Greece, Turkey, Egypt, and Libya each catch more than 2,000 turtles per year. Further, Spain and Albania may each capture a few hundred sea turtles per year (Casale, 2008). Available data suggest the annual number of sea turtle captures by all Mediterranean trawlers may be greater than 40,000 (Casale, 2008). Although juveniles are incidentally captured in trawl gear in many areas of the Mediterranean (Casale et al., 2004, 2007c; Jribi et al., 2007), adult turtles are also found. In Egypt, 25 percent of loggerheads captured in bottom trawl gear (n=16) were greater than or equal to 70 cm CCL, and in Tunisia, 26.2 percent (n=62) were of this larger size class (Laurent et al., 1996). Off Lampedusa Island, Italy, the average size of turtles caught by bottom trawlers was 51.8 cm CCL (range 22–87 cm CCL; n=368), and approximately 10 percent of the animals measured greater than 75 cm CCL (Casale et al., 2007c). For all areas of the Mediterranean, Casale (2008) reported that medium to large turtles are generally caught by bottom trawl gear (mean 53.9 cm CCL; range 22–87 cm CCL; n=648).

While there is a notable interaction rate in the Mediterranean, it appears that the mortality associated with trawling is relatively low. Incidents of mortality have ranged from 3.3 percent (n=60) in Tunisia (Jribi et al., 2007) and 3.3 percent (n=92) in France (Laurent, 1991) to 9.4 percent (n=32) in Italy (Casale et al., 2004). Casale et al. (2004) found that mortality would be higher if all comatose turtles were assumed to die. It also should be noted that the mortality rate in trawls depends on the duration of the haul, with longer haul durations resulting in higher mortality rates (Henwood and Stuntz, 1987; Sasso and Epperly, 2006). Jribi et al. (2007) stated that the low recorded mortality in the Gulf of Gabès is likely due to the short haul durations in this area. Based on available information from multiple areas of the Mediterranean, and assuming that comatose animals die if released in that condition, the overall average mortality rate for bottom trawlers was estimated to be 20 percent (Casale, 2008). This results in at least 7,400 turtles killed per year by bottom trawlers in all of the Mediterranean, but the number is likely more than 10,000 (Casale, 2008).

Mid-water trawling may have less total impact on sea turtles found in the Mediterranean than some other gear types, but interactions still occur. Casale et al. (2004) found that while no turtles were caught on observed mid-water trawl trips in the North Adriatic Sea, vessel captains reported 13 sea turtles captured from April to September. Considering total fishing effort, these reports resulted in a minimum total catch estimate of 161 turtles a year in the Italian mid-water trawl fishery. Off Turkey, 71 loggerheads were captured in mid-water trawls from 1995–1996, while 43 loggerheads were incidentally taken in bottom trawls (Oruç, 2001). In this same study, of a total 320 turtles captured in mid-water trawls (loggerheads and greens combined), 95 percent were captured alive and apparently healthy. While the total catch numbers throughout the Mediterranean have not been estimated, mid-water trawl fisheries do present a threat to loggerhead sea turtles.

Other Gear Types

Seine, dredge, trap/pot, and hook and line fisheries operate in Mediterranean waters and may affect loggerhead sea turtles, although incidental captures in these gear types are largely unknown (Camiñas, 2004). Artisanal fisheries using a variety of gear types also have the potential for sea turtle takes, but the effects of most artisanal gear types on sea turtles have not been estimated.

Other Manmade and Natural Impacts

Other anthropogenic threats, such as interactions with recreational and commercial vessels, marine pollution, and intentional killing, also impact loggerheads found in the Mediterranean. Propeller and collision injuries from boats and ships are becoming more common in sea turtles, although it is unclear as to whether the events are increasing or just the reporting of the injuries. Speedboat impacts are of particular concern in areas of intense tourist activity, such as Greece and Turkey. Losses of nesting females from vessel collisions have been documented in Zakynthos and Crete in Greece (Camiñas, 2004). In the Gulf of Naples, 28.1 percent of loggerheads recovered from 1993–1996 had injuries attributed to boat strikes (Bentivegna and Paglialonga, 1998). Along the Greece coastline from 1997–1999, boat strikes were reported as a seasonal phenomenon in stranded turtles (Kopsida et al., 2002), but numbers were not presented.

Direct or indirect disposal of anthropogenic debris introduces potentially lethal materials into loggerhead foraging habitats. Unattended or discarded nets, floating plastics and bags, and tar balls are of particular concern (Camiñas, 2004; Margaritoulis, 2007). Monofilament netting appears to be the most dangerous waste produced by the fishing industry (Camiñas, 2004). In the Mediterranean, 20 of 99 loggerhead sea turtles examined from Maltese fisheries were found contaminated with plastic or metal litter and hydrocarbons, with crude oil being the most common pollutant (Gramentz, 1988). Of 54 juvenile loggerhead sea turtles incidentally caught by fisheries in Spanish Mediterranean waters, 79.6 percent had debris in their digestive tracts (Tomás et al., 2002). In this study, plastics were the most frequent type of marine debris observed (75.9 percent), followed by tar (25.9 percent). However, an examination of stranded sea turtles in Northern Cyprus and Turkey found that only 3 of 98 animals were affected by marine debris (Godley et al., 1998b).

Pollutant waste in the marine environment may impact loggerheads, likely more than other sea turtle species. Omnivorous loggerheads stranded in Cyprus, Greece, and Scotland had the highest organochlorine contaminant concentrations, as compared to green and leatherback turtles (Mckenzie et al., 1999). In northern Cyprus, Godley et al. (1999) found heavy metal concentrations (mercury, cadmium, and lead) to be higher in loggerheads than green turtles. Even so, concentrations of contaminants from sea turtles in Mediterranean waters were found to be comparable to other areas, generally with levels lower than concentrations shown to cause deleterious effects in other species (Godley et al., 1999; Mckenzie et al., 1999). However, lead concentrations in some Mediterranean loggerhead hatchlings were at levels known to cause toxic effects in other vertebrate groups (Godley et al., 1999).

As in other areas of the world, intentional killing or injuring of sea turtles has been reported to occur in the Mediterranean. Of 524 strandings in Greece, it appeared that 23 percent had been intentionally killed or injured (Kopsida et al., 2002). While some turtles incidentally captured are used for consumption, it has been reported that some fishermen kill the sea turtles they catch for a variety of other reasons, including non-commercial use, hostility, prejudice, recovery of hooks, and ignorance (Laurent et al., 1996; Godley et al., 1998a; Gerosa and Casale, 1999; Casale, 2008).

Natural environmental events also may affect loggerheads in the Mediterranean. Cyclonic storms that closely resemble tropical cyclones in satellite images occasionally form over the Mediterranean Sea (Emanuel, 2005). While hurricanes typically do not occur in the Mediterranean, researchers have suggested that climate change could trigger hurricane development in this area in the future (Gaertner et al., 2007). Any significant storm event that may develop could disrupt loggerhead nesting activity and hatchling production, but the results are generally localized and rarely result in whole-scale losses over multiple nesting seasons.

Similar to other areas of the world, climate change and sea level rise have the potential to impact loggerheads in the Mediterranean. Over the long term, Mediterranean turtle populations could be threatened by the alteration of thermal sand characteristics (from global warming), resulting in the reduction or cessation of female hatchling production (Camiñas, 2004; Hawkes et al., 2009; Poloczanska et al., 2009). Further, a significant rise in sea level would restrict loggerhead nesting habitat in the eastern Mediterranean.

In summary, we find that the Mediterranean Sea DPS of the loggerhead sea turtle is negatively affected by both natural and manmade impacts as described above in Factor E.

Within Factor E, we find that fishery bycatch that occurs throughout the Mediterranean Sea, particularly bycatch mortality of loggerheads from pelagic and bottom longline, set net, driftnet, and trawl fisheries, is a significant threat to the persistence of this DPS. In addition, boat strikes are becoming more common and are likely also a significant threat to the persistence of this DPS.

South Atlantic Ocean DPS

A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Terrestrial Zone

Destruction and modification of loggerhead nesting habitat in the South Atlantic result from coastal development and construction, placement of erosion control structures and other barriers to nesting, beachfront lighting, vehicular and pedestrian traffic, sand extraction, beach erosion, beach sand placement, beach pollution, removal of native vegetation, and planting of non-native vegetation (D’Amato and Marczwski, 1993; Marcovaldi and Marcovaldi, 1999; Naro-Maciel et al., 1999; Marcovaldi et al., 2002b, 2005; Marcovaldi, 2007).

The primary nesting areas for loggerheads in the South Atlantic are in the States of Sergipe, Bahia, Espírito Santo, and Rio de Janeiro in Brazil (Marcovaldi and Marcovaldi, 1999). These primary nesting areas are monitored by Projeto TAMAR, the national sea turtle conservation program in Brazil. Since 1980, Projeto TAMAR has worked to establish legal protection for nesting beaches (Marcovaldi and Marcovaldi, 1999). As such, human activities, including sand extraction, beach nourishment, seawall construction, beach driving, and artificial lighting, that can negatively impact sea turtle nesting habitat, as well as directly impact nesting turtles and their eggs and hatchlings during the reproductive season, are restricted by various

State and Federal laws (Marcovaldi and Marcovaldi, 1999; Marcovaldi et al., 2002b, 2005). Nevertheless, tourism development in coastal areas in Brazil is high, and Projeto TAMAR works toward raising awareness of turtles and their conservation needs through educational and informational activities at their Visitor Centers that are dispersed throughout the nesting areas (Marcovaldi et al., 2005).

In terms of non-native vegetation, the majority of nesting beaches in northern Bahia, where loggerhead nesting density is highest in Brazil (Marcovaldi and Chaloupka, 2007), have coconut plantations dating back to the 17^{th} century backing them (Naro-Maciel et al., 1999). It is impossible to assess whether this structured habitat has resulted in long-term changes to the loggerhead nesting rookery in northern Bahia.

Neritic/Oceanic Zones

Human activities that impact bottom habitat in the loggerhead neritic and oceanic zones in the South Atlantic Ocean include fishing practices, channel dredging, sand extraction, marine pollution, and climate change (e.g., Ibe, 1996; Silva et al., 1997). General human activities have altered ocean ecosystems, as identified by ecosystem models (http://www.lme.noaa.gov). On the western side of the South Atlantic, the Brazil Current LME region is characterized by the Global International Waters Assessment as suffering severe impacts in the areas of pollution, coastal habitat modification, and overexploitation of fish stocks (Marques et al., 2004). The Patagonian Shelf LME is moderately affected by pollution, habitat modification, and overfishing (Mugetti et al., 2004). On the eastern side of the South Atlantic, the Benguela Current LME has been characterized as moderately impacted in the area of overfishing, with future conditions expected to worsen by the Global International Waters Assessment (Prochazka et al., 2005). Climate change also may result in future trophic changes, thus impacting loggerhead prey abundance and distribution.

In summary, we find that the South Atlantic Ocean DPS of the loggerhead sea turtle is negatively affected by ongoing changes in its marine habitats as a result of land and water use practices as considered above in Factor A. The best available data suggest that threats to neritic and oceanic habitats are potentially affecting the persistence of this DPS; however, sufficient data are not available to assess the significance of these threats to the persistence of this DPS.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Deliberate hunting of loggerheads for their meat, shells, and eggs is reduced from previous exploitation levels, but still exists. Limited numbers of eggs are taken for human consumption in Brazil, but the relative amount is considered minor when compared to historical rates of egg collection (Marcovaldi and Marcovaldi, 1999; Marcovaldi et al., 2005; Almeida and Mendes, 2007). Use of sea turtles including loggerheads for medicinal purposes occasionally occurs in northeastern Brazil (Alves and Rosa, 2006). Use of bycaught loggerheads for subsistence and medicinal purposes is likely to occur in southern Atlantic Africa, based on information from central West Africa (Fretey, 2001; Fretey et al., 2007).

In summary, the harvest of loggerheads in Brazil for their meat, shells, and eggs likely was a factor that contributed to the historical decline of this DPS. However, current harvest levels are greatly reduced from historical levels. Although harvest is known to still occur in Brazil and southern Atlantic Africa, it no longer appears to be a significant threat to the persistence of this DPS.

C. Disease or Predation

The potential exists for diseases and endoparasites to impact loggerheads found in the South Atlantic Ocean. There have been five confirmed cases of fibropapillomatosis in loggerheads in Brazil (Baptistotte, 2007). There is no indication that this disease poses a major threat for this species in the eastern South Atlantic (Formia et al., 2007).

Eggs and nests in Brazil experience depredation, primarily by foxes (Marcovaldi and Laurent, 1996). Nests laid by loggerheads in the southern Atlantic African coastline, if any, likely experience similar predation pressures to those on nests of other species laid in the same area (e.g., jackals depredate green turtle nests in Angola; Weir et al., 2007).

Loggerheads in the South Atlantic also may be impacted by harmful algal blooms (Gilbert et al., 2005).

In summary, disease and predation are known to occur. The best available data suggest these threats are potentially affecting the persistence of this DPS; however, quantitative data are not sufficient to assess the degree of impact of these threats on the persistence of this DPS.

D. Inadequacy of Existing Regulatory Mechanisms

International Instruments

The BRT identified several regulatory mechanisms that apply to loggerhead sea turtles globally and within the South Atlantic Ocean. The reader is directed to sections 5.1.4. and 5.2.9.4. of the Status Review for a discussion of these regulatory mechanisms. Hykle (2002) and Tiwari (2002) have reviewed the effectiveness of some of these international instruments. The problems with existing international treaties are often that they have not realized their full potential, do not include some key countries, do not specifically address sea turtle conservation, and are handicapped by the lack of a sovereign authority to enforce environmental regulations.

The ineffectiveness of international treaties and national legislation is oftentimes due to the lack of motivation or obligation by countries to implement and enforce them. A thorough discussion of this topic is available in a special 2002 issue of the Journal of International Wildlife Law and Policy: International Instruments and Marine Turtle Conservation (Hykle, 2002).

National Legislation and Protection

Fishery bycatch that occurs throughout the South Atlantic Ocean is substantial (see Factor E). Although national and international governmental and non-governmental entities on both sides of the South Atlantic are currently working toward reducing loggerhead bycatch in the South Atlantic, it is unlikely that this source of mortality can be sufficiently reduced across the range of the DPS in the near future because of the diversity and magnitude of the commercial and artisanal fisheries operating in the South Atlantic, the lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies.

In the primary nesting areas in the States of Sergipe, Bahia, Espírito Santo, and Rio de Janeiro in Brazil, human activities, including sand extraction, beach nourishment, seawall construction, beach driving, and artificial lighting, are restricted by various State and Federal laws (Marcovaldi and Marcovaldi, 1999; Marcovaldi et al., 2002b, 2005).

In summary, our review of regulatory mechanisms under Factor D demonstrates that although regulatory mechanisms are in place that should address direct and incidental take of South Atlantic Ocean loggerheads, these regulatory mechanisms are insufficient or are not being implemented effectively to address the needs of loggerheads. We find that the threat from the inadequacy of existing regulatory mechanisms for fishery bycatch (Factor E) is significant relative to the persistence of this DPS.

E. Other Natural or Manmade Factors Affecting its Continued Existence

Incidental Bycatch in Fishing Gear

Incidental capture of sea turtles in artisanal and commercial fisheries is a significant threat to the survivability of loggerheads in the South Atlantic. Sea turtles may be caught in pelagic and demersal longlines, drift and set gillnets, bottom and mid-water trawling, fishing dredges, pound nets and weirs, haul and purse seines, pots and traps, and hook and line gear. In the western South Atlantic, there are various efforts aimed at mitigating bycatch of sea turtles in various fisheries. In Brazil, there is the National Action Plan to Reduce Incidental Capture of Sea Turtles in Fisheries, coordinated by Projeto TAMAR (Marcovaldi et al., 2006). This action plan focuses on both artisanal and commercial fisheries, and collects data directly from fishers as well as on-board observers. Although loggerheads have been observed as bycatch in all fishing gear and methods identified above, Marcovaldi et al. (2006) have identified longlining as the major source of incidental capture of loggerhead sea turtles. Reports of loggerhead bycatch by pelagic longlines come mostly from the southern portion of the Brazilian Exclusive Economic Zone, between 20º S. and 35º S. latitude. Bugoni et al. (2008) reported a loggerhead bycatch rate of 0.52 juvenile turtles/1,000 hooks by surface longlines targeting dolphinfish. Pinedo and Polacheck (2004) reported seasonal variation in bycatch of juvenile loggerheads (and other sea turtle species) by pelagic longlines in the same region of Brazil, with the highest rates (1.85 turtles/1,000 hooks) in the austral spring. Kotas et al. (2004) reported the highest rates of loggerhead bycatch (greater than 10 turtles/1,000 hooks) by pelagic longlines in the austral summer/fall months. A study based on several years found that the highest rate of loggerhead bycatch in pelagic longlines off Uruguay and Brazil was in the late austral summer month of February: 2.72 turtles/1,000 hooks (López-Medilaharsu et al., 2007). Sales et al. (2008) reported a loggerhead bycatch rate of 0.87/1,000 hooks near the Rio Grande Elevacao do Rio Grande, about 600 nautical miles off the coast of southern Brazil. In Uruguayan waters, the primary fisheries with loggerhead bycatch are bottom trawlers and longlines (Domingo et al., 2006). Domingo et al. (2008) reported bycatch rates of loggerheads of 0.9–1.3/1,000 hooks by longline deployed south of 30º S. latitude. In waters off Argentina, bottom trawlers also catch some loggerheads (Domingo et al., 2006).

In the eastern South Atlantic, sea turtle bycatch in fisheries has been documented from Gabon to South Africa (Fretey, 2001). Limited data are available on bycatch of loggerheads in coastal fisheries, although loggerheads are known (or strongly suspected) to occur in coastal waters from Gabon to South Africa (Fretey, 2001; Bal et al., 2007; Weir et al., 2007). Coastal fisheries implicated in bycatch of loggerheads and other turtles include gillnets, beach seines, and trawlers (Bal et al., 2007).

In the high seas, longlines are used by fishing boats targeting tuna and swordfish in the eastern South Atlantic. A recent study by Honig et al. (2008) estimates 7,600–120,000 sea turtles are incidentally captured by commercial longlines fishing in the Benguela Current LME; 60 percent of these are loggerheads. Petersen et al. (2007, 2009) reported that the rate of loggerhead bycatch in South African longliners was around 0.02 turtles/1,000 hooks, largely in the Benguela Current LME. In the middle of the South Atlantic, loggerhead bycatch by longlines was reported to be low, relative to other regions in the Atlantic (Mejuto et al., 2008).

Other Manmade and Natural Impacts

Other anthropogenic impacts, such as boat strikes and ingestion or entanglement in marine debris, also apply to loggerheads in the South Atlantic. Bugoni et al. (2001) have suggested the ingestion of plastic and oil may contribute to loggerhead mortality on the southern coast of Brazil. Plastic marine debris in the eastern South Atlantic also may pose a problem for loggerheads and other sea turtles (Ryan, 1996). Similar to other areas of the world, climate change and sea level rise have the potential to impact loggerheads in the South Atlantic. This includes beach erosion and loss from rising sea levels, repeated inundation of nests, skewed hatchling sex ratios from rising beach incubation temperatures, and abrupt disruption of ocean currents used for natural dispersal during the complex life cycle (Hawkes et al., 2009; Poloczanska et al., 2009). Climate change impacts could have profound long-term impacts on nesting populations in the South Atlantic Ocean, as is the case for all DPSs, but at this time we cannot predict what those impacts may be.

Oil reserve exploration and extraction activities also may pose a threat for sea turtles in the South Atlantic. Seismic surveys in Brazil and Angola have recorded sea turtle occurrences near the seismic work (Gurjão et al., 2005; Weir et al., 2007). While no sea turtle takes were directly observed on these surveys, increased equipment and presence in the water that is associated with these activities also increases the likelihood of sea turtle interactions (Weir et al., 2007).

Natural environmental events may affect loggerheads in the South Atlantic. However, while a rare hurricane hit Brazil in March 2004, typically hurricanes do not occur in the South

Atlantic (McTaggart-Cowan et al., 2006). This is generally due to higher windspeeds aloft, preventing the storms from gaining height and therefore strength.

In summary, we find that the South Atlantic Ocean DPS of the loggerhead sea turtle is negatively affected by both natural and manmade impacts as described above in Factor E. Within Factor E, we find that fishery bycatch, particularly bycatch mortality of loggerheads from pelagic longline fisheries, is a significant threat to the persistence of this DPS.

Supplemental Extinction Risk Assessments

In addition to the status evaluation and Section 4(a)(1) 5-factor analysis provided above, the BRT conducted two independent analyses to further assess extinction risks of the nine identified DPSs. Although these analyses provided some additional insights into the status of the nine DPSs, ultimately the conclusions and determinations made were primarily based on an assessment of population sizes and trends, current and anticipated threats, and conservation efforts for each DPS.

The first analysis used the diffusion approximation approach based on time series of counts of nesting females (Lande and Orzack, 1988; Dennis et al., 1991; Holmes, 2001; Snover and Heppell, 2009). This analysis provided a metric (SQE) to determine if the probability of a population's risk of quasi-extinction is high enough to warrant a particular listing status (Snover and Heppell, 2009). The term "quasi-extinction" is defined by Ginzburg et al. (1982) as the minimum number of individuals (often females) below which the population is likely to be critically and immediately imperiled. The diffusion approximation approach is based on stochastic projections of observed trends and variability in the numbers of mature females at various nesting beaches. The second analysis used a deterministic stage-based population model that focused on determining the effects of known anthropogenic mortalities on each DPS with respect to the vital rates of the species. Anthropogenic mortalities were added to natural mortalities and possible ranges of population growth rates were computed as another metric of population health. Because this approach is based on matrix models, the BRT referred to it as a threat matrix analysis. This approach focused on how additional mortalities may affect the future growth and recovery rate of a loggerhead sea turtle DPS. The first approach (SQE) was solely based on the available time-series data on the numbers of nests at nesting beaches, whereas the second approach (threat matrix analysis) was based on the known biology of the species, natural mortality rates, and anthropogenic mortalities, independent of observed nesting beach data.

The BRT found that for three of five DPSs with sufficient data to conduct the SQE analysis (North Pacific Ocean, South Pacific Ocean, and Northwest Atlantic Ocean), these DPSs were at risk of declining to levels that are less than 30 percent of the current numbers of nesting females (QETs < 0.30). The BRT found that for the other two DPSs with sufficient data to conduct the SQE analysis (Southwest Indian Ocean and South Atlantic Ocean), the risk of declining to any level of quasi-extinction is negligible using the SQE analysis because of the observed increases in the nesting females in both DPSs. There were not enough data to conduct the SQE analysis for the North Indian Ocean, Southeast Indo-Pacific Ocean, Northeast Atlantic Ocean, and Mediterranean Sea DPSs. It is important to note that the BRT's analysis was not based on the actual population size at the end of the 100-year projection period, but was based on reaching a certain proportion (2.5 and 97.5 percent) of the current population size. Thus, it is possible to greatly diminish a population but still have a large population size after 100 years.

According to the threat matrix analysis using a majority of experts' opinions in the matrix model framework, the BRT determined that all loggerhead sea turtle DPSs have the potential to decline in the future. Although some DPSs are indicating increasing trends at nesting beaches (Southwest Indian Ocean and South Atlantic Ocean), available information about anthropogenic threats to juvenile and adult loggerheads in neritic and oceanic environments indicate possible unsustainable additional mortalities. According to the threat matrix analysis, the potential for future decline is greatest for the North Indian Ocean, Northwest Atlantic Ocean, Northeast Atlantic Ocean, Mediterranean Sea, and South Atlantic Ocean DPSs.

The BRT's approach to the risk analysis presented several important points. First, the lack of precise estimates of age at first reproduction hindered precise assessment of the status of any DPS. Within the range of possible ages at first reproduction of the species, however, some DPSs could decline rapidly regardless of the exact age at first reproduction because of high anthropogenic mortality.

Second, the lack of precise estimates of anthropogenic mortalities resulted in a wide range of possible status using the threat matrix analysis. For the best case scenario, a DPS may be considered healthy, whereas for the worst case scenario the same DPS may be considered as declining rapidly. The precise prognosis of each DPS relies on obtaining precise estimates of anthropogenic mortality and vital rates.

Third, the assessment of a population without the information on natural and anthropogenic mortalities is difficult. Because of the longevity of the species, loggerhead sea turtles require high survival rates throughout their life to maintain a population. Anthropogenic mortality on the species occurs at every stage of their life, where the exact magnitude of the mortality is often unknown. As described in the Status Review, the upper end of natural mortality can be computed from available information.

Nesting beach count data for the North Pacific Ocean DPS indicated a decline of loggerhead sea turtle nesting in the last 20 years. The SQE approach reflected the observed decline. However, in the threat matrix analysis, the asymptotic population growth rates (λ) with anthropogenic mortalities ranged from less than one to greater than one, indicating a large uncertainty about the future of the DPS. Fishery bycatch along the coast of the Baja Peninsula and the nearshore waters of Japan are the main known sources of mortalities. Mortalities in the high-seas, where a large number of juvenile loggerhead sea turtles reside (Kobayashi et al., 2008), from fishery bycatch are still unknown.

The SQE approach indicated that, based on nest count data from the mid-1970s through the early to mid-2000s, the South Pacific Ocean DPS is at risk and thus likely to decline in the future. These results were based on recently published nesting census data for loggerhead sea turtles at index beaches in eastern Australia (Limpus, 2009). The threat matrix analysis provided uncertain results: in the case of the lowest anthropogenic threats, the South Pacific Ocean DPS may recover, but in the worst-case scenario, the DPS may substantially decline in the future. These results are largely driven by the ongoing threats to juvenile and adult loggerheads from fishery bycatch that occur throughout the South Pacific Ocean and the uncertainty in estimated mortalities.

For the North Indian Ocean DPS, there were no nesting beach data available to conduct the SQE analysis. The threat matrix analysis indicated a decline of the DPS in the future, primarily as a result of fishery bycatch in neritic habitats. Cumulatively, substantial threats may exist for eggs/hatchlings. Because of the lack of precise estimates of bycatch, however, the range of possible λ values was large.

Similar to the North Indian Ocean DPS, no nesting beach data were available for the Southeast Indo-Pacific Ocean DPS. The level of anthropogenic mortalities is low for the Southeast Indo-Pacific Ocean DPS, based on the best available information, resulting in relatively large P_λ (the proportion of λ values greater than 1) and a narrow range. The greatest threats for the Southeast Indo-Pacific Ocean DPS exist for the first year of the life stages (eggs and hatchlings).

For the Southwest Indian Ocean DPS, the SQE approach, based on a 37-year time series of nesting female counts at Tongaland, South Africa (1963–1999), indicated this segment of the population, while small, has increased, and the likelihood of quasi-extinction is negligible. The threat matrix analysis, on the other hand, provided a wide range of results: in the best case scenario, the DPS would grow slowly, whereas in the worst case scenario, the DPS would decline in the future. The results of the threat matrix analysis were driven by uncertainty in anthropogenic mortalities in the neritic environment and the eggs/hatchlings stage.

Within the Northwest Atlantic Ocean DPS, four of the five identified recovery units have adequate time series data for applying the original SQE analysis; these are the Northern, Peninsular Florida, Northern Gulf of Mexico, and Greater Caribbean Recovery Units. The original SQE analysis indicated differences in SQEs among these four recovery units. Although the Northern Gulf of Mexico Recovery Unit indicated the worst result among the four recovery units assessed the length of the time series was shortest (12 data points). The other three recovery units, however, appeared to show similar declining trends, which were indicated through the SQE approach. A revision of the SQE analysis, however, had different results. Including nesting data through 2009 instead of just 2007, and redoing the analysis to use a range of adult female abundance estimates as QETs, it was determined that there was little risk (SQE<0.3) of the Peninsular Florida Recovery Unit (comprising approximately 80 percent of the Northwest Atlantic Ocean DPS) reaching 1,000 or fewer females in 100 years. This revised analysis was done by the same member of the BRT that performed the original SQE analysis. The threat matrix analysis indicated a likely decline of the DPS in the future. The greatest threats to the DPS result from cumulative fishery bycatch in neritic and oceanic habitats.

Sufficient nesting beach data for the Northeast Atlantic Ocean DPS were not available to conduct the SQE analysis. The high likelihood of the predicted decline of the Northeast Atlantic Ocean DPS from the threat matrix analysis is largely driven by the ongoing harvest of nesting females, low hatchling and emergence success, and mortality of juvenile and adult turtles from fishery bycatch throughout the Northeast Atlantic Ocean. The threat matrix analysis indicated a consistently pessimistic future for the DPS.

Representative nesting beach data for the Mediterranean Sea DPS were not available to conduct the SQE analysis. The threat matrix analysis indicated the DPS is likely to decline in the future. The primary threats are fishery bycatch in neritic and oceanic habitats.

The two approaches for determining risks to the South Atlantic Ocean DPS provided different, although not incompatible, results. The SQE approach indicated that, based on nest count data for the past 2 decades, the population was unlikely to decline in the future. These results were based on recently published nesting beach trend analyses by Marcovaldi and Chaloupka (2007) and this QET analysis was consistent with their conclusions. However, the

SQE approach was based on past performance of the DPS, specifically only nesting beach data, and did not address ongoing or future threats to segments of the DPS that might not have been or might not yet be reflected by nest count data. The threat matrix approach indicated that the South Atlantic Ocean DPS is likely to decline in the future. These results were largely driven by the ongoing mortality threats to juvenile turtles from fishery bycatch that occurs throughout the South Atlantic Ocean. Although conservation efforts by national and international groups in the South Atlantic are currently working toward mitigating bycatch in the South Atlantic, it is unlikely that this source of mortality can be greatly reduced in the near future, largely due to inadequate funding and knowledge gaps that together inhibit implementation of large-scale management actions (Domingo et al., 2006).

Conservation Efforts

When considering the listing of a species, section 4(b)(1)(A) of the ESA requires us to consider efforts by any State, foreign nation, or political subdivision of a State or foreign nation to protect the species. Such efforts would include measures by Native American tribes and organizations. Also, Federal, tribal, State, and foreign recovery actions (16 U.S.C. 1533(f)), and Federal consultation requirements (16 U.S.C. 1536) constitute conservation measures. In addition to identifying these efforts, under the ESA and our policy implementing this provision (68 FR 15100; March 28, 2003) we must evaluate the certainty of an effort's effectiveness on the basis of whether the effort or plan establishes specific conservation objectives; identifies the necessary steps to reduce threats or factors for decline; includes quantifiable performance measures for the monitoring of compliance and effectiveness; incorporates the principles of adaptive management; is likely to be implemented; and is likely to improve the species' viability at the time of the listing determination.

North Pacific Ocean DPS

NMFS has formalized two conservation actions to protect foraging loggerheads in the North Pacific Ocean, both of which were implemented to reduce loggerhead bycatch in U.S. fisheries. Prior to 2001, the Hawaii-based longline fishery had annual interaction levels of 300 to 500 loggerhead sea turtles. The temporary closure of the shallow-set swordfish fishery in 2001 in large part over concerns of turtle interactions brought about the immediate need to develop effective solutions to reduce turtle interactions while maintaining the viability of the industry. Since the reopening of the swordfish sector in 2004, the fishery has operated under strict management measures, including the use of large circle hooks and fish bait, restricted annual effort, annual caps on loggerhead interactions (17 annually), and 100 percent onboard observer coverage (50 CFR 665.3). As a result of these measures, loggerhead interactions in the swordfish fishery have been reduced by over 90 percent (Gilman et al., 2007). Furthermore, in 2003, NMFS implemented a time/area closure in southern California during forecasted or existing El Niño-like conditions to reduce the take of loggerheads in the California/Oregon drift gillnet fishery (68 FR 69962; December 16, 2003). While this closure has not been implemented since the passage of these regulations due to the lack of conditions occurring in the area, such a closure is expected to reduce interactions between the large-mesh gillnet fishery and loggerheads by over 70 percent. NMFS has also developed a mapping product known as TurtleWatch that provides a near real time product that recommends areas where the deployment of pelagic longline shallow sets should be avoided to help reduce interactions between Hawaii-based pelagic longline fishing vessels and loggerhead sea turtles (Howell et al., 2008).

Loggerhead interactions and mortalities with coastal fisheries in Mexico and Japan are of concern and are considered a major threat to North Pacific loggerhead recovery. NMFS and U.S. non-governmental organizations have worked with international entities to: (1) assess bycatch mortality through systematic stranding surveys in Baja California Sur, Mexico; (2) reduce interactions and mortalities in two bottom-set fisheries in Mexico; (3) conduct gear mitigation trials to reduce bycatch in Japanese pound nets; and (4) convey information to fishers and other stakeholders through participatory activities, events and outreach.

In 2003, the Grupo Tortuguero's ProCaguama (Operation Loggerhead) was initiated to partner directly with fishermen to assess and mitigate their bycatch while maintaining fisheries sustainability in Baja California, Mexico. ProCaguama's fisher-scientist team discovered the highest turtle bycatch rates documented worldwide and has made considerable progress in mitigating anthropogenic mortality in Mexican waters (Peckham et al., 2007, 2008). As a result of the 2006 and 2007 tri-national fishermen's exchanges run by ProCaguama, Sea Turtle Association of Japan, and the Western Pacific Fisheries Management Council, in 2007 a prominent Baja California Sur fleet retired its bottom-set longlines (Peckham et al., 2008; Peckham and Maldonado-Diaz, in press). Prior to this closure, the longline fleet interacted with an estimated 1,160-2,174 loggerheads annually, with nearly all (89 percent) of the takes resulting in mortalities (Peckham et al., 2008). Because this fleet no longer interacts with loggerheads, conservation efforts have resulted in the continued protection of approximately 1,160-2,174 juvenile loggerheads annually.

Led by the Mexican wildlife service (Vida Silvestre), a Federal loggerhead bycatch reduction task force was organized in 2008 to ensure loggerheads receive the protection they are afforded by Mexican law. The task force is comprised of Federal and State agencies, in addition to non-governmental organizations, to address the bycatch problem, meeting ProCaguama's bottom-up initiatives with complementary top-down management and enforcement resources. In 2009, while testing a variety of potential solutions, ProCaguama's fisher-scientist team demonstrated the commercial viability of substituting bycatch-free hook fishing for gillnet fishing. Local fishers are interested in adoption of this gear because the technique results in higher quality catch offering access to higher-value markets and potentially higher sustainability with zero bycatch. ProCaguama, in coordination with the task force, is working to develop a market-based bycatch solution consisting of hook substitution, training to augment ex-vessel fish value, development of fisheries infrastructure, linkage of local fleets with regional and international markets, and concurrent strengthening of local fisheries management.

The United States has also funded non-governmental organizations to convey bycatch solutions to local fishers as well as to educate communities on the protection of all sea turtles (i.e., reduce directed harvest). The effectiveness of these efforts are difficult to quantify without several post-outreach years of documenting reductions in sea turtle strandings, directed takes, or bycatch in local fisheries.

Due to concerns of high adult loggerhead mortality in mid-water pound nets, as documented in 2006, Sea Turtle Association of Japan researchers began to engage the pound net operators in an effort to study the impact and reduce sea turtle bycatch. This work was expanded in 2008 with U.S. support and, similar to outreach efforts in Mexico, is intended to engage local fishermen in conservation throughout several Japanese prefectures. Research opportunities will be developed with and for local fishermen in order to assess and mitigate bycatch.

The Southeast Asian Fisheries Development Center (SEAFDEC), an intergovernmental organization established in 1967 to promote sustainable fisheries development, also has made progress in managing sea turtle bycatch in the North Pacific region. SEAFDEC activities include research for the enhancement of sea turtle populations that is comprised of a sea turtle tagging and satellite telemetry study aimed at determining migration routes, inter-nesting and foraging habitats, and other relevant biological information of sea turtles in the region; investigation of the interaction between fisheries activities and sea turtle mortality; and an assessment of the effectiveness of the use of TEDs and circle hooks in reducing sea turtle mortality (SEAFDEC 2009, 2010). Since 2003, with the assistance of the United States, the Sea Turtle Association of Japan and, in recent years with the Grupo Tortuguero, has conducted nesting beach monitoring and management at several major loggerhead nesting beaches, with the intent of increasing the number of beaches surveyed and protected. Due to logistical problems and costs, the Sea Turtle Association of Japan's program had been limited to five primary rookeries. At these areas, hatchling production has been augmented through: (1) relocation of doomed nests; and (2) protection of nests in situ from trampling, desiccation, and predation. Between 2004 and 2008, management activities have been successful with over 160,000 hatchlings released from relocated nests that would have otherwise been lost to inundation or erosion, with many more hatchlings produced from in situ nests.

The United States plans to continue supporting this project in the foreseeable future, increasing relocation activities at other high-density nesting beaches, implementing predator control activities to reduce predation by raccoon dogs and raccoons, and assessing the effects of light pollution at a major nesting beach (Maehama Beach). Determination of hatching success will also be initiated at several key nesting beaches (Inakahama, Maehama, Yotsuse, and Kurio, all in Yakushima) to provide information to support the removal of armoring structures and to evaluate the success of relocation and other nest protection activities. Outreach and education activities in coastal cities will increase public awareness of problems with foot traffic, light pollution, and armoring.

Egg harvest was common in Japan until the 1970s, when several of the major nesting areas (notably Yakushima and Miyazaki) led locally based efforts to ban or eliminate egg harvest. As a result, egg harvest at Japanese nesting beaches was eliminated by the early 1980s.

The establishment of the Sea Turtle Association of Japan in 1990 created a network of individuals and organizations conducting sea turtle monitoring and conservation activities in Japan for the first time. The Sea Turtle Association of Japan also served to standardize data collection methods (for tagging and measuring). The Association greatly depends on its members around Japan to gather nesting data as well as to conduct various conservation measures.

Shoreline erosion and bycatch are some of the major concerns the Sea Turtle Association of Japan is dealing with today. Much of Japan's coastline is "armored" using concrete structures to prevent and minimize impacts to coastal communities from natural disasters. These structures have resulted in a number of nesting beaches losing sand suitable for sea turtle nesting, and nests are often relocated to safe areas or hatcheries to protect them from further erosion and inundation. In recent years, a portion of the concrete structures at a beach in Toyohashi City, Aichi Prefecture, was experimentally removed to create better nesting habitat. The Sea Turtle Association of Japan, along with various other organizations in Japan, are carrying out discussions with local and Federal Government agencies to develop further solutions to the beach erosion issue and to maintain viable nesting sites. Beach erosion and armament still remain one of the most significant threats to nesting beaches in Japan.

While conservation efforts for the North Pacific Ocean DPS are substantive and improving and may be reflected in the recent increases in the number of nesting females, they still remain inadequate to ensure the long-term viability of the population. For example, while most of the major nesting beaches are monitored, some of the management measures in place are inadequate and may be inappropriate. On some beaches, hatchling releases are coordinated with the tourist industry or nests are being trampled on or are unprotected. The largest threat on the nesting beach, reduced availability of habitat due to heavy armament and subsequent erosion, is just beginning to be addressed but without immediate attention may ultimately result in the demise of the highest density beaches. Efforts to reduce loggerhead bycatch in known coastal fisheries off Baja California, Mexico, and Japan is encouraging, but concerns remain regarding the mortalities of adult and juvenile turtles in mid-water pound nets and the high costs that may be involved in replacing or mitigating this gear. With these coastal fishery threats still emerging, there has not yet been sufficient time – or a nationwide understanding of the threat – to develop appropriate conservation strategies or work to fully engage with the government of Japan. Greater international cooperation and implementation of the use of circle hooks in longline fisheries operating in the North Pacific Ocean is necessary, as well as understanding fishery related impacts in the South China Sea. Further, it is suspected that there are substantial impacts from illegal, unreported, and unregulated fishing, which we are unable to mitigate without additional fisheries management efforts and international collaborations. While conservation projects for this population have been in place since 2004 for some important areas, efforts in other areas are still being developed to address major threats, including fisheries bycatch and long-term nesting habitat protection.

South Pacific Ocean DPS

The New Caledonia Aquarium and NMFS have collaborated since 2007 to address and influence management measures of the regional fishery management organization. Their intent is to reduce pelagic fishery interactions with sea turtles through increased understanding of pelagic habitat use by South Pacific loggerheads using satellite telemetry, oceanographic analysis, and juvenile loggerheads reared at the Aquarium. NMFS augments this effort by supporting animal husbandry, education and outreach activities coordinated through the New Caledonia Aquarium to build capacity, and public awareness regarding turtle conservation in general.

The United States has collaborated on at-sea conservation of sea turtles with Chile under the US-Chile Fisheries Cooperation Agreement, and with Peru in collaboration with El Instituto del Mar del Peru and local non-governmental organizations. Research from this collaboration showed that loggerheads of southwestern Pacific stock origin interact with commercial and artisanal longline fisheries off the South American coast. NMFS has supported efforts by Chile to reduce bycatch and mortality by placing observers that have been trained and equipped to dehook, resuscitate, and release loggerheads on vessels. Since 2002, Chile also has closed the northernmost sector where the loggerheads interactions occur to longline fishing (Miguel Donoso, Pacifico Laud, personal communication, 2009). Local non-governmental organizations, such as Pacifico Laud (Chile), Associacion Pro Delphinus (Peru), and Areas Costeras y Recursos

Marinos (Peru), have been engaged in outreach and conservation activities promoting loggerhead bycatch reduction, with support from NMFS.

Coastal trawl fisheries also threaten juvenile and adult loggerheads foraging off eastern Australia, particularly the northern Australian prawn fishery (estimated to take between 5,000 and 6,000 turtles annually in the late 1980s/early 1990s). However, since the introduction and requirement for these fisheries to use TEDs in 2000, that threat has been drastically reduced, to an estimated 200 turtles/year (Robins et al., 2002a). TEDs were also made mandatory in the Queensland East Coast trawl fisheries (2000), the Torres Strait prawn fishery (2002), and the Western Australian prawn and scallop fisheries (2002) (Limpus, 2009).

Predation of loggerhead eggs by foxes was a major threat to nests laid in eastern Australia through the late 1970s, particularly on Mon Repos and Wreck Rock. Harassment by local residents and researchers, as well as baiting and shooting, discouraged foxes from encroaching on the nesting beach at Mon Repos so that by the mid-1970s predation levels had declined to trivial levels. At Wreck Rock, fox predation was intense through the mid-1980s, with a 90–95 percent predation rate documented. Fox baiting was introduced at Wreck Rock and some adjacent beaches in 1987, and has been successful at reducing the predation rate to low levels by the late 1990s (Limpus, 2009). To reduce the risk of hatchling disorientation due to artificial lighting inland of the nesting beaches adjacent to Mon Repos and Heron Island, low pressure sodium vapor lights have been installed or, where lighting has not been controlled, eggs are relocated to artificial nests on nearby dark beaches. Limpus (2009) reported that hatchling mortality due to altered light horizons on the Woongara coast has been reduced to a handful of clutches annually.

Since the Great Barrier Reef's listing on the United Nations Educational, Scientific and Cultural Organization's World Heritage List in 1981, protection of habitats within the GBRWHA has increased, with the current zone-based management plan enacted in 2004 (Dryden et al., 2008). Nesting habitat protection has also increased with the addition of indigenous co-management plans and ecotourism regulations at Mon Repos (M. Hamann, James Cook University, personal communication, 2010).

While most of the conservation efforts for the South Pacific Ocean DPS are long-term, substantive, and improving, given the low number of nesting females, the declining trends, and major threats that are just beginning to be addressed, they still remain inadequate to ensure the long-term viability of the population. The use of TEDs in most of the major trawl fisheries in Australia has certainly reduced the bycatch of juvenile and adult turtles, as has the reduction in fox predation on important nesting beaches. However, the intense effort by longline fisheries in the South Pacific, particularly from artisanal fleets operating out of Peru, and its estimated impact on this loggerhead population, particularly oceanic juveniles, remains a significant threat that is just beginning to be addressed by most participating countries, including the regional fishery management council(s) that manages many of these fleets. Modeling by Chaloupka (2003) showed the impact of this fleet poses a greater risk than either fox predation at major nesting beaches (90 percent egg loss per year during unmanaged periods) or past high mortalities in coastal trawl fisheries. The recent sea turtle conservation resolution by the Western and Central Pacific Fisheries Commission, requiring longline fleets to use specific gear and collect information on bycatch, is encouraging but took effect in January 2010, so improvement in the status of this population may not be realized for many years. Potentially important pelagic foraging habitat in areas of high fishing intensity remains poorly studied but is improving through U.S. and international collaborations. While a comprehensive conservation program for this population has been in place for important nesting beaches, efforts in other areas are still being developed to address major threats, including fisheries bycatch.

North Indian Ocean DPS

The main threats to North Indian Ocean loggerheads are fishery bycatch and nesting beach habitat loss and degradation. Royal Decree 53/81 prohibits the hunting of turtles and eggs in Oman. The Ministry of Environment and Climate Affairs (MECA) and Environmental Society of Oman (ESO) are collaborating to carry out a number of conservation measures at Masirah Island for the nesting loggerhead population. First and foremost are standardized annual nesting surveys to monitor population trends. Standardized surveys were first implemented in 2008. Less complete nesting surveys have been conducted in some previous years beginning in 1977, but the data have yet to be adequately analyzed to determine their usefulness in determining population size and trends. Nine kilometers of nesting habitat within the Masirah Air Force Base is largely protected from tourist development but remains subject to light pollution from military operations. The remaining 50 kilometers of loggerhead nesting beaches are not protected from egg harvest, lighting, or beach driving. Currently, MECA is in the process of developing a protected area proposal for Masirah Island that will address needed protection of nesting beaches, including protection from egg collection and beach driving. In the meantime, development is continuing and it is uncertain how much, when, and if nesting habitat will receive adequate protection. MECA is beginning to regulate artificial lighting in new development. In 2010, a major outreach effort in the form of a Turtle Celebration Day is planned at Masirah Island to raise greater awareness of the local communities about the global importance of the Masirah Island loggerhead nesting population and to increase community involvement in conservation efforts. Nesting surveys are also being conducted on the Halaniyat Islands. There are no specific efforts underway to designate Halaniyat nesting beaches as Protected Areas in the face of proposed development plans. Although important management actions are underway on the nesting beaches, their effectiveness has yet to be determined and the potential for strong habitat protection and restoration of degraded nesting habitat remains uncertain. At present, hatchling production is not measured.

The only research that has been conducted on the nesting population to date was a study of internesting and post-nesting movements conducted in 2006 when 20 nesting females were fitted with satellite transmitters. This research identified important inter-seasonal foraging grounds but is considered incomplete, and additional nesting females were satellite tagged in 2011 to assess clutch frequency, determine inter-nesting and post-nesting movements, and identify potential overlap of loggerhead habitat use with coastal fisheries. In 2009, efforts to investigate loggerhead bycatch in gillnet fisheries at Masirah were initiated, and some fisherman are cooperating and documenting bycatch.

While conservation efforts for the North Indian Ocean loggerhead DPS are substantive and improving, they still remain inadequate to ensure the long-term viability of the population. For example, there is currently no assessment of hatchling production on the main nesting beaches, no efforts underway to restore the largely degraded nesting habitat on the major nesting beaches, and little understanding or knowledge of foraging grounds for juveniles or adults and the extent of their interactions with fisheries. There is no information on bycatch from fisheries off the main nesting beaches other than reports that this bycatch occurs. A comprehensive conservation program for this population is under development, but is incomplete relative to fisheries bycatch and long-term nesting habitat protection.

Southeast Indo-Pacific Ocean DPS

The level of anthropogenic mortalities is low for the Southeast Indo-Pacific Ocean DPS, based on the best available information. However, there are many known opportunities for conservation efforts that would aid recovery. Some significant conservation efforts are underway.

One of the principal nesting beaches for this DPS, Australia's Dirk Hartog Island, is part of the Shark Bay World Heritage Area and recently became part of Australia's National Park System. This designation may facilitate monitoring of nesting beaches and enforcement of prohibitions on direct take of loggerheads and their eggs. Loggerheads are listed as Endangered under Australia's Environment Protection and Biodiversity Conservation Act of 1999.

Conservation efforts on nesting beaches have included invasive predator control. On the North West Cape and the beaches of the Ningaloo coast of mainland Australia, a long established feral European red fox (Vulpes vulpes) population preyed heavily on eggs and is thought to be responsible for the lower numbers of nesting turtles on the mainland beaches (Baldwin et al., 2003). Fox populations have been eradicated on Dirk Hartog Island and Murion Islands (Baldwin et al., 2003), and threat abatement plans have been implemented for the control of foxes (1999) and feral pigs (2005).

In 2000, the use of TEDs in the Northern Australian Prawn Fishery (NPF) was made mandatory. Prior to the use of TEDs in this fishery, the NPF annually took between 5,000 and

6,000 sea turtles as bycatch, with a mortality rate estimated to be 40 percent (Poiner and Harris, 1996). Since the mandatory use of TEDs has been in effect, the annual bycatch of sea turtles in the NPF has dropped to less than 200 sea turtles per year, with a mortality rate of approximately 22 percent (based on recent years). Initial progress has been made to measure the threat of incidental capture of sea turtles in other artisanal and commercial fisheries in the Southeast Indo-Pacific Ocean (Lewison et al., 2004; Limpus, 2009); however, the data remain inadequate for population assessment.

As in other DPSs, persistent marine debris poses entanglement and ingestion hazards to loggerheads. In 2009, Australia's Department of the Environment, Water, Heritage and the Arts published a threat abatement plan for the impacts of marine debris on vertebrate marine life.

In spite of these conservation efforts, considerable uncertainty in the status of this DPS lies with inadequate efforts to measure bycatch in the region, a short time-series of monitoring on nesting beaches, and missing vital rates data necessary for population assessments.

Southwest Indian Ocean DPS

The Southwest Indian Ocean DPS is small but has experienced an increase in numbers of nesting females. Although there is considerable uncertainty in anthropogenic mortalities, especially in the water, the DPS may have benefitted from important conservation efforts at the nesting beaches.

All principal nesting beaches, centered in South Africa, are within protected areas (Baldwin et al., 2003). In Mozambique, nesting beaches in the Maputo Special Reserve (approximately 60 kilometers of nesting beach) and in the Paradise Islands are also within protected areas (Baldwin et al., 2003; Costa et al., 2007).

The international regulatory mechanisms described in Section 5.1.4. of the Status Review apply to loggerheads found in the Southwest Indian Ocean. In addition, loggerheads of this DPS benefit from the Indian Ocean–South-East Asian Marine Turtle Memorandum of Understanding (IOSEA) and the Nairobi Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region.

In spite of these conservation efforts, caution in the status of this DPS lies with its small population size, inadequate efforts to measure bycatch in the region, and missing vital rates data necessary for population assessments.

Northwest Atlantic Ocean DPS

The main threats to Northwest Atlantic Ocean loggerheads include fishery bycatch mortality, particularly in gillnet, longline, and trawl fisheries; nesting beach habitat loss and degradation (e.g., beachfront lighting, coastal armoring); and ingestion of marine debris during the epipelagic lifestage. In addition, mortality from vessel strikes is increasing and likely also a significant threat to this DPS.

Mortality resulting from domestic and international commercial fishing is the most significant threat to Northwest Atlantic loggerheads. Fishing gear types include gillnets, trawls, hook and line (e.g., longlines), seines, dredges, and various types of pots/traps. Among these, gillnets, longlines, and trawl gear collectively result in tens of thousands of Northwest Atlantic loggerhead deaths annually throughout their range (see for example, NMFS, 2002, 2004; Lewison et al., 2004; Wallace et al., 2008, 2010).

Considerable effort has been expended since the 1980s to document and reduce commercial fishing bycatch mortality. NMFS has implemented observer programs in many federally managed and some State-managed fisheries to collect turtle bycatch data and estimate mortality. NMFS, working with industry and other partners, has reduced bycatch in some fisheries by developing technological solutions to prevent capture or to allow most turtles to escape without harm (e.g., TEDs), by implementing time and area closures to prevent interactions from occurring (e.g., prohibitions on gillnet fishing along the mid-Atlantic coast during the periods of high loggerhead abundance), and by modifying gear (e.g., requirements to reduce mesh size in the leaders of pound nets to prevent entanglement, requirements to use large circle hooks with certain bait types in segments of the pelagic longline fishery). Many of these measures have been implemented within the lifetime of one generation of loggerhead sea turtles, and thus the conservation benefits may not yet be observed on the nesting beaches. NMFS is currently working to implement a coastwide, comprehensive strategy to reduce bycatch of sea turtles in State and Federal fisheries in the U.S. Atlantic and Gulf of Mexico. This approach was developed to address sea turtle bycatch issues on a per-gear basis, rather than a fishery by fishery basis, with a goal of developing and implementing coastwide solutions for reducing turtle bycatch inshore, nearshore, and offshore.

The development and implementation of TEDs in the shrimp trawl fishery is arguably the most significant conservation accomplishment for Northwest Atlantic loggerheads in the marine environment since their listing. In the southeastern United States and Gulf of Mexico, TEDs have been mandatory in shrimp and flounder trawls for over a decade. However, TEDs are not required in all trawl fisheries, and significant loggerhead mortality continues in some trawl fisheries. In addition, enforcement of TED regulations depends on available resources, and illegal or improperly installed TEDs continue to contribute to mortality. Current observer coverage in the shrimp fishery is very limited, at around 2 percent of total directed effort, as a result of the size of the fishery and the expense of observer programs.

Gillnets of various mesh sizes are used extensively to harvest fish in the Atlantic Ocean and Gulf of Mexico. All size classes of loggerheads in coastal waters are prone to entanglement in gillnets, and, generally, the larger the mesh size the more likely that turtles will become entangled. State resource agencies and NMFS have been addressing this issue on several fronts. In the southeastern United States, gillnets are prohibited in the State waters of South Carolina, Georgia, Florida, and Texas and are restricted to fishing for pompano and mullet in saltwater areas of Louisiana. Reducing bycatch of loggerheads in the remaining State and federally regulated gillnet fisheries of the U.S. Atlantic and Gulf of Mexico has not been fully accomplished. NMFS has addressed the issue for several federally managed fisheries, such as the large-mesh gillnet fishery (primarily for monkfish) along the Atlantic coast, where gillnets larger than 8-inch stretched mesh are now regulated in North Carolina and Virginia through rolling closures timed to match the northward migration of loggerheads along the mid-Atlantic coast in late spring and early summer. The State of North Carolina, working with NMFS through the ESA section 10 process, has been making some progress in reducing bycatch of loggerheads in gillnet fisheries operating in Pamlico Sound though that fishery predominantly catches green and Kemp's ridley turtles, with loggerheads accounting for a smaller percentage. The large mesh driftnet fishery for sharks off the Atlantic coast of Florida and Georgia remains a concern as do gillnet fisheries operating elsewhere in the range of the DPS, including Mexico and Cuba.

Observer programs have documented significant bycatch of loggerheads in the U.S. longline fishery operating in the Atlantic Ocean and Gulf of Mexico. In recent years, NMFS has dedicated significant funding and effort to address this bycatch issue. In partnership with academia and industry, NMFS has funded and conducted field experiments in the Northwest Atlantic Ocean to develop gear modifications that eliminate or significantly reduce loggerhead bycatch and mortality. As a result of these experiments, NMFS now requires the use of circle hooks fleet-wide and larger circle hooks in combination with whole finfish bait in the Northeast Distant area (69 FR 40734; July 6, 2004). Gear limitations, seasonal restrictions, and sea turtle release gear and handling requirements in the Gulf of Mexico and South Atlantic bottom longline fisheries are also expected to reduce loggerhead bycatch and mortality.

The incidental capture and mortality of loggerheads by international longline fleets operating in the North Atlantic Ocean and Mediterranean Sea is of great concern. The United States has been attempting to work through Regional Fisheries Management Organizations, such as the International Commission for the Conservation of Atlantic Tunas, to encourage member nations to adopt gear modifications (e.g., large circle hooks) that have been shown to significantly reduce loggerhead bycatch. As stated previously, in late 2010, ICCAT approved a proposal to require data reporting on the capture of sea turtles in the Atlantic Ocean and mandated the use of hook-removal and fishing line disentanglement gear. To date, limited success in reducing loggerhead bycatch has been achieved in these international forums, but efforts are ongoing.

Although numerous efforts are underway to reduce loggerhead bycatch in fisheries, and many positive actions have been implemented, it is unknown whether this source of mortality can be sufficiently reduced across the range of the DPS in the near future because of the diversity and magnitude of the fisheries operating in the North Atlantic, the lack of comprehensive information on fishing distribution and effort (primarily international, but even some State fisheries), limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies. The advent of TED requirements, longline requirements, and other conservation measures, along with the decline of some fisheries, especially trawling and surface longlining, have primarily occurred within one generation of loggerhead sea turtles. A number of measures (larger TED openings and longline requirements among the most important) occurred only in the past 8 years or less. Therefore, the conservation benefit to loggerhead populations is difficult to gauge at this time as the effect on the nesting population may only be starting to be realized.

In the southeastern U.S., nest protection efforts have been implemented on the majority of nesting beaches, and progress has been made in reducing mortality from human-related impacts on the nesting beach. A key effort has been the acquisition of Archie Carr National Wildlife Refuge in Florida, where nesting densities often exceed 600 nests per km (1,000 nests per mile). Over 60 percent of the available beachfront acquisitions for the Refuge have been completed as the result of a multi-agency land acquisition effort. In addition, 14 additional refuges, as well as numerous coastal national seashores, military installations, and State parks in the Southeast where loggerheads regularly nest are also provided protection. However, despite these efforts, alteration of the coastline continues, and outside of publicly owned lands, coastal development and associated coastal armoring remains a serious threat.

Efforts are also ongoing to reduce light pollution on nesting beaches. A significant number of local governments in the southeastern U.S. have enacted lighting ordinances designed to reduce the effects of artificial lighting on sea turtles. However, enforcement of the lighting ordinances varies considerably and efforts to strengthen these measures are ongoing.

With regard to marine debris, the MARPOL Convention (International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978) is the main international convention that addresses prevention of pollution (including oil, chemicals, harmful substances in packaged form, sewage, and garbage) of the marine environment by ships from operational or accidental causes. However, challenges remain to implementation and enforcement of the MARPOL Convention and marine pollution remains an issue of concern.

The seriousness of the threat caused by vessel strikes to loggerheads in the Atlantic and Gulf of Mexico is not fully understood at this time, but is expected to be significant. This growing problem is particularly difficult to address. In some cases, NMFS, through section 7 of the ESA, has worked with the U.S. Coast Guard in an attempt to reduce the probability of vessel strikes during permitted offshore race events. However, most vessel strikes occur outside of these venues and the growing number of licensed vessels over the years, especially inshore and nearshore, exacerbates the conflict.

A number of regulatory instruments at international, regional, national, and local levels have been developed that provide legal protection for loggerhead sea turtles globally and within the Northwest Atlantic Ocean. The Status Review identifies and includes a discussion of these regulatory instruments (Conant et al., 2009). The problems with existing international treaties are often that they have not realized their full potential, do not include some key countries, do not specifically address sea turtle conservation, and are handicapped by the lack of a sovereign authority to enforce environmental regulations. Continued efforts are needed to develop and strengthen these international initiatives.

In summary, while conservation efforts for the Northwest Atlantic Ocean loggerhead DPS are substantive and improving, it is still too soon to tell if they are adequate to ensure the long-term viability of the population.

Northeast Atlantic Ocean DPS

Since 2002, all sea turtles and their habitats in Cape Verde have been protected by law (Decreto-Regulamentar n° 7/2002). The reality, however, is that the laws are not respected or enforced and that in recent years until 2008 up to 25–30 percent of nesting females were illegally killed for meat each year on the nesting beaches. Egg collection is also a serious threat on some of the islands. Other major threats include developments and commensurate light pollution behind one important nesting beach on Boa Vista and the most important nesting beach on Sal, as well as sand mining on many of the islands. Other planned and potential developments on these and other islands present future threats. Bycatch and directed take in coastal waters is likely a significant mortality factor to the population given the importance of the coastal waters as loggerhead foraging grounds and the extensive fisheries occurring there. Adult females nesting in Cape Verde have been found foraging along the mainland coast of West Africa as well as in the oceanic environment, thereby making them vulnerable to impacts from a wide range of fisheries (Hawkes et al., 2006). Unfortunately, law enforcement on the nesting beaches and in the marine environment is lacking in Cape Verde.

Conservation efforts in Cape Verde began in the mid-1990s and focused on efforts to raise local, national, and international awareness of the importance of the Cape Verdian loggerhead population and the ongoing slaughter of nesting females. A field camp set up by the non-governmental organization Cabo Verde Natura 2000 in 1999 on the 10-kilometer Ervatao Beach, the single most important nesting beach at Boa Vista, grew out of this initial effort. This camp established a presence to deter poaching and gather data on nesting and poaching activity. In 2008, The Turtle Foundation, another non-governmental organization, began to work at Porto Ferreira Beach, the second most important nesting area on Boa Vista. The non-governmental organization SOS Tartarugas began conservation work on the important nesting beaches of Sal in 2008. In May 2009, USFWS funded a workshop in Cape Verde to bring together representatives from the three non-governmental organizations and the universities involved with loggerhead conservation in Cape Verde and government representatives from the Ministry of Environment, Military and Municipalities to discuss the threats, current conservation efforts, and priority actions needed. A Sea Turtle Network was established to better coordinate and expand conservation efforts throughout the Cape Verdean islands.

Cabo Verde Natura 2000 has continued its efforts on Ervatao Beach and in 2009 assumed responsibility for work on Porto Ferreira Beach. Cabo Verde Natura 2000 has reduced poaching to about 5 percent on these two important beaches, which represent 75 percent of the nesting on Boa Vista. The Turtle Foundation also conducts extensive public outreach on sea turtle conservation issues. The Turtle Foundation covered four other important beaches in 2009 with the assistance of the Cape Verdian military and likewise believes poaching was reduced to about 5 percent of nesting females on the beaches covered. The University of Algarve established a research project on Santiago Island in 2007; activities included nest monitoring and protection, collecting biological data and information on poaching, and outreach through the media and to the government representatives (Loureiro, 2008). This project minimized its efforts in 2009. The Turtle Foundation continued to focus its primary efforts on patrolling beaches to protect nesting females on Boa Vista with the assistance of the military. SOS Tartarugas has also been doing regular monitoring of beaches with support from the military, extensive public outreach on light pollution behind nesting beaches, and relocating nests to a hatchery to alleviate hatchling disorientation, as well as assisting with training of turtle projects on the islands of Maio and Sao Nicolau.

In the last 2 years, new efforts to better coordinate and expand projects being conducted by the three non-governmental organizations, as well as engage the national and municipal governments, are dramatically decreasing the poaching of nesting turtles and with sustained and planned efforts may be able to reduce it to less than 1 percent in the next few years. The issues of light pollution, sand mining on nesting beaches, long-term protection of even the most important nesting beaches, law enforcement, and bycatch have not even begun to be addressed. While there is definite improvement in a once gloomy situation as recent as 2 years ago, the future of the population is tenuous.

Mediterranean Sea DPS

The main threats to Mediterranean Sea loggerheads include fishery bycatch, as well as pollution/debris, vessel collisions, and habitat destruction impacting eggs and hatchlings at nesting beaches. Most Mediterranean countries have developed national legislation to protect sea turtles and nesting habitats (Margaritoulis, 2007). National protective legislation generally prohibits intentional killing, harassment, possession, trade, or attempts at these (Margaritoulis et al., 2003). Some countries have site specific legislation for turtle habitat protection. In 1999, a National Marine Park was established on Zakynthos in western Greece, with the primary aim to provide protection to loggerhead nesting areas (Dimopoulos, 2001). Zakynthos represents approximately 43 percent of the average annual nesting effort of the major and moderate nesting areas in Greece (Margaritoulis et al., 2003) and about 26 percent of the documented nesting effort in the Mediterranean (Touliatou et al., 2009). It is noteworthy for conservation purposes that this site is legally protected. While park management has improved over the last several years, there are still some needed measures to improve and ensure sufficient protection at this Park (Panagopoulou et al., 2008; Touliatou et al., 2009).

In Turkey, five nesting beaches (Belek, Dalyan, Fethiye, Goksu Delta, and Patara) were designated Specially Protected Area status in the context of the Barcelona Convention (Margaritoulis et al., 2003). Based on the average annual number of nests from the major nesting sites, these five beaches represent approximately 56 percent of nesting in Turkey (World Wildlife Fund, 2005). In Cyprus, the two nesting beaches of Lara and Toxeftra have been afforded protection through the Fisheries Regulation since 1989 (Margaritoulis, 2007), and Alagadi is a Specially Protected Area (World Wildlife Fund, 2005). Of the major Cyprus nesting sites included in the 2005 World Wildlife Fund Species Action Plan, the nesting beaches afforded protection represent 51 percent of the average annual number of nests in Cyprus. Note, however, that the annual nesting effort in Cyprus presented in Margaritoulis et al. (2003) includes additional sites, so the total proportion of protected nesting sites in Cyprus is much lower, potentially around 22 percent. In Italy, a reserve to protect nesting on Lampedusa was established in 1984 (Margaritoulis et al., 2003). In summary, Mediterranean loggerhead nesting primarily occurs in Greece, Libya, Turkey, and Cyprus, and a notable proportion of nesting in those areas is protected through various mechanisms. It is important to recognize the success of these protected areas, but as the protection has been in place for some time and the threats to the species remain (particularly from increasing tourism activities), it is unlikely that the conservation measures discussed here will change the status of the species as outlined in Conant et al. (2009).

Protection of marine habitats is at the early stages in the Mediterranean, as in other areas of the world. Off Zakynthos, the National Marine Park established in 1999 also included maritime zones. The marine area of Laganas Bay is divided into three zones controlling maritime traffic from May 1 to October 31: Zone A – no boating activity; Zone B – speed limit of 6 knots, no anchoring; Zone C – speed limit of 6 knots. The restraints on boating activity are particularly aimed at protecting the internesting area surrounding the Zakynthos Laganas Bay nesting area. However, despite the regulations, there has been insufficient enforcement (especially of the 6 knot speed limit), and a high density of speedboats and recorded violations within the marine area of the Park have been reported. In 2009, 13 of 28 recorded strandings in the area of the National Marine Park bore evidence of watercraft injuries and fishing gear interactions, and four live turtles were found with fishing gear lines/hooks. Another marine zone occurs in Cyprus; off the nesting beaches of Lara and Toxeftra, a maritime zone extends to the 20 meter isobath as delineated by the Fisheries Regulation (Margaritoulis, 2007).

The main concern to loggerheads in the Mediterranean includes incidental capture in fisheries. While there are country specific fishery regulations that may limit fishing effort to some degree (to conserve the fishery resource), little, if anything, has been undertaken to reduce sea turtle bycatch and associated mortality in Mediterranean fisheries. Given the lack of conservation efforts to address fisheries and the limited in-water protection provided to turtles to reduce the additional impacts of vessel collisions and pollution/debris interactions, it is unlikely that the status of the species will change given the measures discussed here.

It appears that international and national laws are not always enforced or followed. This minimizes the potential success of these conservation efforts. For example, in Egypt, international and national measures to protect turtles were not immediately adhered to, but in recent years, there has been a notable effort to enforce laws and regulations that prohibit the trade of sea turtles at fish markets. However, the illegal trade of turtles in the Alexandria fish market has persisted and a black market has been created (Nada and Casale, 2008). This is an example of ineffective sea turtle protection and continuing threat to the species, even with conservation efforts in place.

South Atlantic Ocean DPS

The only documented and confirmed nesting locations for loggerhead sea turtles in the South Atlantic occur in Brazil, and major nesting beaches are found in the States of Rio de Janeiro, Espirito Santo, Bahia, and Sergipe (Marcovaldi and Marcovaldi, 1999). Protection of nesting loggerheads and their eggs in Brazil is afforded by national law that was established in 1989 and most recently reaffirmed in 2008. Illegal practices, such as collecting eggs or nesting females for consumption or sale, are considered environmental crimes and are punishable by law. Other State or Federal laws have been established in Brazil to protect reproductive females, incubating eggs, emergent hatchlings, and nesting habitat, including restricting nighttime lighting adjacent to nesting beaches during the nesting/hatching seasons and prohibiting vehicular traffic on beaches. Projeto TAMAR, a semi-governmental organization, is responsible for sea turtle conservation in Brazil. In general, nesting beach protection in Brazil is considered to be effective and successful for loggerheads and other species of nesting turtles (e.g. Marcovaldi and Chaloupka, 2007; Thomé et al., 2007; da Silva et al., 2007). Efforts at protecting reproductive turtles, their nests, hatchlings and their nesting beaches have been supplemented by the establishment of federally mandated protected areas that include major loggerhead nesting populations: Reserva Biologica de Santa Isabel (established in 1988 in Sergipe) and Reserva Biologica de Comboios (established in 1984 in Espirito Santo); at the State level, Environmental Protection Areas have been established for many loggerhead nesting beaches in Bahia and Espirito Santo (Marcovaldi et al., 2005). In addition, Projeto TAMAR has initiated several high-profile public awareness campaigns, which have focused national attention on the conservation of loggerheads and other marine turtles in Brazil.

Loggerhead sea turtles of various sizes and life stages occur throughout the South Atlantic, although density/observations are more limited in equatorial waters (Ehrhart et al., 2003). Within national waters of specific countries, various laws and actions have been instituted to mitigate threats to loggerheads and other species of sea turtles; less protection is afforded in the high seas of the South Atlantic. Overall, the principal in-water threat to loggerheads in the South Atlantic is incidental capture in fisheries. In the southwest Atlantic, the South Atlantic Association is a multinational group that includes representatives from Brazil, Uruguay, and Argentina, and meets bi-annually to share information and develop regional action plans to address threats including bycatch (http://www.tortugasaso.org/). At the national level, Brazil has developed a national plan for the reduction of incidental capture of sea turtles that was initiated in 2001 (Marcovaldi et al., 2002a). This national plan includes various activities to mitigate bycatch, including time-area restrictions of fisheries, use of bycatch reduction devices, and working with fishermen to successfully release live-captured turtles. In Uruguay, all sea turtles are protected from human impacts, including fisheries bycatch, by presidential decree (Decreto presidencial 144/98). The Karumbe conservation project in Uruguay has been working on assessing in-water threats to loggerheads and marine turtles for several years (see http://www.seaturtle.org/promacoda), with the objective of developing mitigation plans in the future. In Argentina, various conservation organizations are working toward assessing bycatch of loggerheads and other sea turtle species in fisheries, with the objective of developing mitigation plans for this threat (see http://www.prictma.com.ar). Overall, more effort to date has been expended on evaluating and assessing levels of fisheries bycatch of loggerhead sea turtles, than concretely reducing bycatch in the Southwest Atlantic, but this information is necessary for developing adequate mitigation plans. In the southeastern Atlantic, efforts have been directed toward assessing the distribution and levels of bycatch of loggerheads in coastal waters of southwestern Africa (Petersen et al., 2007, 2009; Weir et al., 2007). Bycatch of loggerheads has been documented in longline fisheries off the Atlantic coasts of Angola, Namibia, and South Africa (Petersen et al., 2007), and several authors have highlighted the need to develop regional mitigation plans to reduce bycatch of loggerheads and other sea turtle species in coastal waters (Formia et al., 2003; Weir et al., 2007; Petersen et al., 2009). On the high seas of the South Atlantic, little is known about exact bycatch levels, but there are some areas of higher concentration of longline effort that are likely to result in loggerhead bycatch (Lewison et al., 2004).

Overall, conservation efforts for loggerhead sea turtles in the South Atlantic are dichotomous. On the nesting beaches (almost exclusively in Brazil), conservation actions are successful at protecting nesting females and their clutches, resulting in large numbers of hatchlings being released each year. In contrast, fisheries bycatch in coastal and oceanic waters remains a serious threat, despite regional emphasis on assessing bycatch rates in various fisheries on both sides of the South Atlantic. Comprehensive management actions to reduce or eliminate bycatch mortality are lacking in most areas, which is likely to result in a decline of this DPS in the future.

Finding

We find that nine loggerhead sea turtle DPSs exist. We have carefully considered the best scientific and commercial data available regarding the past, present and future threats faced by the nine loggerhead sea turtle DPSs. We are listing the North Pacific Ocean, South Pacific Ocean, North Indian Ocean, Northeast Atlantic Ocean, and Mediterranean Sea DPSs of the loggerhead sea turtle as endangered and the Southeast Indo-Pacific Ocean, Southwest Indian Ocean, Northwest Atlantic Ocean, and South Atlantic Ocean DPSs as threatened for the reasons described below for each DPS.

North Pacific Ocean DPS

In the North Pacific, loggerhead nesting is essentially restricted to Japan where monitoring of loggerhead nesting began in the 1950s on some beaches, and expanded to include most known nesting beaches since approximately 1990. While nesting numbers have gradually increased in recent years and the number for 2009 is similar to the start of the time series in 1990, historical evidence indicates that there has been a substantial decline over the last half of the 20th century and that current nesting represents a fraction of historical nesting levels. In addition, based on nest count data for nearly the past 2 decades, the North Pacific population of loggerheads is small. The SQE approach described in the Status and Trends of the Nine Loggerhead DPSs section suggested that the North Pacific Ocean DPS appears to be declining, is at risk, and is thus likely to decline in the future. The stage-based deterministic modeling approach suggested that the North Pacific Ocean DPS could grow slightly, but in the worst-case scenario, the model indicates that the population is likely to substantially decline in the future. These results are largely driven by the mortality of juvenile and adult loggerheads from fishery bycatch that occurs throughout the North Pacific Ocean, including the coastal pound net fisheries off Japan, coastal fisheries impacting juvenile foraging populations off Baja California, Mexico, and undescribed fisheries likely affecting loggerheads in the South China Sea and the North Pacific Ocean (Factor E). Although national and international governmental and non-governmental entities on both sides of the North Pacific are currently working toward reducing loggerhead bycatch, and some positive actions have been implemented, it is unlikely that this source of mortality can be sufficiently reduced in the near future due to the challenges of mitigating illegal, unregulated, and unreported fisheries, the lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies. In addition to fishery bycatch, coastal development and coastal armoring on nesting beaches in Japan continues as a substantial threat (Factor A). Coastal armoring, if left unaddressed, will become an even more substantial threat as sea level rises as a result of climate change. It is highly uncertain whether the actions identified in the Conservation Efforts section above will be fully implemented in the near future or that they will be sufficiently effective. While climate change may have adverse effects on all of the loggerhead sea turtle DPSs, it is not possible to predict exactly what those would be and the extent to which they would affect this DPS beyond the concern noted above.

We have considered the five factors described above in the Summary of Factors Affecting the Nine Loggerhead DPSs, efforts to protect the DPS, and the population size and trends of the DPS. In light of the small nesting range and small size of the nesting population, an estimated decline between 50–90 percent in the size of the nesting population since the 1950s, significant and ongoing threats to the nesting beaches, significant and continuing fishery bycatch with limited bycatch reduction success except in the Hawaii longline fishery, and only limited efforts at conservation thus far, we have determined that the North Pacific Ocean DPS is in danger of extinction throughout all of its range. Therefore, we are listing it as endangered. In other words, we believe that a threatened status is not appropriate for this DPS because of the significance of the threats, the small size of the nesting population, and the estimated historical decline in the nesting population.

<u>South Pacific Ocean DPS</u>

In the South Pacific, loggerhead nesting is almost entirely restricted to eastern Australia (primarily Queensland) and New Caledonia. In eastern Australia, there has been a marked decline in the number of females breeding annually since the mid-1970s, with an estimated 50 to 80 percent decline in the number of breeding females at various Australian rookeries up to 1990 and a decline of approximately 86 percent by 1999. Comparable nesting surveys have not been conducted in New Caledonia however. Information from pilot surveys conducted in 2005, combined with oral history information collected, suggest that there has been a decline in loggerhead nesting (see the Status and Trends of the Nine Loggerhead DPSs section above for additional information). Similarly, studies of eastern Australia loggerheads at their foraging areas revealed a decline of 3 percent per year from 1985 to the late 1990s on the coral reefs of the southern Great Barrier Reef. A decline in new recruits was also measured in these foraging areas. The SQE approach described in the Status and Trends of the Nine Loggerhead DPSs section suggested that, based on nest count data from the mid-1970s through the early to mid-2000s, the population is at risk and thus likely to decline in the future. These results were based on published nesting census data for loggerhead sea turtles at index beaches in eastern Australia. The stage-based deterministic modeling approach provided a wide range of results: in the case of the lowest anthropogenic mortality rates (or the best case scenario), the deterministic model suggests that the South Pacific Ocean DPS will grow slightly, but in the worst-case scenario, the model indicates that the population is likely to substantially decline in the future. These results are largely driven by mortality of juvenile and adult loggerheads from fishery bycatch that occurs throughout the South Pacific Ocean (Factor E). Although national and international governmental and non-governmental entities on both sides of the South Pacific are currently working toward reducing loggerhead bycatch, and some positive actions have been implemented, it is unlikely that this source of mortality can be sufficiently reduced in the near future due to the challenges of mitigating illegal, unregulated, and unreported fisheries, the continued expansion of artisanal fleets in the southeastern Pacific, the lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies. It is highly uncertain whether the actions identified in the Conservation Efforts section above will be fully implemented in the near future or that they will be sufficiently effective. While climate change may have adverse effects on all of the loggerhead sea turtle DPSs, it is not possible to predict exactly what those would be and the extent to which they would affect this DPS.

We have considered the five factors described above in the Summary of Factors Affecting the Nine Loggerhead DPSs, efforts to protect the DPS, and the population size and trends of the DPS. In light of the small nesting range and small size of the nesting population, a marked decline in the number of females nesting annually since the mid-1970s, and significant and continuing fishery bycatch with limited bycatch reduction success except in the northern Australian prawn fishery, we have determined that the South Pacific Ocean DPS is in danger of extinction throughout all of its range. Therefore, we are listing it as endangered. In other words, we believe that a threatened status is not appropriate for this DPS because of the significance of the threats, the small size of the nesting population, and the observed marked decline in the nesting population.

North Indian Ocean DPS

In the North Indian Ocean, nesting occurs in greatest density on Masirah Island. Reliable trends in nesting cannot be determined due to the lack of standardized surveys at Masirah Island prior to 2008. However, a reinterpretation of the 1977–1978 and 1991 estimates of nesting females was compared to survey information collected since 2008 and results suggest a significant decline in the size of the nesting population, which is consistent with observations by local rangers that the population has declined dramatically in the last three decades. Nesting trends cannot be determined elsewhere in the North Indian Ocean where loggerhead nesting occurs because the time series of nesting data based on standardized surveys is not available. The SQE approach described in the Status and Trends of the Nine Loggerhead DPSs section is based on nesting data; however, an adequate time series of nesting data for this DPS was not available. Therefore, we could not use this approach to evaluate extinction risk. The stage-based deterministic modeling approach indicated the North Indian Ocean DPS is likely to decline in the future. These results are driven by cumulative mortality from a variety of sources across all life stages. Threats to nesting beaches are likely to increase, which would require additional and widespread nesting beach protection efforts (Factor A). Little is currently being done to monitor and reduce mortality from neritic and oceanic fisheries in the range of the North Indian Ocean DPS; this mortality is likely to continue and increase with expected additional fishing effort from commercial and artisanal fisheries (Factor E). Reduction of mortality would be difficult due to a lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies. It is highly uncertain whether the actions identified in the Conservation Efforts section above will be fully implemented in the near future or that they will be sufficiently effective. While climate change may have adverse effects on all of the loggerhead sea turtle DPSs, it is not possible to predict exactly what those would be and the extent to which they would affect this DPS.

We have considered the five factors described above in the Summary of Factors Affecting the Nine Loggerhead DPSs, efforts to protect the DPS, and the population size and trends of the DPS. In light of the estimated significant decline in the number of females nesting annually since the late 1970s, significant and increasing threats on nesting beaches, insufficient monitoring and reduction of bycatch in neritic and oceanic fisheries, and only limited efforts at conservation thus far, we have determined that the North Indian Ocean DPS is in danger of extinction throughout all of its range. Therefore, we are listing it as endangered. In other words, we believe that a threatened status is not appropriate for this DPS because of the significance of the threats and the estimated significant decline in the nesting population.

Southeast Indo-Pacific Ocean DPS

The Services originally published a proposed rule (75 FR 12598; March 16, 2010) in which a Southeast Indo-Pacific Ocean DPS would be established and listed as endangered under the ESA. Subsequently, based on information provided by one of the peer reviewers and information gathered in response, the Services determined that the Southeast Indo-Pacific Ocean population warranted DPS designation, but that the proposed listing status of the Southeast Indo-Pacific Ocean DPS needed to be revisited prior to making a final determination. The Services ultimately determined that the Southeast Indo-Pacific Ocean DPS should be listed as threatened because the majority of nesting occurs on protected lands and nesting trends have been stable. However, the nesting survey effort and methods have varied over the last 2 decades and currently there are no nesting population estimates available to suggest any positive trend in nesting populations. In addition, some of the fisheries bycatch impacts appear to have been resolved through requirement of TEDs in shrimp trawlers, and longline fishery effort has declined due to fish stock decreases and economic reasons. However, a new fisheries effort has emerged for portunid crabs and is posing new threats to loggerheads, and longline fishing effort for tuna and billfish is also subject to increase if and when economics and fish populations improve.

In the Southeast Indo-Pacific Ocean, loggerhead nesting is restricted to Western Australia, with the greatest number of loggerheads nesting on Dirk Hartog Island. Loggerheads also nest on the Muiron Islands and North West Cape, but in smaller numbers. Although data are insufficient to determine trends, evidence suggests the nesting population in the Muiron Islands and North West Cape region was depleted before recent beach monitoring programs began. The SQE approach described in the Status and Trends of the Nine Loggerhead DPSs section is based on nesting data; however, an adequate time series of nesting data for this DPS was not available; therefore, we could not use this approach to evaluate extinction risk. The stage-based deterministic modeling approach provided a wide range of results: in the case of the lowest anthropogenic mortality rates, the deterministic model suggests that the Southeast Indo-Pacific Ocean DPS will grow slightly, but in the worst-case scenario, the model indicates that the population is likely to substantially decline in the future. These results are largely driven by mortality of juvenile and adult loggerheads from fishery bycatch that occurs throughout the region, as can be inferred from data from Australia's Pacific waters (Factor E). However, the current level of anthropogenic mortalities is low for the Southeast Indo-Pacific Ocean DPS, based on the best available information. In addition, some significant conservation efforts are underway. One of the principal nesting beaches for this DPS, Australia's Dirk Hartog Island, is part of the Shark Bay World Heritage Area and recently became part of Australia's National Park System. Control of red foxes, formerly a significant threat to nests laid on the principal nesting beaches for this DPS, has been extremely successful with fox populations now eradicated on Dirk Hartog Island and Murion Islands. A requirement for the mandatory use of TEDs in the Northern Australian Prawn Fishery in 2000 has substantially reduced the annual bycatch of sea turtles in this fishery. Regardless, although national and international governmental and non-governmental entities are currently working toward reducing loggerhead bycatch, and some positive actions have been implemented, it is unlikely that mortality from fishery bycatch that occurs throughout the entire region can be sufficiently reduced in the near future due to the challenges of mitigating illegal, unregulated, and unreported fisheries, the continued expansion of artisanal fleets, the lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies. In spite of the actions identified in the Conservation Efforts section above, considerable uncertainty in the status of this DPS still exists relative to inadequate efforts to measure bycatch throughout the entire region, a short time-series of monitoring on nesting beaches, and missing vital rates data necessary for population assessments. While climate change may have adverse effects on all the loggerhead sea turtle DPSs, it is not possible to predict exactly what those would be and the extent to which they would affect this DPS.

We have considered the five factors described above in the Summary of Factors Affecting the Nine Loggerhead DPSs, efforts to protect the DPS, and the population size and trends of the DPS. Although the nesting population is small, the primary nesting beaches on Dirk Hartog Island and the Murion Islands are undeveloped and are now both protected under the Western Australian Protected Area System; Dirk Hartog also recently became a National

Park. In addition, nest predation and bycatch from the northern Australian prawn fishery that contributed to the historical decline of this DPS have been greatly reduced and are no longer significant threats. However, bycatch in other fisheries, including a new fishery for portunid crabs and pelagic longline fishing, are believed to be substantial. As a result, we have determined that the Southeast Indo-Pacific Ocean DPS of the loggerhead sea turtle is not currently in danger of extinction, but is likely to become so in the foreseeable future throughout all of its range. Therefore, we are listing it as threatened. In other words, we believe that an endangered status is not appropriate for this DPS because of the protected status of the primary nesting beaches and the successful conservation efforts that have significantly reduced some of the key threats that historically affected this DPS.

Southwest Indian Ocean DPS

In the Southwest Indian Ocean, the highest concentration of nesting occurs on the coast of Tongaland, South Africa, where surveys and management practices were instituted in 1963. A trend analysis of index nesting beach data from this region from 1965 to 2008 indicates an increasing nesting population between the first decade of surveys and the last 8 years. These data represent approximately 50 percent of all nesting within South Africa and are believed to be representative of trends in the region. Loggerhead nesting occurs elsewhere in South Africa, but sampling is not consistent and no trend data are available. Similarly, in Madagascar, loggerheads have been documented nesting in low numbers, but no trend data are available. The SQE approach described in the Status and Trends of the Nine Loggerhead DPSs section, based on a 37-year time series of nesting female counts at Tongaland, South Africa (1963–1999), indicated this segment of the population, while small, has increased, and the likelihood of quasi-extinction is negligible. We note that the SQE approach we used is based on past performance of the DPS (nesting data from 1963–1999) and does not fully reflect ongoing and future threats to all life stages within the DPS. The stage-based deterministic modeling approach provided a wide range of results: in the case of the lowest anthropogenic mortality rates, the deterministic model suggests that the Southwest Indian Ocean DPS will grow slightly, but in the worst-case scenario, the model indicates that the population is likely to substantially decline in the future. These results are largely driven by mortality of juvenile loggerheads from fishery bycatch that occurs throughout the Southwest Indian Ocean (Factor E). This mortality is likely to continue and may increase with expected additional fishing effort from commercial and artisanal fisheries. Reduction of mortality would be difficult due to a lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies. Although there is uncertainty in anthropogenic mortalities, especially in the water, this DPS has likely benefitted from important conservation efforts at the nesting beaches. All principal nesting beaches, centered in South Africa, are within protected areas. In Mozambique, nesting beaches in the Maputo Special Reserve and in the Paradise Islands are also within protected areas. However, in spite of the actions identified in the Conservation Efforts section above, caution in the status of this DPS lies with its small, although increasing, population size, inadequate efforts to measure bycatch in the region, and missing vital rates data necessary for population assessments. While climate change may have adverse effects on all of the loggerhead sea turtle DPSs, it is not possible to predict exactly what those would be and the extent to which they would affect this DPS.

We have considered the five factors described above in the Summary of Factors Affecting the Nine Loggerhead DPSs, efforts to protect the DPS, and the population size and trends of the DPS. Although the nesting population is small, increased nesting has been observed since the 1960s in Tongaland where the highest concentration of nesting occurs for this DPS, and this trend is believed to be representative of nesting trends for the entire DPS. However, fishery bycatch in neritic and oceanic fisheries remains of concern and is not yet fully addressed. As a result, we have determined that the Southwest Indian Ocean DPS of the loggerhead sea turtle is not currently in danger of extinction, but is likely to become so in the foreseeable future throughout all of its range. Therefore, we are listing it as threatened. In other words, we believe that an endangered status is not appropriate for this DPS because of the observed increase in the nesting population, the protected status of the primary nesting beaches, and the success of conservation efforts on the nesting beaches.

Northwest Atlantic Ocean DPS

The Services originally published a proposed rule (75 FR 12598; March 16, 2010) in which a Northwest Atlantic Ocean DPS would be established and listed as endangered under the ESA. Subsequently, the Services determined that the Northwest Atlantic Ocean population warranted DPS designation, but that the proposed listing status of the Northwest Atlantic Ocean DPS needed to be revisited prior to making a final determination. Nesting data available after the proposed rule was published, information provided by commenters on the proposed rule, and further discussions within the Services were taken into account to determine whether this DPS should be classified as threatened or endangered. A working group comprised of biologists and managers from NMFS and USFWS met in November 2010 to discuss these issues and begin working toward a final agreement on the listing status for both the Northwest Atlantic Ocean DPS and the North Pacific Ocean DPS. Subsequent discussions and review of the full range of information available occurred over the months following the working group meeting, with the Services ultimately determining that it was more appropriate to list the Northwest Atlantic Ocean DPS as threatened. The rationale for that decision is contained in the information presented in the previous sections, and is summarized below.

The two primary lines of evidence upon which the Services ultimately determined that the Northwest Atlantic Ocean DPS should be listed as threatened were population abundance and population trend. As detailed previously, the absolute magnitude of the population is calculated to be in the millions, with just mature adult individuals numbering over 60,000. The adult population exceeds that of any other ESA-listed marine species in the Atlantic. While population abundance is important, population trend is also a vital component of the status of a species. For sea turtles in general, including the Northwest Atlantic Ocean DPS, there is currently a large gap in our knowledge of population trends. As a result, nesting trends are typically used as a proxy. Although using the most complete and consistent dataset (Florida Index Nesting Beach Survey data starting with 1989), the nesting trend for this DPS was determined to be declining through the 2007 nesting season. With the addition of nesting data available after the proposed rule was published (data through 2010), the nesting trend is slightly negative, but not statistically different from zero. Although not as complete and consistent as the nesting dataset, Epperly et al. (2007) and TEWG (2009) examined data from in-water research sites in the United States that they determined were suitable for trend analysis and concluded these data suggested a likely increasing juvenile population. Additionally, a revision of the SQE analysis conducted in the Status Review indicated that the Northwest Atlantic Ocean DPS had a lower risk of extinction with the addition of nesting data available after the proposed rule was published. Including nesting data through 2009, and redoing the analysis to use a range of adult female abundance estimates as QETs, it was determined that there was little risk (SQE<0.3) of the Peninsular Florida Recovery Unit (comprising over 80 percent of the Northwest Atlantic Ocean DPS) reaching 1,000 or fewer females in 100 years. This revised analysis was done by the same member of the BRT that performed the original SQE analysis.

In addition to population abundance and trends, an understanding of the threats faced by the listed entity and effects of conservation efforts must be taken into consideration when making a determination on whether a species would be more appropriately classified as threatened or as endangered. As described previously, loggerhead sea turtles of the Northwest Atlantic Ocean DPS face a multitude of threats. The scope of these threats are examined, in the context of the DPS' population abundance and trends, and conservation efforts, to determine whether the DPS is in danger of extinction or likely to become so and therefore more appropriate to classify the DPS as threatened or as endangered. The primary threat to the Northwest Atlantic Ocean DPS was determined to be fisheries bycatch and mortality, although other anthropogenic impacts also play an important role. Although bycatch and bycatch mortality levels of Northwest Atlantic Ocean DPS loggerheads in domestic and foreign fisheries remain high, and continued efforts are necessary to reduce those impacts, it is too early to determine if the bycatch and mortality reduction measures to date are adequate. Many of the most significant bycatch and bycatch mortality reduction efforts have occurred within the past generation of loggerhead sea turtles, and many fisheries have experienced effort reductions in recent years, and thus the benefits may not yet be observed on the nesting beaches. This does not, however, mean that the Services are to take a "wait and see" approach; continued efforts to reduce bycatch and bycatch mortality, as well as reduce other sources of anthropogenic impacts, are a priority of the Services. Because the majority of nesting of loggerhead sea turtles within the Northwest Atlantic Ocean DPS is on U.S. beaches, and a great number of large neritic juveniles and adults from this DPS spend a substantial portion of their time in U.S. waters, this provides us the opportunity to use U.S. regulatory mechanisms to afford a greater degree of protection to the Northwest Atlantic Ocean DPS compared to other loggerhead DPSs. While climate change may have adverse effects on all of the loggerhead sea turtle DPSs, it is not possible to predict exactly what those would be and the extent to which they would affect this DPS.

We have considered the five factors described above in the Summary of Factors Affecting the Nine Loggerhead DPSs, efforts to protect the DPS, and the population size and trends of the DPS. Although this DPS faces significant threats from fishery bycatch, particularly bycatch mortality from gillnet, longline, and trawl fisheries throughout their range in the Atlantic Ocean and Gulf of Mexico, as well as negative impacts to both its terrestrial and marine habitats, the nesting population is large and widespread, and the nesting population trend appears to be stabilizing. As a result, we have determined that the Northwest Atlantic Ocean DPS of the loggerhead sea turtle is not currently in danger of extinction, but is likely to become so in the foreseeable future throughout all of its range. Therefore, we are listing it as threatened. In other words, we believe that an endangered status is not appropriate for this DPS because of the large size of the nesting population, the overall nesting population remains widespread, the trend for the nesting population appears to be stabilizing, and substantial conservation efforts are underway to address threats.

Northeast Atlantic Ocean DPS

In the Northeast Atlantic Ocean, the Cape Verde Islands support the only large nesting population of loggerheads in the region. Nesting occurs at some level on most of the islands in the archipelago with the largest nesting numbers reported from the island of Boa Vista where studies have been ongoing since 1998. Due to limited data available, a population trend cannot currently be determined for the Cape Verde population; however, available information on the directed killing of nesting females suggests that this nesting population is under severe pressure and likely significantly reduced from historical levels. In addition, based on interviews with elders, a reduction in nesting from historical levels at Santiago Island has been reported. Elsewhere in the northeastern Atlantic, loggerhead nesting is non-existent or occurs at very low levels. The SQE approach described in the Status and Trends of the Nine Loggerhead DPSs section is based on nesting data. However, we had insufficient nest count data over an appropriate time series for this DPS and could not use this approach to evaluate extinction risk. The stage-based deterministic modeling approach indicated the Northeast Atlantic Ocean DPS is likely to decline in the future, even under the scenario of the lowest anthropogenic mortality rates. These results are largely driven by the ongoing directed lethal take of nesting females and eggs (Factor B), low hatching and emergence success (Factors A, B, and C), and mortality of juveniles and adults from fishery bycatch (Factor E) that occurs throughout the Northeast Atlantic Ocean. Currently, conservation efforts to protect nesting females are growing, and a reduction in this source of mortality is likely to continue in the near future. Although national and international governmental and non-governmental entities in the Northeast Atlantic are currently working toward reducing loggerhead bycatch, and some positive actions have been implemented, it is unlikely that this source of mortality can be sufficiently reduced across the range of the DPS in the near future because of the lack of bycatch reduction in high seas fisheries operating within the range of this DPS, lack of bycatch reduction in coastal fisheries in Africa, the lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies. It is highly uncertain whether the actions identified in the Conservation Efforts section above will be fully implemented in the near future or that they will be sufficiently effective. While climate change may have adverse effects on all of the loggerhead sea turtle DPSs, it is not possible to predict exactly what those would be and the extent to which they would affect this DPS.

We have considered the five factors described above in the Summary of Factors Affecting the Nine Loggerhead DPSs, efforts to protect the DPS, and the population size and trends of the DPS. In light of available information indicating significant directed killing of nesting females and eggs for consumption at the main nesting beaches, evidence indicating the nesting population is significantly reduced from historical levels, significant and unaddressed fishery bycatch, particularly bycatch in longline and trawl fisheries, and only limited efforts at conservation thus far, we have determined that the Northeast Atlantic Ocean DPS is in danger of extinction throughout all of its range. Therefore, we are listing it as endangered. In other words, we believe that a threatened status is not appropriate for this DPS because of the significance of the threats, particularly directed harvest and fishery bycatch, and evidence that the nesting population is significantly reduced from historical levels.

Mediterranean Sea DPS

Nesting occurs throughout the central and eastern Mediterranean in Italy, Greece, Cyprus, Turkey, Syria, Lebanon, Israel, the Sinai, Egypt, Libya, and Tunisia. In addition, sporadic nesting has been reported from the western Mediterranean, but the vast majority of nesting (greater than 80 percent) occurs in Greece and Turkey. There is no discernible trend in nesting at the two longest monitoring projects in Greece, Laganas Bay and southern Kyparissia Bay. However, the nesting trend at Rethymno Beach, which hosts approximately 7 percent of all documented loggerhead nesting in the Mediterranean, shows a highly significant declining trend (1990–2004). In Turkey, intermittent nesting surveys have been conducted since the 1970s with more consistent surveys conducted on some beaches only since the 1990s, making it difficult to assess trends in nesting. A declining trend (1993–2004) has been reported at Fethiye Beach, which represents approximately 10 percent of loggerhead nesting in Turkey. The SQE approach described in the Status and Trends of the Nine Loggerhead DPSs section is based on nesting data; however, region-wide nesting data for this DPS were not available. Therefore, we could not use this approach to evaluate extinction risk. The stage-based deterministic modeling approach indicated the Mediterranean Sea DPS is likely to decline in the future, even under the scenario of the lowest anthropogenic mortality rates. These results are largely driven by mortality of juvenile and adult loggerheads from fishery bycatch that occurs throughout the Mediterranean Sea (Factor E), as well as anthropogenic threats to nesting beaches (Factor A) and eggs/hatchlings (Factors A, B, C, and E). Although conservation efforts to protect some nesting beaches are underway, more widespread and consistent protection is needed. Although national and international governmental and non-governmental entities in the Mediterranean Sea are currently working toward reducing loggerhead bycatch, it is unlikely that this source of mortality can be sufficiently reduced across the range of the DPS in the near future because of the lack of bycatch reduction in commercial and artisanal fisheries operating within the range of this DPS, the lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies. It is highly uncertain whether the actions identified in the Conservation Efforts section above will be fully implemented in the near future or that they will be sufficiently effective. While climate change may have adverse effects on all of the loggerhead sea turtle DPSs, it is not possible to predict exactly what those would be and the extent to which they would affect this DPS.

We have considered the five factors described above in the Summary of Factors Affecting the Nine Loggerhead DPSs, efforts to protect the DPS, and the population size and trends of the DPS. In light of the significant fishery bycatch that occurs throughout the Mediterranean Sea, particularly ongoing bycatch mortality from pelagic and bottom longline, set net, driftnet, and trawl fisheries, as well as ongoing threats to terrestrial and marine habitats, current illegal harvest of loggerheads in Egypt for human consumption, and only limited efforts at bycatch reduction thus far, we have determined that the Mediterranean Sea DPS is in danger of extinction throughout all of its range. Therefore, we are listing it as endangered. In other words, we believe that a threatened status is not appropriate for this DPS because of the significance of the threats, particularly fishery bycatch, and ineffective protection of loggerheads even with some conservation efforts in place.

South Atlantic Ocean DPS

In the South Atlantic nesting occurs primarily along the mainland coast of Brazil from Sergipe south to Rio de Janeiro. Prior to 1980, loggerhead nesting populations in Brazil were considered severely depleted. More recently, a long-term, sustained increasing trend in nesting abundance has been observed over a 16-year period from 1988 through 2003 on 22 surveyed beaches containing more than 75 percent of all loggerhead nesting in Brazil. The SQE approach described in the Status and Trends of the Nine Loggerhead DPSs section suggested that, based on nest count data for the past 2 decades, the population is unlikely to decline in the future. These results are consistent with Marcovaldi and Chaloupka's (2007) nesting beach trend analyses. We note that the SQE approach is based on past performance of the DPS (nesting data) and does not fully reflect ongoing and future threats to all life stages within the DPS. The stage-based deterministic modeling approach indicated the South Atlantic Ocean DPS is likely to decline in the future, even under the scenario of the lowest anthropogenic mortality rates. This result is largely driven by mortality of juvenile loggerheads from fishery bycatch that occurs throughout the South Atlantic Ocean (Factor E). Although national and international governmental and non-governmental entities on both sides of the South Atlantic are currently working toward reducing loggerhead bycatch in the South Atlantic, it is unlikely that this source of mortality can be sufficiently reduced across the range of the DPS in the near future because of the diversity and magnitude of the commercial and artisanal fisheries operating in the South Atlantic, the lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies. It is highly uncertain whether the actions identified in the Conservation Efforts section above will be fully implemented in the near future or that they will be sufficiently effective. While climate change may have adverse effects on all of the loggerhead sea turtle DPSs, it is not possible to predict exactly what those would be and the extent to which they would affect this DPS.

We have considered the five factors described above in the Summary of Factors Affecting the Nine Loggerhead DPSs, efforts to protect the DPS, and the population size and trends of the DPS. Although the nesting population is small and is believed to be severely depleted from historical levels, trends observed since the 1980s have shown a more recent increase in nesting abundance, nesting beach protection in Brazil has been effective and successful, and many important nesting beaches have been placed in protected status. However, fishery bycatch is believed to be a significant threat to this DPS. Although efforts have been made to evaluate and assess levels of fishery bycatch, actions to reduce or eliminate bycatch mortality are lacking in most areas. As a result, we have determined that the South Atlantic Ocean DPS of the loggerhead sea turtle is not currently in danger of extinction, but is likely to become so in the foreseeable future throughout all of its range. Therefore, we are listing it as threatened. In other words, we believe that an endangered status is not appropriate for this DPS because of the increased trend in nesting abundance observed since the 1980s, the protected status of many of the important nesting beaches, and successful efforts to address threats on the nesting beaches.

Take Prohibitions

The existing take prohibitions and exceptions contained in 50 CFR 17.31, 17.42(b), 223.205, 223.206, and 223.207 remain in effect and continue to apply to those DPSs listed as threatened sea turtle species, which are the Southeast Indo-Pacific Ocean, Southwest Indian Ocean, Northwest Atlantic Ocean, and South Atlantic Ocean DPSs.

Critical Habitat

Section 3(5)(A) of the ESA defines critical habitat 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 Secretaries of Commerce and Interior that such areas are essential for the conservation of the species." Section 3(3) of the ESA (16 U.S.C. 1532(3)) also defines the terms "conserve," "conserving," and "conservation" to mean "to use and 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 chapter are no longer necessary."

Section 4(a)(3) of the ESA requires that, to the extent prudent and determinable, critical habitat be designated concurrently with the listing of a species. Section 4(b)(2) provides that designation of critical habitat must be based on the best scientific data available. 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 destroy or adversely modify that habitat. This requirement is in addition to section 7's requirement that Federal agencies ensure their actions do not jeopardize the continued existence of the species.

In determining what areas qualify as critical habitat, 50 CFR 424.12(b) requires that the Services consider those physical or biological features that are essential to the conservation of a given species including space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, and rearing of offspring; and habitats that are protected from disturbance or are representative of the historical geographical and ecological distribution of a species. The regulations further direct the Services to "focus on the principal biological or physical constituent elements . . . that are essential to the conservation of the species," and specify that the "Known primary constituent elements shall be listed with the critical habitat description." The regulations identify primary constituent elements (PCEs) as including, but 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."

The ESA also directs the Secretaries of Commerce and Interior to consider the economic, national security, and other relevant impacts of specifying any particular area as critical habitat, and under section 4(b)(2) the Secretaries may exclude any area from such designation if the benefits of exclusion outweigh those of inclusion, provided that the exclusion will not result in the extinction of the species. In addition, the Secretaries may not designate as critical habitat any lands or other geographical areas owned or controlled by the Department of Defense, or designated for its use, that are subject to an integrated natural resources management plan under section 101 of the Sikes Act (16 U.S.C. 670a), if the Secretaries determine in writing that such a plan provides a benefit to the species for which critical habitat is proposed for designation (see section 318(a)(3) of the National Defense Authorization Act, Public Law 108–136). We also cannot designate critical habitat in foreign countries or other areas outside U.S. jurisdiction (50 CFR 424.12 (h)).

At this time, we lack the comprehensive data and information necessary to identify and describe physical and biological features of the marine and terrestrial habitats of the loggerhead sea turtle. Accordingly, we find designation of critical habitat to be “not determinable” at this time.

Public Comments Solicitied

We request interested persons to submit information related to the identification of critical habitat and essential physical or biological features for this species, as well as economic or other relevant impacts of designation of critical habitat, for the U.S. marine and terrestrial habitats of loggerhead sea turtles occurring within the U.S. range of the North Pacific Ocean DPS and the Northwest Atlantic Ocean DPS. We solicit information from the public, other concerned governmental agencies, the scientific community, industry, or any other interested party. You may submit this information by any one of several methods (see **ADDRESSES**).

Peer Review

In December 2004, the Office of Management and Budget (OMB) issued a Final Information Quality Bulletin for Peer Review, establishing minimum peer review standards, a transparent process for public disclosure of peer review planning, and opportunities for public participation. The OMB Bulletin, implemented under the Information Quality Act (Public Law

106–554), is intended to enhance the quality and credibility of the Federal government's scientific information, and applies to influential or highly influential scientific information disseminated on or after June 16, 2005. We obtained independent peer review of the scientific information compiled in the 2009 Status Review (Conant et al., 2009) that supported the proposed rule (75 FR 12598; March 16, 2010) to list nine DPSs of the loggerhead sea turtle as endangered or threatened. The Status Review underwent independent peer review by nine scientists with expertise in loggerhead sea turtle biology, genetics, and modeling. We also solicited technical review of the proposed listing determination from six independent experts, and received reviews from all six of these experts.

On July 1, 1994, the Services published a policy for peer review of scientific data (59 FR 34270). The intent of the peer review policy is to ensure that listings are based on the best scientific and commercial data available. We solicited the expert opinions of six qualified and independent specialists from the academic and scientific community. We have addressed their comments in the Summary of Comments section and incorporated them as appropriate in this final rule.

References

A complete list of the references and all non-copyrighted publications cited in this final rule are available on the Internet at http://www.regulations.gov.

Classification

National Environmental Policy Act

ESA listing decisions are exempt from the requirement to prepare an environmental assessment (EA) or environmental impact statement (EIS) under the National Environmental

Policy Act of 1969 (NEPA) (NOAA Administrative Order 216–6.03(e)(1); Pacific Legal Foundation v. Andrus, 675 F. 2d 825 (6th Cir. 1981)). Thus, we have determined that the final listing determinations for the nine loggerhead DPSs described in this notice are exempt from the requirements of NEPA.

Information Quality Act

The Information Quality Act directed the Office of Management and Budget to issue government wide guidelines that “provide policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by federal agencies.” Compliance of this document with NOAA guidelines is evaluated below.

• Utility: The information disseminated is intended to describe a species’ life history, population status, threats, and risks; management actions; and the effects of management actions. The information is intended to be useful to State and Federal agencies, non-governmental organizations, industry groups and other interested parties so they can understand the listing status of the species.

• Integrity: No confidential data were used in the analysis of the impacts associated with this document. All information considered in this document and used to analyze the proposed action, is considered public information.

• Objectivity: The NOAA Information Quality Guidelines require disseminated information to be presented in an accurate, clear, complete, and unbiased manner. This document was prepared with these objectives in mind. It was also reviewed by a variety of biologists, policy analysts, and attorneys from NMFS and USFWS.

Administrative Procedure Act

The Federal Administrative Procedure Act (APA) establishes procedural requirements applicable to informal rulemaking by Federal agencies. The purpose of the APA is to ensure public access to the Federal rulemaking process and to give the public notice and an opportunity to comment before the agency promulgates new regulations. These public notice and comment procedures have been completed in this rulemaking as further explained in the Background.

Coastal Zone Management Act

Section 307(c)(1) of the Federal Coastal Zone Management Act of 1972 requires that all Federal activities that affect any land or water use or natural resource of the coastal zone be consistent with approved State coastal zone management programs to the maximum extent practicable. NMFS and USFWS have determined that this action is consistent to the maximum extent practicable with the enforceable policies of approved Coastal Zone Management Programs of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, California, Oregon, Washington, Hawaii, Puerto Rico, and the U.S. Virgin Islands. Letters documenting our determination, along with the proposed rule, were sent to the coastal zone management program offices of these States. A list of the specific State contacts and a copy of the letters are available upon request. A copy of the final rule will be sent to the coastal zone management programs in these States.

Executive Order 13132 Federalism

Executive Order 13132 requires agencies to take into account any federalism impacts of regulations under development. It includes specific directives for consultation in situations where a regulation will preempt State law or impose substantial direct compliance costs on State and local governments (unless required by statute). Neither of those circumstances is applicable to this final rule. In keeping with the intent of the Administration and Congress to provide continuing and meaningful dialogue on issues of mutual State and Federal interest, the proposed rule was provided to each State in which the subject species occurs, and the State was invited to comment. We considered and incorporated their comments and recommendations into this final determination where applicable. We also provided responses to their comments in the Summary of Comments section.

Environmental Justice

Executive Order 12898 requires that Federal actions address environmental justice in decision-making process. In particular, the environmental effects of the actions should not have a disproportionate effect on minority and low-income communities. The final listing determinations are not expected to have a disproportionate effect on minority or low-income communities because the implications of these listing actions do not adversely affect the human health of low-income, minority, or other populations or the environment in which these various populations live.

Executive Order 12866, Regulatory Flexibility Act, and Paperwork Reduction Act (PRA)

As noted in the Conference Report on the 1982 amendments to the ESA, economic impacts shall not be considered when assessing the status of a species. Therefore, the economic analysis requirements of the Regulatory Flexibility Act are not applicable to the listing process. In addition, this rule is exempt from review under Executive Order 12866. This rule does not contain a collection-of-information requirement for the purposes of the PRA.

List of Subjects

50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

50 CFR Part 223

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

50 CFR Part 224

Administrative practice and procedure, Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Dated: September 9, 2011.

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Daniel M. Ashe,
Director,
U.S. Fish and Wildlife Service.

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Samuel D. Rauch III,
Deputy Assistant Administrator for Regulatory Programs,
National Marine Fisheries Service.

For the reasons set out in the preamble, FWS and NOAA amend 50 CFR parts 17, 223, and 224 as follows:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 16 U.S.C. 1531–1544; 16 U.S.C. 4201–4245; Pub. L. 99–625, 100 Stat. 3500; unless otherwise noted.

2. In §17.11(h) revise the entry for "Sea turtle, loggerhead", which is in alphabetical order under REPTILES, to read as follows:

§ 17.11 Endangered and threatened wildlife.

*****

(h) ***

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
*	*	*	*	*		*	*
Sea turtle, loggerhead, Mediterranean Sea	Caretta caretta	Mediterranean Sea Basin.	Mediterranean Sea east of 5º 36’ W. Long.	E	794	NA	NA
Sea turtle, loggerhead, North Indian Ocean	Caretta caretta	North Indian Ocean Basin.	North Indian Ocean north of the equator and south of 30º N. Lat.	E	794	NA	NA
Sea turtle, loggerhead, North Pacific Ocean	Caretta caretta	North Pacific Ocean Basin.	North Pacific north of the equator and south of 60º N. Lat.	E	794	NA	NA

Sea turtle, loggerhead, Northeast Atlantic Ocean	Caretta caretta	Northeast Atlantic Ocean Basin.	Northeast Atlantic Ocean north of the equator, south of 60º N. Lat., and east of 40º W. Long., except in the vicinity of the Strait of Gibraltar where the eastern boundary is 5º 36’ W. Long.	E	794	NA	NA
Sea turtle, loggerhead, Northwest Atlantic Ocean	Caretta caretta	Northwest Atlantic Ocean Basin.	Northwest Atlantic Ocean north of the equator, south of 60º N. Lat., and west of 40º W. Long.	T	794	NA	NA
Sea turtle, loggerhead, South Atlantic Ocean	Caretta caretta	South Atlantic Ocean Basin.	South Atlantic Ocean south of the equator, north of 60º S. Lat., west of 20º E. Long., and east of 67º W. Long.	T	794	NA	NA
Sea turtle, loggerhead, South Pacific Ocean	Caretta caretta	South Pacific Ocean Basin.	South Pacific south of the equator, north of 60º S. Lat., west of 67º W. Long., and east of 141º E. Long.	E	794	NA	NA

Sea turtle, loggerhead, Southeast Indo-Pacific Ocean	Caretta caretta	Southeast Indian Ocean Basin; South Pacific Ocean Basin as far east as 141º E. Long.	Southeast Indian Ocean south of the equator, north of 60º S. Lat., and east of 80º E. Long.; South Pacific Ocean south of the equator, north of 60º S. Lat., and west of 141º E. Long.	T	794	NA	NA
Sea turtle, loggerhead, Southwest Indian Ocean	Caretta caretta	Southwest Indian Ocean Basin.	Southwest Indian Ocean north of the equator, south of 30º N. Lat., west of 20º E. Long., and east of 80º E. Long.	T	794	NA	NA
*	*	*	*	*		*	*

PART 223—THREATENED MARINE AND ANADROMOUS SPECIES

3. The authority citation for part 223 continues to read as follows:

Authority: 16 U.S.C. 1531–1543; subpart B, § 223.201-202 also issued under 16 U.S.C. 1361 et seq.; 16 U.S.C. 5503(d) for § 223.206(d)(9).

4. Amend the table in § 223.102 by revising paragraph (b) to read as follows:

§ 223.102 Enumeration of threatened marine and anadromous species.

* * * * *

Species[1] Common name	Scientific name	Where Listed	Citation(s) for Listing Determination(s)	Citation(s) for Critical Habitat Designation(s)
*	*	* * *	*	*
(b) Sea Turtles				
(1) Green sea turtle[2]	Chelonia mydas	Wherever found, except where listed as endangered under §224.101(c); circumglobal in tropical and temperate seas and oceans.	43 FR 32800; Jul 28, 1978	63 FR 46693; Sep 2, 1998 64 FR 14052; Mar 23, 1999
(2) Loggerhead sea turtle - Northwest Atlantic Ocean DPS[2]	Caretta caretta	Northwest Atlantic Ocean north of the equator, south of 60º N. Lat., and west of 40º W. Long.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE]*	NA
(3) Loggerhead sea turtle - South Atlantic Ocean DPS[2]	Caretta caretta	South Atlantic Ocean south of the equator, north of 60º S. Lat., west of 20º E. Long., and east of 67º W. Long.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE]*	NA
(4) Loggerhead sea turtle - Southeast Indo-Pacific Ocean DPS[2]	Caretta caretta	Southeast Indian Ocean south of the equator, north of 60º S. Lat., and east of 80º E. Long.; South Pacific Ocean south of the equator, north of 60º S. Lat., and west of 141º E. Long.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE]*	NA

(5) Loggerhead sea turtle - Southwest Indian Ocean DPS[2]	Caretta caretta	Southwest Indian Ocean north of the equator, south of 30º N. Lat., west of 20º E. Long., and east of 80º E. Long.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE]*		NA
(6) Olive ridley sea turtle[2]	Lepidochelys olivacea	Wherever found, except where listed as endangered under §224.101(c); circumglobal in tropical and temperate seas.	43 FR 32800; Jul 28, 1978	NA	

* * * * * * *

[1] Species includes taxonomic species, subspecies, distinct population segments (DPSs) (for a policy statement, see 61 FR 4722, February 7, 1996), and evolutionarily significant units (ESUs) (for a policy statement, see 56 FR 58612, November 20, 1991).

[2]Jurisdiction for sea turtles by the Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, is limited to turtles while in the water.

PART 224—ENDANGERED MARINE AND ANADROMOUS SPECIES

5. The authority citation for part 224 continues to read as follows:

Authority: 16 U.S.C. 1531–1543 and 16 U.S.C. 1361 et seq.

6. Amend § 224.101 by revising paragraph (c) to read as follows:

§ 224.101 Enumeration of endangered marine and anadromous species.

* * * * *

(c) Sea turtles. The following table lists the common and scientific names of endangered sea turtles, the locations where they are listed, and the citations for the listings and critical habitat designations. Jurisdiction for sea turtles by the Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, is limited to turtles while in the water.

Species[1]		Where Listed	Citation(s) for Listing Determination(s)	Citation(s) for Critical Habitat Designation(s)
Common name	Scientific name			
*	* * *	*	*	*
(1) Green sea turtle	Chelonia mydas	Breeding colony populations in Florida and on the Pacific coast of Mexico.	43 FR 32800; Jul 28, 1978	NA
(2) Hawksbill sea turtle	Eretmochelys imbricata	Wherever found; tropical seas.	35 FR 8491; Jun 2, 1970	47 FR 27295; Jun 24, 1982 63 FR 46693; Sep 2, 1998 64 FR 14052; Mar 23, 1999
(3) Kemp's ridley sea turtle	Lepidochelys kempii	Wherever found; tropical and temperate seas in Atlantic Basin, incl. Gulf of Mexico.	35 FR 18319; Dec 2, 1970	NA
(4) Leatherback sea turtle	Dermochelys coriacea	Wherever found; tropical, temperate, and subpolar seas.	35 FR 8491; Jun 2, 1970	43 FR 43688; Sep 26, 1978 44 FR 17710; Mar 23, 1979 64 FR 14052; Mar 23, 1999

(5) Loggerhead sea turtle - Mediterranean Sea DPS	Caretta caretta	Mediterranean Sea east of 5º 36’ W. Long.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE]*	NA
(6) Loggerhead sea turtle - North Indian Ocean DPS	Caretta caretta	North Indian Ocean north of the equator and south of 30º N. Lat.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE]*	NA
(7) Loggerhead sea turtle - North Pacific Ocean DPS	Caretta caretta	North Pacific north of the equator and south of 60º N. Lat.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE]*	NA
(8) Loggerhead sea turtle - Northeast Atlantic Ocean DPS	Caretta caretta	Northeast Atlantic Ocean north of the equator, south of 60º N. Lat., and east of 40º W. Long., except in the vicinity of the Strait of Gibraltar where the eastern boundary is 5º 36’ W. Long.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE]*	NA
(9) Loggerhead sea turtle - South Pacific Ocean DPS	Caretta caretta	South Pacific south of the equator, north of 60º S. Lat., west of 67º W. Long., and east of 141º E. Long.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE]*	NA
(10) Sea turtle, olive ridley	Lepidochelys olivacea	Breeding colony populations on the Pacific coast of Mexico.	43 FR 32800; Jul 28, 1978	NA

[1] Species includes taxonomic species, subspecies, distinct population segments (DPSs) (for a policy statement, see 61 FR 4722, February 7, 1996), and evolutionarily significant units (ESUs) (for a policy statement, see 56 FR 58612, November 20, 1991).

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