DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Parts 223 and 224

[Docket No. 120425024–5022–02]

RIN 0648–XB089

Endangered and Threatened Species; Identification and Proposed Listing of Eleven Distinct Population Segments of Green Sea Turtles (Chelonia mydas) as Endangered or Threatened and Revision of Current Listings

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

ACTION: Proposed rule; 12-month petition finding; request for comments; notice of public hearing.

SUMMARY: The green sea turtle (*Chelonia mydas;* hereafter referred to as the green turtle) is currently listed under the Endangered Species Act (ESA) as a threatened species, with the exception of the Florida and Mexican Pacific coast breeding populations, which are listed as endangered. We, NMFS and USFWS, find that the green turtle is composed of 11 distinct population segments (DPSs) that qualify as ''species'' for listing under the ESA. We propose to remove the current range-wide listing and, in its place, list eight DPSs as threatened and three as endangered. We also propose to apply existing protective regulations to the DPSs. We solicit comments on these proposed actions.

Although not determinable at this time, designation of critical habitat may be prudent, and we solicit relevant information for those DPSs occurring within U.S. jurisdiction. In the interim, we propose to continue the existing critical habitat designation (*i.e.*, waters surrounding Culebra Island, Puerto Rico) in effect for the North Atlantic DPS.

This proposed rule also constitutes the 12-month finding on a petition to reclassify the Hawaiian green turtle population as a DPS and to delist that DPS. Although we find the Hawaiian green turtle population to constitute a DPS (referred to in this proposed rule as the Central North Pacific DPS), we do not find delisting warranted.

A public hearing will be held in Hawai'i. Interested parties may provide oral or written comments at this hearing.

DATES: Comments and information regarding this proposed rule must be received by close of business on June 22, 2015. A public hearing will be held on April 8, 2015 from 6 to 8 p.m., with an informational open house starting at 5:30 p.m. Requests for additional public hearings must be made in writing and received by May 7, 2015.

ADDRESSES: You may submit comments on this document, identified by NOAA–NMFS–2012–0154, by the following methods:

- *Electronic Submissions:* Submit all electronic public comments via the Federal e-Rulemaking Portal.

1. Go to *www.regulations.gov/#!docketDetail;D=NOAA-NMFS-2012-0154*.
2. Click the ''Comment Now!'' icon, complete the required fields.
3. Enter or attach your comments.

OR

- *Mail:* Submit written comments to Green Turtle Proposed Listing Rule, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Room 13535, Silver Spring, MD 20910; or Green Turtle Proposed Listing Rule, U.S. Fish and Wildlife Service, North Florida Ecological Services Office, 7915 Baymeadows Way, Suite 200, Jacksonville, FL 32256.

OR

- *Public hearing:* Interested parties may provide oral or written comments at the public hearing to be held at the Japanese Cultural Center, 2454 South Beretania Street, Honolulu, Hawai'i 96826. Parking is available at the Japanese Cultural Center for $5.

Instructions: Comments sent by any other method, to any other address or individual, or received after the end of the comment period, may not be considered by the Services. All comments received are a part of the public record and will generally be posted for public viewing on *www.regulations.gov* without change. All personal identifying information (*e.g.*, name, address, etc.), confidential business information, or otherwise sensitive information submitted voluntarily by the sender will be publicly accessible. The Services will accept anonymous comments (enter ''N/A'' in the required fields if you wish to remain anonymous). The proposed rule is available electronically at *http://www.nmfs.noaa.gov/pr/species/turtles/green.htm* and *http://www.fws.gov/northflorida/seaturtles/turtle%20factsheets/green-sea-turtle.htm*.

FOR FURTHER INFORMATION CONTACT: Jennifer Schultz, NMFS (ph. 301–427–8443, email *jennifer.schultz@noaa.gov*), or Ann Marie Lauritsen, USFWS (ph. 904–731–3032, email *annmarie_lauritsen@fws.gov*). 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, and 7 days a week.

SUPPLEMENTARY INFORMATION:

Public Comments Solicited on the Proposed Listing

We intend that any final action resulting from this proposal be as accurate and effective as possible and informed by the best available scientific and commercial information. Therefore, we request comments or information from the public, other concerned governmental agencies, the scientific community, industry, or any other interested party concerning this proposed rule. We are seeking information and comments on whether each of the 11 proposed green turtle DPSs qualify as DPSs, whether listing of each DPS is warranted, and, if so, whether they should be classified as threatened or endangered as described in the ''Listing Determinations Under the ESA'' section provided below. Specifically, we are soliciting information on the following subjects relative to green turtles within the 11 proposed DPSs: (1) Historical and current population status and trends, (2) historical and current distribution, (3) migratory movements and behavior, (4) genetic population structure, (5) current or planned activities that may adversely affect green turtles, (6) conservation efforts to protect green turtles, and (7) our extinction risk analysis and findings. We request that all data, information, and comments be accompanied by supporting documentation such as maps, bibliographic references, or reprints of pertinent publications. We will consider comments and new information when making final determinations.

Public Comments Solicited on Critical Habitat

Though we are not proposing to designate critical habitat at this time, we request evaluations describing the quality and extent of existing habitats within U.S. jurisdiction for the proposed North Atlantic, South Atlantic (U.S. Virgin Islands), Central South Pacific (American Samoa), Central West Pacific (Commonwealth of the Northern

Mariana Islands (CNMI) and Guam), Central North Pacific, and East Pacific DPSs, as well as information on other areas that may qualify as critical habitat for these proposed DPSs. Specifically, we are soliciting the identification of particular areas within the geographical area occupied by these species that include physical or biological features that are essential to the conservation of these DPSs and that may require special management considerations or protection (16 U.S.C. 1532(5)(A)(i)). Essential features may include, but are not limited to, features specific to individual species' ranges, habitats, and life history characteristics within the following general categories of habitat features: (1) Space for individual growth and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction and development of offspring; and (5) habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of the species (50 CFR 424.12(b)). Areas outside the geographical area occupied by the species at the time of listing should also be identified, if such areas are essential for the conservation of the species (16 U.S.C. 1532(5)(A)(ii)). Unlike for occupied habitat, such areas are not required to contain physical or biological features essential to the conservation of the species. ESA implementing regulations at 50 CFR 424.12(h) specify that critical habitat shall not be designated within foreign countries or in other areas outside of U.S. jurisdiction. Therefore, we request information only on potential areas of critical habitat within locations under U.S. jurisdiction.

Section 4(b)(2) of the ESA requires the Secretary to consider the ''economic impact, impact on national security, and any other relevant impact'' of designating a particular area as critical habitat. Section 4(b)(2) also authorizes the Secretary to conduct a balancing of the benefits of inclusion and the benefits of exclusion from a critical habitat designation of a particular area, and to exclude any particular area where the Secretary finds that the benefits of exclusion outweigh the benefits of designation, unless excluding that area will result in extinction of the species. Therefore, for features and areas potentially qualifying as critical habitat, we also request information describing: (1) Activities or other threats to the essential features that could be affected by designating them as critical habitat (pursuant to section 4(b)(8) of the ESA); and (2) the positive and negative economic, national security and other relevant impacts, including benefits to the recovery of the species, likely to result if these areas are designated as critical habitat. We also seek information regarding the conservation benefits of designating areas within nesting beaches and waters under U.S. jurisdiction as critical habitat. Data sought include, but are not limited to the following: (1) Scientific or commercial publications, (2) administrative reports, maps or other graphic materials, and (3) information from experts or other interested parties. Comments and data particularly are sought concerning the following: (1) Maps and specific information describing the amount, distribution, and type of use (*e.g.*, foraging or migration) by green turtles, as well as any additional information on occupied and unoccupied habitat areas; (2) the reasons why any habitat should or should not be determined to be critical habitat as provided by sections 3(5)(A) and 4(b)(2) of the ESA; (3) information regarding the benefits of designating particular areas as critical habitat; (4) current or planned activities in the areas that might be proposed for designation and their possible impacts; (5) any foreseeable economic or other potential impacts resulting from designation, and in particular any impacts on small entities; and (6) whether specific unoccupied areas may be essential to provide additional habitat areas for the conservation of the proposed DPSs. We seek information regarding critical habitat for the proposed green turtle DPSs as soon as possible, but no later than June 22, 2015.

Public Hearings

The Services will hold a public hearing in Hawaiʻi. Interested parties may provide oral or written comments at this hearing. A public hearing will be held on April 8, 2015 from 6 to 8 p.m., with an informational open house starting at 5:30 p.m., at the Japanese Cultural Center, 2454 South Beretania Street, Honolulu, Hawaiʻi 96826. Parking is available at the Japanese Cultural Center for $5. If requested by the public by May 7, 2015, additional hearings will be held regarding the proposed listing of the green turtle DPSs. If additional hearings are requested, details regarding location(s), date(s), and time(s) will be published in a forthcoming **Federal Register** notice.

References

A complete list of all references cited herein is available upon request (see **FOR FURTHER INFORMATION CONTACT**).

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I. Background

On July 28, 1978, NMFS and USFWS, collectively referred to as the Services, listed the green turtle (*Chelonia mydas*) under the ESA (43 FR 32800). Pursuant to the authority that the statute provided, and prior to the current language in the definition of ''species'' regarding DPSs, the Services listed the species as threatened, except for the Florida and Mexican Pacific Coast breeding populations, which were listed as endangered. The Services published recovery plans for U.S. Atlantic (*http://www.nmfs.noaa.gov/pr/recovery/plans.htm*) and U.S. Pacific (including the East Pacific) populations of the green turtle (63 FR 28359, May 22, 1998). NMFS designated critical habitat for the species to include waters surrounding Culebra Island, Commonwealth of Puerto Rico, and its outlying keys (63 FR 46693, September 2, 1998).

On February 16, 2012, the Services received a petition from the Association of Hawaiian Civic Clubs to identify the Hawaiian green turtle population as a DPS and ''delist'' the DPS under the ESA. On August 1, 2012, NMFS, with USFWS concurrence, determined that the petition presented substantial information indicating that the petitioned action may be warranted (77 FR 45571). Initiating a review of new information in accordance with the DPS policy was consistent with the recommendation made in the Services' 2007 Green Sea Turtle 5-year Review. The Services initiated a status review to consider the species across its range, determine whether the petitioned action is warranted, and determine whether other DPSs could be recognized. The Services decided to review the Hawaiian population in the context of green turtles globally with regard to application of the DPS policy and in light of significant new information since the listing of the species in 1978.

The Services appointed a Status Review Team (SRT) in September 2012. SRT members were affiliated with NMFS Science Centers and the Services' field, regional, and headquarters offices, and provided a diverse range of expertise, including green turtle genetics, demography, ecology, and management, as well as risk analysis and ESA policy. The SRT was charged with reviewing and evaluating all relevant scientific information relating to green turtle population structure globally to determine whether any populations may qualify as DPSs and, if so, to assess the extinction risk for each proposed DPS. Findings of the SRT are detailed in the ''Green Turtle (*Chelonia mydas*) Status Review under the U.S. Endangered Species Act'' (hereinafter referred to as the Status Review; NMFS and USFWS, 2014). The Status Review underwent independent peer review by 14 scientists with expertise in green turtle biology, genetics, or related fields, and endangered species listing policy. The Status Review is available electronically at *http://www.nmfs.noaa.gov/pr/species/turtles/green.htm*.

This **Federal Register** document announces the 12-month finding on the petition to identify the Hawaiian green turtle population as a DPS and remove the protections of the ESA from the DPS, and includes a proposed rule to revise the existing listings to identify 11 green turtle DPSs worldwide and list them as threatened or endangered under the ESA in place of the existing listings. Our determinations have been made only after review of the best available scientific and commercial information pertaining to the species throughout its range and within each DPS. This is similar to the action we took for loggerhead sea turtles (76 FR 58868, September 22, 2011).

The ESA gives us clear authority to make these listing determinations and to revise the lists of endangered and threatened species to reflect these determinations. Section 4(a)(1) of the ESA authorizes us to determine by regulation whether ''any species,'' which is expressly defined to include species, subspecies, and DPS, is an endangered species or a threatened species based on certain factors. Review of the status of a species may be commenced at any time, either on the Services' own initiative—through a status review or in connection with a 5-year review under Section 4(c)(2)—or in response to a petition. Because a DPS is not a scientifically recognized entity, but rather one that is created under the language of the ESA and effectuated through our DPS Policy (61 FR 4722, February 7, 1996), we have some discretion to determine whether the species should be reclassified into DPSs and what boundaries should be recognized for each DPS. Section 4(c)(1) gives us authority to update the lists of threatened and endangered species to reflect these determinations. This can include revising the lists to remove a species or reclassify the listed entity.

II. 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. Therefore, the Services adopted a joint policy for recognizing DPSs under the ESA (DPS Policy; 61 FR 4722) on February 7, 1996. The DPS Policy requires the consideration of three elements when evaluating the status of possible DPSs: (1) The discreteness of the population segment in relation to the remainder of the species to which it belongs; (2) the significance of the population segment to the species to which it belongs; and (3) the population segment's conservation status in relation to the

ESA's standards for listing. This is discussed further in the Status Review, in the section entitled, ''Overview of Information and Process Used to Identify DPSs.''

III. 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 (section 3(6)), 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 (section 3(20)). Thus, in the context of the ESA, the Services interpret an ''endangered species'' to be one that is presently in danger of extinction. A ''threatened species,'' on the other hand, is not presently in danger of extinction, but is likely to become so in the foreseeable future. In other words, the primary statutory difference between a threatened and endangered species is the timing of when a species may be in danger of extinction, either presently (endangered) or in the foreseeable future (threatened).

When we consider whether a species might qualify as threatened under the ESA, we must consider the meaning of the term ''foreseeable future.'' It is appropriate to interpret ''foreseeable future'' as the horizon over which predictions about the conservation status of the species can be reasonably relied upon. The foreseeable future considers the life history of the species, habitat characteristics, availability of data, particular threats, ability to predict threats, and the reliability to forecast the effects of these threats and future events on the status of the species under consideration. Because a species may be susceptible to a variety of threats for which different data are available, or which operate across different time scales, the foreseeable future is not necessarily reducible to a particular number of years. For the green turtle, the SRT used a horizon of 100 years to evaluate the likelihood that a DPS would reach a critical risk threshold (*i.e.,* quasi-extinction). In making the proposed listing determinations, we applied the horizon of 100 years in our consideration of foreseeable future under the scope of the definitions of endangered and threatened species, pursuant to section 3 of the ESA.

The statute requires us to determine whether any species is endangered or threatened as a result of any one or combination of the following 5-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) of the ESA). Section 4(b)(1)(A) of the ESA requires us to make this determination based solely on the best available scientific and commercial data available 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.

IV. Biology and Life History of Green Turtles

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

The green turtle, *C. mydas,* has a circumglobal distribution, occurring throughout tropical, subtropical, and, to a lesser extent, temperate waters. Their movements within the marine environment are not fully understood, but it is believed that green turtles inhabit coastal waters of over 140 countries (Groombridge and Luxmoore, 1989). The Status Review lists 468 known nesting sites worldwide, with 79 having nesting aggregations with greater than 500 females. The largest green turtle nesting aggregation, with an estimated number of nesting females greater than 132,000, is Tortuguero, Costa Rica (Sea Turtle Conservancy, 2013). There are 14 aggregations estimated to have 10,001–100,000 nesting females: Quintana Roo, Mexico (Julio Zurita, pers. comm., 2012); Ascension Island, UK (S. Weber, Ascension Island Government, pers. comm., 2013); Poilão, Guinea-Bissau (Catry *et al.,* 2009); Aldabra Atoll, Seychelles (Mortimer *et al*., 2011; Mortimer, 2012; J. Mortimer, unpubl. data.); Mohéli, Comoros Islands, France (Bourjea, 2012); Mayotte, Comoros Islands (Bourjea, 2012); Europa, Esparses Islands, France (Lauret-Stepler *et al.,* 2007; Bourjea, 2012); Ras Al Hadd, Oman (AlKindi *et al.,* 2008); Ras Sharma, Yemen (PERSGA/GEF, 2004); Wellesley Group, Australia (Unpubl. data cited in Limpus, 2009); Raine Island, Australia (Chaloupka *et al.,* 2008a; Limpus, 2009); Moulter Cay, Australia (Limpus, 2009); Capricorn Bunker Group of Islands, Australia (Limpus *et al.,* 2003); and Colola, Mexico (Delgado-Trejo and Alvarado-Figueroa, 2012).

Most green turtles spend the majority of their lives in coastal foraging grounds. These areas include fairly shallow waters in open coastline and protected bays and lagoons. While in these areas, green turtles rely on marine algae and seagrass as their primary diet constituents, although some populations also forage heavily on invertebrates. These marine habitats are often highly dynamic and in areas with annual fluctuations in seawater and air temperatures, which can cause the distribution and abundance of potential green turtle food items to vary substantially between seasons and years (Carballo *et al.,* 2002).

At nesting beaches, green turtles rely on beaches characterized by intact dune structures, native vegetation, little to no artificial lighting, and 26 to 35° C beach temperatures for nesting (Limpus, 1971; Salmon *et al.,* 1992; Ackerman, 1997; Witherington, 1997; Lorne and Salmon, 2007). Nests are typically laid at night at the base of the primary dune (Hirth, 1997; Witherington *et al.,* 2006). Complete removal of vegetation, or coastal construction, can affect thermal regimes on beaches and thus affect the incubation and resulting sex ratio of hatchling turtles. Nests laid in these areas are at a higher risk of tidal inundation (Schroeder and Mosier, 2000).

Hatchlings emerge from their nests *en masse* and almost exclusively at night, presumably using decreasing sand temperature as a cue (Hendrickson, 1958; Mrosovsky, 1968). Immediately after hatchlings emerge from the nest, they begin a period of frenzied activity. During this active period, hatchlings crawl to the surf, swim, and are swept through the surf zone (Carr and Ogren, 1960; Carr, 1961; Wyneken and Salmon, 1992). They orient to waves in the nearshore area and to the magnetic field as they proceed further toward open water (Lohmann and Lohmann, 2003).

Upon leaving the nesting beach and entering the marine environment, post-hatchling green turtles begin an oceanic juvenile phase during which they are presumed to primarily inhabit areas where surface waters converge to form local downwellings that result in linear accumulations of floating material, especially *Sargassum* sp. This association with downwellings is well-documented for loggerhead sea turtles (*Caretta caretta*), as well as for some post-hatchling green turtles (Witherington *et al.,* 2006; 2012). The smallest of oceanic green turtles associating with these areas are relatively active, moving both within *Sargassum* sp. mats and in nearby open water, which may limit the ability of researchers to detect their presence as compared to relatively immobile loggerheads of the same life stage that associate with similar habitat (Smith and Salmon, 2009; Witherington *et al.,* 2012).

Oceanic-stage juvenile green turtles originating from nesting beaches in the Northwest Atlantic appear to use oceanic developmental habitats and move with the predominant ocean gyres for several years before returning to their neritic (shallower water, generally to 200 m depth, including open coastline and protected bays and lagoons) foraging and developmental habitats (Musick and Limpus, 1997; Bolten, 2003). Larger neonate green turtles (at least 15–26 cm straight carapace length; SCL) are known to occupy *Sargassum* sp. habitats and surrounding epipelagic waters, where food items include *Sargassum* sp. and associated invertebrates, fish eggs, and insects (Witherington *et al.,* 2012). Knowledge of the diet and behavior of oceanic stage juveniles, however, is limited.

The neritic juvenile stage begins when green turtles exit the oceanic zone and enter the neritic zone (Bolten, 2003). The age at recruitment to the neritic zone likely varies with individuals leaving the oceanic zone over a wide size range (summarized in Avens and Snover, 2013). After migrating to the neritic zone, juveniles continue maturing until they reach adulthood, and some may periodically move between the neritic and oceanic zones (NMFS and USFWS, 2007; Parker *et al.,* 2011). The neritic zone, including both open coastline and protected bays and lagoons, provides important foraging habitat, inter-nesting habitat, breeding, and migratory habitat for adult green turtles (Plotkin, 2003; NMFS and USFWS, 2007). Some adult females may also periodically move between the neritic and oceanic zones (Plotkin, 2003; Hatase *et al.,* 2006) and, in some instances, adult green turtles may reside in the oceanic zone for foraging (NMFS and USFWS, 2007; Seminoff *et al.,* 2008; Parker *et al.,* 2011). Despite these uses of the oceanic zone by green turtles, much remains unknown about how oceanography affects juvenile and adult survival, adult migration, prey availability, and reproductive output.

Most green turtles exhibit slow growth rates, which has been described as a consequence of their largely herbivorous (*i.e.,* low net energy) diet (Bjorndal, 1982). Consistent with slow growth, age-to-maturity for green turtles appears to be the longest of any sea turtle species (Chaloupka and Musick, 1997; Hirth, 1997). Published age at sexual maturity estimates are as high as 35–50 years, with lower ranges reported for known age turtles from the Cayman Islands (15–19 years; Bell *et al.,* 2005) and Caribbean Mexico (12–20 years; Zurita *et al.,* 2012) and some mark-recapture projects (*e.g.,* 15–25 years in the Eastern Pacific; Seminoff *et al.,* 2002a). Mean adult reproductive lifespan of green turtles from Australia's southern Great Barrier Reef (GBR) has been estimated at 19 years using mark-recapture and survival data (Chaloupka and Limpus, 2005). The maximum nesting lifespan observed in a 27-year tag return dataset from Trindade Island, Brazil was 16 years; however, nesting monitoring was discontinuous over time (Almeida *et al.,* 2011). Tag return data comprising 2,077 females (42,928 nesting events, 1968-partial 2012 season) from continuous monitoring at French Frigate Shoals (FFS), Hawai'i show maximum nesting lifespans of 37–38 years (n=2), with many individuals (n=54) documented nesting over a minimum of 25–35 years (I. Nurzia-Humburg, S. Hargrove, and G. Balazs, NMFS, unpublished data, 2013).

V. Overview of the Policies and Process Used To Identify DPSs

The SRT considered a vast array of information in assessing whether there are any green turtle population segments that satisfy the DPS criteria of being both discrete and significant. In anticipation of conducting a green turtle status review, NMFS contracted two post-doctoral associates in 2011 to collect and synthesize genetic and demographic information on green turtles worldwide. The SRT was presented with, and evaluated, this genetic and demographic information. Demographic information included green turtle nesting information; morphological and behavioral data; movements, as indicated by tagging (flipper and passive integrated transponder (PIT) tags) and satellite telemetry data; and anthropogenic impacts. Also discussed and considered as a part of this analysis were oceanographic features and geographic barriers.

A population 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 as a consequence of physical, physiological, ecological, or behavioral factors; 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 (61 FR 4722, February 7, 1996). According to the policy, quantitative measures of genetic or morphological discontinuity can be used to provide evidence for item (1). The SRT compiled a list of attributes that suggested various population groups might be considered discrete, identified potentially discrete units, and discussed alternative scenarios for lumping or splitting these potentially discrete units. After arriving at a tentative list of units, each member of the SRT was given 100 points that could be distributed among two categories: (1) The unit under consideration is discrete, and (2) the unit under consideration is not discrete. The spread of points reflects the level of certainty of the SRT surrounding a decision to call the unit discrete. The SRT determined that there are 11 discrete regional populations of green turtles globally. Each of these was then evaluated for significance.

A population may be considered significant if it satisfies any one of the following conditions: (1) Persistence of the discrete segment in an ecological setting unusual or unique for the taxon; (2) evidence that loss of the discrete segment would result in a significant gap in the range of the taxon; (3) 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 (4) evidence that the discrete segment differs markedly from other populations of the species in its genetic characteristics. Because condition (3) is not applicable to green turtles, the SRT addressed conditions (1), (2) and (4). The SRT listed the attributes that would make potential DPSs (those determined to be discrete in the previous step) significant. As in the vote for discreteness, members of the SRT were then given 100 points with which to vote for whether each unit met the significance criterion in the joint policy. All units that had been identified as discrete were also determined to be significant.

For more discussion on the process the SRT used to identify DPSs, see Section 3 of the Status Review document.

A. Discreteness Determination

In evaluating discreteness among the global green turtle population, the SRT began by focusing on the physical separation of ocean basins (*i.e.,* Atlantic, Pacific, and Indian Oceans). The result was an evaluation of data by major ocean basins, although it quickly became clear that the Indian and Pacific

Ocean populations overlapped. The evaluation by ocean basin was not to preclude any larger or smaller DPS delineation, but to aid in data organization and assessment. We organized this section by ocean basin to explain the discreteness determination process and results.

Within each ocean basin, the SRT started by evaluating genetic information. The genetic data consisted of results from studies using maternally inherited mitochondrial DNA (mtDNA), biparentally inherited nuclear DNA (nDNA) microsatellite (a section of DNA consisting of very short nucleotide sequences repeated many times), and single nucleotide polymorphism (a DNA sequence variation occurring commonly within a population) markers. Next, the SRT reviewed tagging, telemetry and demographic data, and additional information such as potential differences in morphology. The SRT also considered whether the available information suggests that green turtle population segments are separated by vicariant barriers, such as oceanographic features (*e.g.,* current systems), or biogeographic boundaries.

Genetic information that was presented to the SRT resulted from a global phylogenetic analysis (analysis based on natural evolutionary relationships) based on sequence data from a total of 129 mtDNA haplotypes (*i.e.,* mtDNA sequences, which are inherited together) identified from approximately 4,400 individuals sampled at 105 green turtle nesting sites around the world (Jensen and Dutton, NMFS, unpublished data; M. Jensen, NRC, pers. comm., 2013). Results indicated that the mtDNA variation present in green turtles throughout the world today occurs within eight major clades (*i.e.,* a group consisting of an ancestor and all its descendants) that are structured geographically within ocean basins. These clades represent similarities between haplotypes on evolutionary timescales as opposed to ecological timescales. See Figure 1 for a visual representation of these clades. There is divergence among individual haplotypes within each green turtle clade (M. Jensen, NRC, pers. comm., 2013) and discrete populations can exist within these clades.

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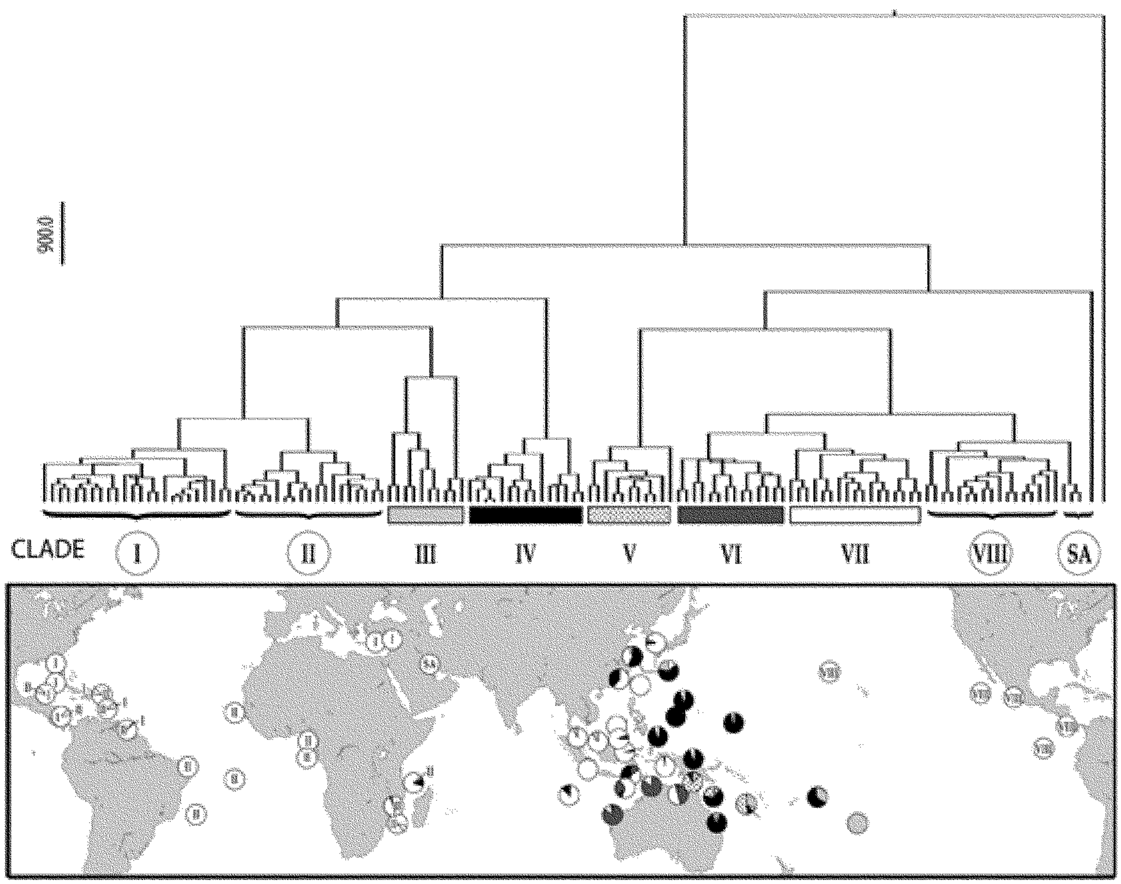
Figure 1. Bayesian phylogenetic tree showing relationships (average number of base substitutions) among 129 mtDNA haplotypes that group into eight major clades (Clade I – VIII), defined by a shaded box or brackets. The geographic distribution of haplotypes is shown by pie charts with corresponding shading or Roman numerals. Each pie chart corresponds to a genetically distinct management unit, which exhibits significant divergence of haplotype frequencies, as described by Moritz (1994; Jensen and Dutton, NMFS, unpublished data). The samples from Saudi Arabia (SA) contain two highly divergent groups of haplotypes. More sampling is needed from this region to assess their placement in the tree.



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1. Atlantic Ocean/Mediterranean Sea

Two of the eight major mtDNA clades, Clades I and II, are found in the Atlantic/Mediterranean region. Clade I includes haplotypes primarily found in turtles from the Mediterranean and the western North Atlantic. Within Clade I, two strongly divergent groups of haplotypes are found, with one group being restricted to the Mediterranean and the other being restricted to the western North Atlantic. Mediterranean and western North Atlantic turtles share only one specific haplotype that has been found in only two individuals, indicating very strong long-term isolation of females. As such, there is strong evidence that these two geographically-separated groups of divergent haplotypes may be considered discrete.

In addition to genetic evidence for discreteness, in the Mediterranean, green turtles are spatially separated from populations in the Atlantic and Indian Oceans, with the nearest known nesting sites outside the Mediterranean being several thousand kilometers away in the Republic of Senegal (Senegal), and the North Atlantic population being more than 8,000 km away. Further, no turtles tagged in the eastern Mediterranean have been recovered farther west than the Tunisian Republic (Tunisia) inside the Mediterranean. Nesting females from Cyprus, Turkey, the Syrian Arab Republic (Syria), and the State of Israel (Israel) have been satellite tracked to the Arab Republic of Egypt (Egypt), Libya, and Turkey—with movements largely restricted to the eastern Mediterranean (Godley *et al.,* 2002; Broderick *et al.,* 2007). Post-nesting turtles from this region migrate primarily along the coast from their nesting beach to their foraging and overwintering grounds in the Mediterranean (Godley *et al.,* 2002; Broderick *et al.,* 2007).

Demographic evidence of discreteness of Mediterranean green turtles lies in the fact that Mediterranean green turtles are the second smallest green turtles worldwide (the smallest being in the eastern Pacific), with a mean nesting size in Alagadi, Cyprus of 92 cm Curved Carapace Length (CCL; Broderick *et al.,* 2003), compared with 95 cm to 110 cm CCL size range for most other populations.

In the North Atlantic, tag recovery and telemetry data indicate that nesting females primarily reside within the North Atlantic. Some nesting females tagged at Tortuguero, Costa Rica were recaptured in the South Atlantic (Troëng *et al.,* 2005). There is some degree of mixing of immature turtles on foraging pastures between the North and South Atlantic; however, nesting sites in the eastern Caribbean carry mostly mtDNA haplotypes from a different clade (II), indicating strong long-term isolation. Tagging studies have identified juveniles from this population in waters off Brazil and Argentina, but we found no evidence of movement of mature individuals.

The second clade within the Atlantic Ocean basin, Clade II, includes haplotypes found in all South Atlantic nesting sites, some eastern Caribbean turtles, and some turtles in the southwest Indian Ocean. With a few exceptions, green turtles in the South Atlantic carry an mtDNA haplotype that is found nowhere else, indicating strong isolation of matrilines over evolutionary time periods. The exceptions to this pattern are: (1) One nesting site from the eastern Caribbean, which exhibits a low frequency of a haplotype from the North Atlantic/Mediterranean clade (Clade I); (2) nesting sites from the Gulf of Mexico/Central America, which have a low frequency of Clade II haplotypes; and (3) two nesting sites from southeast Africa, which have high frequencies of Clade II haplotypes. The presence of a shared haplotype in South Atlantic and southwest Indian Ocean rookeries demonstrates for the first time a recent matrilineal link between Atlantic and Indian Ocean green turtle populations (Bourjea *et al.,* 2007b). However, the SRT believes all these exceptions reflect historical events rather than contemporary connectivity. This interpretation is supported by satellite telemetry, which reveals extensive movements of turtles within the South Atlantic region but no evidence for migrations into other areas, other than rare instances of movement into foraging areas in the North Atlantic. Long stretches of cold water along the coasts of Patagonia and southwest Africa serve to isolate South Atlantic turtles from populations in the Indian and Pacific Oceans.

Foraging ground studies in the Atlantic have generally shown regional structuring with strong stock contribution from nearby regional nesting sites, but little mixing over long distances (Bolker *et al.,* 2007). Overall, the distribution of the two genetic haplotype lineages (Clade I and Clade II) is very similar to what is seen for the nesting sites and indicates a strong regional structuring with little overlap (Bolker *et al.,* 2007). However, a recent study showed that a large proportion of juvenile green turtles in the Cape Verde Islands in the eastern Atlantic originated from distant nesting sites across the Atlantic, namely Suriname (38 percent), Ascension Island (12 percent) and Guinea Bissau (19 percent), suggesting that, like loggerheads, green turtles in the Atlantic undertake transoceanic developmental migrations (Monzón-Argüello *et al.,* 2010). The fact that long distance dispersal is only seen for juvenile turtles suggests that larger adult-sized turtles return to forage within the region of their natal nesting sites, thereby limiting the potential for gene-flow across larger scales (Monzón-Argüello *et al.,* 2010).

In the South Atlantic, flipper tag recoveries have established movement between feeding grounds and nesting sites in the Caribbean and Brazil (Lima *et al.,* 2003; Lima *et al.,* 2008; Lima *et al.,* 2012), and telemetry data indicate that juvenile green turtles move from Argentina to Uruguay and Brazil, from Uruguay to Brazil, and from the Guianas to Brazil. Telemetry studies indicate that nesting females from the eastern South Atlantic (west coast of Africa) are confined to the eastern South Atlantic, and nesting females from the western South Atlantic are confined to the western South Atlantic. In the eastern South Atlantic, all tracked turtles remained in the general vicinity of their release location. Nesting females from Ascension Island were tracked to foraging grounds along the coast of Brazil.

Finally, demographic evidence for discreteness of South Atlantic green turtles lies in the fact that the South Atlantic is home to the largest green turtles in the world, with a mean nesting size of green turtles at Atol das Rocas, Brazil of 118.6 cm CCL (n=738), compared with 95 cm to 110 cm CCL size range for most other populations.

Based on the information presented above, the SRT concluded, and we concur, that three discrete populations exist in the Atlantic Ocean/Mediterranean: (1) North Atlantic, (2) Mediterranean, and (3) South Atlantic. These three populations are markedly separated from each other and from populations within the Pacific Ocean and Indian Ocean basins as a consequence of physical (including both oceanographic basins and currents), ecological, and behavioral factors. Information supporting this conclusion includes genetic analysis, flipper tag recoveries, and satellite telemetry.

2. Indian Ocean

Green turtles from the Indian Ocean exhibit haplotypes from Clades II, III, IV, VI, and VII. In the southwest Indian Ocean, Bourjea *et al.* (2007b) genetically assessed the population structure among 288 nesting green turtles from 10 nesting sites. Overall, the southwest Indian Ocean appears to have at least two genetic stocks: (1) The South Mozambique Channel (Juan de Nova and Europa); and (2) the North Mozambique Channel. As stated earlier, the authors recorded a high presence of a common and widespread South Atlantic Ocean haplotype (CM–A8) in the South Mozambique Channel. However, the observation that only a single Atlantic haplotype has been observed and that it occurs in high frequency among South Mozambique Channel rookeries suggests that gene flow is not ongoing (Bourjea *et al.,* 2007b). Nesting sites in the North Mozambique Channel share several haplotypes (including CmP47 and CmP49) with nesting sites in the eastern Indian Ocean, Southeast Asia and the Western Pacific, indicating strong-connectivity with the eastern Indian Ocean population. However, tagging and tracking data document movements within the Southwest Indian Ocean but not between it and the eastern Indian and western Pacific Oceans. Although there is some evidence of trans-boundary movement between the southwest Indian Ocean and the population in the North Indian Ocean, evidence from tag returns indicates that most remain in the southwest Indian Ocean. Indeed, some green turtles in Tanzania are probably resident, and others are highly migratory, moving to and from nesting and feeding grounds within the southwest Indian Ocean in Kenya, Seychelles, Comoros, Mayotte, Europa Island and South Africa (Muir, 2005). From 2009 to 2011, 90 satellite transmitters deployed on nesting green turtles at five nesting sites in the southwest Indian Ocean showed that nearly 20 percent of the tracked turtles used Madagascar coastal foraging grounds while more than 80 percent used the east African coasts, including waters off north Mozambique and south Tanzania. The SRT determined that spatial separation between the southwest Indian Ocean and other Indo-Pacific populations, as well as an apparent nesting gap, the lack of trans-boundary recoveries in tagging, and localized telemetry, indicate discreteness from other populations in the Indo-Pacific.

In the North Indian Ocean, limited information from only a single nesting site (Jana Island, Saudi Arabia, n=27) exists on the genetic structure (M. Jensen, NRC, pers. comm., 2013). Nonetheless, four mtDNA haplotypes never reported from any other nesting site were identified from Jana Island, and are highly divergent from other haplotypes in the Indian Ocean. This population also appears to be isolated from other Indian populations by substantial breaks in nesting habitat along the Horn of Africa and along the entire eastern side of the Indian subcontinent.

Tagging of turtles on nesting beaches of the North Indian Ocean started in the late 1970s and indicates that some turtles in the North Indian Ocean migrate long distances from distant feeding grounds to nesting beaches while others are quite sedentary, but all stay within the North Indian Ocean. Tagging studies have revealed that some turtles nesting on Ras Al Hadd and Masirah, Oman can be found as far away as Somalia, Ethiopia, Yemen, Saudi Arabia, the upper Gulf, and Pakistan (Ross, 1987; Salm, 1991), and a green turtle tagged in Oman was found in the Maldives (Al-Saady *et al.,* 2005). No tagging has been carried out on feeding grounds (Al-Saady *et al.,* 2005).

A few green turtles in the North Indian Ocean have been fitted with satellite transmitters and reported at *www.seaturtle.org*, but no data have been published. One telemetered female green turtle remained in the coastal areas of the Persian Gulf for 49 days (N. Pilcher, Marine Research Foundation, pers. comm., 2013), and two nesting turtles were telemetered at Masirah Island, Oman, both of which moved southward along the Arabian Peninsula and were found in the Red Sea when the transmissions ceased (Rees *et al.* 2012). Telemetry data for captive-hatched and reared green turtles at Republic of Maldives (Vabbinfaru Island, Male Atoll) have indicated wide movement patterns within the Indian Ocean (N. Pilcher, Marine Research Foundation, pers. comm., 2013).

In the eastern Indian Ocean, turtles mix readily with those in the western Pacific. Genetic sampling in the eastern Indian and western Pacific Ocean regions has been fairly extensive with more than 22 nesting sites sampled although, because there are a high number of nesting sites in this region and there is complex structure, there remain gaps in sampling relative to distribution (*e.g.,* Thailand, Vietnam, parts of Indonesia, and the Philippines). Most nesting sites are dominated by haplotypes from Clade VII, but with some overlap of Clades III and IV throughout the Indian Ocean—evidence of a complex colonization history in this region. While one common haplotype is shared across the Indian Ocean, substantial gaps in nesting sites along the east coast of India and in the southern Indian Ocean serve to isolate the eastern Indian-western Pacific population from those in the north and southwest Indian Ocean. The Wallace Line (a boundary drawn in 1859 by the British naturalist Alfred Russel Wallace that separates the highly distinctive faunas of the Asian and Australian biogeographic regions) and its northern extension separate this population from populations to the east, which carry haplotypes primarily from Clade IV. Nesting sites to the northern extreme (Taiwan and Japan) show more complex patterns of higher mixing of divergent haplotypes, and the placement of individual nesting sites within this area is somewhat uncertain and may become better resolved when additional genetic data are available.

Significant population substructuring occurs among nesting sites in this area. Mixed-stock analysis of foraging grounds shows that green turtles from multiple nesting beaches commonly mix at feeding areas across northern Australia (Dethmers *et al.,* 2006) and Malaysia (Jensen, 2010), with higher contributions from nearby large nesting sites. Satellite tracking also shows green turtle movement throughout the eastern Indian and western Pacific (Cheng, 2000; Dermawan, 2002; Charuchinda *et al.,* 2003; Wang, 2006).

Given the information presented above, the SRT concluded, and we concur, that three discrete populations exist in the Indian Ocean, with the third overlapping with the Pacific: (1) Southwest Indian, (2) North Indian, and (3) East Indian-West Pacific. These three populations are markedly separated from each other and from populations within the Atlantic Ocean as a consequence of physical, ecological, and behavioral factors. Information supporting this conclusion includes genetic analysis, flipper tag recoveries, and satellite telemetry.

3. Pacific Ocean

The central west Pacific encompasses most of the area commonly referred to as Micronesia as well as parts of Melanesia. Genetic sampling in the central west Pacific has recently improved, but remains challenging, given the large number of small island and atoll nesting sites. At least five management units have been identified in the region (Palau, Independent State of Papua New Guinea (PNG), Yap, CNMI/Guam, and the Republic of the Marshall Islands (Marshall Islands); Dethmers *et al.,* 2006; M. Jensen, NRC, pers. comm., 2013; Dutton *et al.,* 2014). The central west Pacific carries haplotypes from Clade IV, while the populations to the west carry haplotypes predominantly from Clade VII, so any mixing presumably reflects foraging migrations rather than interbreeding. The boundary between the central west Pacific and the East Indian-West Pacific populations is congruent with the northern portion of the Wallace Line. Wide expanses of open ocean separate the central west Pacific from the central north Pacific, and genetic data provide no evidence of gene flow between the central west Pacific and the central north Pacific over evolutionary time scales. Tagging studies also have not found evidence for migration of breeding adults to or from adjacent populations.

In the southwest Pacific, genetic sampling has been extensive for larger nesting sites along the GBR, the Coral Sea and New Caledonia (Dethmers *et al.,* 2006; Jensen, 2010; Dutton *et al.,* 2014). However, several smaller nesting sites in this region have not been sampled (*e.g.,* Solomon Islands, Republic of Vanuatu (Vanuatu), Tuvalu, PNG, etc.). The southwest Pacific population is characterized by haplotypes from Clade V, which have been found only at nesting sites in this population. It also has a high frequency of haplotypes from Clades III and IV, as well as low frequency of haplotypes from Clades VI and VII, making this area highly diverse (haplotypes from the widespread Clade IV differ from those found in the central west and central south Pacific).

Traditional capture-mark-recapture studies (Limpus, 2009) and genetic mixed-stock analysis (Jensen, 2010) show that turtles from several different southwest Pacific nesting sites overlap on feeding grounds along the east coast of Australia. This mixing in foraging areas might provide mating opportunities between turtles from different stocks as evidenced by the lack of differentiation found between the northern and southern GBR nesting sites for nuclear DNA (FitzSimmons *et al.,* 1997). However, tagging, telemetry, and genetic studies show movement of breeding adults occurs mainly within the southwest Pacific.

In the central South Pacific, genetic sampling has been limited to two nesting sites (American Samoa and French Polynesia) among the many small isolated nesting sites that characterize this region, but they both contain relatively high frequencies of Clade III haplotypes, which are not found in the central west and southwest Pacific populations. Nesting sites from this area share some haplotypes with surrounding nesting sites, but at low frequency. There are also limited data on mixed-stock foraging areas from this region. Flipper tag returns and satellite tracking studies demonstrate that post-nesting females travel the complete geographic breadth of this population, from French Polynesia in the east to Fiji in the west, and sometimes even slightly beyond (Tuato'o-Bartley *et al.,* 1993; Craig *et al.,* 2004; Maison *et al.,* 2010; White, 2012), as far as the Philippines (Trevor, 2009). The complete extent of migratory movements is unknown. The central South Pacific is isolated by vast expanses of open ocean from turtle populations to the north (Hawai'i) and east (Galapagos), and in both of these areas all turtle haplotypes are from an entirely different clade (Clade VIII), indicating lack of genetic exchange across these barriers.

The central North Pacific, which includes the Hawaiian Archipelago and Johnston Atoll, is inhabited by green turtles that are geographically discrete in their genetic characteristics, range, and movements, as evidenced by genetic studies and mark-recapture studies using flipper tags, microchip tags, and satellite telemetry. The key nesting aggregations within the Hawaiian Archipelago have all been genetically sampled. Mitochondrial DNA studies show no significant differentiation (based on haplotype frequency) between FFS and Laysan Island (P. Dutton, NMFS, pers. comm., 2013). While the Hawaiian Islands do share haplotypes with Revillagigedos Islands (CmP1.1 and CmP3.1) at low frequency, the populations remain highly differentiated, and there is little evidence of significant ongoing gene flow. The Frey *et al.* (2013) analysis of mtDNA and nDNA in scattered nesting sites on the main Hawaiian Islands (MHI; Molokai, Maui, Oahu, Lanai, and Kauai) showed that nesting in the MHI might be attributed to a relatively small number of females that appear to be related to each other and demographically isolated from FFS.

Turtles foraging in the MHI originate from Hawaiian nesting sites, with very rare records of turtles from outside the central North Pacific (Dutton *et al.,* 2008), and there is a general absence of turtles from the Hawaiian breeding population at foraging areas outside the central North Pacific. From 1965–2013, 17,536 green turtles (juvenile through adult stages) were tagged. With only three exceptions, the 7,360 recaptures of these tagged turtles have been within the Hawaiian Archipelago. The three outliers involved recoveries in Japan, the Marshall Islands, and the Philippines (G. Balazs, NMFS, pers. comm., 2013).

Information from tagging at FFS, areas in the MHI, the Northwest Hawaiian Islands (NWHI) to the northwest of FFS, and at Johnston Atoll shows that reproductive females and males periodically migrate to FFS for seasonal breeding from the other locations. At the end of the season they return to their respective foraging areas. The reproductive migrations of 19 satellite tracked green turtles (16 females and 3 males) all involved movements between FFS and the MHI. Conventional tagging using microchips and metal flipper tags has resulted in the documentation of 164 turtles making reproductive movements from or to FFS and foraging pastures in the MHI, and 58 turtles from or to FFS and the foraging pastures in the NWHI (G. Balazs, NMFS, unpubl. data).

Hawaiian green turtles also exhibit morphological features that may make them discrete from other populations, possibly reflecting genetic as well as ecological adaptations. In the Hawai'i population, and in Australian populations, green turtles have a well-developed crop, which has not been found in Caribbean or eastern Pacific populations of green turtles (Balazs *et al.,* 1998; J. Seminoff, NMFS, unpubl. data). In addition, juvenile green turtles in Hawai'i have proportionally larger rear flippers than those in the western Caribbean (Wyneken and Balazs, 1996; Balazs *et al.,* 1998). These anatomical differences may reflect adaptive variation to different environmental conditions. A crop that holds food material in the esophagus would permit more food to be ingested during each foraging event in a more dynamic feeding environment, which is helpful along wind-swept rugged coastlines where large waves crash ashore. Larger flippers would also aid in making them stronger swimmers in this feeding environment, and during reproductive migrations across rough pelagic waters, as opposed to calmer coastal waters (Balazs *et al.,* 1998).

The central North Pacific population and those in the central South Pacific and central west Pacific appear to be separated by large oceanic areas, and the central North Pacific and the eastern Pacific populations are separated by the East Pacific Barrier, an oceanographic barrier that greatly restricts or eliminates gene flow for most marine species from a wide range of taxa (Briggs, 1974).

In the eastern Pacific, genetic sampling has been extensive and the coverage in this region is substantial, considering the relatively small population sizes of most eastern Pacific nesting sites, which include both mainland and insular nesting. This sampling indicates complete isolation of nesting females between the eastern and western Pacific nesting sites. Recent efforts to determine the nesting stock origins of green turtles assembled in foraging areas have found that green turtles from several eastern Pacific nesting stocks commonly mix at feeding areas in the Gulf of California and along the Pacific coast in San Diego Bay, U.S. (Nichols, 2003; P. Dutton, NMFS, unpubl. data). In addition, green turtles of eastern Pacific origin have been found, albeit very rarely, in waters off Hawai'i (LeRoux *et al.,* 2003; Dutton *et al.,* 2008), Japan (Kuroyanagi *et al.,* 1999; Hamabata *et al.,* 2009), and New Zealand (Godoy *et al.,* 2012). A recent study of juvenile green turtles foraging at Gorgona Island in the Republic of Colombia indicated a small number (5 percent) of turtles with the haplotype CmP22, which was recently discovered to be common in nesting green turtles from the Marshall Islands and American Samoa (Dutton *et al.,* 2014). This shows that, despite the isolation of nesting females between the eastern and western Pacific, a small number of immature turtles successfully cross the Pacific during developmental migrations in both directions. However, it is important to point out that there is no evidence of mature turtles inhabiting foraging or nesting habitat across the Pacific from their region of origin.

Recent nDNA studies provide insights that are consistent with patterns of differentiation found with mtDNA in the eastern Pacific. Roden *et al.* (2013) found significant differentiation between FFS and two eastern Pacific populations (the Galápagos Islands, Ecuador and Michoacán, Mexico) and greater connectivity between Galapagos and Michoacán than between FFS and either of the eastern Pacific nesting sites.

Flipper tagging and satellite telemetry data show that dispersal and reproductive migratory movements of green turtles originating from the eastern Pacific region are generally confined to that region. Long-term flipper tagging programs at Michoacán (Alvarado-Díaz and Figueroa, 1992) and in the Galápagos Islands (Green, 1984; P. Zarate, University of Florida, pers. comm., 2012) produced 94 tag returns from foraging areas throughout the eastern Pacific (*e.g.,* Seminoff *et al.,* 2002b). There were two apparent groupings, with tags attached to turtles nesting in the Galápagos largely recovered along the shores from Costa Rica to Chile in the southeastern Pacific, and long-distance tag returns from the Michoacán nesting site primarily from foraging areas in Mexico to Nicaragua. However, there was a small degree of overlap between these two regions, as at least one Michoacán tag was recovered as far south as Colombia (Alvarado-Díaz and Figueroa, 1992).

Satellite telemetry efforts with green turtles in the region have shown similar results to those for flipper tag recoveries. A total of 23 long-distance satellite tracks were considered for the Status Review (Seminoff, 2000; Nichols, 2003; Seminoff *et al.,* 2008). Satellite data show that turtles tracked in northeastern Mexico (Nichols, 2003; J. Nichols, California Academy of Sciences, unpubl. data) and California (P. Dutton, NMFS, pers. comm., 2010) all stayed within the region, whereas turtles tracked from nesting beaches in the Galápagos Islands all remained in waters off Central America and the broader southeastern Pacific Ocean (Seminoff *et al.,* 2008).

Demographic evidence of discreteness is also found in morphological differences between green turtles in the eastern Pacific and those found elsewhere. The smallest green turtles worldwide are found in the eastern Pacific, where mean nesting size is 82.0 cm CCL in Michoacán, Mexico (n=718, (Alvarado-Díaz and Figueroa, 1992) and 86.7 cm CCL in the Galápagos (n=2708; (Zárate *et al.,* 2003), compared to the 95 cm to 110 cm CCL size range for most green turtles. In addition, Kamezaki and Matsui (1995) found differences in skull morphology among green turtle populations on a broad global scale when analyzing specimens representing west and east Pacific (Japan and Galápagos), Indian Ocean (Comoros and Seychelles), and Caribbean (Costa Rica and Guyana) populations. The eastern Pacific was different from others based on discriminant function analysis (used to discriminate between two or more naturally occurring groups).

Given the information presented above, the SRT concluded, and we concur, that there are five discrete populations entirely within the Pacific Ocean: (1) Central West Pacific, (2) Southwest Pacific, (3) Central South Pacific, (4) Central North Pacific, and (5) East Pacific. These five populations are markedly separated from each other and from populations within the Atlantic Ocean and Indian Oceans as a consequence of physical, ecological, behavioral, and oceanographic factors. Information supporting this conclusion includes genetic analysis, flipper tag recoveries, and satellite telemetry.

Collectively, all observations above led the SRT to propose that green turtles from the following geographic areas might be considered ''discrete'' according to criteria in the joint DPS policy:

(1) North Atlantic Ocean
(2) Mediterranean Sea
(3) South Atlantic Ocean
(4) Southwest Indian Ocean
(5) North Indian Ocean
(6) East Indian Ocean-West Pacific Ocean
(7) Central West Pacific Ocean
(8) Southwest Pacific Ocean
(9) Central South Pacific Ocean
(10) Central North Pacific Ocean
(11) East Pacific Ocean

B. Significance Determination

In accordance with the DPS Policy, the SRT next reviewed whether the population segments identified in the discreteness analysis were biologically and ecologically significant to the taxon to which they belong, which is the taxonomic species *C. mydas.* Data relevant to the significance question include ecological, behavioral, genetic and morphological data. The SRT considered the following factors, listed in the DPS Policy, in determining whether the discrete population segments were significant: (1) Evidence that loss of the discrete segment would result in a significant gap in the range of the taxon; (2) evidence that the discrete segment differs markedly from other populations of the species in its genetic characteristics; and (3) persistence of the discrete segment in an unusual or unique ecological setting. The DPS policy also allows for consideration of other factors if they are appropriate to the biology or ecology of the species, such as unique morphological or demographic characteristics, and unique movement patterns.

1. North Atlantic

Green turtles in the North Atlantic differ markedly in their genetic characteristics from other regional populations. They are strongly divergent from the Mediterranean population (the only other population within Clade I), and turtles from adjacent populations in the eastern Caribbean carry haplotypes from a different clade. The North Atlantic population has globally unique haplotypes. Therefore, the loss of the population would result in significant genetic loss to the species as a whole.

The green turtles within the North Atlantic population occupy a large portion of one of the major ocean basins in the world; therefore, the loss of this segment would represent a significant gap in the global range of green turtles. Green turtles take advantage of the warm waters of the Gulf Stream to nest in North Carolina at 34° N., which is farther from the equator than any other nesting sites outside the Mediterranean Sea. Tagging and telemetry studies show that the North Atlantic green turtle population has minimal mixing with populations in the South Atlantic and Mediterranean regions. The mean size of nesting females in the North Atlantic, which could reflect the ecological setting and/or be genetically based, is larger (average 101.7–109.3 cm CCL; (Guzmán-Hernández, 2001, 2006) than those in the adjacent Mediterranean Sea (average 88–96 cm CCL), and smaller than those at varying locations in the South Atlantic, such as those at Isla Trindade, Brazil (average 115.2 cm CCL; Hirth, 1997; Almeida *et al.,* 2011), Atol das Rocas, Brazil (112.9–118.6 cm CCL; Hirth, 1997; Bellini *et al.,* 2013), and Ascension Island (average 116.8 cm CCL; Hirth, 1997).

Another factor indicating uniqueness of the North Atlantic population is a typical 2-year remigration interval, as compared to 3-year or longer intervals that are more common elsewhere (Witherington *et al.,* 2006).

2. Mediterranean

Mediterranean turtles differ markedly in their genetic characteristics from other regional populations, with globally unique haplotypes and strong divergence from the other population within Clade I (the North Atlantic population). Therefore, the loss of the population would result in significant genetic loss to the species as a whole. Given this genetic distinctiveness and the distinctive environmental conditions, it is likely that turtles from the eastern Mediterranean have developed local adaptations that help them persist in this area. Mediterranean females are smaller than those in any other regional population except the Eastern Pacific, averaging 92.0 cm CCL (Broderick *et al.,* 2003) compared to the global average of 95 cm–110 cm CCL.

The loss of the population would result in a significant gap in the range of the taxon. The population encompasses a large region, separated from other regional populations by large expanses of ocean, and with an apparent biogeographic boundary formed by the western Mediterranean.

Finally, the Mediterranean Sea appears to be a unique ecological setting for the species. It is the most saline marine water basin in the world (38 parts per thousand (ppt) or higher), is nearly enclosed, and is outside the normal latitudinal range for the species, being the farthest from the equator of any green turtle population. Although similar information is not available for green turtles, it has been postulated that the high salinity of sea water in the Mediterranean acts as a ''barrier'' preventing loggerhead sea turtles from moving among the areas of the Western Mediterranean, explaining why they do not mix between the north and south Mediterranean as juveniles (Revelles *et al.,* 2008). All nesting sites within the Mediterranean are between latitudes 31–40° N., which not only affects temperature but results in more seasonal variation in day length and environmental conditions, which may have fostered local adaptations in green turtles living there.

3. South Atlantic

The South Atlantic population has globally unique haplotypes. Therefore, the loss of the population would result in significant genetic loss to the species as a whole. The South Atlantic population contains the only nesting site in the world associated with a mid-ocean ridge. This unique ecological setting at Ascension Island, one of the largest nesting sites within this population, ensures diverse nesting habitats and promotes resilience for the species. This population spans an entire hemispheric ocean basin, and its loss would result in a gap of at least 12,000 km between populations off southeast Africa and those in Florida, clearly a significant gap in the range of the taxon. Brazil and Guinea Bissau may have acted as a refuge for Atlantic green turtles during the Pleistocene period (Reece *et al.,* 2005). The average size of nesting females is larger here than in any other populations, ranging from 112.9–118.6 cm CCL (Hirth, 1997; Almeida *et al.,* 2011) compared to 95–110 cm CCL worldwide, which could reflect an adaptation to local environmental conditions such as habitat, availability of food, water temperature, and population dynamics.

4. Southwest Indian

Within the Southwest Indian Ocean, strong upwelling in the Mozambique Channel produces distinctive areas of high productivity that support a robust turtle population, and complex current patterns in the area create a distinctive ecological setting for green turtles. Madagascar is one of the largest islands in the world and its proximity to the African coast, along with a proliferation of nearby islands, creates a complex series of habitats suitable for green turtles. Loss of this population would leave a gap of over 10,000 km between populations in southern India and those in west-central Africa. Nesting turtles from this population are the largest within the Indian Ocean, ranging from 103 cm (SCL)–112.3 cm (CCL) (Frazier, 1971; 1985) which could reflect growth due to presence of a network of foraging areas and localize migratory movements.

5. North Indian

The ecological setting for this region is unique for green turtles in that it contains some of the warmest and highly saline waters in the world, indicative of the partially enclosed marine habitats within this system. The salinity in the North Indian Ocean varies from 32 to 37 ppt comparable only to the Mediterranean Sea. Salinity in this region varies with local and seasonal differences particularly in the Arabian Sea (dense, high-salinity) and the Bay of Bengal (low-salinity). Although genetic data are very limited for this population, with the only sample being from the Persian Gulf, it has two groups of highly divergent haplotypes that are not found anywhere else in the world (*i.e.,* markedly different genetic characteristics). The loss of this population, and its globally unique haplotypes, which are not found in any other population, would result in significant genetic loss to the species as a whole. This population is isolated from other Indian Ocean populations which would render its loss a significant gap in the range of the species. Nesting turtles are smaller here than in other Indian Ocean regions, possibly reflecting genetic adaptations to local environmental conditions.

6. East Indian-West Pacific

This area of complex habitats at the confluence of the tropical Indian and Pacific Oceans is a well-known hotspot for speciation and diversification of both terrestrial and marine taxa. It is unique in that it contains the most extensive continental shelf globally, and particularly low salinity waters in the northeastern Indian Ocean. Loss of green turtles from this vast area would create a substantial gap in the global distribution and, because this population is located at the center of the species' range, would strongly affect connectivity within the species as a whole. Connectivity is important for the maintenance of genetic diversity and resilience of the species. Genetic data indicate the presence of ancestral haplotypes with significant mtDNA diversity. The loss of this population, and its ancestral haplotypes, would represent a significant genetic loss to the species. The wide size range of nesting females within this population (82.1 cm–105.6 cm; Charuchinda and Monanunsap, 1998; Cheng, 2000) is also an indication of the high level of diversity within this population.

7. Central West Pacific

The Central West Pacific population is genetically significant in that it has both globally unique haplotypes and ancestral haplotypes. The Central West Pacific has no continental shelf habitats, with all nesting occurring on small islands or atolls that are volcanic or coralline limestone. There is an apparent oceanic boundary between the Central West Pacific and the Central North Pacific population and an apparent biogeographic boundary between the Central West Pacific and the East Indian-West Pacific population. Loss of turtles from this population would create a large gap near the center of the geographic range of the species.

8. Southwest Pacific

Clade V haplotypes have only been found at nesting sites in the Southwest Pacific population. In addition to these globally unique haplotypes, the presence of the ancestral haplotypes and significant mtDNA diversity make this population genetically significant.

Unlike most other populations in the Pacific Ocean, this population includes island nesting sites in close proximity to coastal foraging areas. The Great Barrier Reef (GBR) is the largest coral reef system in the world and was periodically isolated over geological time. It provides expansive, year-round foraging habitat for green turtles and supports one of the largest nesting sites in the world.

9. Central South Pacific

This population has globally unique haplotypes. Therefore, the loss of the population would result in significant genetic loss to the species as a whole. To a greater extent than in any other regional population, nesting sites are widely dispersed among a large number of small habitats on islands and atolls. Foraging areas are mostly coral reef ecosystems, with seagrass beds in Tonga and Fiji being a notable exception.

There is an apparent oceanic boundary with the Central North Pacific population. Although turtles in this area are poorly studied, they may have evolved adaptations to persist with this very diffuse metapopulation structure. If green turtles were lost from this entire area, it would create a significant gap in the range across the southern Pacific Ocean.

10. Central North Pacific

Mitochondrial DNA in this extensively sampled region includes globally unique haplotypes. Although two haplotypes are shared with individuals in the Revillagigedos Islands in the East Pacific, there is little evidence of significant ongoing gene flow. The loss of this population would result in significant genetic loss to the species as a whole.

This population has no continental-shelf habitat and all nesting occurs on mid-basin pinnacles. Turtles in this population are known to bask, a rare behavior for modern-day sea turtles, and have unique morphological traits such as unusually large flippers, possibly reflecting adaptations to their ecological setting. This is the most isolated of all populations, with an apparent biogeographic boundary with the Eastern Pacific population and oceanic boundaries with the Central West and Central South Pacific populations. If all turtles were lost from this vast geographic area, it would create a significant gap in the global range of the species.

11. East Pacific

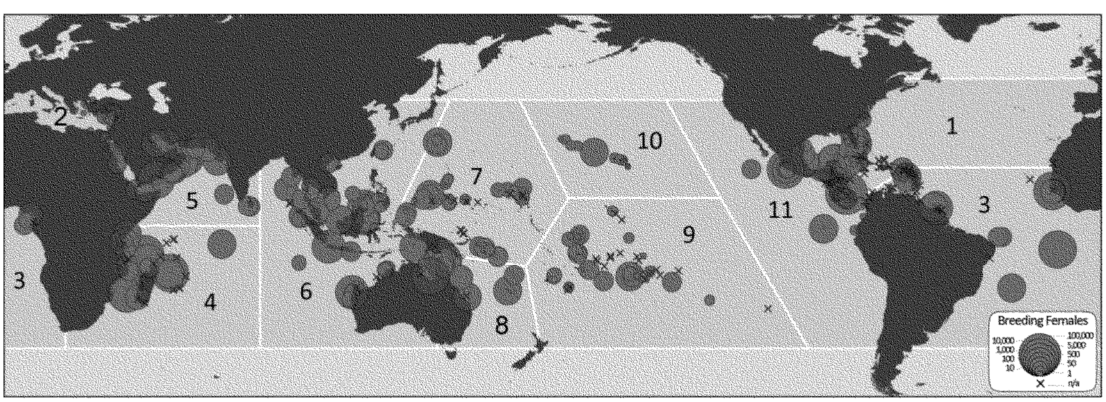
The two cold-water currents on the east side of the Pacific Ocean (the Humboldt Current in the south and the California Current in the north) leave a distinctive region of tropical ocean along the west coasts of Mexico, Central America, and northern South America that is known as the Eastern Pacific Zoogeographic Region (Briggs, 1974). Perhaps as a result, some turtles in this area exhibit a unique overwintering behavior similar to hibernation. This area also has a very narrow continental shelf and low levels of seagrass, resulting in a unique diet for green turtles (*e.g.,* tunicates and red mangrove fruits; Amorocho and Reina, 2007). This population has globally unique haplotypes. Therefore, the loss of the population would result in significant genetic loss to the species as a whole. Mean size of nesting turtles in the East Pacific is smaller, at approximately 82 cm CCL (Pritchard, 1971) than in any other population, which could reflect an adaptation to local ecological conditions, as could the distinctive ''black'' phenotype. The Galapagos Island chain is one of the few areas where green turtles bask (Hawai'i being the other). Loss of all turtles from this population would leave a significant gap in the range of the species as it occurs along much of the eastern boundary of the world's largest ocean.

C. Summary of Discreteness and Significance Determinations

In summary, the 11 discrete populations identified in the Discreteness Determination section were also determined to be significant to the species, *C. mydas.* Each is genetically unique, and many are identified by unique mtDNA haplotypes which could represent adaptive differences. Some populations exist in unique or unusual ecological settings influenced by local ecological and physical factors which may also lead to adaptive differences and represent adaptive potential. Some also possess unique morphological or other demographic characteristics that render them significant. Most populations represent a large portion of the species' range, and their loss would result in a significant gap in the range of the species.

Based on the information provided in the Discreteness Determination and Significance Determination sections above, the SRT identified the following 11 potential green turtle DPSs (Figure 2): (1) North Atlantic, (2) Mediterranean, (3) South Atlantic, (4) Southwest Indian, (5) North Indian, (6) East Indian-West Pacific, (7) Central West Pacific, (8) Southwest Pacific, (9) Central South Pacific, (10) Central North Pacific, and (11) East Pacific. We concur with the findings of the SRT and conclude that the 11 potential DPSs identified by the SRT warrant delineation as DPSs.

Figure 2. Map of all *C. mydas* nesting sites indicating delineation of DPSs: (1) North Atlantic, (2) Mediterranean, (3) South Atlantic, (4) Southwest Indian, (5) North Indian, (6) East Indian-West Pacific, (7) Central West Pacific, (8) Southwest Pacific, (9) Central South Pacific, (10) Central North Pacific, and (11) East Pacific.



VI. Listing Evaluation Process

A. Discussion of Population Parameters for the Eleven Green Turtle DPSs

In these sections, we describe the geographic range of each DPS. We discuss its population parameters, which are derived from population data and influence the persistence of the DPS. These population parameters include: Abundance, growth rates or trends, spatial structure, and diversity or resilience (McElhany *et al.,* 2000). NMFS has used this approach in numerous status reviews. USFWS uses a similar approach, based on Shaffer and Stein (2000), to evaluate a species' status in terms of its representation, resiliency, and redundancy; this methodology has also been a widely accepted approach (Tear *et al.,* 2005). Though expressed differently, these two approaches rely on the same conservation biology principles. Though this information is presented separately from the assessment of threats under section 4(a)(1) of the ESA, population dynamics represent one aspect of the other natural or manmade factors affecting the continued existence of the species that we consider under Factor E.

Complete population abundance and trend estimates do not exist for any of the 11 DPSs. The data used in the Status Review and summarized here represent the best scientific information available. The data are more robust for some areas than for others. For 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 and often non-existent, primarily because these data are, relative to nesting beach studies, logistically difficult and expensive to obtain. Therefore, the primary and best available information source for directly evaluating status and trends of the DPSs is nesting data.

Nesting female abundance estimates for each nesting site or nesting beach are presented in the Status Review for each potential DPS. Accompanying this information is trend information in the form of bar plots and Population Viability Analysis (PVA) models extending 100 years into the future for the 33 sites that met the criteria for depicting the data this way, *i.e.,* recent (<10 year old) data over a given period of time (10 years for bar plots, 15 years for PVA) with consistent protocols and effort during that time.

With regard to spatial structure, the SRT used information from genetic, tagging, telemetry, and demographic data to identify structuring and substructuring within each DPS. This informed the SRT of metapopulation dynamics in order that it might consider these dynamics in considerations about the future of the species, including whether source populations and genetic diversity are being maintained.

With regard to diversity and resilience, the SRT considered the extent of ecological variation, including the overall nesting spatial range, diversity in nesting season, and diversity of nesting site structure and orientation, *e.g.,* whether nesting sites are insular or continental, have a high or low beach face, and whether there are a variety of types of sites. The SRT also considered demographic and genetic diversity of the DPS which may indicate its ability to adapt and thus its resilience. One of the considerations when looking at diversity was the DPS's ability to adapt to climate change including, but not limited to, sea level rise and warming of nesting beaches.

B. Summary of Factors Affecting the Eleven Green Turtle 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 Wildlife Species. Under section 4(a) of the ESA, the Services must determine whether a species is threatened or endangered because of any of the following 5 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.

In this rulemaking, information regarding the status of each of the 11 green turtle DPSs is considered in relation to the five factors provided in section 4(a)(1) of the ESA. That information presented here is a summary of the information in the Status Review. The reader is directed to the subsection within each DPS section of the Status Review titled ''Analysis of Factors Listed Under ESA Section 4(a)(1)'' for a more detailed discussion of the factors.

C. Conservation Efforts

In evaluating the efficacy of protective efforts not yet implemented or not yet proven to be effective, we rely on the Policy on Evaluation of Conservation Efforts When Making Listing Decisions (''PECE''; 68 FR 15100, March 28, 2003), issued jointly by the Services. Information on conservation efforts for each DPS is summarized from the Status Review. For a more detailed description of conservation efforts, please see that document. When assessing conservation efforts, the SRT assumed that all conservation efforts would remain in place at their current levels. In our final determinations, we considered the conservation benefits of continued protections under the ESA.

D. Extinction Risk Assessments and Findings

To analyze the extinction risk of each DPS, the SRT collected and presented information on the six critical assessment elements: (1) Abundance, (2) growth rates/trends, (3) spatial structure, (4) diversity/resilience, (5) five factor analysis/threats, and (6) conservation efforts. Shortly after each presentation, the SRT voted twice: A vote on the contribution of each critical assessment element to extinction risk, and a vote on the overall risk of extinction to the DPS (see section 3.3.4 of the Status Review for a more detailed discussion of this process).

In the first vote, SRT members ranked the importance of each of the four population parameters (Abundance, Trends, Spatial Structure, Diversity/Resilience) by assigning them a value from 1 to 5 for each DPS, with 1 indicating a very low risk and 5 indicating a very high risk. SRT members then ranked the influence of the section 4(a)(1) factors (threats) on the status of each DPS by assigning a value of 0 (neutral effect on status—this could mean that threats are not sufficient to appreciably affect the status of the DPS, or that threats are already reflected in the population parameters), –1 (threats described in the 5-factor analysis suggest that the DPS will experience some decline (<5 percent decline) in abundance within 100 years), or –2 (threats described in the 5-factor analysis suggest that the DPS will experience significant decline (≥5 percent decline) in abundance within 100 years). They then ranked the influence of conservation efforts on the status of each DPS by assigning a value of 0 (neutral effect on status—this could mean that conservation efforts are not sufficient to appreciably affect the status of the DPS, or that conservation efforts are already reflected in the population parameters), +1 (activities described in Conservation Efforts suggest that the DPS will experience <5 percent increase in abundance within 100 years), or +2 (activities described in Conservation Efforts suggest that the DPS will experience ≥5 percent increase in abundance within 100 years). The SRT did note in discussions that none of these elements is entirely independent. Abundance, growth rates, spatial structure, and diversity/resilience are linked and often dependent on each other. Past threats and conservation efforts affect these four population parameters. To minimize ''double counting,'' the SRT considered only those threats and conservation measures that are unlikely to be reflected in the population parameters.

In the second vote, SRT members provided their expert opinion (via vote) on the likelihood that each DPS would reach a critical risk threshold (quasi-extinction) within 100 years. In the Status Review, the SRT defined the critical risk threshold (quasi-extinction) as follows: ''A DPS that has reached a critical risk threshold has such low abundance, declining trends, limited distribution or diversity, and/or significant threats (untempered by significant conservation efforts) that the DPS would be at very high risk of extinction with little chance for recovery.'' Generally, DPSs were considered to have higher viability if they were composed of a number of relatively large populations, distributed throughout the geographic range of the DPS, and exhibited stable or increasing growth rates. DPSs were considered to be at higher risk if they were composed of fewer robust populations or with robust populations all concentrated in a small geographic area, where they might be susceptible to correlated catastrophes. Any DPS with low phenotypic and/or habitat diversity were also considered to be at higher risk because the entire DPS could be vulnerable to persistent environmental conditions (Limpus and Nicholls, 2000; Saba *et al.,* 2008; Van Houtan and Halley, 2011) or stochastic catastrophic events (Hawkes *et al.,* 2007; Van Houtan and Bass, 2007; Fuentes *et al.,* 2011).

Each member was given 100 points to spread across risk categories, reflecting their interpretation of the information for that DPS; the voting results are available in the Status Review. The spread of points is meant to reflect the amount of uncertainty in the risk threshold bins. Risk categories were <1 percent, 1–5 percent, 6–10 percent, 11–20 percent, 21–50 percent, and >50 percent. We note that, presumably because this species is such a long-lived species and, as such, it is unlikely that it would go extinct within 100 years even if it was lost in many places, every DPS received numerous points in the <1 percent category, including those with the most depressed numbers and that face the highest threats.

As noted above, the SRT estimated the likelihood that a population would fall below a critical risk threshold within 100 years. The SRT did not define the critical risk threshold quantitatively but instead provided the following definition: ''A DPS that has reached a critical risk threshold has such low abundance, declining trends, limited distribution or diversity, and/or significant threats (untempered by significant conservation efforts) that the DPS would be at very high risk of extinction with little chance for recovery.''

While the SRT's review of the DPSs' statuses was rigorous and extensive, the framework used does not allow us to easily or clearly translate a particular critical risk category to an ESA listing status. Structured expert opinion is a valid and commonly used method of evaluating extinction risk and forms a useful starting point for our analysis. However, in our judgment, the critical risk threshold approach used for this status review does not directly correlate with the ESA's definitions of endangered and threatened. The ESA defines an ''endangered species'' as ''any species which is in danger of extinction throughout all or a significant portion of its range.'' The critical risk threshold, as defined by the SRT, is a condition worse than endangered, because it essentially precludes recovery. Thus, while the SRT votes informed our listing determinations, we did not equate a particular critical risk category with an ESA listing status, and therefore the votes were not the basis for those determinations. However, to make our proposed listing determinations, we applied the best available science that was compiled by the SRT in examining the definitions of endangered and threatened species under section 3 of the ESA.

After considering the extinction risk, the Services then reviewed the present threats and threats anticipated in the foreseeable future for each DPS. We examined the significant threats to each DPS, how these threats affected that DPS, and how they were predicted to affect the DPS in the foreseeable future. Our analysis weighed each factor within the scope of the ESA's definitions of threatened and endangered for each DPS.

Among other things, the Services also carefully considered where current conditions or protections are present specifically because green turtles are listed under the ESA, and whether those conditions would likely exist absent such a listing. We note that the latter was not considered by the SRT, meaning the SRT conducted all risk analyses assuming all protections would remain in place.

VII. North Atlantic DPS

A. Discussion of Population Parameters for the North Atlantic DPS

The range of the North Atlantic DPS extends from the boundary of South and Central America north along the coast to the northern extent of the green turtle's range to include Panama, Costa Rica, Nicaragua, Honduras, Belize, Mexico, and the United States. It then extends due east across the Atlantic Ocean at 48° N.; follows the coast south to include the northern portion of the Islamic Republic of Mauritania (Mauritania; to 19° N.) on the African continent; and west along the 19° N. latitude to the Caribbean basin, turning south and west at 63.5° W., 19° N., and due south at 7.5° N., 77° W. to the boundary of South and Central to include Puerto Rico, the Bahamas, Cuba, Turks and Caicos Islands, Republic of Haiti (Haiti), Dominican Republic, Cayman Islands, and Jamaica. The North Atlantic DPS includes the Florida breeding population, which was originally listed as endangered (43 FR 32800, July 28, 1978). Critical habitat was previously designated for areas within the range of this DPS (*i.e.,* coastal waters surrounding Culebra Island, Puerto Rico; 63 FR 46693, September 2, 1998).

Green turtle nesting sites in the North Atlantic are some of the most studied in the world, with time series exceeding 40 years in Costa Rica and 35 years in Florida. Seventy-three nesting sites were identified within the North Atlantic DPS, although some represent numerous individual beaches. For instance, Florida nesting beaches were listed by county with the numerous beaches in each county representing one site and, for other U.S. beaches (from Texas to North Carolina), each state's nesting beaches were represented as one site. There are four regions that support high density nesting concentrations for which data were available: Tortuguero, Costa Rica; Mexico (Campeche, Yucatan, and Quintana Roo); Florida, United States; and Cuba. There is one nesting site with >100,000 nesting females (Tortuguero at 131,751; Chaloupka *et al.,* 2008a; Sea Turtle Conservancy, 2013), one with 10,001–100,000 (Quintana Roo, Mexico at 18,257; Julio Zurita, pers. comm. 2012) and six with 1,001–5,000: Cayo Largo, Cuba; Campeche, Yucatan, and Veracruz, Mexico; and Brevard and Palm Beach Counties, FL, United States. There are four with 501–1,000; Tamaulipas, Mexico; Vieques, Puerto Rico; Martin and Indian River Counties, FL, United States; nine with 101–500; 26 with <50; and 26 with numbers unquantified. Seventy-nine percent of the nesting turtles in this DPS nest at Tortuguero.

Of the nesting sites with long-term data sets, both Tortuguero and the index beaches in Florida exhibit a strong positive trend in the PVAs that were conducted on them, as does Isla Aguada, Mexico (one beach in the Campeche group). Three beaches in Cuba (total of 489 nesting females) either showed no trend or a modest positive trend. One beach in Mexico (El Cuyo, Yucatan) exhibited no trend.

Genetic sampling in the North Atlantic DPS has been generally extensive with good coverage of large populations in this region; however, some smaller Caribbean nesting sites are absent and coastal nesting sites in the Gulf of Mexico are under-represented. Genetic differentiation based on mtDNA indicated that there are at least four independent nesting subpopulations in the North Atlantic DPS characterized by shallow regional substructuring: (1) Florida (Hutchinson Island; Lahanas *et al.,* 1994), (2) Cuba (Guanahacabibes Península and Cayería San Felipe; Ruiz-Urquiola *et al.*, 2010), (3) Mexico (Quintana Roo; Encalada *et al.,* 1996), and (4) Costa Rica (Tortuguero; Lahanas *et al.,* 1994). These nesting sites are characterized by common and widespread haplotypes dominated by CM–A1 and/or CM–A3. A relatively low level of spatial structure is detected due to shared common haplotypes, although there are some rare/unique haplotypes at some nesting sites. Connectivity may indicate recent shared common ancestry.

Green turtles nest on both continental and island beaches throughout the range of the DPS (Witherington *et al.,* 2006). Major nesting sites are primarily continental with hundreds of lower density sites scattered throughout the Caribbean. Green turtles nesting in Florida seem to prefer barrier island beaches that receive high wave energy and that have coarse sands, steep slopes, and prominent foredunes. The greatest nesting is on sparsely developed beaches that have minimal levels of artificial lighting. A high-low nesting pattern for Florida and Mexico occurs during the same years; however, nesting in Tortuguero, Costa Rica is not always in sync with Florida and Mexico (*e.g.,* 2011 was a high nesting year in Florida, but for Tortuguero the high nesting year was 2010). The nesting season is similar throughout the range of the DPS, with green turtles nesting from June to November in Costa Rica (Bjorndal *et al.,* 1999), and May through September in the United States, Mexico, and Cuba (Witherington *et al.,* 2006).

B. Summary of Factors Affecting the North Atlantic DPS

1. Factor A: The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

a. Terrestrial Zone

Within the range of the North Atlantic DPS, nesting beaches continue to be degraded from a variety of activities. Destruction and modification of green turtle nesting habitat results from coastal development, coastal armoring, beachfront lighting, erosion, sand extraction, and vehicle and pedestrian traffic on nesting beaches (Witherington and Bjorndal, 1991; Witherington, 1992; Witherington *et al.,* 1996; Lutcavage *et al.,* 1997; Bouchard *et al.,* 1998; Mosier, 1998; Witherington and Koeppel, 2000; Mosier and Witherington, 2002; Leong *et al.,* 2003; Roberts and Ehrhart, 2007). In addition, sea level rise resulting from climate change poses a threat to all nesting beaches. Portions of the Southern United States and Caribbean are found be to highly vulnerable to sea level rise (Melillo *et al.,* 2014). For instance, along the southern portion of the Florida coastline, one climate change model predicted one meter of sea level rise by 2060, resulting in the inundation of more than 50 percent of coastal wildlife refuges (Flaxman and Vargas-Moreno, 2011). Most green turtle nesting in the United States is concentrated along the southeastern coast of Florida with more than 90 percent of nesting occurring from Brevard to Broward counties (*http://ocean.floridamarine.org/SeaTurtle/nesting/FlexViewer/*). Loss of nesting habitat as a result of sea level rise poses a threat to the population. Sea level rise is exacerbated by coastal development and armoring, which prevents the beach from migrating and causes nesting green turtles to abandon their nesting attempts more frequently as a result of their encounter with such structures (Mosier, 1998; Mosier and Witherington, 2000; Rizkalla and Savage, 2011). Females might nest in sub-optimal habitats, where nests are more vulnerable to erosion or inundation (Rizkalla and Savage 2011). As a result, nests would be subject to more frequent inundation, exacerbated erosion, and increased moisture from tidal overwash, which can potentially alter thermal regimes, an important factor in determining the sex ratio of hatchlings.

b. Neritic/Oceanic Zones

Green turtles in the post-hatchling and early-juvenile stages are closely associated with *Sargassum* algae in the Atlantic and Gulf of Mexico (Witherington *et al.,* 2012), and vulnerable to ingesting contaminants such as tar balls and plastics that aggregate in convergent zones where *Sargassum* aggregates (Witherington, 2002). Juvenile and adult green turtles and their nearshore foraging habitats are also exposed to high levels of pollutants, such as agricultural and residential runoff, and sewage which result in degraded foraging habitat (Smith *et al.,* 1992). Further, increased nutrient load in these coastal waters causes eutrophication. Eutrophication is linked to harmful algal blooms that result in the loss and degradation of seagrass beds, and possibly fibropapilloma tumors in green turtles (Milton and Lutz, 2003).

In Cuba, Jamaica, Puerto Rico, and Panama, water quality is also affected by sewage and industrial and agricultural runoff. Pollution remains a major threat in the waters of Jamaica. Major sources of pollution are industrial and agricultural effluent, garbage dumps and solid waste, and household sewage (Greenway, 1977; Green and Webber, 2003).

Nearshore foraging habitats such as seagrass beds are affected by propeller scarring, anchor damage, dredging, sand mining, and marina construction throughout the range of the DPS (Smith *et al.,* 1992; Dow *et al.,* 2007; Patrício *et al.,* 2011). Sand placement projects along the Florida coastline affect nearshore reefs as a result of direct burial of portions of the reef habitat and loss of food sources available to green turtles (Lindeman and Snyder, 1999).

The SRT found, and we concur, that the North Atlantic DPS of the green 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. The increasing threats to the terrestrial and marine habitats are not reflected in the current trend for the North Atlantic DPS, as it was based on nesting numbers and not on all current life stages. These increasing threats to the population will become apparent when those life stages affected by the threats return to nest, as the trend information is based solely on numbers of nests. This lag time was considered in our analysis. For example, a threat that affects the oceanic juvenile phase would not be detected until those turtles return to nest, approximately 15 to 20 years later. The SRT also found, and we concur, that coastal development, beachfront lighting, erosion, sand extraction, and sea level rise increasingly impact nesting beaches of this DPS and are increasing threats to the DPS.

2. Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

A partial list of the countries within the range of the North Atlantic DPS where ongoing intentional capture of green turtles occurs, includes Costa Rica (Mangel and Troëng, 2001; Gonzalez Prieto and Harrison, 2012), Mexico (Seminoff, 2000; Gardner and Nichols, 2001; Dirado *et al.,* 2002; Guzmán-Hernández and García Alvarado, 2011), Cuba (Fleming, 2001; F. Moncado, Ministerio de la Industria Pesquera, pers. comm., 2013), Nicaragua (Lagueux, 1998; Humber *et al.,* 2014), the Bahamas (Fleming, 2001), Jamaica (Haynes-Sutton *et al.,* 2011), and the Cayman Islands (Fleming, 2001). Harvest remains legal in several of these countries (Humphrey and Salm, 1996; Wamukoya *et al.*, 1996; Fleming, 2001; Fretey, 2001; Bräutigam and Eckert, 2006).

The commercial artisanal green turtle fishery in Nicaragua continues to be a threat to the Tortuguero nesting population, the largest remaining green turtle population in the Atlantic (Campbell and Lagueux, 2005). Local demand for turtle meat in coastal communities continues (Garland and Carthy, 2010). There is a legal turtle fishery on the Caribbean coast that is located in the most important developmental and foraging habitat for Caribbean green turtles (Fleming, 2001; Campbell and Lagueux, 2005). The hunting of juvenile and adult turtles continues both legally and illegally in many foraging areas where green turtles originating from Florida nesting beaches are known to occur (Chacón, 2002; Fleming, 2001).

Direct take of eggs is also an ongoing threat in Panama (Evans and Vargas, 1998). Green turtles nesting on Belize's beaches and foraging along its coast are harvested in the Robinson Point area and sold in markets and restaurants (Searle, 2003). Large numbers of green turtles are captured in the area southeast of Belize, an area which may be an important migratory corridor (Searle, 2004). There are important feeding grounds in the Banc d'Arguin, Mauritania. While the frequency of green turtle nesting in Mauritania is not known, green turtle nests are reported as being harvested there (Fretey, 2001; Fretey and Hama, 2012).

Commercial harvest of green turtles was a factor that contributed to the historic decline of this DPS. Current harvest of green turtles and eggs, in a portion of this DPS, continues to be significant threat to the persistence of this DPS.

3. Factor C: Disease or Predation

Fibropapillomatosis (FP) has been found in green turtle populations in the United States (Hirama, 2001; Ene *et al.,* 2005; Foley *et al.,* 2005; Hirama and Ehrhart, 2007), the Bahamas, the Dominican Republic, Puerto Rico (Dow *et al.*, 2007; Patrício *et al.,* 2011), Cayman Islands (Wood and Wood, 1994; Dow *et al.,* 2007), Costa Rica (Tortuguero; Mangel and Troëng, 2001), Cuba (Moncada and Prieto, 2000), Mexico (Yucatan Peninsula; K. Lopez, pers. comm., as cited in MTSG, 2004), and Nicaragua (Lagueux, 1998).

FP continues to be a major problem in some lagoon systems and along the nearshore reefs of Florida. It is a chronic, often lethal disease occurring predominantly in green turtles (Van Houtan *et al.,* 2014). A correlation appeared to exist between these degraded habitats and the prevalence of FP in the green turtles that forage in these areas but no direct link was established (Aguirre and Lutz, 2004; Foley *et al.,* 2005). Indeed, across green turtle populations, it is widely observed that FP occurs most frequently in eutrophied and otherwise impaired waterways (Herbst, 1994; Van Houtan *et al.,* 2010). A recent study establishes that eutrophication substantially increases the nitrogen content of macroalgae, thereby promoting the latent herpes virus which causes FP tumors in green turtles (Van Houtan *et al.,* 2014) although it is argued that there is no inferential framework to base this conclusion (Work *et al.,* 2014). Despite the high incidence of FP among foraging populations, there is no conclusive evidence on the effect of FP on reproductive success (Chaloupka and Balazs, 2005).

Harmful algal blooms, such as a red tide, also affect green turtles in the North Atlantic DPS. In Florida, the species that causes most red tides is *Karenia brevis,* a dinoflagellate that produces a toxin (Redlow *et al.,* 2002). Since 2007, there were two red tide events, one in 2007 along the east coast of Florida, and one in 2012 along the west coast of Florida. Sea turtle stranding trends indicated that these events were acting as a mortality factor (A. Foley, Florida Fish and Wildlife Conservation Commission, pers. comm., 2013). These events may impact a population's present and future reproductive status.

Predators such as raccoons (*Procyon lotor*), feral hogs (*Sus scrofa*), foxes (*Urocyon cinereoargenteus* and *Vulpes vulpes*), and coyotes (*Canis latrans*) may take significant numbers of turtle eggs (Stancyk, 1982; Allen *et al.,* 2001). Nest protection programs are in place at most of the major nesting beaches in the North Atlantic DPS, although they are managed at varying levels and degrees of effectiveness (Engeman *et al.,* 2005). Predator species that are particularly difficult to manage include red fire ants (*Solenopsis invicta*) and jaguars (*Panthera onca*) (Wetterer, 2006; Prieto and Harrison, 2012).

Although FP disease is of major concern, with increasing levels in some green turtle populations in this DPS, it should be noted there is uncertainty of the long-term survivability and effect on the reproductive effort of the population. Predation is known to occur throughout this DPS, and we find it to be a significant threat to this DPS in the absence of well managed nest protection programs.

4. Factor D: Inadequacy of Existing Regulatory Mechanisms

At least 15 regulatory mechanisms that apply to green turtles regionally (*e.g.,* U.S. Magnuson-Stevens Fishery Conservation and Management Act) or globally (*e.g.,* Convention on International Trade in Endangered Species of Wild Fauna and Flora) apply to green turtles within the North Atlantic Ocean. The analysis of these existing regulatory mechanisms assumed that all would remain in place at their current levels.

In the United States, regulatory mechanisms that protect green turtles are in place and include State, Federal, and international laws. The green turtle was listed under the ESA in 1978, providing relatively comprehensive protection and recovery activities to minimize the threats to green turtles in the United States. Considering the dependence of the species on conservation efforts, significant concerns remain regarding the inadequacy of regulatory mechanisms. The development and implementation of Turtle Excluder Devices (TEDs) in the shrimp trawl fishery was likely the most significant conservation accomplishment for North Atlantic green turtles in the marine environment since their 1978 ESA listing. In the southeast United States and Gulf of Mexico, TEDs have been mandatory in shrimp and flounder trawls for over a decade. These regulations are implemented and enforced to varying degrees throughout the Gulf and U.S. Southeast Atlantic. For example, the State of Louisiana prohibits enforcement of TED regulations and tow time limits. In other States, enforcement of TED regulations depends on available resources, and illegal or improperly installed TEDs continue to contribute to mortality of green turtles. Further, TEDs are not required in all trawl fisheries, and green turtle mortality continues in the Gulf of Mexico, where shrimp trawling is the highest (Lewison *et al.,* 2014). There are also regulatory mechanisms in place that address the loss of nesting habitat, such as the Florida Administrative Code Rule 62B–33.0155, which addresses threats from armoring structures. However, these regulatory mechanisms allow for variances and armoring permits continue to be issued along nesting beaches.

Other threats, such as light pollution on nesting beaches, marine debris, vessel strikes, and continued direct harvest of green turtles in places like Nicaragua, are being addressed to some extent by regulatory mechanisms, although they remain a problem. In addition, other regional and national legislation to conserve green turtles (often all sea turtles) exists throughout the range of the DPS. The extent to which threats have been reduced as a result of these efforts is difficult to ascertain. When the SRT assessed conservation efforts, it assumed that all conservation efforts would remain in place at their current levels. The following countries have laws to protect green turtles: The Bahamas, Belize, Bermuda, Canary Islands, Cayman Islands, Costa Rica, Cuba, Dominican Republic, Guatemala, Haiti, Honduras, Jamaica, Mauritania, Mexico, Nicaragua, Panama, and the United States (including the commonwealth of Puerto Rico).

With regard to the United States, the key law currently protecting green turtles is the ESA. This law has been instrumental in conserving sea turtles, eliminating directed take of turtles in U.S. waters unless authorized by permit and reducing indirect take. In addition, the Magnuson-Stevens Fishery Management and Conservation Act has been effective at mandating responsible fishing practices and bycatch mitigation within fleets that sell fisheries products to the United States, and the Marine Turtle Conservation Act authorizes a dedicated fund to support marine turtle conservation projects in foreign countries, with emphasis on protecting nesting populations and nesting habitat. In addition, at least 12 international treaties and/or regulatory mechanisms apply to the conservation of green turtles in the North Atlantic DPS.

Outside of the United States, there are some national regulations that address the harvest of green turtles as well as the import and export of turtle parts. These regulations allow for the harvest of green turtles of certain sizes, months, or for ''traditional'' use. Gear restrictions and TED requirements exist in a few countries, although the compliance level is unknown. Our Status Review did not reveal regulatory mechanisms in place to specifically address marine pollution, sea level rise, and other effects of climate change that continue to contribute to the extinction risk of this DPS.

5. Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

a. Incidental Bycatch in Fishing Gear

Fisheries bycatch in artisanal and industrial fishing gear continues to be a major threat to green turtles in the North Atlantic DPS. The adverse impacts of bycatch on sea turtles has been documented in marine environments throughout the world (National Research Council, 1990b; Epperly, 2003; Lutcavage *et al.,* 1997). The lack of comprehensive and effective monitoring and bycatch reduction efforts in many pelagic and near-shore fisheries operations throughout the range of the North Atlantic DPS still allows substantial direct and indirect mortality (NMFS and USFWS, 2007).

i. Gill Net and Trawl Fisheries

Gill net fisheries may be the most ubiquitous of fisheries operating in the neritic range of the North Atlantic DPS. In the United States, some states (*e.g.,* South Carolina, Georgia, Florida, Louisiana, and Texas) have prohibited gill nets in their waters, but there remain active gill net fisheries in other U.S. states, in U.S. Federal waters, Mexican waters, Central and South America, and the Northeast Atlantic. Finfish fisheries accounted for the greatest proportion of turtle bycatch (53 percent) in Cuba. In Jamaica, fish traps and gill nets are the gear primarily identified in sea turtle bycatch. Purse seine and gill nets are used commonly in the waters of the Dominican Republic (Dow *et al.,* 2007). In Costa Rica, gill nets, hook and line, and trawls are the main gear types deployed (Food and Agriculture Organization of the United Nations, 2004). Shark-netting operations in Panama are known to capture green turtles (Meylan *et al.,* 2013).

The development and implementation of TEDs in the U.S. shrimp trawl fishery was likely the most significant conservation accomplishment for North Atlantic green turtles in the marine environment since their 1978 ESA listing. In the southeast United States and Gulf of Mexico, TEDs have been mandatory in shrimp and flounder trawls for over a decade. However, compliance varies throughout the States, and green turtle mortality continues in the Gulf of Mexico, where shrimp trawling is the highest (Lewison *et al.,* 2014). With the current regulations in place, an estimated 3,000 green turtles are captured (1,400 killed) by shrimp trawls each year in the Gulf and U.S. Southeast Atlantic (*http://sero.nmfs.noaa.gov/protected_resources/section_7/freq_biop/documents/fisheries_bo/shrimp_biop_2014.pdf*). These regulations are implemented and enforced to varying degrees throughout the Gulf and U.S. Southeast Atlantic (see discussion in Factor D).

ii. Dredge Fishing

Dredge fishing gear is the predominant gear used to harvest sea scallops off the mid- and northeastern U.S. Atlantic coast. Sea scallop dredges are composed of a heavy steel frame and cutting bar located on the bottom part of the frame and a bag made of metal rings and mesh twine attached to the frame. Turtles can be struck and injured or killed by the dredge frame and/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.

b. Channel Dredging

In addition to the destruction or degradation of habitat as described in Factor A above, periodic dredging of sediments from navigational channels can also result in incidental mortality of sea turtles. Direct injury or mortality of green turtles by dredges has been well documented in the southeastern and mid-Atlantic U.S. (National Research Council, 1990b). From 1980 to 2013, 105 green turtles were impacted as a result of dredging operations in the U.S Atlantic and Gulf of Mexico. Solutions, including modification of dredges, have been successfully implemented to reduce mortalities and injuries to sea turtles in the United States (73 FR 18984, April 8, 2008; 77 FR 20728, April 6, 2012), and NMFS imposes annual take limits based on the expected number of green turtles impacted that will not, directly or indirectly, appreciably reduce the likelihood of survival and recovery of the green turtle in the wild.

c. Vessel Strikes and Boat Traffic

Boat strikes have been shown to be a major mortality source in Florida (Singel *et al.,* 2003). Vessel strikes are a growing concern and, as human populations increase in coastal areas, vessel strikes are likely to increase (NMFS and FWS, 2008). From 2005 to 2009, 18.2 percent of all stranded green turtles (695 of 3,818) in the U.S. Atlantic (Northeast, Southeast, and Gulf of Mexico) were documented as having sustained some type of propeller or collision injuries (L. Belskis, NMFS, pers. comm., 2013). It is quite likely that this is a chronic, albeit unreported, problem near developed coastlines in other areas as well, such as Panama (*e.g.,* Orós *et al.,* 2005).

d. Effects of Climate Change and Natural Disasters

While sea turtles have survived past eras that have included significant temperature fluctuations, future climate change is expected to happen at unprecedented rates, and if turtles cannot adapt quickly, they may face local to widespread extirpations (Hawkes *et al.,* 2009). Climate change and sea level rise have the potential to affect green turtles significantly in the North Atlantic DPS. North Atlantic turtle populations could be affected by the alteration of thermal sand characteristics of beaches (from warming temperatures), resulting in the reduction or cessation of male hatchling production (Hawkes *et al.,* 2009; Poloczanska *et al.,* 2009). Increased sea surface temperatures may alter the timing of nesting for some stocks (Weishampel *et al.,* 2004), although the implications of changes in nesting timing are unclear. Changes in sea temperatures will also likely alter seagrass, macroalgae, and invertebrate populations in coastal habitats in many regions (Scavia *et al.,* 2002). Further, a significant rise in sea level, as is projected for areas within the range of the North Atlantic DPS (Flaxman and Vargas-Moreno, 2011), could significantly restrict green turtle nesting habitat due to coastal development. Structures on the landward side of the beach can effectively prevent access to nesting habitat and reduce available nesting habitat (Mosier, 1998). The increasing interaction between the structures and the hydrodynamics of tide and current, due to sea level rise, often results in the alteration of the beach profile seaward and in the immediate vicinity of the structure (Pilkey and Wright, 1988; Terchunian, 1988; Tait and Griggs, 1990; Plant and Griggs, 1992), increased longshore currents that move sand away from the area, loss of interaction between the dune and the beach berm, and concentration of wave energy at the ends of the structure (Schroeder and Mosier, 1996). Impacts from global climate change induced by human activities are likely to become more apparent in future years (IPCC, 2007).

Periodic hurricanes and other weather events are generally localized and rarely result in whole-scale losses over multiple nesting seasons. However, storm intensity and frequency are predicted to increase as a result of climate change (Melillo *et al.,* 2014). The negative effects of hurricanes on low-lying and/or developed shorelines may be longer-lasting and a greater threat to the DPS overall when combined with the effects of climate change, and particularly sea level rise.

e. Effects of Cold Stunning

Cold stunning is the hypothermic reaction that occurs when sea turtles are exposed to prolonged cold water temperatures. Cold stunning of green turtles regularly occurs 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 Lagoon system and the panhandle of Florida (Mendonça and Ehrhart, 1982; Witherington and Ehrhart, 1989; Foley *et al.,* 2007); and Texas inshore waters (Hildebrand, 1982; Shaver, 1990). Cold-stunning events at these foraging areas (Witherington and Ehrhart, 1989; McMichael *et al.,* 2006) leads to mortality of juvenile and adult green turtles, which may affect the present and future green turtle population trend.

f. Contaminants and Marine Debris

Several activities associated with offshore oil and gas production, including oil spills, operational discharge, seismic surveys, explosive platform removal, platform lighting, and drilling and production activities, are known to affect sea turtles (National Research Council, 1996; Davis *et al.,* 2000; Viada *et al.,* 2008; Conant *et al.,* 2009; G. Gitschlag, NMFS, pers. comm., 2007, as cited in Conant *et al.,* 2009). Oil spills near nesting beaches just prior to or during the nesting season place nesting females, incubating egg clutches, and hatchlings at significant risk from direct exposure to contaminants (Fritts and McGehee, 1982; Lutcavage *et al.,* 1997; Witherington, 1999), and have negative impacts on nesting habitat. The Deepwater Horizon (Mississippi Canyon 252) oil spill, which started April 20, 2010, discharged oil into the Gulf of Mexico through July 15, 2010. Witherington *et al.* (2012) note that the Deepwater Horizon oil spill was particularly harmful to pelagic juvenile green turtles. Due to their size, turtles in these stages are more vulnerable as a result of ingesting contaminants (Witherington, 2002).

Green turtles are affected by anthropogenic marine debris (including discarded fishing gear) and plastics throughout the North Atlantic DPS. Juvenile green turtles in pelagic waters are particularly susceptible to these effects as they feed on Sargassum in which there is a high occurrence of debris (Wabnitz and Nichols, 2010; Witherington *et al.,* 2012). In recent decades, there has been an increase in stranded green turtles reported as affected by discarded fishery gear throughout the southeastern United States (Teas and Witzell, 1996; Adimey *et al.,* 2014).

C. Conservation Efforts for the North Atlantic DPS

In the North Atlantic, nest protection efforts have been implemented on two major green turtle nesting beaches, Tortuguero National Park in Costa Rica and Florida, and progress has been made in reducing mortality from human-related impacts on other nesting beaches. Tortuguero National Park was established in 1976 to protect the nesting turtles and habitat at this nesting beach, which is by far the largest in the DPS and the western hemisphere. Since that time, the harvest of nesting turtles on the beach has been reduced by an order of magnitude (Bjorndal *et al.,* 1999). At Tortuguero, Sea Turtle Conservancy researchers and volunteers regularly monitor green turtle nesting trends, growth rates and reproductive success, and also conduct sea turtle lighting surveys, education, and community outreach.

In Florida, a key effort was the acquisition of the Archie Carr National Wildlife Refuge in Florida in 1991 by Federal, State, Brevard and Indian River counties, and a non-governmental organization, where nesting densities range from 36 nests/km (22 nests/mi) to 262 nests/km (419 nests/mi) (D. Bagley, University of Central Florida, pers. comm., 2014; K. Kneifl, USFWS, pers. comm., 2014). 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, Hobe Sound National Wildlife Refuge, as well as coastal national seashores such as the Dry Tortugas National Park and Canaveral National Seashore, military installations such as Patrick Air Force Base and Canaveral Air Force Station, and State parks where green turtles regularly nest, provide protection for nesting turtles. However, despite these efforts, alteration of the coastline continues and, outside of publicly-owned lands, coastal development and associated coastal armoring remain serious threats.

Considerable effort has been expended since the 1980s to document and reduce commercial fishing bycatch mortality. In the Atlantic and Gulf of Mexico, measures (such as gear modifications, changes to fishing practices, and time/area closures) are required to reduce sea turtle bycatch in pelagic longline, mid-Atlantic gill net, Virginia pound net, scallop dredge, and southeast shrimp and flounder trawl fisheries. However, enforcement of regulations depends on available resources, and bycatch continues to contribute to mortality. Since 1989, the United States has prohibited the importation of shrimp harvested in a manner that adversely affects sea turtles.

As a result of conservation efforts, many of the intentional impacts directed at sea turtles have been lessened. For example, harvest of eggs and adults has been reduced at several nesting areas, including Tortuguero, and an increasing number of community-based initiatives are in place to reduce the take of turtles in foraging areas. However, despite these advances, human impacts continue throughout the North Atlantic. The lack of effective monitoring in pelagic and near-shore fisheries operations still allows substantial direct and indirect mortality, and the uncontrolled development of coastal and marine habitats threatens to destroy the supporting ecosystems of long-lived green turtles.

D. Extinction Risk Assessment and Findings for the North Atlantic DPS

In the North Atlantic DPS, there are several regions that support high density nesting concentrations, including possibly the largest in the world at Tortuguero, Costa Rica. Green turtle nesting population trends have been encouraging, exhibiting long-term increases at all major nesting sites, including Tortuguero (Troëng, 1998; Campbell and Lagueux, 2005; Troëng and Rankin, 2005) and Florida (Chaloupka *et al.,* 2008; B. Witherington, Florida Fish and Wildlife Conservation Commission, pers. comm., 2013). The North Atlantic DPS is characterized by geographically widespread nesting at a diversity of sites, both mainland and insular. The increasing threats are not reflected in the current trend for the North Atlantic DPS as it was based on nesting numbers and not all current life stages. These increasing threats to the population will become apparent when those life stages affected by the threats return to nest as the trend information is based solely on numbers of nests. This lag time was considered in our analysis. However, the 5-factor (section 4(a)(1) of the ESA) analysis revealed continuing threats to green turtles and their habitat that affect all life stages.

On nesting beaches, many portions of the DPS continue to be exposed to, and are negatively impacted by, coastal development and associated beachfront lighting, coastal armoring, and erosion as described in Factor A above. Impacts from such development are further exacerbated by existing and planned shoreline development and shoreline engineering. The current and anticipated increase in armored shoreline along high density nesting beaches, particularly in Florida, is a substantial unresolved threat to the recovery and stability of this DPS as it will result in the permanent loss of nesting habitat.

Nests and hatchlings are susceptible to predation which is prevalent throughout the beaches within the range of the North Atlantic DPS. Predation would be an increasing threat without nest protection and predatory control programs in place.

Nesting beaches are also extremely susceptible to sea level rise, which will exacerbate some of the issues described above in addition to leading to the potential loss of nesting beaches. Along the southeastern United States, one climate change model predicted a 1-meter sea level rise by 2060, resulting in the inundation of more than 50 percent of coastal wildlife refuges (Flaxman and Vargas-Moreno, 2011). Green turtle nesting in Florida is concentrated along coastal wildlife refuges in southern Florida such as Hobe Sound National Wildlife Refuge and the Archie Carr National Wildlife Refuge, with more than 90 percent of nesting occurring along southeast Florida. This increase in sea level will result in the permanent loss of current green turtle nesting habitat. Loss of beach is expected to be worse as a result of the increase in hurricane frequency and intensity (Flaxman and Vargas-Moreno, 2011). The increasing threat of coastal erosion due to climate change and sea level rise is expected to be exacerbated by increasing human-induced pressures on coastal areas (IPCC, 2007).

In the water, fisheries bycatch, habitat degradation, direct harvest, and FP are major threats to green turtles in the North Atlantic DPS. Artisanal and industrial fishing gear, including drift nets, set nets, pound nets, and trawls, still cause substantial direct and indirect mortality of green turtles (NMFS and USFWS, 2007). In addition, degradation and loss of foraging habitat due to pollution, including agricultural and residential runoff, anchor damage, dredging, channelization, and marina construction remains a threat to both juvenile and adult green turtles. Many green turtles in this DPS remain susceptible to direct harvesting. Current legal and illegal harvest of green turtles and eggs for human consumption continues in the eastern Atlantic and the Caribbean. A remaining threat is the directed harvest of turtles in Nicaragua that nest at Tortuguero and thus belong to the largest and arguably the most important population within the DPS (although this population continues to increase in spite of the harvest). However, potential degradation or loss of other, smaller populations is also of concern, as these contribute to the diversity and resilience of the DPS. Finally, the prevalence of FP has reached epidemic proportions in some parts of the North Atlantic DPS. The extent to which this will affect the long-term outlook for green turtles in the North Atlantic DPS is unknown. Nesting trends across the DPS continue to increase despite the high incidence of the disease.

While the Status Review indicates that the DPS shows strength in many of the critical population parameters (abundance, population trends, spatial structure, and diversity/resilience), as indicated above, numerous threats continue to act on the DPS, including habitat degradation (coastal development and armoring, loss of foraging habitat, and pollution), bycatch in fishing gear, continued turtle and egg harvesting, FP, and climate change. Importantly, the analysis of threats in the Status Review was conducted assuming current management regimes would continue.

Many of the gains made by the species over the past few decades are a direct result of ESA protections in the United States, as well as protections by U.S. States and local jurisdictions and other countries within the DPS range that are influenced by the species' ESA status.

Because the green turtle is currently listed under the ESA, take can only be authorized in the United States through the processes provided in sections 7 and 10 of the ESA and their implementing regulations. In the southeastern United States, threats to nesting beaches and nearshore waters include: Sand placement on nesting beaches and associated impacts to nearshore hardbottom habitat; groin, jetty and dock construction; and other activities. Any such activities that are currently funded, permitted and/or authorized by Federal agencies are subject to consultation with USFWS and NMFS, and therefore are subject to reasonable and prudent measures to minimize effects of these activities as well as conservation recommendations associated with those consultations. Federally-managed fisheries are also subject to interagency consultation under section 7 of the ESA. During the consultation process NMFS and USFWS have an opportunity to work with the action agency to design practices to minimize effects on green turtles, such as when the activity occurs in areas or habitats used mostly by green turtles (*i.e.,* seagrass beds and nesting beaches). Activities that affect green turtles and do not involve Federal agencies, such as beach driving, some beach armoring, and research, must comply with section 10 of the ESA to avoid violating the statute. Section 10 permits require avoiding, minimizing, and mitigating impacts to green turtles to the extent possible. In addition to the above requirements, the requirement for use of TEDs in fisheries within the United States and in fisheries outside of the United States that export wild-caught shrimp to the United States is tied to listing under the ESA.

This DPS has exhibited increases at major nesting sites, and has several stronghold populations. Green turtles in the U.S. Atlantic have increased steadily since being protected by the ESA (Suckling *et al.,* 2006). ESA driven programs such as land acquisition, nest protection, development of the TEDs, and educational programs provide a conservation benefit to green turtles. The species is conservation dependent or conservation-reliant in that even when biological recovery goals are achieved, maintenance of viable populations will require continuing, species-specific intervention (Scott *et al.,* 2010). Without alternate mechanisms in place to continue certain existing conservation efforts and protections, threats would be expected to increase and population trends may be curtailed or reversed. Considering the conservation dependence of the species, significant concerns remain regarding the inadequacy of regulatory mechanisms (one of the five section 4(a)(1) factors (Factor D), especially when we evaluate the status of the DPS absent the protections of the ESA.

For the above reasons, we propose to list the North Atlantic DPS as threatened. We do not find the DPS to be in danger of extinction presently because of the increasing nesting population trends and geographically widespread nesting at a diversity of sites; however, continued threats are likely to endanger the DPS within the foreseeable future.

VIII. Mediterranean DPS

A. Discussion of Population Parameters for the Mediterranean DPS

The Mediterranean Sea is a virtually enclosed basin occupying an area of approximately 2.5 million square kilometers. The Mediterranean DPS is bounded by the entire coastline of the Mediterranean Sea, excluding the Black Sea. The westernmost border of the range of this DPS is marked by the Strait of Gibraltar (Figure 2).

Nesting in the Mediterranean occurs mostly in the eastern Mediterranean, with three nesting concentrations in Turkey, Cyprus, and Syria. Currently, approximately 452 to 2,051 nests are laid in the Mediterranean each year—about 70 percent in Turkey, 15 percent in Cyprus, and 15 percent in Syria, with trace nesting in Israel, Egypt, the Hellenic Republic (Greece), and Lebanon (Kasparek *et al.,* 2001; Rees *et al.,* 2008; Casale and Margaritoulis, 2010). There are no sites with greater than 500 nesting females. These numbers are depleted from historical levels (Kasparek *et al.,* 2001). In terms of distribution of nesting sites in the Mediterranean, there are 32 sites, with Akyatan, Turkey being the largest nesting site, hosting 25 percent of the total annual nesting (35–245 nesting females; Türkozan and Kaska, 2010).

There are seven sites for which 10 years or more of recent data are available for annual nesting female abundance (a criterion for presenting trends in a bar graph). Of these, only one site—West Coast, Cyprus—met our standards for conducting a PVA. Of the seven sites, five appeared to be increasing, although some only slightly, and two had no apparent trend. However, while the Mediterranean DPS appears to be stable or increasing, it is severely depleted relative to historical levels. This dynamic is particularly apparent along the coast of Palestine/Israel, where 300–350 nests were deposited each year in the 1950s (Sella, 1995) compared to a mean of eight nests each year from 1993 to 2008 (Casale and Margaritoulis, 2010).

With regard to spatial structure, genetic sampling in the Mediterranean has been extensive and the coverage in this region is substantial. Within the Mediterranean, rookeries are characterized by one dominant haplotype CM–A13 and a recent study showed no population substructuring between several rookeries in Cyprus and Turkey (Bagda *et al.,* 2012). However, analysis using unpublished data from additional rookery samples in Cyprus shows evidence for two stocks: Cyprus (Karpaz, North Cyprus and Lara Bay; Bagda *et al.,* 2012; Dutton unpublished data, 2013); and Turkey (Akayatan, Alata, Kazanli, Samandag and Yumurtalık; Bagda *et al.,* 2012). The demography of green turtles in the Mediterranean appears to be consistent among the various nesting assemblages (Broderick and Godley, 1996; Broderick *et al.,* 2002a). This consistency in parameters such as mean nesting size, inter-nesting interval, clutch size, hatching success, nesting season, and clutch frequency suggests a low level of population structuring in the Mediterranean. Mediterranean turtles have not been detected foraging outside the Mediterranean (*e.g.,* Lahanas *et al.,* 1998; Monzón-Argüello *et al.,* 2010). Despite years of flipper tagging (Demetropoulos and Hadjichristophorou, 1995, 2010; Y. Kaska, Pamukkale University, pers. comm., 2013), few tag recoveries have been reported. However, satellite tracking revealed that post-nesting turtles migrate primarily along the coast from their nesting beach to foraging grounds, increasing the likelihood of interacting with fisheries (Broderick *et al.,* 2002a).

With regard to diversity and resilience, the overall spatial range of the DPS is limited. Green turtle nesting is found primarily in the eastern Mediterranean (Turkey, Syria, Cyprus, Lebanon, Israel, and Egypt: Kasparek *et al.,* 2001). The nesting season is consistent throughout the range of this DPS (June to August; Broderick *et al.,* 2002a), thus limiting the temporal buffering against climate change in terms of impacts due to storms and other seasonal events. The fact that turtles nest on both insular and continental sites suggests some degree of nesting diversity, but with the sites so close together, the benefits of this diversity may be minimal.

B. Summary of Factors Affecting the Mediterranean DPS

1. Factor A: The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

a. Terrestrial Zone

In the Mediterranean, destruction and modification of green turtle nesting habitat result from coastal development and construction, beachfront lighting, sand extraction, beach erosion, vehicular and pedestrian traffic, and beach pollution (Kasparek *et al.,* 2001; Casale and Margaritoulis, 2010). These activities may directly affect the amount and suitability of nesting habitat available to nesting females and thus affect the nesting success of green turtles, as well as the survivability of eggs and hatchlings. In Turkey, coastal construction on Samandağ and Kazanli beaches is of concern, particularly from associated lighting and human activities on the beach (Türkozan and Kaska, 2010). In Cyprus, the increased construction of beachfront hotels and other properties in some areas in recent years, as well as the associated increase in beachfront lighting and human activity on the beach, is decreasing the quality of nesting habitat (Demetropoulos and Hadjichristophorou, 2010; Fuller *et al.,* 2010). In Turkey and Latakia beach in Syria, beach erosion and sand extraction also pose a problem to green turtle nesting habitat (Türkozan and Kaska, 2010; Rees *et al.,* 2010).

Nesting beaches in the eastern Mediterranean are exposed to high levels of pollution and marine debris, in particular the beaches of Cyprus, Turkey, and Egypt (Camiñas, 2004). In Turkey, marine debris washing ashore is a substantial problem and has degraded nesting beaches, especially Akyatan and Samandağ beaches. In Syria, Jony and Rees (2008) reported that beaches contain a large amount of plastic litter that washes ashore or is blown in from dumps located in the beach dunes; this litter has been documented as accumulating in such large amounts that it can hinder nesting females from locating suitable nesting sites and cause emergent hatchlings to have difficulty crawling to the sea (Rees *et al.,* 2010). In Cyprus, marine debris has also been a significant problem on some beaches, although organized beach clean-ups in recent years have greatly reduced the amount of litter on the beach (Demetropoulos and Hadjichristophorou, 2010; Fuller *et al.,* 2010).

b. Neritic/Oceanic Zones

Dynamite fishing and boat anchors affect green turtles and their habitat in the Mediterranean. Khalil *et al.* (2009) reported that dynamite fishing offshore of nesting beaches is a common problem in Lebanon. Illegal dynamite fishing also occurs year round in Libya (Hamza, 2010), and, although illegal, explosions at sea that are likely due to dynamite fishing have been reported off the coast of Syria (Saad, unpubl. data, as cited in Rees *et al.,* 2010). Further, the Mediterranean is a site of intense tourist activity, and corresponding boat anchoring also may affect green turtle foraging habitat in the neritic environment.

Because 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 (International Convention for the Prevention of Pollution from Ships), in which deliberate petroleum discharges from vessels are banned, but numerous repeated offenses are still thought to occur (Pavlakis *et al.,* 1996).

2. Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization for commercial purposes likely was a factor that contributed to the historical declines of this DPS. Egg collection and turtle harvest for individual consumption still occurs in Egypt (Clarke *et al.,* 2000; Nada and Casale, 2008). 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). Several hundred turtles are currently estimated to be slaughtered each year in Egypt (Nada and Casale, 2008). In Syria and Egypt, as reported for other countries, green turtles incidentally captured by fishers are sometimes eaten (Nada and Casale, 2008; Rees *et al.,* 2010). Small quantities of stuffed turtles and juvenile turtle carapaces, presumably of Syrian origin, have been observed for sale in Latakia and Damascus (Rees *et al.,* 2010).

3. Factor C: Disease or Predation

Nest and hatchling predation likely was a factor that contributed to the historical decline of the Mediterranean DPS. There have been no records of FP or other diseases in green turtles in this DPS. In this DPS, green turtle eggs and hatchlings are subject to depredation by wild canids (*i.e.,* foxes (*Vulpes vulpes*), golden jackals (*Canis aureus*), feral and domestic dogs (*Canis lupus familiaris*), and ghost crabs (*Ocypode cursor;* van Piggelen and Strijbosch, 1993; Brown and MacDonald, 1995; Aureggi *et al.,* 1999, 2005; Simms *et al.,* 2002; Akcinar *et al.,* 2006; Jony and Rees, 2008; Khalil *et al.,* 2009; Aureggi and Khalil, 2010; Demetropoulos and Hadjichristophorou, 2010; Fuller *et al.,* 2010; Rees *et al.,* 2010).

4. Factor D: Inadequacy of Existing Regulatory Mechanisms

There are at least 13 international treaties and/or regulatory mechanisms that pertain to the Mediterranean, and nearly all countries lining the Mediterranean have some level of national legislation directed at sea turtle protection. The SRT analysis of these existing regulatory mechanisms assumed that all would remain in place at their current levels.

Regulatory mechanisms are in place throughout the range of the DPS that address the direct capture of green turtles for most of the countries within this DPS. Most Mediterranean countries have developed national legislation to protect sea turtles and nesting habitats (Casale and Margaritoulis, 2010). The following countries have laws to protect green turtles: Albania, Croatia, Cyprus, Egypt, Greece, Israel, Italy, Lebanon, Libya, Syria, Tunisia, and Turkey. In addition, at least 13 international treaties and/or regulatory mechanisms apply to the conservation of green turtles in the Mediterranean DPS. National protective legislation generally prohibits intentional killing, harassment, possession, trade, or attempts at these (Margaritoulis *et al.,* 2003). In addition, some countries have site-specific legislation or conservation designation for turtle habitat protection. These are implemented to various degrees throughout the range of the DPS. There are some national regulations, within this DPS, that specially address the harvest of green turtles.

In western Cyprus, Lara-Toxeftra beaches have been afforded protection through the Fisheries Law and Regulations since 1989 (Margaritoulis, 2007). In northern Cyprus, four beaches (Alagadi Beach, Karpaz Peninsular, South Karpaz, and Akdeniz) have been designated as Special Protected Areas (Fuller *et al.,* 2010). These four areas include the third and fifth most important green turtle nesting beaches in the Mediterranean (Kasparek *et al.,* 2001). In Syria, establishment of a protected area at Latakia beach, the most important green turtle nesting beach in the country, is being sought but is facing strong opposition from the tourism sector (Rees *et al.,* 2010). While it is important to recognize the success of these protected areas, we must also note that 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 protective measures discussed here are sufficient for the conservation of the species in the Mediterranean.

Regulatory mechanisms are not in place in many countries within this DPS to address the major threat of sea turtle bycatch. Some of the countries in which this DPS is located limit the number and type of fishing licenses issued but sea turtle bycatch is not considered in these authorizations. It is unlikely that bycatch 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 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. Our Status Review did not reveal regulatory mechanisms in place to specifically address coastal development, marine pollution, sea level rise, and effects of climate change that continue to contribute to the extinction risk of this DPS.

5. Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

a. Incidental Bycatch in Fishing Gear

Incidental capture of sea turtles in artisanal and commercial fisheries is a significant threat to the survival of green turtles in the Mediterranean. Fishing practices alone have been estimated to result in over 150,000 sea turtle captures per year, with approximately 50,000 mortalities (Lucchetti and Sala, 2009; Casale, 2011) and sea turtle bycatch in multiple gears in the Mediterranean is considered among the most urgent conservation priorities globally (Wallace *et al.,* 2010).

i. Longline Fisheries

In the Mediterranean, surface longline fisheries are a source of green turtle bycatch (Camiñas, 2004). Incidental captures have been reported from Cyprus (Godley *et al.,* 1998), Turkey (Godley *et al.,* 1998), Italy (Laurent *et al.,* 2001), and Egypt (Nada, 2001; Camiñas, 2004). In Egypt, based on fleet data and catch rates reported by fishers during the 2000s, the total number of sea turtles (*i.e.,* all species) bycaught in longlines was estimated to be over 2,200 per year (Nada and Casale, 2008). Fishers also reported that some of the caught turtles are dead, and the incidence of mortality is particularly high in longlines and gill nets.

ii. Set Net (Gill Net) Fishing

Casale (2008) considered mortality by set nets to be 60 percent, with a resulting estimate of 16,000 turtles killed per year. However, a breakdown of these estimates by turtle species is not available. Most of these turtles are likely juveniles, with an average size of 45.4 cm CCL (n=74, Casale, 2008).

iii. Trawl Fisheries

Green turtles have been reported as incidentally captured in bottom trawls in Egypt (Nada and Casale, 2011), Greece (Margaritoulis *et al.,* 2003), Tunisia (Laurent *et al.,* 1990), Turkey (Laurent *et al.,* 1996; Oruç, 2001), Syria, Israel, and Libya (Casale *et al.,* 2010), but are likely also captured by bottom trawlers in other neritic foraging areas in the eastern Mediterranean (Casale *et al.,* 2010). Laurent *et al.* (1996) estimated that approximately 10,000 to 15,000 sea turtles were being captured annually by bottom trawling in the eastern Mediterranean. Although most of the turtles taken were loggerheads, they estimated that the number of green turtles taken was 1,000 to 3,000 annually in Turkey and Egypt alone. More recently, Casale (2011) 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, Libya, Greece, and Egypt each have an estimated 1,900 or more sea turtle captures per year. Further, Albania, Algeria, Cyprus, Morocco, Slovenia, Spain, and Syria may each capture a few hundred sea turtles per year (Casale, 2011). Available data suggest the annual number of sea turtle captures by all Mediterranean trawlers may be greater than 39,000 (Casale, 2011). Although most of the turtles reported by Casale (2011) as taken by bottom trawlers were undoubtedly loggerheads, a few thousand were likely green turtles based on earlier reports (Laurent *et al.,* 1990; Laurent *et al.,* 1996; Oruç, 2001; Margaritoulis *et al.,* 2003; Nada and Casale, 2008).

b. Vessel Strikes and Boat Traffic

Propeller and collision injuries from boats and ships are becoming more common for sea turtles in the Mediterranean, although it is unclear as to whether the events, or just the reporting of the injuries, are increasing. Speedboat and jet-ski impacts are of particular concern in areas of intense tourist activity, such as Greece, Turkey, and Syria. Boats operating near sea turtle nesting beaches during the nesting season are likely to either cause females to abandon nesting attempts or cause their injury or death (Camiñas, 2004). Males may also be affected in high-use boating areas where sea turtle mating occurs (Demetropoulos, 2000; Rees *et al.,* 2010).

c. Pollution

Unattended or discarded nets, floating plastics and bags, and tar balls are of particular concern in the Mediterranean (Camiñas, 2004; Margaritoulis, 2007). Monofilament netting appears to be the most dangerous waste produced by the fishing industry (Camiñas, 2004).

The discharge of chemical substances, including highly toxic chromium compounds from a soda-chromium factory close to the Kazanli nesting beach in Turkey, is cause for concern (Kasparek *et al.,* 2001; Venizelos and Kasparek, 2006).

d. Effects of Climate Change

Both the marine and terrestrial realms will be influenced by temperature increases and will likely undergo alterations that will adversely affect green turtles. Mediterranean turtle populations could be affected by the alteration of thermal sand characteristics (from global warming), resulting in the reduction or cessation of male hatchling production (Kasparek *et al.,* 2001; Camiñas, 2004; Hawkes *et al.,* 2009; Poloczanska *et al.,* 2009). In northern Cyprus, green turtle hatchling sex ratios are already thought to be highly female biased (approximately 95 percent female; Wright *et al.,* 2012). This, in tandem with predicted future rises in temperatures, is cause for concern (Fuller *et al.,* 2010). As temperatures increase, there is also concern that incubation temperatures will reach levels that exceed the thermal tolerance for embryonic development, thus increasing embryo and hatchling mortality (Fuller *et al.,* 2010). Further, a significant rise in sea level would restrict green turtle nesting habitat in the eastern Mediterranean. While sea turtles have survived past eras that have included significant temperature fluctuations, future climate change is expected to happen at unprecedented rates, and if turtles cannot adapt quickly they may face local to widespread extirpations (Hawkes *et al.,* 2009). Impacts from global climate change induced by human activities are likely to become more apparent in future years (IPCC, 2007).

In summary, within Factor E, we find that fishery bycatch and marine pollution that occurs throughout the range of the Mediterranean DPS are significant threats to this DPS. In addition, boat strikes and changes likely to result from climate change are an increasing threat to the persistence of this DPS.

C. Conservation Efforts

Regional and national efforts are underway to conserve green turtles (often all sea turtles) throughout the range of the DPS. The extent to which threats have been reduced as a result of these efforts is difficult to ascertain.

Green turtle nesting primarily occurs in Turkey, Cyprus, and Syria, and a notable proportion of nesting in those areas is protected through various mechanisms. In Turkey, three important green turtle nesting beaches (Alata, Kazanli, and Akyatan) were all designated as protected areas by the Turkish Ministry of Culture, while two other beaches (Belek and Gösku Delta) also have some level of protected status (Kasparek *et al.,* 2001; Fuller *et al.,* 2010). These five protected beaches represent approximately 60 percent of nesting in Turkey (see Canbolat *et al.,* 2009 and Fuller *et al.,* 2010).

There has been success within 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 protective measures discussed here are sufficient for the conservation of the species in the Mediterranean.

Marine debris is also a significant problem on many green turtle nesting beaches in the eastern Mediterranean, in particular the nesting beaches of Cyprus and Turkey (Camiñas, 2004; Demetropoulos and Hadjichristophorou, 2010; Fuller *et al.,* 2010; Türkozan and Kaska, 2010). Although organized beach clean-ups in recent years on some beaches in Cyprus have greatly reduced the amount of litter on the beach (Demetropoulos and Hadjichristophorou, 2010; Fuller *et al.,* 2010), it is still an overall pervasive problem.

Protection of marine habitats is in the early stages in the Mediterranean, as in other areas of the world. Off the Lara-Toxeftra nesting beaches in western Cyprus, a marine protection zone extends to the 20-m isobath (*i.e.,* 20-m depth line) as delineated by the Fisheries Regulation (Margaritoulis, 2007; Demetropoulos and Hadjichristophorou, 2010). As mentioned above, establishment of a protected area at Latakia beach in Syria is being sought and would include protection of a section of sea offshore; however, it is facing strong opposition from the tourism sector (Serra, 2008; Rees *et al.,* 2010).

D. Extinction Risk Assessment and Findings

The Mediterranean DPS is characterized by low green turtle nesting abundance at 32 different locations, with many of these sites having only one or two known nesting females and none having greater than 245 nesting females. While some of these sites show stable or increasing trends, the extremely low nesting abundance of this DPS compared to historical abundance creates an intrinsically high risk to the long-term stability of the population. The spatial range of the population is limited to the eastern Mediterranean, and the nesting season is consistent throughout this DPS (June to August; Broderick *et al.,* 2002a), thus limiting the temporal buffering against climate change in terms of impacts due to storms and other seasonal events. The fact that turtles nest on both insular and continental sites suggests some degree of nesting diversity but, with the sites so close together, the benefits of this diversity may be minimal. Mitochondrial DNA studies have identified two stocks but, in general there is low population substructuring in the Mediterranean.

The five-factor analysis in the Status Review reveals numerous significant threats to green turtles within the range of the DPS. Coastal development, beachfront lighting, erosion resulting from sand extraction, illegal harvest, detrimental fishing practices, and marine pollution both at nesting beaches and important foraging grounds are continuing concerns across the Mediterranean DPS, and are insufficiently tempered by conservation efforts. Current illegal harvest of green turtles for human consumption continues as a moderate threat to this DPS. Fishery bycatch occurs throughout the Mediterranean Sea, particularly bycatch mortality of green turtles in pelagic longline, set net, and trawl fisheries. Additional threats from boat strikes, which are becoming more common, and changes likely to result from climate change will negatively affect this DPS.

For the above reasons, we propose to list the Mediterranean DPS as endangered. Based on its low nesting abundance, limited spatial distribution, and exposure to increasing threats, we find that this DPS is presently in danger of extinction throughout its range.

IX. South Atlantic DPS

A. Discussion of Population Parameters for the South Atlantic DPS

The South Atlantic DPS's range boundary begins at the border of Panama and Colombia at 7.5° N., 77° W., heads due north to 10.5° N., 77° W., then northeast to 19° N., 63.5° W., and along 19° N. latitude to Mauritania in Africa, to include the U.S. Virgin Islands in the Caribbean. It extends along the coast of Africa to South Africa, with the southern border being 40° S. latitude.

Green turtle nesting occurs on beaches along the western coast of Africa from southern Mauritania to South Africa, in the middle of the South Atlantic on Ascension Island, in the Caribbean portion of the South Atlantic including Caribbean South America, and along eastern South America down through Brazil (Figure 2). In the eastern South Atlantic, significant sea turtle habitats have been identified, including green turtle feeding grounds in Corisco Bay, Equatorial Guinea/Gabon (Formia, 1999); Congo (Bal *et al.,* 2007; Girard *et al.,* 2014); Mussulo Bay, Angola (Carr and Carr, 1991); and Principe Island (SWOT, 2010). In the western South Atlantic, juvenile and adult green turtles utilize foraging areas throughout the Caribbean areas of the South Atlantic, often resulting in interactions with fisheries occurring in those same waters (Dow *et al.,* 2007). While no nesting occurs as far south as Uruguay and Argentina, both countries have important foraging grounds for South Atlantic green turtles (Lopez-Mendilaharsu *et al.,* 2006; Lezama, 2009; González Carman *et al.,* 2011; Prosdocimi *et al.,* 2012; Rivas-Zinno, 2012). Within the range of the South Atlantic DPS, there are a total of 51 nesting sites (some being individual beaches and others representing multiple nesting beaches) that can be roughly divided into four regions: western Africa, Ascension Island, Brazil, and the South Atlantic Caribbean (including Colombia, the Guianas, and Aves Island in addition to the numerous small, insular nesting sites). Much of the South Atlantic is data poor with only occasional or incomplete nesting surveys. Therefore, for 37 of the 51 identified nesting areas of this DPS, we were not able to estimate nesting female abundance, even for relatively large nesting sites such as French Guiana. Of the nesting sites for which an estimate could be derived, three account for the bulk of the nesting: Poilão, Guinea-Bissau (29,016 nesting females; Catry *et al.,* 2009); Ascension Island, UK (13,417 nesting females; S. Weber, Ascension Island Government, pers. comm., 2013); and the Galibi Reserve, Suriname (9,406 nesting females; Schulz, 1975; Weijerman *et al.,* 1998). There are two sites with >10,000 nesting females (Poilão and Ascension Island); one site with 5,001–10,000 nesting females (Suriname); three sites with 1,001–5,000 nesting females (Trindade Island, Brazil (2,016; Almeida *et al.,* 2011; Projecto Tamar, 2011); Aves Island, Venezuela (2,833; Prieto *et al.,* 2012); and Matapica Reserve, Suriname (3,661; A. Turney, pers. comm., 2012). There are three sites with 501–1,001 nesting females, three sites with 101–500, two sites with 51–100, and 37 unquantified sites. Poilão accounts for almost 46 percent of the total number of nesting females.

Long-term monitoring data for this DPS are relatively scarce. There are three sites for which 10 or more years of recent data are available for annual nesting female abundance (a criterion for presenting trends in a bar graph in the Status Review): (1) Ascension Island, UK; (2) Galibi and Matapica Reserves, Suriname; and (3) Atol das Rocas, Brazil. Together, the first two sites represent approximately 26,759 nesting females (42 percent of the population), while the third site has only 275 nesting females (Bellini *et al.,* 2013). Ascension Island, and Galibi and Matapica Reserves have exhibited substantial increases since the 1970s. Although they did not meet the criteria for presenting bar graphs, there are indications of trends at other beaches in the South Atlantic, such as increasing trends at Isla Trindade, Brazil, and Aves Island, Venezuela, and decreasing trends at Bioko Island, Equatorial Guinea.

With regard to spatial structure, the phylogenic relationship of the eastern Caribbean nesting sites indicates that, despite the close proximity of other Caribbean nesting sites, they are more closely related to the nesting sites in the South Atlantic (M. Jensen, NRC, unpubl. data). Green turtle nesting sites found in Brazil, Ascension Island, and West Africa have shallow structuring and are dominated by a common and widespread haplotype, CM–A8, that is found in high frequency across all nesting sites in the South Atlantic (Bjorndal *et al.,* 2006; Formia *et al.,* 2006). A recent study showed that a large proportion of juvenile green turtles foraging in Cape Verde in the eastern Atlantic originated from distant nesting sites across the Atlantic, namely Suriname (38 percent), Ascension Island (12 percent), and Guinea Bissau (19 percent), suggesting that, like the loggerheads, green turtles in the Atlantic undertake transoceanic developmental migrations (Monzón-Argüello *et al.,* 2010). The fact that long distance dispersal is only seen for juvenile turtles suggests that larger adult-sized turtles return to forage within the region of their natal nesting sites, thereby limiting the potential for gene flow across larger scales (Monzón-Argüello *et al.,* 2010). Important foraging grounds in the western South Atlantic, such as those off of Brazil, Uruguay and Argentina, are shared by turtles from various nesting assemblages in the western South Atlantic and Ascension Island. Important foraging grounds in the eastern South Atlantic, such as the Gulf of Guinea, are shared by turtles from the eastern South Atlantic as well as juveniles from Suriname and Ascension Island.

Overall, many demographic parameters of green turtles in the South Atlantic appear to vary widely among the various nesting assemblages. However, this variability in parameters such as remigration interval, clutch size, hatching success, sex ratio, and clutch frequency is not separated out regionally within the range of the DPS and therefore does not necessarily suggest a high level of population structuring. Average sizes of nesting females are the largest reported for females globally (Hirth, 1997; Almeida *et al.,* 2011; Bellini *et al.,* 2013).

With regard to diversity and resilience, the overall range of the DPS is extensive and varied, with both insular and continental nesting. Ascension Island, one of the largest nesting sites, is isolated and protected in the middle of the South Atlantic, and appears to have migratory connections to nesting sites on the eastern and western ends of the DPS's range. The insular sites vary quite a bit in terms of potential impacts from sea level rise and tropical weather. Aves Island, one of the largest Caribbean nesting sites within the range of the South Atlantic DPS is particularly vulnerable to sea level rise as it is a very low-lying island.

B. Summary of Factors Affecting the South Atlantic DPS

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

a. Terrestrial Zone

At continental sites in the South Atlantic DPS destruction and modification of sea turtle nesting habitat (for green turtles and other species) 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 dei Marcovaldi, 1999; Naro-Maciel *et al.,* 1999; Broderick *et al.,* 2002b; Marcovaldi *et al.,* 2002; Formia *et al.,* 2003; Tanner, 2013).

In very low-lying islands such as Aves, rising sea levels and increased storms could result in a loss of nesting habitat, thus potentially eliminating their functionality as nesting beaches.

b. Neritic/Oceanic Zones

On the western side of the South Atlantic, the Brazil Current Large Marine Ecosystem (LME) region is characterized by the Global International Waters Assessment (GIWA) 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). In the Canary Current LME, the area is characterized by the GIWA 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 (Valdéz-González and Ramírez-Bautista, 2002). The Gulf of Guinea has been characterized as severely impacted in the area of solid wastes by the GIWA; this and other pollution indicators are increasing (*http://www.lme.noaa.gov*). On the eastern side of the South Atlantic, the Benguela Current LME has been moderately impacted by overfishing, with future conditions expected to worsen by the GIWA (Prochazka *et al.,* 2005).

In Brazil, green turtles in degraded coastal areas that have ingested plastic debris have been found to have diets that are lower in diversity and quality (Santos *et al.,* 2011). Off the northwestern coast of Suriname run-off from rice production and other agricultural activities is a problem (Reichart and Fretey, 1993) and likely would have similar impacts. The reduction of carrying capacity for green turtles in seagrass beds impacted by anchor damage in popular bays in the U.S. Virgin Islands has also been documented (Williams, 1988). Likewise, sediment contamination from coastal and upstream industrial sites has been recognized in the Caribbean, including St. Croix (Ross and DeLorenzo, 1997), and has the potential to impact green turtle habitat as well as the turtles themselves. Such coastal degradation has been seen throughout the Caribbean areas that fall within the range of the South Atlantic DPS (Dow *et al.,* 2007).

In summary, we find that the South Atlantic DPS of the green 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, sufficient data are not available to assess the significance of these threats to the persistence of this DPS.

2. Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization for commercial purposes likely was a factor that contributed to the historical declines of this DPS. Although legal and illegal collection of eggs and harvest of turtles persists as a threat to this DPS, it does not appear to be a significant threat to its resilience. Eggs are taken for human consumption in Brazil, but the amount is considered minor when compared to historical rates of egg collection (Marcovaldi and dei Marcovaldi, 1999; Marcovaldi *et al.,* 2005; Almeida and Mendes, 2007). Use of sea turtles, including green turtles, for medicinal purposes occasionally occurs in northeastern Brazil (Alvez and Rosa, 2006; Braga-Filho and Schiavetti, 2013). Egg harvest occurred in the Galibi area until 1967 when a ban was enacted. Subsequently, a controlled harvest was allowed until the early 2000s via permit with poaching continuing at approximately 100 to 450 nests per year (Reichart and Fretey, 1993).

Throughout the Caribbean areas of the South Atlantic DPS, harvest of green turtle eggs and turtles, both illegal and legal, continues (Dow *et al.,* 2007). Among the British Caribbean territories within the South Atlantic DPS (including Anguilla, Turks and Caicos, the British Virgin Islands, and Montserrat) there are legal sea turtle fisheries, with anywhere from a few (Montserrat) to over a thousand (Turks and Caicos) green turtles taken per year (Godley *et al.,* 2004).

Turtles are harvested along the west African coast and, in some areas, are considered a significant source of food and income due to the poverty of many residents (Formia *et al.,* 2003; Tomás *et al.,* 2010). In the Bijagós Archipelago (Guinea-Bissau), all sea turtles are protected by national law, but enforcement is limited and many turtles are killed by locals for consumption (Catry *et al.,* 2009).

3. Factor C: Disease or Predation

FP is highly variable in its presence and severity throughout the range of the DPS, with areas of lower water quality, especially due to nutrient enrichment, often being the sites with the most prevalent and most severe cases of FP. In Brazilian waters, FP has been documented but is highly variable among sites (Williams and Bunkley-Williams, 2000). FP has been confirmed among green turtles of Africa's Atlantic coast, from Gabon and Equatorial Guinea (Formia *et al.,* 2013), Guinea-Bissau (Catry *et al.,* 2009), Gambia, and Senegal (Barnett *et al.,* 2004), the Congo and Principe Island (Girard *et al.,* 2013). The prevalence varies greatly among locations.

Eggs and nests in Brazil experience depredation, primarily by foxes (*Dusycion vetulus;* Marcovaldi and Laurent, 1996). Nests laid by green turtles in the southern Atlantic African coastline experience predation from local wildlife and feral animals, such as jackals (*Canus* sp.; Weir *et al.,* 2007). Shark predation on green turtles, especially by tiger sharks (*Galeocerdo cuvier*), has been documented off northeastern Brazil at a frequency high enough to indicate that green turtles may be an important food source for tiger sharks off Brazilian waters (Bornatowski *et al.,* 2012). Predation on nesting females can also occur from large predators, such as jaguars (*Panthera onca*) in Suriname (Autar, 1994). On Ascension Island predation by domestic and feral cats (*Felus* sp.) and dogs (*Canus* sp.), frigate birds (*Fregata minor*), land crabs (subphylum Crustacea), and fish (class Osteichthyes) have all been cited as mortality sources for hatchling green turtles (Broderick *et al.,* 2002a). On the Bijagós Archipelago nest predation by monitor lizards (*Varanus* sp.) was highly variable, with green turtle nests experiencing 76 percent predation rates on João Vieira (da Silva Ferreira, 2012). On the southern beaches of Bioko in the Gulf of Guinea, predation on eggs and hatchlings can come from a wide variety of species, such as ghost crabs (family Ocypodidae), ants (family Formicidae), monitor lizards, monkeys (suborder Haplorrhini), porcupines (order Rodentia), vultures (family Accipitridae) and crows (*Corvus* sp.), in addition to village dogs (Tomás *et al.,* 1999).

Although disease and predation are known to occur, quantitative data are not sufficient to assess the degree of impact of these threats on the persistence of this DPS.

4. Factor D: Inadequacy of Existing Regulatory Mechanisms

There are at least 20 national and international treaties and/or regulatory mechanisms that pertain to the South Atlantic DPS. Regulatory mechanisms that address the direct capture of green turtles for most of the countries within this DPS are implemented to various degrees throughout the range of the DPS, with some countries having no commitment to the implementation of the regulation. The main threats to South Atlantic green turtles include fishery bycatch, marine debris and pollution, habitat destruction affecting eggs and hatchlings at nesting beaches, and nest and hatchling predation. Most South Atlantic countries, including those in South America, the Caribbean, and Africa, have developed national legislation and have various projects sponsored by governments, local communities, academic institutions, and non-governmental organizations to protect sea turtles and nesting and foraging habitats to varying degrees (Dow et al., 2007; Formia et al., 2003). The consistency and effectiveness of such programs likely vary greatly across countries and over time based on resource availability and political stability. In addition, some countries have site specific legislation or conservation designation for turtle habitat protection. Regional and national legislation to conserve green turtles (often all sea turtles) exists throughout the range of the DPS. The extent to which threats have been reduced as a result of these efforts is difficult to ascertain. The following countries have laws to protect green turtles: Angola, Argentina, Ascension Island, Benin, Brazil, British Virgin Islands, Cameroon, Cape Verde, Colombia, Congo, Democratic Republic of the Congo, Equatorial Guinea, French Guiana, Gabon, The Gambia, Ghana, Guinea-Bissau, Guinea, Guyana, Ivory Coast, Liberia, Namibia, Nigeria, St. Helena, Sao Tome and Principe, Senegal, Sierra-Leone, South Africa, Suriname, Togo, Trinidad and Tobago, Turks and Caicos Islands, U.S. Virgin Islands, Uruguay, Venezuela.

The Status Review described limited regulatory mechanisms to address bycatch, such as TED requirements; however, there are no widespread regulations to address bycatch as a result of the gill net fisheries. A variety of countries operate industrial trawling off Guinea-Bissau. The national government does not have any requirements for TED use in their waters. There is also extensive illegal fishing occurring (Catry *et al.,* 2009). While the Bolama-Bijagós Biosphere Reserve covers the entire archipelago and provides some protection through the management of the reserve and the survey work patrolling the areas, limited enforcement and resource shortages limit the effectiveness of the reserve. It is unlikely that bycatch mortality, discussed in more detail in Factor E, 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 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.

The Status Review did not reveal any regulatory mechanisms in place to specifically address coastal development, marine pollution, sea level rise, and effects of climate change that continue to contribute to the extinction risk of this DPS.

5. Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

a. Incidental Bycatch in Fishing Gear

Green turtles are incidentally captured throughout the South Atlantic DPS in pelagic and demersal longlines, drift and set gill nets, bottom and mid-water trawls, fishing dredges, pound nets and weirs, haul and purse seines, pots and traps, and hook and line gear.

There is also substantial documentation of the interaction of small-scale artisanal gill net fisheries with green turtles in their foraging grounds along the western South Atlantic, with green turtles documented as the most common species stranded throughout the coast of Brazil (Marcovaldi *et al.,* 2009); Lima *et al.,* 2010; Barata *et al.,* 2011; López-Barrera *et al.,* 2012). Similarly, artisanal gill net fisheries in the coastal waters of the Rio de la Plata area of Uruguay were estimated to have captured 1,861 green turtles over the 13-month duration of a study, despite a time-area closure during the ''peak'' season identified in Lezama (2009).

Incidental captures of juvenile green turtles have also been documented on important foraging grounds off Argentina, especially Samborombón Bay and El Rincón, primarily from gill nets used by the artisanal fisheries, but also from shrimp nets and other artisanal fishing gear (González Carman *et al.,* 2011). Green turtles utilizing foraging grounds off Argentina have been demonstrated to be primarily from the Ascension Islands nesting beaches, although individuals from Trindade Island, Suriname, and Aves Island nesting assemblages were also utilizing the Argentine foraging grounds (Prosdocimi *et al.,* 2012). Therefore impacts to green turtles off Argentina affect a variety of nesting assemblages within the western and central South Atlantic.

A variety of countries operate industrial trawling off Guinea-Bissau. The national government does not have any requirements for TED use in their waters. There is also extensive illegal fishing occurring (Catry *et al.,* 2009). While the Bolama-Bijagós Biosphere Reserve covers the entire archipelago and provides some protection through the management of the reserve and the survey work patrolling the areas, limited enforcement and resource shortages limit the effectiveness of the reserve.

In Ghana and the Ivory Coast, fish stocks have been reduced through overfishing and environmental degradation, and many fishers that incidentally catch sea turtles will keep and kill the turtle to feed their families (Tanner, 2013). Since 2001, a push has been made to generate alternative sources of income for the local populations of the Ivory Coast and to employ ex-poachers to patrol the beaches (Peñate *et al.,* 2007).

b. Marine Debris and Pollution

Various studies have shown high prevalence of marine debris ingestion by green turtles in the western South Atlantic, in some cases occurring in 100 percent of the individuals examined (Bugoni *et al.,* 2001; Tourinho *et al.,* 2010; Guebert-Bartholo *et al.,* 2011; Murman, 2011).

Oil exploration and extraction within the Gulf of Guinea rapidly increased since the discovery of oil reserves in the 1980s and 1990s (Formia *et al.,* 2003), with the associated activities and potential for oil spills and other pollution creating a threat to the important foraging areas and nesting beaches for green turtles in the area.

c. Effects of Climate Change

As in other areas of the world, climate change and sea level rise have the potential to affect green turtles in the South Atlantic. Effects of climate change include, among other things, increased sea surface temperature, the alteration of thermal sand characteristics of beaches (from warming temperatures), which could result in the reduction or cessation of male hatchling production (Hawkes *et al.,* 2009; Poloczanska *et al.,* 2009), and a significant rise in sea level, which could significantly restrict green turtle nesting habitat. In very low-lying islands such as Aves, rising sea levels and increased storms could potentially eliminate its functionality as a nesting beach. Some beaches will likely experience lethal incubation temperatures that will result in losses of complete hatchling cohorts (Fuentes *et al.,* 2010; Fuentes *et al.,* 2011; Glen and Mrosovsky, 2004). While sea turtles have survived past eras that have included significant temperature fluctuations, future climate change is expected to happen at unprecedented rates, and if turtles cannot adapt quickly they may face local to widespread extirpations (Hawkes *et al.,* 2009). Impacts from global climate change induced by human activities are likely to become more apparent in future years (IPCC, 2007).

In summary, within Factor E, we find that bycatch that occurs throughout the South Atlantic, particularly bycatch mortality of green turtles from nearshore gill net fisheries, continues to be a significant threat to this DPS. In addition, changes likely to result from climate change are also an increasing threat to this DPS and likely a significant threat to the persistence of this DPS.

C. Conservation Efforts for the South Atlantic DPS

The main in-water threat to green turtles in the South Atlantic DPS is incidental capture in fisheries, although marine debris and pollution are also threats. The main threat on beaches is habitat destruction, followed by hatchling predation. Most South Atlantic countries, including those in South America, the Caribbean, and Africa, have developed national legislation and have various projects sponsored by governments, local communities, academic institutions, and non-governmental organizations to protect sea turtles, and nesting and foraging habitats to varying degrees (Dow *et al.,* 2007; Formia *et al.,* 2003). The consistency and effectiveness of such programs likely vary greatly across countries and over time based on resource availability and political stability. In addition, some countries have site specific legislation or conservation designation for turtle habitat protection. When assessing conservation efforts, we assumed that all conservation efforts would remain in place at their current levels.

Conservation through education is a widely-used and valuable tool throughout nations within the range of the South Atlantic DPS and around the world. Such education initiatives can be highly successful. In Akassa, Nigeria, a dedicated, intensive conservation education program by the Akassa Community Development Project resulted in sea turtles being recognized locally as an essential part of the area's natural heritage. This has resulted in the majority of the nests in Akassa being protected, and when live stranded turtles are found, they are released (Formia *et al.,* 2003). However, in areas where the utilization of sea turtles is deeply ingrained in the local culture, such as the La Guajira region of

Colombia (Patino-Martinez *et al.,* 2012), changing people's attitudes about the use of sea turtles can be a long, slow process.

In the Caribbean, green turtle conservation on the nesting beach varies widely among the 22 nations and territories. However, programs at the three largest nesting sites—Aves Island, French Guiana, and Suriname—with over 500 crawls per year (Dow *et al.,* 2007), provide protection to a significant proportion of nesting in the area.

In South America, outside of the Caribbean, Brazil is the only nation with substantial green turtle nesting. In Brazil, the primary nesting areas are monitored by Projeto TAMAR, the national sea turtle conservation program, and many detrimental human activities are restricted by various state and Federal laws (Marcovaldi and dei Marcovaldi, 1999; Marcovaldi *et al.,* 2002; 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; Marcovaldi 2011). Since 1990, TAMAR has worked along green turtle foraging areas such as Almofala and Ubatuba (Marcovaldi *et al.,* 2002).

The South Atlantic Association is a multinational group that includes representatives from Brazil, Uruguay, and Argentina that meets bi-annually to share information and develop regional action plans to address threats, including bycatch. In 2001, the Brazilian Plan for Reduction of Incidental Sea Turtle Capture in Fisheries was created to address incidental capture of the five species in the country (Marcovaldi *et al.,* 2002, 2006). This national plan includes various activities to mitigate bycatch, including time-area restrictions of fisheries, use of bycatch reduction devices, and working with fishers 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 marine turtles for several years (see *http://cicmar.org/proyectos/promacoda*), with the objective of developing mitigation plans in the future. In Argentina, various conservation organizations are working toward assessing bycatch of green turtles and other sea turtle species in fisheries, with the objective of developing mitigation plans for this threat (*http://www.prictma.com.ar*).

Green turtle nesting occurs on many beaches along the western coast of Africa, and there have been, and continue to be, sea turtle projects in many of the nations in the area ranging from research to public awareness to government conservation efforts (see Formia *et al.,* 2003 for a regional synopsis). The largest nesting assemblages occur on Poilão, Bijagós Archipelago, Guinea Bissau, and on Bioko Island, Equatorial Guinea. While conservation efforts on the beaches have been established, issues with enforcement capabilities and resources make consistent protection problematic (Catry *et al.,* 2009; Formia *et al.,* 2003; Tomás *et al.,* 2010). Since 2001, a push has been made to generate alternative sources of income for the local populations of the Ivory Coast and to employ ex-poachers to patrol the beaches (Peñate *et al.,* 2007).

Green turtle conservation efforts on Ascension Island have involved extensive monitoring, outreach, and research. The group Turtles in the UK Overseas Territories promotes the conservation, research, and management of marine turtle populations and their habitats, and has worked extensively on Ascension Island (*http://www.seaturtle.org/mtrg/projects/tukot/ascension.shtml*). Additionally, there are legal prohibitions protecting sea turtles on Ascension.

Overall, conservation efforts for green turtles in the South Atlantic DPS are inconsistent. While there are numerous and varied conservation efforts, especially on the primary nesting beaches, many issues remain due to limited enforcement of existing laws and marine protected areas as well as extensive fishery bycatch, especially in coastal waters. The effectiveness and consistency of conservation measures will need to be increased substantially to prevent the further decline, and allow the recovery, of this DPS in the future.

D. Extinction Risk Assessment and Findings for the South Atlantic DPS

Nesting abundance for this DPS is relatively high, with large rookeries spread out geographically, the two largest at Poilão, Guinea-Bissau, and Ascension Island, UK. Population trends within rookeries are inconsistent and, in many cases, the data are limited and a trend could not be determined, even for major rookeries. While some nesting beaches such as Ascension Island, Aves Island, and Galibi appear to be increasing, others such as Poilão, Trindade, and Atol das Rocas seem to be stable or do not have sufficient data to make a determination. Bioko, Equatorial Guinea, appears to be in decline. The diversity/resilience of the DPS is bolstered by the widespread nature of the rookeries, but a potential concern is the domination of the DPS by insular nesting sites, which has the potential to reduce the resilience of the DPS in the face of sea level rise and increasing tropical storm activity.

The 5-factor analysis in the Status Review revealed numerous continuing threats to green turtles within the South Atlantic DPS. Habitat destruction and degradation both at nesting beaches and important foraging grounds is a continuing concern, though inconsistent across the DPS. Overutilization (harvest) of green turtles within the South Atlantic was likely a primary factor in past declines. While reduced from those levels due to increased legal protections, harvest is still thought to be fairly extensive in some areas of western Africa. Fishery bycatch also continues to be a major concern throughout the range of the DPS, near nesting beaches and foraging areas as well as on the high seas. Despite increasing legal protections for sea turtles within the DPS, the inadequacy of existing regulatory mechanisms is a noted issue. While many international and national laws purporting to protect sea turtles exist, limitations in resources and political will create a situation of inconsistent or sometimes nonexistent practical measures to enforce those laws. Increasing awareness and conservation efforts by governments, local communities, non-governmental organizations, and industries have helped to reduce threats, but efforts remain inconsistent and often resource limited.

While the Status Review indicates that the DPS shows strength in many of the critical population parameters, there are still concerns about the impacts of ongoing threats. The increasing threats are not reflected in the current trend for the South Atlantic DPS as it was based on nesting numbers and not all current life stages. These increasing threats to the population will only become apparent when those life stages affected by the threats return to nest and the beaches are consistently monitored, as the trend information is based solely on numbers of nests. This lag time and nesting data were considered in our analysis.

For the above reasons, we propose to list the South Atlantic DPS as threatened. We do not find the DPS to be in danger of extinction presently because of high nesting abundance and geographically widespread nesting at a diversity of sites; however, the continued threats are likely to endanger the DPS within the foreseeable future.

X. Southwest Indian DPS

A. Discussion of Population Parameters for the Southwest Indian DPS

The range of the Southwest Indian DPS has as its western boundary the shores of continental Africa from the equator, just north of the Kenya-Somalia border, south to the Cape of Good Hope (South Africa), and extends south from there along 19° E. longitude to 40° S., 19° E. Its southern boundary extends along 40° S. latitude from 19° E. to 84° E., and its eastern boundary runs along 84° E. longitude from 40° S. latitude to the equator. Its northern boundary extends along the equator from 84° E. to the continent of Africa just north of the Kenya-Somalia border (Figure 2). Nesting occurs along the east coast of Africa as far south as 25° S., the north, west, and south coasts of Madagascar, and scattered offshore islands in the southwest Indian Ocean (Figure 8.1 in the Status Review). Foraging occurs along the east coast of Africa, around Madagascar where numerous seagrass beds are found, and on shallow banks and shoals throughout the region, including those associated with virtually every island in Seychelles (Mortimer, 1984; Mortimer *et al.,* 1996). Small and immature turtles are also concentrated in Mozambique around Bazaruto and Inhassoro and in Maputo Bay (Bourjea, 2012). Along the coast of Kenya, an aerial survey in 1994 indicated that sea turtles are widely distributed within the 20-m isobaths mainly within seagrass beds and coral reefs (Frazier, 1975; Wamukoya *et al.,* 1996; Okemwa *et al.,* 2004). The eastern seaboard of South Africa serves as a feeding and developmental area for green turtles (Bourjea, 2012).

For the DPS, there are 14 nesting sites with some measure of abundance, four of which have more than 10,000 nesting females: Europa (Eparses Islands, France; 25,500; Lauret-Stepler *et al.,* 2007; Bourjea, 2012), Aldabra Atoll (Seychelles; 16,000 (Mortimer *et al.,* 2011; Mortimer, 2012; J. Mortimer unpubl. data)), Mohéli (Comoros; 15,000 (Bourjea, 2012), and Mayotte (France; 12,000; Bourjea *et al.,* 2007a; Bourjea, 2012). Les Glorieuses has 5,001–10,000 nesting females (6,000; Lauret-Stepler *et al.,* 2007; Bourjea, 2012). Five sites have 1,001–5,000 nesting females: Tromelin Island; 4,500 (Lauret-Stepler *et al.,* 2007; Bourjea, 2012); Kenya; 1,500 (Okemwa *et al.,* 2004); Tanzania; 1,500 (Muir, 2005; Bourjea, 2012); Mauritius; 1,800 (Bourjea, 2012); and Assumption, Cosmoledo, Astove, and Farquhar in the Seychelles; ~2,000 (J. Mortimer unpubl. data). There are four sites with <500 nesting females: Madagascar; Mozambique; Amirantes Group, Seychelles; and Inner Islands of the Seychelles; and 23 more sites with unquantified numbers of nesting females. The largest nesting site, Europa, accounts for approximately 30 percent of all nesting.

Green turtles in the Southwest Indian Ocean were exploited for many decades (Hughes, 1974; Frazier, 1980, 1982; Mortimer *et al.,* 2011); however, the species has successfully recovered at some nesting beaches in the recent years and trend data show increasing trends, albeit largely at protected sites (Bourjea, 2012). At protected nesting sites with long-term monitoring, five out of six monitoring sites have shown increase in nesting activities (Europa, Glorieuses, Mayotte, Mohéli, and Aldabra), whereas a declining trend has been reported for Tromelin Island (Bourjea, 2012). There are three nesting sites with greater than 10 years of recent monitoring data: Les Glorieuses, Europa and Tromelin, Eparses Islands, the trends of which are discussed above. No sites met our standards for conducting a PVA.

With regard to spatial structure, genetic sampling in the Southwest Indian DPS has been fairly extensive and nesting sites are relatively well represented, with the exception of the northern nesting sites. Mitochondrial DNA studies indicate a moderate degree of spatial structuring within this DPS, with connectivity between proximate nesting sites (see below). Overall, the Southwest Indian DPS appears to have at least two genetic stocks: (1) The South Mozambique Channel consisting of Juan de Nova and Europa; and (2) the numerous nesting sites in the North Mozambique Channel consisting of Nosy Iranja, Mayotte, Mohéli, Glorieuses, Cosmoledo, Aldabra, Farquhar, also including Tromelin located east of Madagascar (Bourjea *et al.,* 2006). Satellite telemetry data are available for green turtles that nest at some nesting beaches within the range of this DPS. Green turtles nesting along the East African coast confine their migration to along the coast. This is in contrast to those nesting on islands (*e.g.,* Comoros, Eparses, and Seychelles), which reach the East African or Malagasy coast via 'migration corridors' or along mid-oceanic seagrass beds. This behavior is believed to be mainly attributable to the fact that those areas are characterized by a network of large seagrass beds (Bourjea, 2012).

With regard to diversity and resilience, nesting in the Southwest Indian DPS occurs throughout the range of this DPS on islands, atolls, and on the main continent of Africa in Kenya. The nesting substrate can be variable as some of the nesting beaches are volcanic islands and the atolls are made of coralline sand. Nesting occurs throughout the year with peaks that vary among nesting sites (Dalleau *et al.,* 2012; Mortimer, 2012). The fact that turtles nest on both insular and continental sites, in variable substrates and at different peak seasons suggests a high degree of nesting diversity and indicates some resiliency.

The genetic structure of this DPS is characterized by high diversity and a mix of unique and rare haplotypes, as well as common and widespread haplotypes. These common and widespread haplotypes (CM–A8, CmP47 and CmP49) make up the majority of the haplotypes present in the Southwest Indian DPS and appear to be ancestral haplotypes (based on presence in the South Atlantic and Southwest Pacific DPSs). The Southwest Indian Ocean represents a genetic hotspot with 0.3 to 6.5 percent (mean = 4.2 percent) estimated sequence divergence among the seven haplotypes identified. These haplotypes belong to three highly diverged genetic clades of haplotypes and highlights the complex colonization history of the region. There have been no nDNA studies from this region, nor are there studies published on genetic stock composition at foraging areas within the range of the Southwest Indian DPS.

B. Summary of Factors Affecting the Southwest Indian DPS

1. Factor A: The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

a. Terrestrial Zone

Habitat degradation is reported as an important source of additional mortality for this DPS, although the exact scale of habitat destruction at nesting beaches often is undocumented (Bourjea, 2012). In particular, habitat destruction due to development of the coastline and dredging or land-fill in foraging areas is a threat to green turtles throughout the Seychelles (Mortimer *et al.,* 1996). Increases in tourism and human population growth on Mayotte Island may lead to further negative impacts upon this coastal environment (Bourjea *et al.,* 2007). The possible negative effects of artificial lighting at a main nesting beach on Aldabra are of concern at the Seychelles (Mortimer *et al.,* 2011), although it is currently being addressed

(J. Mortimer, Seychelles Dept. of Environment, pers. comm., 2014).

b. Neritic/Oceanic Zones

In Mohéli, Comoros Islands, habitat degradation due to sedimentation, sand extraction, and coral reef/seagrass bed degradation is also a concern (Ahamada, 2008). Similar situations are reported for Tanzania (Bourjea, 2012) and Madagascar (Ciccione *et al.,* 2002; Rakotonirina and Cooke, 1994 as cited in Bourjea, 2012).

For both the terrestrial and the neritic/oceanic zones, we believe that sufficient data are not available to assess the significance of these threats to the persistence of this DPS.

2. Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Legal and illegal collection of eggs and harvest of turtles throughout the Southwest Indian DPS for human consumption persists as a threat to this DPS. Egg poaching has been reported for Comoros Islands (Ahamada, 2008; Bourjea, 2012); Mozambique (Costa *et al.,* 2007; Videira *et al.,* 2008); Tanzania (Bourjea, 2012); Madagascar (Rakotonirina and Cooke, 1994; Ciccione *et al.* 2002 as cited in Bourjea, 2012; Lilette, 2006 as cited in Bourjea, 2012); and Kenya (Bourjea, 2012). Egg exploitation has affected green turtle populations in the Maldives (Seminoff *et al.,* 2004). Illegal egg collection in Mauritius seems to be an important source of mortality but no data are available.

Nesting green turtle numbers in the Seychelles have increased at protected sites, but declined where there has been heavy poaching, as on the developed islands of Mahé, Praslin, and La Digue (Bourjea, 2012). On Assumption Island and Aldabra, the number of nesting females was known to have decreased due to overharvesting (Mortimer, 1984), but they have been protected at Aldabra since 1968 (J. Mortimer, pers. comm., Seychelles Dept. of Environment, 2014).

Areas of particularly heavy exploitation of green turtles include foraging locations in the Western Indian Ocean such as Madagascar (Rakotonirina and Cooke, 1994; Mbindo, 1996; Bourjea, 2012). Artisanal fisheries, such as beach seines and gill nets, have been reported to take tens of thousands of turtles annually (Hughes, 1981; Rakotonirina, 1987; Rakotonirina and Cooke, 1994; Lilette, 2006; Humber *et al.,* 2010). This exploitation affects turtles nesting in the Eparses Islands, where poaching and illegal trade at international foraging grounds are also a threat (Rakotonirina and Cooke, 1994; Lauret-Stepler *et al.,* 2007). Similarly, commercial and small-scale fisheries at foraging grounds along the east African coast, mainly Tanzania and Kenya, affect green turtles nesting on Mayotte, Comoros Islands (Bourjea *et al.,* 2007). Intentional capture of green turtles continues in the Seychelles (Seminoff *et al.,* 2004) and in the east coast of Africa (Baldwin *et al.,* 2003; Louro *et al.,* 2006).

In summary, current legal and illegal collection of eggs and harvest of turtles persists as a threat throughout this DPS. The killing of nesting females continues to threaten the stability of green turtle populations in many areas affecting the DPS by reducing adult abundance and egg production.

3. Factor C: Disease or Predation

The prevalence of FP in the Southwest Indian DPS is not known. FP is extremely rare among green turtles in Seychelles (J.A. Mortimer, unpublished data). Side striped jackals (*Canis adustus)* and honey badgers (*Melivora capensis*) are known to depredate nests on the mainland coast of East Africa (Baldwin *et al.,* 2003).

However, quantitative data are not sufficient to assess the degree of impact of these threats on the persistence of this DPS.

4. Factor D: Inadequacy of Existing Regulatory Mechanisms

There are at least 15 national and international treaties and/or regulatory mechanisms that pertain to the Southwest Indian DPS. The analysis of these existing regulatory mechanisms assumed that all would remain in place at their current levels; however, some are not realizing their full potential because they are not adequately enforced.

Regulatory mechanisms that address the direct capture of green turtles are implemented to various degrees throughout the range of the DPS with some countries having no commitment to the implementation of the regulation. Existing regulatory mechanisms to address bycatch and coastal development are not implemented adequately as evident by the high level of bycatch within this DPS.

In addition to broad-reaching international instruments, the following countries have laws to protect green turtles: Mozambique, Republic of Seychelles, Comoros Islands, Mayotte Island, and the French Eparses Islands. However, these regulatory mechanisms are not range-wide and do not address the loss of the nesting beach, overutilization, and bycatch that are significant threats to this DPS. The Status Review revealed a lack of existing regulatory mechanisms to address sea level rise, and effects of climate change that continue to contribute to the extinction risk of this DPS.

5. Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

a. Incidental Bycatch in Fishing Gear

Quantifying the magnitude of the threat of fisheries on green turtles in the Southwest Indian DPS is very difficult given the low level of observer coverage and dearth of investigations into bycatch conducted by countries that have large fishing fleets. Sea turtles are caught in demersal and pelagic longlines, trawls, gill nets, and seines (Peterson, 2005; Louro *et al.,* 2006; Costa *et al.,* 2007; Fennessy and Isaksen, 2007; Peterson *et al.,* 2007; 2009). Bycatch is a concern along the east coast of Africa and in many island Exclusive Economic Zones (EEZs), including the Seychelles, Mayotte, Comoros, Tanzania, Kenya, and South Africa. (Mortimer *et al.,* 1996; Bourjea *et al.,* 2007a; Bourjea, 2012).

b. Effects of Climate Change and Natural Disasters

Effects of climate change include, among other things, increased sea surface temperatures, the alteration of thermal sand characteristics of beaches (from warming temperatures), which could result in the reduction or cessation of male hatchling production (Hawkes *et al.,* 2009; Poloczanska *et al.,* 2009), and a significant rise in sea level, which could significantly restrict green turtle nesting habitat. In the Southwest Indian DPS, climate change could have profound long-term impacts on nesting populations because much of the nesting occurs in low-lying islands and atolls. The pending sea level rise from climate change is a potential problem, as this will inundate nesting sites and decrease available nesting habitat (Daniels *et al.,* 1993). While sea turtles have survived past eras that have included significant temperature fluctuations, future climate change is expected to happen at unprecedented rates, and if turtles cannot adapt quickly they may face local to widespread extirpations (Hawkes *et al.,* 2009). Impacts from global climate change induced by human activities are likely to become more apparent in future years (IPCC, 2007).

In summary, within Factor E, we find that fishery bycatch that occurs throughout the range of the DPS, particularly bycatch of green turtles from long lining operations, small prawn trawl fishery, and coastal gill nets, can affect juvenile to adult size turtles. In addition, climate change and natural disasters are expected to be an increasing threat to the persistence of this DPS.

C. Conservation Efforts for the Southwest Indian DPS

Nine countries of the southwest Indian Ocean developed and signed the Indian Ocean Southeast Asian Marine Turtle Memorandum of Understanding (IOSEA; *www.ioseaturtles.org*): Comoros in June 2001, United Republic of Tanzania in June 2001, Kenya in May 2002, Mauritius in July 2002, Madagascar in January 2003, Seychelles in January 2003, South Africa in February 2005; and Mozambique and France (Indian Ocean) in December 2008. IOSEA aims to develop and assist countries of the region in the implementation of the IOSEA regional strategy for management and conservation of sea turtles and their habitats. Accordingly, IOSEA has been successfully coordinating and closely monitoring region-wide conservation efforts in the Indian Ocean for years. This has included the development of a state-of-the-art online reporting facility, satellite tracking, genetic regional database, flipper tag inventory, and a global bibliographic resource.

Also within the Southwest Indian DPS, the Western Indian Ocean-Marine Turtle Task Force plays a role in sea turtle conservation. This is a technical, non-political working group comprised of specialists from eleven countries: Comoros, France (La Réunion), Kenya, Madagascar, Mauritius, Mozambique, Seychelles, Somalia, South Africa, United Kingdom and Tanzania, as well as representatives from intergovernmental organizations, academic, and non-governmental organizations within the region.

The Indian Ocean Tuna Commission (IOTC) is playing an increasingly constructive role in turtle conservation. In 2005, the IOTC adopted Resolution 05/08, superseded by Resolution 09/06 on Sea Turtles, which sets out reporting requirements on interactions with sea turtles and accordingly provides an executive summary per species for adoption at the Working Party on Ecosystem and By-catch and then subsequently at the Scientific Committee. In 2011, IOTC developed a ''Sea Turtle Identification Card'' to be distributed to all long-liners operating in the Indian Ocean (*http://www.iotc.org/*).

Although there is considerable uncertainty in anthropogenic mortalities, especially in the water, the DPS may have benefitted from conservation efforts at the nesting beaches.

D. Extinction Risk Assessment and Findings for the Southwest Indian DPS

The Southwest Indian DPS is characterized by relatively high levels of green turtle nesting abundance and increasing trends. The overall nesting range for the Southwest Indian DPS occurs throughout the range of this DPS on islands, atolls, and on the main continent of Africa in Kenya. The fact that turtles nest on both insular and continental sites, and nesting substrate can be variable as some of the nesting beaches are volcanic islands and the atolls are made of coralline sand, suggests a high degree of nesting diversity. Nesting also occurs throughout the year with peaks that vary among rookeries (Dalleau *et al.,* 2012; Mortimer, 2012). The genetic structure of this DPS is characterized by high diversity and a mix of unique and rare haplotypes, as well as common and widespread haplotypes. However, the five-factor analysis in the Status Review revealed continuing threats to green turtles and their habitat within the range of the DPS.

Nesting beaches throughout the range of this DPS are susceptible to coastal development and associated beachfront lighting, erosion, and sea level rise. Coral reef and seagrass bed degradation continues in portions of the range of the DPS affecting foraging turtles. Direct capture of juvenile and adult turtles continues to take place using a variety of gear types in artisanal and industrial fisheries.

The Southwest Indian DPS is protected by various international treaties and agreements as well as a few national laws, and there are protected beaches throughout the range of this DPS. As a result of these designations and agreements, many of the intentional impacts directed at sea turtles have been lessened, such as the harvest of eggs and adults in several nesting areas, although the extent to which they are reduced is not clear.

While the Status Review indicates that the DPS shows strength in many of the critical population parameters, there are still concerns about threats to the DPS from fisheries interactions, direct harvest (eggs and adults), and climate change.

For the above reasons, we propose to list the Southwest Indian DPS as threatened. We do not find the DPS to be in danger of extinction presently because of the high nesting abundance and geographically widespread nesting at a diversity of sites; however, the continued threats are likely to endanger the DPS within the foreseeable future.

XI. North Indian DPS

A. Discussion of Population Parameters for the North Indian DPS

The range of the North Indian DPS begins at the border of Somalia and Kenya north into the Gulf of Aden, Red Sea, Persian Gulf and east to the Gulf of Mannar off the southern tip of India and includes a major portion of India's southeastern coast up to Andra Pradesh. The southern and eastern boundaries are the equator (0°) and 84° E., respectively, which intersect in the southeast corner of the range of the DPS. It is bordered by the following countries (following the water bodies from west to east): Somalia, Djibouti, Eritrea, Sudan, Egypt, Israel, Jordan, Saudi Arabia, Yemen, Oman, United Arab Emirates, Qatar, Bahrain, Kuwait, Iraq, Iran, Pakistan, India, and Sri Lanka (Figure 2).

Nesting is concentrated primarily in the northern and western region of the range of the North Indian DPS from the Arabian Peninsula to the Pakistani-Indian border, with smaller but significant nesting colonies occurring in Sri Lanka, India's Lakshadweep Island group, and the Red Sea. Nesting in the Arabian Gulf occurs in low numbers.

Seagrass beds are extensive within the range of the DPS, although a comprehensive understanding of juvenile and adult foraging areas is lacking. There are extensive foraging areas in the Arabian Gulf, on the coasts of Oman and Yemen, Gulf of Aden, and in the Red Sea (Ross and Barwani, 1982; Salm, 1991; Salm and Salm, 2001). Barr al Hickman, along the Sahil al Jazit coastline in Oman, is one of the most important known foraging grounds for green turtles. Although development of dense seagrass beds is limited seasonally due to monsoons, the Arabian Sea coast's foraging areas are extensive (Jupp *et al.,* 1996 as cited in Ferreira *et al.,* 2006). Juvenile green turtles have been sighted and captured year-round in the lagoons in Agatti and Kavaratti. These Lakshadweep lagoons are known to be important developmental habitat for green turtles in this DPS (Tripathy *et al.,* 2002; Tripathy *et al.,* 2006).

Thirty-eight total nesting sites were identified by the SRT, some being individual beaches and others representing multiple nesting beaches, although nesting data is more than a decade old for the vast majority of these sites. Nonetheless, our best estimates indicate that, of the 38 sites, two have >10,000 nesting females (Ras Sharma, Yemen; 18,000 (PERSGA/GEF, 2004) and Ras Al Hadd, Oman; 16,184 (Ross, 1979; AlKindi *et al.,* 2008)); one has 5,001–10,000 nesting females (Kamgar Beach at Ormara, Pakistan; 6,000 (Groombridge *et al.,* 1988)); five have 1,001–5,000 nesting females (Saudi Arabian Gulf Islands; 2,410 (Al-Merghani *et al.,* 2000; Pilcher, 2000); north coast of Ras Al Hadd, Oman; 1,875 (Salm *et al.,* 1993); Ra's Jifan to Ra's Jibsh, Oman; 1,500 (Ross, 1979; AlKindi *et al.,* 2008); Masirah Island, Oman; 1,125 (Grobler *et al.,* 2001); and Gujarat, India; 1,125 (Sunderraj *et al.,* 2006a, 2006b; K. Shanker pers. comm., 2013); 15 sites have 101–500 nesting females; 10 have fewer than 50; and one is unquantified. The largest site, Ras Sharma in Yemen, accounts for 33 percent of the nesting females. Daran Beach, Jiwani, Pakistan, with an estimated 371 nesting females (Waqas *et al.,* 2011), and Zabargard Island, Egypt, with an estimated 444 nesting females (Hanafy, 2012; El-Sadek *et al.,* 2013), are the only sites for which 10 or more years of recent data are available for annual nesting female abundance (the standards for representing trends in bar plot in this report). It is difficult to ascertain any trend from these data. No sites met the standards for PVA. However, some other sites were examined, with caveats, as follows.

Nesting at Ras Al Hadd appears to have increased from approximately 6,000 females nesting each year for the period 1977 to 1979 (Ross and Barwani, 1982) through the late 1980s (Groombridge and Luxmoore, 1989), to the estimate of 16,184 nesting females, as calculated from 21,578 nests found in 2007 (AlKindi *et al.,* 2008). Declines are evident at Hawkes Bay and Sandspit, Pakistan, where a mean of approximately 1,300 nests were deposited annually from 1981 to 1985 (Groombridge and Luxmoore, 1989) and a mean of approximately 600 nests were laid from 1994 to 1997 (Asrar, 1999). At Gujarat, India, 866 nests were deposited in 1981 (Bhaskar, 1984) and 461 nests in 2000 (Sunderraj *et al.,* 2006); however, because there are only two data points, it is not possible to determine a trend. At Ras Sharma, counts of nightly nesting females during peak nesting season in 1966 and 1972 (30–40 females; Hirth, 1968; Hirth and Hollingsworth, 1973) versus the same index during the peak of the 1999 nesting season (15 females; Saad, 1999) are suggestive of a decline. Again the lack of multiple-year data sets for both Gujarat and Ras Sharma preclude trend assessment.

With regard to spatial structure, only one stock from this DPS (in Saudi Arabia) has been characterized genetically based on limited sampling; however, it was found to be very distinct from other nesting sites elsewhere in the Indian Ocean based on mtDNA analysis. There are no studies of foraging grounds within the range of the North Indian DPS to provide information on the distribution or the mixing of turtles outside of this DPS. A few flipper tag recoveries have been reported with no reported recoveries outside of the range of the North Indian DPS. Adult females from Egypt, Sri Lanka, and Oman were satellite tagged and tracked during post-nesting migrations, and all remained within the range of the North Indian DPS. The satellite telemetry data for nesting females in Sri Lanka provided some information on possible foraging locations which were within the inshore waters of southern Sri Lanka and the Gulf of Mannar Biosphere Reserve, although sample size was limited (Richardson *et al.,* 2013). Satellite telemetry for nesting females in Kuwait verified nesting in Qaru Island. These turtles migrated to the shallow seas in Saudi Arabia (Rees *et al.,* 2013).

With regard to diversity and resilience, the demography of green turtles in the North Indian DPS appears to vary among nesting assemblages, suggesting a complex population structuring in the North Indian DPS. The population is moderately dispersed within the range of the North Indian DPS, although the greatest nesting is concentrated in the northern and western region of the DPS's range, with about 72 percent of the nesting concentrated in Oman and Yemen. The nesting season varies widely within the range of the DPS. The peak nesting season in Ras Sharma, Yemen is July, in Gujarat, India, it is from August to March (Sunderraj *et al.,* 2006), and in Oman, nesting occurs year-round.

B. Summary of Factors Affecting the North Indian DPS

1. Factor A: The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

a. Terrestrial Zone

One of the largest green turtle nesting populations within this DPS is concentrated on the nesting beaches of Ras Al Hadd, Oman (Ross, 1979). Ras Al Hadd, Ras al Jinz, and the numerous smaller nesting beaches south of it are protected from development as part of the Ras Al Hadd Nature Reserve. However, upland light pollution is negatively impacting these otherwise suitable nesting habitats (E. Possardt, USFWS, pers. comm., 2013). The most important green turtle nesting beaches in Yemen fall within the Ras Sharma Protected Area, and this nesting habitat is secure from beach development threats.

Light pollution is increasing near the Karan Island, Saudi Arabia site from oil rig developments, but the impact on hatchlings and nesting females is unknown (J. Miller, Biological Research and Education Consultants, pers. comm., 2013). At Ras Baridi, one of the main nesting beaches in Saudi Arabia, uncontrolled particulate emissions from a large cement factory has coated the beaches at times and poses a threat to hatchlings because they are unable to emerge from the nest due to the hardened sand (PERSGA/GEF, 2004; Pilcher, 1999).

b. Neritic/Oceanic Zones

Trawling occurs throughout much of the range of the North Indian DPS and has the potential to destroy bottom habitat in these areas. Marine pollution, including direct contamination and structural habitat degradation, affects green turtle neritic and oceanic habitat. The most dramatic example of the threats to sea turtles and their habitat from oil pollution in the region is the Gulf War oil spill in the Arabian Gulf in 1991, which is estimated to be the largest oil spill in history at the time of the 2010 report (ABC, 2010).

In the Arabian Gulf, extensive seagrass beds provide important foraging sites for green turtles within waters of Bahrain, United Arab Emirates, Qatar, and Saudi Arabia, but these are being degraded and lost from the continual threat of dredging, siltation, and land reclamation (Pilcher, 2000, 2006; Al-Muraikhi *et al.,* 2005; Abdulqader, 2008; Al-Abdessalaam *et al.,* 2008).

In the waters surrounding the Lakshadweep islands in India, there exist high densities of green turtles that, without the natural level of control from the top predators such as tiger sharks, can cause an increase in grazing pressure and reduce the amount of healthy seagrass beds available (Kelkar *et al.,* 2013).

In summary, we find that the North Indian DPS of the green turtle is negatively affected by ongoing changes in both its terrestrial and marine habitats as a result of land and water use practices. Beach and marine pollution are an increasing threat to this DPS.

2. Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Directed take of eggs and turtles by humans occurs at the primary green turtle nesting beaches and in waters off of Saudi Arabia (Al-Merghani *et al.,* 1996; Pilcher, 2000), Yemen (K. Nasher, Sana'a University, pers. comm., 2013), Oman (R. Baldwin, Five Oceans LLC, pers. comm., 2013), Djibouti and Somalia (PERSGA 2001; van de Elst, 2006; Galair, 2009; van de Giessen, 2011; Witsen, 2012), Eritrea (Howe *et al.,* 2004; Pilcher, 2006; Teclemariam *et al.,* 2009), the Islamic Republic of Iran (Mobaraki, 2004; 2007; 2011), India (Sunderraj *et al.,* 2006), and Sri Lanka (Rajakaruna *et al.,* 2009; Turtle Conservation Project, 2009). Directed take of nesting females is also still common at nesting beaches in Yemen (K. Nasher, Sana'a University, pers. comm., 2013). In spite of wildlife protection laws, green turtles are still killed opportunistically for food in Oman (R. Baldwin, Five Oceans LLC, pers. comm., 2013).

Illegal and legal capture of sea turtles and the collection of turtle eggs is fairly widespread in the Djibouti and Somalia region of the Gulf of Aden and the Red Sea, and turtle meat, oil and eggs are an important source of subsidiary food for artisanal fishers (PERSGA, 2001; van de Elst, 2006; Galair, 2009; van de Giessen, 2011; Witsen, 2012). Harvesting of sea turtle eggs and meat for consumption by local communities and fishers occurs at a subsistence level in Eritrea (Howe *et al.,* 2004; Pilcher, 2006; Teclemariam *et al.,* 2009); however, the pressure on green turtle populations is reported to be high because they are prized for their meat products (Teclemariam *et al.,* 2009). Egg harvesting has also been reported as a threat impacting green turtles in the Islamic Republic of Iran, with eggs being used for both consumption (in some cases as an aphrodisiac) and for use in traditional medicines (Mobaraki, 2004; 2007; 2011).

In spite of wildlife protection laws, green turtles are still killed opportunistically for trade in the Bay of Mannar between India and Sri Lanka (Bhupathy and Saravanan, 2006). In India, green turtle export was banned in the 1980s; however, subsistence harvesting continues (Bhupathy and Saravanan, 2006). An increase in the number of green turtles killed by fishers has been reported in Agatti Island, Lakshadweep, India. The cause for the killing has been linked to increases in green turtles within the area. The perception is that green turtles damage fishing gear and overgraze seagrass thereby reducing catch levels (Arthur *et al.,* 2013).

In summary, current legal and illegal collection of eggs and harvest of turtles throughout the range of the North Indian DPS for human consumption persists as a threat to this DPS. The harvest of nesting females continues to threaten the stability of green turtle populations in many areas affecting the DPS by reducing adult abundance and egg production.

3. Factor C: Disease or Predation

The prevalence of FP in the North Indian DPS is not known. Predation of hatchlings and eggs by red foxes (*Vulpes vulpes arabica*) is common at the Ras al Jinz, Oman green turtle nesting beach (Mendonça *et al.,* 2010), and depredation by feral dogs has been identified as a major threat at sea turtle nesting beaches in Pakistan (Asrar, 1999; Firdous, 2001) and the main green turtle nesting beach at Ras Sharma (Stanton, 2008). On two Egyptian Red Sea beaches (Ras Honkorab and Om Al-Abath beaches, which are both within Wadi Gimal National Park limits), predation is reported to be very high with only a few nests surviving (Mancini, 2012). The most common predators observed on these two beaches in Egypt were desert foxes (*V. zerda*) and dogs (*Canis lupus familiaris*), but ghost crabs were regularly observed near nests as well. In Qatar, depredation of eggs and hatchlings by foxes has been identified as a key source of turtle mortality (Al-Muraikhi *et al.,* 2005; Pilcher, 2006). Along the beaches of Gujarat in India, dogs, jackals, monitor lizards, crabs, crows, and possibly hyenas and feral pigs depredate nests and eat hatchings (Sunderraj *et al.,* 2006).

Although disease and predation are known to occur, quantitative data are not sufficient to assess the degree of impact of these threats on the persistence of this DPS.

4. Factor D: Inadequacy of Existing Regulatory Mechanisms

There are several international treaties and/or regulatory mechanisms that pertain to the North Indian DPS, and nearly all countries lining the North Indian DPS have some level of national legislation directed at sea turtle protection. The following countries have laws to protect green turtles: Bahrain, Djibouti, Egypt, Eritrea, India, Iran, Iraq, Kuwait, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Sri Lanka, Sudan, United Arab Emirates, and Yemen. In addition, at least 14 international treaties and/or regulatory mechanisms apply to the conservation of green turtles in the North Indian DPS.

Within the last decade, since the establishment of the Jeddah Convention (The Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment), there is more of an effort to strengthen participation in international and regional agreements (PERSGA, 2010). The analysis of these existing regulatory mechanisms assumed that all would remain in place at their current levels. The overall effectiveness and enforcement of these laws varies among the countries and relies on each country's priorities. Often the enforcement of these laws is done in collaboration with non-governmental agencies such as HEPCA in the Red Sea (*http://www.hepca.org/*).

Regulatory mechanisms that address the direct capture of green turtles are implemented to various degrees throughout the range of the DPS with some countries having no regulation in place. Our Status Review reported no widespread regulations for the gill net and trawl fisheries to address the threat of bycatch. The Status Review revealed a lack of existing regulatory mechanisms to address coastal development, sea level rise, and effects of climate change that continue to contribute to the extinction risk of this DPS.

5. Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

a. Incidental Bycatch in Fishing Gear

Sea turtle bycatch from gill nets, trawls, and longline fisheries is a significant cause of sea turtle mortality for the North Indian DPS, although there are fewer bycatch data than for other regions of the world (Wright and Mohanty, 2002; Project GloBAL, 2007; Bourjea *et al.,* 2008; Abdulqader, 2010; Wallace *et al.,* 2010). The magnitude of trawl, gill net, and longline fisheries within the range of the North Indian DPS is great with no substantive sea turtle protection measures in place to reduce sea turtle bycatch mortality. Along the coast of Ras Al Hadd, one of the densest nesting beaches of this DPS, fishery related mortality is particularly high where green turtles are incidentally caught in fishing gear (Salm, 1991).

i. Gill Net Fisheries

Gill nets are widely deployed and used throughout the region and known to kill thousands of sea turtles in some regions (Project GloBAL, 2007). Two member Indian Ocean Tuna Commission parties, Iran and Kenya, alone reported the use of 12,023 gill nets in the Indian Ocean in 2012. In Lakshadweep and Tamil Nadu, India, the most common net fisheries (*i.e.,* gill net, shore seine, anchor net and drag nets) are known to incidentally catch green turtles (Tripathy *et al.,* 2006; Bhupathy and Saravanan, 2006).

Incidental capture of sea turtles in fishing nets (presumably in gill nets or set nets) has been identified as the main cause of mortality of juvenile green turtles within Iranian and the United Arab Emirates foraging areas (Mobaraki, 2007; Al-Abdessalaam *et al.,* 2008). In Qatar, entrapment of turtles in fishing nets has been identified as a key source of mortality (Al-Muraikhi *et al.,* 2005).

ii. Trawl Fisheries

Shrimp trawling occurs in many countries throughout the range of the North Indian DPS including Pakistan, India, Bahrain, and Saudi Arabia. In Yemen, trawling is believed to be a significant threat to sea turtles, mainly hawksbill and greens; however, no data are available (Bourjea *et al.,* 2008). Pakistan and India require the use of TEDs to meet the requirements of U.S. Public Law 101–162, section 609 for exporting shrimp to the United States, but the level of compliance is unclear (E. Possardt, USFWS, pers. obs. 2013). Nowhere else within the range of the North Indian DPS are TEDs being used and it can be assumed that significant sea turtle bycatch occurs. One documented assessment of the impact of trawling on sea turtles in this region is from Bahrain where trawls were reported to capture over 300 sea turtles annually, mostly greens (Abdulqader and Miller, 2012; Abdulqader, 2010).

b. Vessel Strikes

Boat strikes have been identified as a major cause of sea turtle mortality in the United Arab Emirates (Al-Abdessalaam *et al.,* 2008) and Qatar (Al-Muraikhi *et al.,* 2005). Boat strikes of sea turtles also have been identified as a regular occurrence in Iran and seem to be increasing in some areas (Mobaraki, 2011). Boat strikes are undoubtedly a regular occurrence throughout the Arabian Gulf and other important green turtle foraging grounds within the range of the North Indian DPS and, cumulatively, are likely significant, but quantification is lacking.

c. Beach Driving

Beach driving by fishers who haul and launch boats from Ras al Jinz beach in Oman is highly problematic, and hatchling turtles are likely being caught in ruts, struck or run over. However, no assessment has been conducted to determine the extent of impacts on nesting turtles and hatchlings (E. Possardt, USFWS, pers. comm., 2013).

d. Pollution

Pollution has been identified as a main threat to sea turtles in Iran (Mobaraki, 2007) and Pakistan (Firdous, 2001); however, no specific information about the type of pollution was provided. In Sri Lanka, Kapurusinghe (Kapurusinghe, 2006) stated that polluted inland water flows into Beira Lake and subsequently the sea, and that garbage, including polythene and plastics, dumped on beaches in some areas is washed into the sea, where it can be lethal to sea turtles. In Gujarat, India, the increase in ports and shipping traffic results in problems from oil spills, garbage, and other pollutants such as fertilizers and cement (Surderraj *et al.,* 2006).

e. Effects of Climate Change and Natural Disasters

Similar to other areas of the world, climate change and sea level rise have the potential to affect green turtles in the North Indian DPS. Effects of climate change include, among other things, increased sea surface temperatures, the alteration of thermal sand characteristics of beaches (from warming temperatures), which could result in the reduction or cessation of male hatchling production (Hawkes *et al.,* 2009; Poloczanska *et al.,* 2009), and a significant rise in sea level, which could significantly restrict green turtle nesting habitat. In addition, cyclones such as those occurring in consecutive years in 1998 and 1999 in Kachchch, India, cause severe erosion of the nesting beach (Surderraj *et al.,* 2006) and, when combined with the effects of sea level rise, may have increased cumulative impacts in the future. While sea turtles have survived past eras that have included significant temperature fluctuations, future climate change is expected to happen at unprecedented rates, and if turtles cannot adapt quickly they may face local to widespread extirpations (Hawkes *et al.,* 2009). Impacts from global climate change induced by human activities are likely to become more apparent in future years (IPCC, 2007).

Within Factor E, we find that fishery bycatch (longline, gill net, and trawl fishing) occurs throughout the range of the DPS and is a significant threat to this DPS. In addition, pollution, vessel strikes, climate change and natural disasters are expected to be an increasing threat to the persistence of this DPS.

C. Conservation Efforts for the North Indian DPS

In 2012, the IOTC began requiring its 31 contracting Parties to report sea turtle bycatch and to use safe handling and release techniques for sea turtles on longline vessels. The IOTC and IOSEA also recently completed an ''Ecological Risk Assessment and Productivity—Susceptibility Analysis of sea turtles overlapping with fisheries in the IOTC region.'' One conclusion was that green turtles account for 50 88 percent of artisanal and commercial gill nets bycatch. Two methods of estimating total bycatch were used, and resulted in an annual gill net bycatch estimate of 29,488 sea turtles within the IOTC region.

While conservation efforts for the North Indian DPS are extensive and expanding, they still remain inadequate to ensure the long-term viability of the population. Efforts have been largely focused on the nesting beaches, and there are only recent efforts underway to understand the extent of green turtle interactions with gill nets and trawlers and the resulting cumulative effects from bycatch—one of the major threats to this DPS. Concerted efforts to identify and protected critical foraging grounds is also lacking.

D. Extinction Risk Assessment and Findings for the North Indian DPS

The North Indian DPS has a high level of green turtle nesting abundance with two of the largest nesting assemblages of green turtles in the world nesting in Yemen and Oman. The North Indian DPS also has expansive, largely undeveloped nesting beaches, and many of these beaches are protected from development as nationally designated reserves or protected areas, although threats still remain. The North Indian DPS also features extensive coastal seagrass beds distributed throughout the region, which provide abundant foraging grounds for this species. Nesting beaches are distributed broadly throughout the region.

Coastal development, beachfront lighting, fishing practices, and marine pollution at nesting beaches and important foraging grounds are continuing concerns across the DPS. Current illegal harvest of green turtles and eggs for human consumption is a continuing but limited threat to this DPS. Fishery bycatch occurs throughout the North Indian DPS, particularly bycatch mortality of green turtles from gill nets and trawl fisheries, and the cumulative mortality from these fisheries is probably the greatest threat to this DPS. Additional threats from boat strikes, which are becoming more common, and expected impacts of climate change, will negatively affect this DPS.

Conservation efforts are substantial but uneven in the range of the North Indian DPS and focused almost entirely on nesting beaches. The ability for some countries to sustain or develop needed conservation programs in the context of political instability within the region is of concern. Further, our analysis did not consider the scenario in which current laws or regulatory mechanisms were not continued. Given the conservation dependence of the species, without mechanisms in place to continue conservation efforts in this DPS, some threats could increase and population trends could be affected.

For the above reasons, we propose to list the North Indian DPS as threatened. We do not find the DPS to be in danger of extinction presently because of high nesting abundance in protected areas; however, the continued threats are likely to endanger the DPS within the foreseeable future.

XII. East Indian-West Pacific DPS

A. Discussion of Population Parameters for the East Indian-West Pacific DPS

The western boundary for the range of the East Indian–West Pacific DPS is 84° E. longitude from 40° S. to where it coincides with India near Odisha, northeast along the shoreline and into the West Pacific Ocean to include Taiwan extending east at 41° N. to 146° E. longitude, south and west to 4.5° N., 129° E., then south and east to West Papua in Indonesia and the Torres Straits in Australia. The southern boundary is 40° S. latitude, encompassing the Gulf of Carpentaria (Figure 2).

Green turtle nesting is widely dispersed throughout the range of the East Indian–West Pacific DPS, with important nesting sites occurring in Northern Australia, Indonesia, Malaysia (Sabah and Sarawak Turtle Islands), Peninsular Malaysia, and the Philippine Turtle Islands. The in-water range of the East Indian-West Pacific DPS is similarly widespread with shared foraging sites throughout the range of the DPS. The largest nesting site lies within Northern Australia, which supports approximately 25,000 nesting females (Limpus, 2009). Nonetheless, populations are substantially depleted from historical levels.

There are 58 known nesting sites, although we note that the nesting female estimates for many of these sites are over a decade old. The largest, Wellesley Group, lies in northern Australia and supports approximately 25,000 nesting females (EPA Queensland Turtle Conservation Project unpublished data cited in Limpus, 2009). Five sites have 5,001–10,000 nesting females: Bilang-Bilangan, Indonesia (7,156; Reischig *et al.,* 2012); Sabah Turtle Island Park, Malaysia (7,011; de Silva, 1982; Basintal, 2002; P. Bastinal pers. comm., 2011); Ningaloo, North West Cape, Australia (6,269; Prince, 2003; Markovina, 2008; Bool *et al.,* 2009; Gourlay *et al.,* 2010; Kelliher *et al.,* 2011); Baguan Island, Philippines (5,874; Pawikan Conservation Project, 2013); and Pangumbahan, Indonesia (5,199; Muhara and Herlina, 2012). Seven sites have 1,001–5,000 nesting females: Sangalaki (2,740; Reischig *et al.,* 2012), Enu (2,048; Dethmers, 2010), Mataha (1,652; Reischig *et al.,* 2012), and Belambangan Island, Indonesia (1,736; Dermawan, 2002); Terranganu (1,875; Chan, 2010) and Sarawak Turtle Island, Malaysia (1,155; Groombridge and Luxmoore, 1989; Chan 2006; Chan, 2010); and Lihiman, Philippines (1,217; Pawikan Conservation Project, 2013). Eight sites have 501–1,000 nesting females, 30 have <500 nesting females, and seven are unquantified.

Green turtle populations within the range of the East Indian-West Pacific DPS have experienced apparent declines at some nesting sites, and increases at others in the past several decades. For instance, in Southeast Asia, data suggest that populations have declined in the Gulf of Thailand, Vietnam, and the Berau Islands, Meru Betiri National Park, Pangumbahan, Thamihla Kyun, and perhaps Enu Island, all in Indonesia, although the lack of recent and/or multiple year data prevents an assessment of the current trends at these sites. At Sipadan, Sarawak and Terengganu in Malaysia, nesting appears to be stable, although Terengganu might be decreasing. Nesting has remained stable in the Philippine Turtle Islands and may have increased at the Sabah Turtle Islands, Malaysia. In Western Australia, data are not sufficient to draw any conclusions regarding long-term trends, although these sites, together with the Wellesley Group in Northern Australia (the largest nesting site), may constitute the most important green turtle nesting concentration in the Indian Ocean.

When examining spatial structure for the East Indian-West Pacific DPS, the SRT examined three lines of evidence: genetic data, flipper and satellite tagging, and demographic data. Genetic sampling in the East Indian-West Pacific DPS has occurred at 22 nesting sites. There appears to be a complex population structure, even though there are gaps in sampling relative to distribution. Overall, this region is dominated by a few common and widespread haplotypes and has varying levels of spatial structure characterized by the presence of rare/unique haplotypes at most nesting sites. There is significant population substructuring.

Tagging and tracking studies have been geared to studying internesting migrations, and defining the range of internesting habitats and post-nesting migrations. Green turtles that were satellite tracked from Pulau Redang, Terengganu indicate migrations to the South China Sea and Sulu Sea areas (Liew, 2002). Cheng (2000) reported movements of eight post-nesting green turtles from Wan-An Island, Taiwan that were satellite tracked, and which distributed widely on the continental shelf to the east of mainland China. Satellite telemetry studies conducted from 2000 to 2003 demonstrated that the green turtles nesting at Taipin Tao are a shared natural resource among the nations in the southern South China Sea. Female green turtles tracked in the same area travelled long distances in a post-nesting migration, ending in the Sulu Sea in the Philippines and the Malaysia Peninsula with distances that ranged from 456 to 2,823 km (Charuchinda *et al.,* 2002) and in the coastal region of Japan (Wang, 2006). Waayers and Fitzpatrick (2013) found that in the Kimberly region of Australia, the green turtle appears to have a broad migration distribution and numerous potential foraging areas.

Mixed stock analysis of foraging grounds shows that green turtles from multiple nesting beach origins commonly mix at feeding areas in foraging grounds across northern Australia (Dethmers *et al.,* 2010) and Malaysia (Jensen, 2010) with higher contributions from nearby large nesting sites. There is evidence of low frequency contribution from nesting sites outside the range of the DPS at some foraging areas.

The demography of green turtles in the East Indian-West Pacific DPS varies throughout the nesting assemblages. This variation in parameters such as mean nesting size, remigration interval, internesting interval, clutch size, hatching success, and clutch frequency suggests a high level of population structuring in this DPS.

With regard to diversity and resilience, nesting and foraging areas are widespread within the range of this DPS, providing a level of population resilience through habitat diversity. The nesting season varies throughout the range of the DPS, with nesting from June to August in the inner Gulf of Thailand, peak nesting from March to July on Derawan Island (Charuchinda and Monanunsap, 1998; Abe *et al.,* 2003; Aureggi *et al.,* 2004; Adnyana *et al.,* 2008), year-round nesting in Thameela Island, Myanmar and Aru, Indonesia (although peaking from November to March; (Dethmers, 2010; Lwin, 2009), and peak nesting from November to March in Aru, Indonesia (Dethmers, 2010), Sukamade, southeastern Java (Arinal, 1997), Barrow Island, and western Australia (Pendoley, 2005). Nesting occurs on both insular and continental sites, yielding a degree of nesting diversity. Limited information also suggests that there are two types of nesting females within the DPS: Those with high site fidelity which nest regularly at one site, such as the Sabah Turtle Islands; and those with low site fidelity such as at Ishigaki Island which select different nesting sites allowing for increased diversity and resilience for the DPS (Basintal, 2002; Abe *et al.,* 2003).

B. Summary of Factors Affecting the East Indian-West Pacific DPS

1. Factor A: The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

a. Terrestrial Zone

In the East Indian-West Pacific DPS, the majority of green turtle nesting beaches are extensively eroded. Nesting habitat is degraded due to a variety of human activities largely related to tourism. Coastal development and associated artificial lighting, sand mining, and marine debris affect the amount and quality of habitat that is available to nesting green turtles. However, there are sanctuaries and parks throughout the region where nests are protected to various degrees.

Most of the beaches in Vietnam have a large amount of marine debris, which includes glass, plastics, polystyrenes, floats, nets, and light bulbs. This debris can entrap turtles and impede nesting activity.

In Australia, the majority of green turtle nesting along the beaches of the Gulf of Carpentaria occurs outside of the protection of the National Park. Other minor nesting sites lie within the protected lands of the Indigenous Protected Areas (Limpus, 2009). In Western Australia, the impacts to nesting and hatchling green turtles by independent turtle watchers as well as off-road vehicles has increased in the Ningaloo region as the number of visitors has increased over the years (Waayers, 2010). Nesting turtles and hatchlings are routinely disturbed by people with their cars and flashlights (Kelliher *et al.,* 2011). Burn-off flares associated with oil and gas production on the Northwest shelf of Australia are in sufficiently close proximity to the green turtle nesting beaches to possibly cause hatchling disorientation (Pendoley, 2000)

b. Neritic/Oceanic Zones

Green turtles forage in the seagrass beds around the Andaman and Nicobar Islands in India. Some of these seagrass beds in the South Andaman group are no longer viable foraging habitat because of siltation and degradation due to waste disposal, a byproduct of the rapid increase in tourism (Andrews, 2000). Green turtles that forage off the waters of the Bay of Bengal in south Bangladesh also face depleted foraging habitat from divers collecting seagrass for commercial purposes and by anchoring of commercial ships, ferries, and boats in this habitat (Sarkar, 2001). In the nearshore waters of Thailand, seagrass beds are partially protected since fishing gear such as trawls are prohibited (Charuchinda *et al.,* 2002). In the waters surrounding the islands of Togean and Banggai in Indonesia, the use of dynamite and potassium cyanide are common, and this type of fishing method destroys green turtle foraging habitat (Surjadi and Anwar, 2001).

Seagrass beds are found throughout the nearshore areas of Vietnam's mainland coast and islands (Ministry of Fisheries, 2003). Destructive fishing practices have been and possibly continue to be a major threat to this habitat in 21 of Vietnam's 29 provinces (Asia Development Bank, 1999 as cited in the Ministry of Fisheries, 2003) and in the waters of Indonesia (Cruz, 2002; Dethmers, 2010). Although these destructive fishing practices are prohibited by legislation passed in 1989, enforcement may not be sufficient to prevent these practices from occurring. Green turtle foraging habitat is under increased threat from decreased water quality through river run-off and development (Ministry of Fisheries, 2003).

In summary, within Factor A, we find that coastal development, beachfront lighting, erosion resulting from sand mining, and sea level rise, are a significant threat to a large portion of this DPS. The extent of fishing practices, depleted seagrass beds, and marine pollution is broad with high levels occurring in waters where high numbers of green turtles are known to forage and migrate are significant threats to the persistence of this DPS.

2. Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The green turtle populations within this DPS have been declining throughout their range. Populations throughout Asia have been depleted by long-term harvests of eggs and adults, and by by-catch in the ever-growing fisheries (Shanker and Pilcher, 2003). On St. Martins Island, Bangladesh, over-exploitation has brought the nesting turtles to near extinction (Hasan, 2009). Nesting females continue to be killed in countries within Southeast Asia and the Indian Ocean (Fleming, 2001; Fretey, 2001; Cruz, 2002). Despite substantial declines in green turtle nesting numbers, egg harvest remains legal in several of the countries within the range of this DPS. Some countries have protections in place; however, harvest continues due to lack of enforcement.

In Myanmar and Thailand, hatcheries are set up to protect a portion of the eggs. However, these hatcheries retain hatchlings for several days for tourism purposes, thus reducing the likelihood of hatchling survival (Charuchinda *et al.*, 2002).

Turtle nesting numbers have decreased in peninsular Malaysia and the Philippines due to more than 40 years of overharvesting of eggs and females (Siow and Moll, 1982; de Silva, 1982; Limpus, 1995; Cruz, 2002). In order to provide some protection for turtles, all three Sabah Turtle Islands were acquired and protected by the Sabah State Government in the 1970s (de Silva, 1982). After more than 20 years of conservation efforts (1970–1990), the population had still not shown signs of recovery (Limpus *et al.*, 2001).

Local islanders in Indonesia have traditionally considered turtles, especially green turtles, as part of their diet (Hitipeuw and Pet-Soede, 2004 as cited in FAO, 2004). Illegal egg harvesting continues, but there is an increased effort to fully protect green turtles from harvest on the islands of Bilang-Bilangan and Mataha in Indonesia (Reischig *et al.*, 2012).

Despite legal protections for sea turtles, at-sea poaching of turtles is a continuing problem in Southeast Asia, especially by Hainanese and Vietnamese vessels. The poaching occurs in a wide-ranging area of the region, and has moved as turtle stocks have been depleted, with vessels being apprehended off Malaysia, Indonesia, and the Philippines (Pilcher *et al.*, 2009 as cited in Lam *et al.*, 2011).

In Australia, green turtles are harvested by Aboriginal and Torres Strait Islanders for subsistence purposes. There is a widespread use of motorized aluminum boats in contrast to the traditional dugout canoes powered by paddles or sail. The total harvest of green turtles by indigenous people across northern and Western Australia is probably several thousand annually (Kowarsky, 1982; Henry and Lyle, 2003 as cited in Limpus, 2009).

The indigenous harvest of eggs may be unsustainable in northeast Arnhem Land (Kennett and Yunupingu, 1998).

Current legal and illegal collection of eggs and harvest of turtles occur throughout the East Indian-West Pacific DPS and persists as a significant threat to this DPS. The harvest of nesting females continues to threaten the stability of green turtle populations in many areas affecting the DPS by reducing adult abundance and reducing egg production.

3. Factor C: Disease or Predation

FP has been found in green turtles in Indonesia (Adnyana *et al.*, 1997), Japan (Y. Matsuzawa, Japanese Sea Turtle Association, pers. comm., 2004), the Philippines (Nalo-Ochona, 2000), Western Australia (Raidal and Prince, 1996; Aguirre and Lutz, 2004), and on PhuQuoc in Vietnam (Ministry of Fisheries, 2003). Epidemiological studies indicate rising incidence of this disease (George, 1997), thus the above list will likely grow in the future.

The best available data suggest that current nest and hatchling predation on the East Indian-West Pacific DPS is prevalent and may be an increasing threat without nest protection and predatory control programs in place. Depredation of nests by feral animals is also widespread in many South Asian areas (Sunderraj *et al.*, 2001; Islam, 2002). Nest predation by feral pigs and dogs is a major threat on the Andaman and Nicobar Islands of India (Fatima *et al.*, 2011). Monitor lizards are also a significant and widespread predator in some areas (Andrews *et al.*, 2006). Dog predation is a major threat to the green turtle nests on Sonadia Island in Bangladesh (Islam *et al.*, 2011). Jackals, foxes, wild boars, and monitor lizards also predate green turtle nests and hatchlings along the beaches of Bangladesh, and dogs also kill or injure nesting females in Bangladesh (Andrews *et al.*, 2006). Lizards and ghost crabs are the natural predators of green turtle nests in Thailand (Chantrapornsyl, 1993). In Malaysia, crabs (*Ocypode* spp.) predate green turtle eggs (Ali and Ibrahim, 2000), and gold-ringed cat snakes or mangrove snakes (*Boigadendrophila*), (Asiatic) reticulated pythons (*Python reticulatus*), monitor lizards (*Varanus* sp.), and house mice (*Mus musculus*) predate hatchlings (Hendrickson, 1958). Monitor lizards, crabs, and ants predate eggs and hatchlings on the beaches of Vietnam (as cited in ''Sea Turtle Migration-Tracking and Coastal Habitat Education Program—An Educator's Guide'' *http://www.ioseaturtles.org/Education/seaturtlebooklet.pdf*). In Japan, raccoon dogs (*Nyctereutes procyonoides*) and weasels (*Mustela itatsi*) are a threat to nests (Kamezaki *et al.*, 2003). In Taiwan, snakes predate the nests (Cheng *et al.*, 2009). 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 historically 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; Kelliher *et al.*, 2011).

Although disease and predation are known to occur, quantitative data are not sufficient to assess the degree of impact of these threats on the persistence of this DPS.

4. Factor D: Inadequacy of Existing Regulatory Mechanisms

Although conservation efforts to protect some nesting beaches and marine habitat are underway, more widespread and consistent protection is needed. There are at least 16 national and international treaties and/or regulatory mechanisms that pertain to the East Indian-West Pacific DPS. The analysis of these existing regulatory mechanisms assumed that all would remain in place at their current levels. The following countries have laws to protect green turtles: Australia, Bangladesh, Brunei Darussalam, Cambodia, China, Hong Kong, India, Indonesia, Japan, Myanmar, Thailand, Malaysia, Philippines, Taiwan, and Vietnam. In addition, at least 17 international treaties and/or regulatory mechanisms apply to the conservation of green turtles in the East Indian-West Pacific DPS. However, some regulatory mechanisms, including laws and international treaties, are not realizing their full potential because they are not enforced, or do not apply in all countries occupied by the DPS.

Regulatory mechanisms are in place throughout the range of the DPS that address the direct capture of green turtles for most of the countries within this DPS. These are implemented to various degrees throughout the range of the DPS. There are some national regulations within this DPS that specially address the harvest of green turtles, while a few regulations are limited in that they only apply to certain size classes, or times of year, or allowed for traditional use.

Fishery bycatch throughout the range of the East Indian-West Pacific DPS (see Factor E), as well as anthropogenic threats to nesting beaches and foraging grounds (Factor A) and eggs/turtles and foraging (Factors A, B, C, and E), are substantial. Although national and international governmental and non-governmental entities in the East Indian-West Pacific DPS are currently working toward reducing green turtle bycatch as well as egg and turtle harvest, it is unlikely that this source of mortality can be sufficiently reduced across the range of the DPS in the near future. This is due to 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. Beaches and in-water habitat throughout the range of the DPS are under various levels of protection, depending in part on the clarity of regulations and consistency of funding for enforcement.

In summary, although regulatory mechanisms are in place that should address direct and incidental take of green turtles within this DPS, these regulatory mechanisms are not implemented throughout the range of this DPS. These mechanisms are not sufficiently implemented to address the direct harvest of green turtles and are insufficient to address the major threat of bycatch which remains a significant risk to this DPS.

5. Factor E: Other Natural or Manmade Factors Affecting its Continued Existence

a. Incidental Bycatch in Fishing Gear

Incidental capture in artisanal and commercial fisheries is a significant threat to the survival of green turtles in the East Indian-West Pacific DPS. Green turtles may be caught in drift and set gill nets, bottom and mid-water trawling, fishing dredges, pound nets and weirs, and haul and purse seines.

Bycatch in fisheries using gears such as trawlers, drift nets, and purse seines is thought to be one of the main causes of decline in the green turtle population in Thailand and Malaysia. The rapid expansion of fishing operations is largely responsible for the increase in adult turtle mortality due to bycatch (Settle, 1995). The most used fishing gears in the waters of Thailand are trawling and drift gill nets. Heavy fishing is the main threat to foraging sea turtles (Chan *et al.*, 1988; Chantrapornsyl, 1993; Liew, 2002).

Gill nets and set bag nets are the two major fishing gears used in the Bay of Bengal, and green turtles are likely captured during these fishing operations (Hossain and Hoq, 2010). Along the coast of Andaman and Nicobar Islands, the main type of fishery is gill nets and purse seines with thousands of turtles killed annually by fisheries operations including the shark fishery (Chandi *et al.*, 2012; Shanker and Pilcher, 2003). In 1994, Bhaskar estimated at least 600 green turtles were killed as a result of the shark fishery in this area. Over the last decade, there has been an increase in the large predator fishing industry. Green turtle mortality can be expected to be much higher than that estimated in the 1990s as a result of these current operations (Namboothri *et al.*, 2012).

Trawl fishing is also common in Bangladesh. No green turtle stranding information is available to determine the fishery threat level to the green turtle population; however, it is expected to be high as TEDs are not used and the population has declined (Ahmed *et al.*, 2006; Khan *et al.*, 2006). On the Turtle Islands in the Philippines, there have been an increased number of dead turtles as a result of fishing activities, such as shrimp trawlers and demersal nets (Cruz, 2002).

One of the main threats to green turtles in Vietnam and Indonesia is the incidental capture from gill and trawl nets and the opportunistic capture by fishers. Hundreds of green turtles are captured by fisheries per year in Vietnam (Ministry of Fisheries, 2003; Hamann *et al.*, 2006a; Dethmers, 2010).

In Indonesia, green turtles were recorded as one of the main species caught in the longline fisheries. Trawl gear is still allowed in the Arafura Sea, posing a major threat to green turtles (Dethmers, 2010). Shrimp trawl captures in Indonesia are high because of the limited use of TEDs (Zainudin *et al.*, 2008).

The estimated bycatch of the Japanese large-mesh drift net fishery in the North Pacific Ocean in 1990–1991 was 1,501 turtles, of which 248 were estimated to be green turtles (Wetherall *et al.*, 1993). Wetherall *et al.* (1993) report that the actual mortality of sea turtles taken in the Japanese and Taiwanese large-mesh fisheries may have been between 2,500 and 9,000 per year.

b. Marine Debris and Pollution

Pollution from oil spills, as well as from agricultural and organic chemicals, is a major threat to the waters used by green turtles in the Bay of Bengal (Sarkar, 2001). The result of human population growth in China has been an increased amount of pollutants in the coastal system. Discharges from untreated sewage have occurred in Xisha Archipelago (Li *et al.*, 2004 as cited in Chan *et al.*, 2007). Concentrations of nine heavy metals (iron, manganese, zinc, copper, lead, nickel, cadmium, cobalt, and mercury) and other trace elements were found in liver, kidney, and muscle tissues of green turtles collected from Yaeyama Islands, Okinawa, Japan (Anan *et al.*, 2001). The accumulation of cadmium found in the green turtles is likely due to accumulations of this heavy metal in the plant materials on which they forage (Sakai *et al.*, 2000).

In the Gulf of Carpentaria, Australia, discarded fishing nets have been found to cause a high number of turtle deaths with the majority being green turtles (Chatto *et al.*, 1995).

c. Effects of Climate Change and Natural Disasters

Effects of climate change include, among other things, increased sea surface temperatures, the alteration of thermal sand characteristics of beaches (from warming temperatures), which could result in the reduction or cessation of male hatchling production (Hawkes *et al.*, 2009; Poloczanska *et al.*, 2009), and a significant rise in sea level, which could significantly restrict green turtle nesting habitat. While sea turtles have survived past eras that have included significant temperature fluctuations, future climate change is expected to happen at unprecedented rates, and if turtles cannot adapt quickly they may face local to widespread extirpations (Hawkes *et al.*, 2009). Impacts from global climate change induced by human activities are likely to become more apparent in future years (IPCC, 2007).

Natural environmental events, such as cyclones and hurricanes, may affect green turtles in the East Indian-West Pacific DPS. Typhoons have been shown to cause severe beach erosion and negatively affect hatching success at green turtle nesting beaches in Japan, especially in areas already prone to erosion.

In summary, within Factor E, we find that fishery bycatch, particularly from drift net and purse seine fisheries, occur throughout the East Indian-West Pacific DPS, with localized high levels of mortality in waters where juvenile to adult turtles are known to forage and migrate are a persistent risk to this DPS. In addition, vessel collisions, marine pollution, changes likely to result from climate change, and natural disasters are expected to be an increasing threat to the persistence of this DPS.

C. Conservation Efforts for the East Indian-West Pacific DPS

There are numerous ongoing conservation efforts in this region. Hatcheries have been set up throughout the region to protect a portion of the eggs laid and prevent complete egg harvesting. In addition, bycatch reduction efforts have been made in some areas, protected areas are established throughout the region, and monitoring, outreach and enforcement efforts have made progress in sea turtle conservation. Despite 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.

In India, since 1978, the Centre for Herpetology/Madras Crocodile Bank Trust has conducted sea turtle surveys and studies in the islands. In a bilateral agreement, the Governments of the Philippines and Malaysia established The Turtle Island Heritage Protected Area (TIHPA), made up of nine islands (six in the Philippines and three in Malaysia). The TIHPA is one of the world's major nesting grounds for green turtles. Management of the TIHPA is shared by both countries. One of the 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 green turtles and their eggs. Conservation efforts on nesting beaches have included invasive predator control.

Illegal trade of turtle parts continues to be a problem in the East Indian-West Pacific DPS. In order to reduce this threat, the Vietnamese Government, with assistance from IUCN, WWF, TRAFFIC and the Danish Government, formulated a Marine Turtle Conservation Action Plan in 2010 to expand awareness to fishers and enforcement officers, and to confiscate sea turtle products (Stiles, 2009; Ministry of Fisheries 2010). The level of effectiveness and progress of this program is not known.

TEDs are now in use in Thailand, Malaysia, the Philippines, Indonesia and Brunei, expanded by initiatives of the South East Asian Fisheries Development Center (Food and Agriculture Organization of the United Nations, 2004). In 2000, the use of TEDs in the Northern Australian Prawn Fishery was made mandatory. Prior to the use of TEDs, this fishery took between 5,000 and 6,000 sea turtles as bycatch annually, 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 Northern

Australian Prawn Fishery has dropped to fewer 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 assessments.

As in other DPSs, persistent marine debris poses entanglement and ingestion hazards to green turtles. 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 (*http://www.environment.gov.au/system/files/resources/d945695b-a3b9-4010-91b4-914efcdbae2f/files/marine-debris-threat-abatement-plan.pdf*).

D. Extinction Risk Assessment and Findings for the East Indian-West Pacific DPS

The East Indian-West Pacific DPS is characterized by a relatively large geographic area with widespread nesting reported in 58 different locations throughout the range of the DPS. Although the numerous nesting sites have relatively high abundance of nesting females, decades of harvesting and habitat degradation have led to a drastic decline in the sea turtle populations within this DPS in the last century. Population trends at many of the higher abundance rookeries are decreasing, though there appears to be an increasing trend on Sabah in Malaysia and on Baguan in the Philippines, presumably due to effective conservation efforts.

Continued harvest, coastal development, beachfront lighting, erosion, fishing practices, and marine pollution both at nesting beaches and important foraging grounds are all continuing concerns across the range of the DPS. Harvest of turtles and eggs for human consumption continues as a high threat to this East Indian-West Pacific DPS. Coastal development, largely due to tourism, is an increasing threat in many areas. Fishery bycatch occurs throughout the range of the DPS, particularly bycatch mortality of green turtles from pelagic longline, set net, and trawl fisheries. Additional threats due to climate change, such as loss of habitat due to sea level rise and increased ratio of female to male turtles, negatively impact this DPS. Conservation efforts have been effective in a few areas but are lacking or not effective in most.

For the above reasons, we propose to list the East Indian-West Pacific DPS as threatened. We do not find the DPS to be in danger of extinction presently because of high nesting abundance and geographically widespread nesting at a diversity of sites; however, the continued threats are likely to endanger the DPS within the foreseeable future.

XIII. Central West Pacific DPS

A. Discussion of Population Parameters for the Central West Pacific DPS

The range of the Central West Pacific DPS has a northern boundary of 41° N. latitude and is bounded by 41° N., 169° E. in the northeast corner, going southeast to 9° N., 175° W., then southwest to 13° S., 171° E., west and slightly north to the eastern tip of Papua New Guinea, along the northern shore of the Island of New Guinea to West Papua in Indonesia, northwest to 4.5° N., 129° E. then to West Papua in Indonesia, then north to 41° N., 146° E. It encompasses the Republic of Palau (Palau), FSM, New Guinea, Solomon Islands, Marshall Islands, Guam, the CNMI, and a portion of Japan (Ogasawara; Figure 2).

Green turtle nesting occurs at low levels throughout the geographic distribution of the DPS (approximately 51 sites), with isolated locations having higher nesting activity. Only two populations are known to have >1,000 nesting turtles, with all the rest having fewer than 400 nesting females, for a total number of known nesting females of approximately 6,500. The highest numbers of females nesting in this DPS are located in Gielop and Iar Island, Ulithi Atoll, Yap, Federated States of Micronesia (FSM; 1,412) or 22 percent of the population 2013); Chichijima (1,301) and Hahajima (394), Ogasawara, Japan; Bikar Atoll, Marshall Islands (300); and Merir Island, Palau (441; (NMFS and USFWS, 1998; Bureau of Marine Resources, 2005; Barr, 2006; Palau Bureau of Marine Resources, 2008; Maison *et al.*, 2010; H. Suganuma, Everlasting Nature of Asia, pers. comm., 2012; J. Cruce, Ocean Society, pers. comm., 2013). There are numerous other populations in the FSM, Solomon Islands, Palau, Guam, and the CNMI. Historical baseline nesting information in general is not widely available in this region, but exploitation and trade of green turtles throughout the region is well-known (Groombridge and Luxmoore, 1989).

Green turtles departing nesting grounds within the range of this DPS travel throughout the western Pacific Ocean. Green turtles are found in coastal waters in low to moderate densities at foraging areas throughout the range of the DPS. Aerial sea turtle surveys show that an in-water population exists around Guam (Division of Aquatic and Wildlife Resources, 2011). In-water green turtle density in the Marianas Archipelago is low and mostly restricted to juveniles (Pultz *et al.*, 1999; Kolinski *et al.*, 2005; Kolinski *et al.*, 2006; Palacios, 2012a). In-water information in this DPS overall is particularly limited.

There is insufficient long-term and standardized monitoring information to adequately describe abundance and population trends for many areas of the Central West Pacific DPS. The available information suggests a nesting population decrease in some portions of the DPS like the Marshall Islands, or unknown trends in other areas such as Palau, Papua New Guinea, the Marianas, Solomon Islands, or the FSM (Maison *et al.*, 2010). There is only one site for which 15 or more years of recent data are available for annual nesting female abundance, one of the standards for performing a PVA. This is at Chichijima, Japan, one of the major green turtle nesting concentrations in Japan (Horikoshi *et al.*,1994). Although the PVA has limitations, it shows a continuing upward trend for the population. The population has increased in abundance from a mean of approximately 100 annual nesting females in the late 1970s/early 1980s to a mean of approximately 500 annual nesting females since 2000. Chaloupka *et al.* (2008a) reports an estimated annual population growth rate of 6.8 percent per year for the Chichijima nesting site.

With regard to spatial structure, genetic sampling in the Central West Pacific has recently improved, but remains challenging given the large number of small islands and atoll nesting sites. Stock structure analysis indicated that nesting sites separated by more than 1,000 km were significantly differentiated from each other while neighboring nesting sites within 500 km showed no genetic differentiation (Dutton *et al.*, 2014). Based on mtDNA analyses, there are four independent stocks within the DPS (Dethmers *et al.* 2006; Jensen 2010; Dutton *et al.* 2014).

With respect to tagging and telemetry, there are records of turtles flipper tagged in the Philippines nesting in the FSM; a turtle tagged in Japan was recorded nesting in the FSM; turtles tagged in the Japan Archipelago and China were recorded nesting in the Ogasawara islands (Suganuma, pers. comm., Ogasawara Marine Center, Everlasting Nature of Asia, unpublished data); and turtles tagged in the FSM were recaptured in the Philippines, Marshall

Islands, and Papua New Guinea (Palau BMR, 2008; Cruce, 2009). Satellite telemetry shows that nesting females migrate to areas both within and outside of the range of the Central West Pacific DPS. For example, satellite tracks show turtles moving from the Mariana Islands to the Philippines and Japan, and others moving from the Chichijima Islands of Ogasawara to the main islands of Japan (Hatase *et al.*, 2006; Japan Fisheries Resource Conservation Association, 1999). Green turtles have also been shown to move from the FSM to the Philippines and to the west (G. Balazs, NMFS, unpublished data; Kolinski, *et al.*, unpublished data.)

Demographic data availability is limited and somewhat variable for many nesting sites in the range of this DPS. Variability in parameters such as remigration interval, clutch size, hatching success, and clutch frequency is not separated out regionally within the DPS and, therefore, does not necessarily suggest a high level of population structuring.

With regard to diversity and resilience, the overall range of the DPS is relatively widespread, which lends some resilience. However, nesting generally occurs at what appear to be low numbers, except in several locations, and only on islands and atolls throughout the range of the DPS. Nesting information is limited for some areas, but occurs from November to August in Palau; from March through September in the FSM; and May to August in Ogasawara, Japan. Some turtles travel outside the bounds of the range of this DPS, into the East Indian/West Pacific DPS presumably to forage.

B. Summary of Factors Affecting the Central West Pacific DPS

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

a. Terrestrial Zone

In the Central West Pacific Ocean, some nesting beaches have become severely degraded from a variety of activities. Destruction and modification of green turtle nesting habitat results from coastal development and construction, placement of barriers to nesting, beachfront lighting, vehicular and pedestrian traffic, sand extraction, beach erosion, beach pollution, removal of native vegetation, and presence of non-native vegetation.

Human populations are growing rapidly in many areas of the insular Pacific and this expansion is exerting increased pressure on limited island resources. The most valuable land on most Pacific islands is often located along the coastline, particularly when it is associated with a sandy beach. For instance, construction (and associated lighting) on the islands of Saipan, Tinian, and Rota in the CNMI, is occurring at a rapid rate in some areas and is resulting in loss or degradation of green turtle nesting habitat (NMFS and USFWS, 1998).

In the FSM, construction of houses and pig pens on Oroluk beaches in Pohnpei State interferes with turtle nesting by creating barriers to nesting habitat (NMFS and USFWS, 1998; Buden, 1999). Nesting habitat destruction is also a major threat to Guam turtles and has resulted mainly from construction and development due to increased tourism (NMFS and USFWS, 1998; Project GloBAL, 2009a). Coastal construction is a moderate problem on Majuro Atoll in the Republic of the Marshall Islands (NMFS and USFWS, 1998); however, it is unknown to what extent nesting beaches are being affected. On the outer atolls of the Marshall Islands, beach erosion has been aggravated by airfield and dock development, and by urban development on Majuro and Kwajalein Atolls. In the Republic of Palau, increasing nesting habitat degradation from tourism and coastal development has been identified as a threat to sea turtles (Eberdong and Klain, 2008; Isamu and Guilbeaux, 2002), although the extent and significance of the impacts are unknown.

Also in the CNMI, the majority of the nesting beaches on Tinian are on military-leased land, where the potential for construction impacts exists (CNMI Coastal Resources Management Office, 2011). Increased public use of nesting beaches is a threat to sea turtle nesting habitat throughout the CNMI. Public use of beaches includes a variety of recreational activities, including picnicking, swimming, surfing, playing sports, scuba diving and snorkeling access (CNMI Coastal Resources Management Office, 2011). Beach driving is a pastime on Saipan and could threaten green turtle nesting habitat (NMFS and USFWS, 1998; Palacios, 2012a; Wusstig, 2012).

Expected U.S. military expansion plans for this region are likely to include relocation of thousands of military personnel to Guam and increased training exercises in the CNMI (CNMI Coastal Resources Management Office, 2011).

In the Ogasawara Islands of Japan, nighttime tourist and resident activity on beaches to view and photograph nesting turtles is a problem, resulting in harassment of nesting turtles and increased aborted nesting attempts (Ishizaki *et al.*, 2011).

b. Neritic/Oceanic Zones

Fishing methods not only incidentally capture green turtles and destroy bottom habitat (including seagrasses) but may also deplete invertebrate and fish populations and thus alter ecosystem dynamics. Dynamite fishing occurs in the FSM (NMFS and USFWS, 1998; Government of the Federated States of Micronesia, 2004) and the Marshall Islands (Hay and Sablan-Zebedy, 2005). Dynamite fishing, as well as use of fish poisons, occurs in Papua New Guinea, although these practices are small scale and relatively isolated (Berdach and Mandeakali, 2004). Coral reefs and seagrass beds within the urban centers of the four states of the FSM (Pohnpei, Yap, Chuuk, and Kosrae; NMFS and USFWS, 1998) and Saipan have been reported as being degraded by hotels, golf courses, and general tourist activities (Project GloBAL, 2009b), presumably as a result of runoff and other impacts. Coastal development in Guam has resulted in sedimentation, which has damaged Guam's coral reefs and, presumably, food sources for turtles (NMFS and USFWS, 1998). Coral reefs and seagrass habitat off the lagoon shoreline of the Kwajalein Atoll islands and Majuro Atoll have been degraded by coastal construction, dredging, boat anchoring, and/or eutrophication from sewage and runoff from landfills, grave sites, and pig and chicken pens (NMFS and USFWS, 1998; Hay and Sablan-Zebedy, 2005).

Dredging and filling as well as sand extraction have contributed to changes to longshore processes and coastal erosion in the Marshall Islands, FSM, Kiribati's Gilbert Islands chain, and Palau (Smith *et al.*, 1997; NMFS and USFWS, 1998; Government of the Federated States of Micronesia, 2004; Hay and Sablan-Zebedy, 2005; Pacific News Center, 2012).

Marine pollution, including direct contamination and structural habitat degradation, can affect green turtle neritic and oceanic habitat. In Palau, environmental contamination in the form of sewage effluent is a problem around Koror State, particularly Malakal Harbor, and nearby urban areas (NMFS and USFWS, 1998). In the Solomon Islands, sewage discharges from land and discharges of garbage, bilge water, and other pollutants from ships have been identified as sources of pollution to the coastal and marine environments (Solomon Islands Ministry of Environment Conservation and Meteorology, 2008). Land-based activities, including logging, plantation development, and mining, often cause excessive sedimentation of nearshore waters (Sulu *et al.,* 2000).

Environmental contamination was identified as a minor problem in the Marshall Islands in 1998 (NMFS and USFWS, 1998) and around Wake Island (Defense Environmental Network and Information Exchange, undated). Rudrud *et al.* (2007) found that there is a high probability of green turtles being exposed to toxicants remaining in the Marshall Islands from past wars and weapons testing (*e.g.,* foraging on algae growing on toxic surfaces, resting near irradiated shipwrecks).

In summary, we find that the Central West Pacific DPS of the green 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. Destruction and modification of green turtle nesting habitat resulting from coastal development and construction, beachfront lighting, vehicular and pedestrian traffic, beach erosion, and pollution are significant threats to the persistence of this DPS.

2. Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Directed take of eggs is a known ongoing problem in the Central West Pacific in the CNMI, FSM, Guam, Kiribati (Gilbert Islands chain), Papua, Papua New Guinea, Marshall Islands, and Palau (Eckert, 1993; Guilbeaux, 2001; Hitipeuw and Maturbongs, 2002; Philip, 2002). In addition to the collection of eggs from nesting beaches, the killing of nesting females continues to threaten the stability of green turtle populations. Ongoing harvest of nesting adults has been documented in the CNMI (Palacios, 2012a), FSM (Cruce, 2009), Guam (Cummings, 2002), Papua (Hitipeuw and Maturbongs, 2002), Papua New Guinea (Maison *et al.,* 2010), and Palau (Guilbeaux, 2001). Mortality of turtles in foraging habitats is also problematic for recovery efforts. Ongoing intentional capture of green turtles in their marine habitats has been documented in southern and eastern Papua New Guinea (Limpus *et al.,* 2002) and the Solomon Islands (D. Broderick, 1998; Pita and Broderick, 2005).

Green turtles have long been harvested for their meat in the Ogasawara Islands, and records show a rapid decline in the sea turtle population between 1880 and 1920 (Horikoshi *et al.,* 1994; Ishizaki, 2007). Currently, sea turtle harvest is strictly regulated with a harvest limit of 135 mature turtles per year (Ishizaki, 2007).

3. Factor C: Disease or Predation

The potential effects of FP and endoparasites also exist for green turtles found in the Central West Pacific Ocean, but the impacts to the population are unknown.

The loss of eggs to non-human predators is a severe problem in some areas. These predators include domestic animals, such as cats, dogs, and pigs, as well as wild species such as rats, mongoose, birds, monitor lizards, snakes, and crabs, ants, and other invertebrates (Suganuma *et al.,* 1996; NMFS and USFWS, 1998; Maturbongs, 2000; Cummings, 2002; Wilson *et al.,* 2004; Cruce, 2008).

Although disease and predation are known to occur, quantitative data are not sufficient to assess the degree of impact of these threats on the persistence of this DPS.

4. Factor D: Inadequacy of Existing Regulatory Mechanisms

Regional and national legislation to conserve green turtles (often all sea turtles) exists throughout the range of the DPS. National protective legislation generally prohibits intentional killing, harassment, possession, trade, or attempts at these; however, a lack of or inadequate enforcement of these laws appears to be pervasive. The following countries have laws to protect green turtles: CNMI, FSM, Guam, Japan (Ogasawara Islands), Kiribati, Marshall Islands, Nauru, Palau, Papua, Papua New Guinea, Solomon Islands, and United States (Wake Island). In addition, at least 17 international treaties and/or regulatory mechanisms apply to the conservation of green turtles in the Central West Pacific DPS. These are implemented to various degrees throughout the range of the DPS. There are some national regulations, within this DPS, that specially address the harvest of green turtles while a few regulations are limited in that they only apply to turtles of certain sizes, times of years, or allow for harvest for tradition use.

On December 12, 2008, the Western and Central Pacific Fisheries Commission issued a Conservation and Management Measure (2008–03; *https://www.wcpfc.int/doc/cmm-2008-03/conservation-and-management-sea-turtles*) to reduce sea turtle mortality during fishing operations, collect and report information on fisheries interactions with turtles, and encourage safe handling and resuscitation of turtles. This measure requires purse seine vessels to avoid encircling turtles and to release entangled turtles. It also requires longline vessels to use line cutters and dehookers to release turtles. However, enforcement mechanisms are not explicit, and the level of compliance is uncertain.

Additional regulatory mechanisms are not in place in many countries within this DPS to address the major threat of bycatch within this DPS. It is unlikely that bycatch 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 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. Although conservation efforts to protect some nesting beaches are underway, more widespread and consistent protection would speed recovery. Some regulatory mechanisms, including laws and international treaties, are not realizing their full potential because they are not enforced adequately, or do not apply in all countries occupied by the DPS.

The Status Review revealed a lack of existing regulatory mechanisms to address coastal development, pollution, sea level rise, and effects of climate change that continue to contribute to the extinction risk of this DPS.

5. Factor E: Other Natural or Manmade Factors Affecting its Continued Existence

a. Incidental Bycatch in Fishing Gear

Incidental capture in artisanal and commercial fisheries is a threat to the survival of green turtles in the Central West Pacific. Sea turtles may be caught in longline, pole and line, and purse seine fisheries.

Within the Marshall Islands, Palau, the FSM, and the Solomon Islands, a purse-seine fishery for tuna and a significant longline fishery operate, and sea turtles have been captured in both fisheries with green turtle mortality occurring (Oceanic Fisheries Programme, 2001; McCoy, 2003; Hay and Sablan-Zebedy, 2005; McCoy, 2007a; McCoy, 2007b; Western and Central Pacific Fisheries Commission, 2008).

Numerous subsistence and small-scale commercial fishing operations occur along Saipan's western coast and along both the Rota and Tinian coasts (CNMI Coastal Resources Management Office, 2011). Incidental catch of turtles in Guam's coastal waters by commercial fishing vessels likely also occurs (NMFS and USFWS, 1998). In 2007, 222 fishing vessels (200 purse-seiners and 22 longliners) had access to Papua New Guinea waters (Kumoru, 2008). Although no official reports have been released on sea turtle bycatch within these fisheries (Project GloBAL, 2009c), sea turtle interactions with both fisheries have been commonly observed (Kumoru, 2008). However, the level of mortality is unknown.

b. Vessel Strikes

The impacts of vessel strikes in the Central West Pacific are unknown, but not thought to be of great consequence, except possibly in Palau where high speed skiffs constantly travel throughout the lagoon south of the main islands (NMFS and USFWS, 1998). However, green turtles have been documented as occasionally being hit by boats in Guam (Guam Division of Aquatic and Wildlife Resources, 2012).

c. Pollution

In the FSM, debris is dumped freely and frequently off boats and ships (including government ships). Landfill areas are practically nonexistent in the outer islands and have not been addressed adequately on Yap proper or on Chuuk and Pohnpei. The volume of imported goods (including plastic and paper packaging) appears to be increasing (NMFS and USFWS, 1998). In Palau, entanglement in abandoned fishing nets has been identified as a threat to sea turtles (Eberdong and Klain, 2008). In the Marshall Islands, debris and garbage disposal in coastal waters is a serious problem on Majuro Atoll and Ebete Island (Kwajalein Atoll), both of which have inadequate space, earth cover, and shore protection for sanitary landfills. This problem also exists to a lesser extent at Daliet Atoll (NMFS and USFWS, 1998).

A study of the gastrointestinal tracts of 36 slaughtered green turtles in the Ogasawara Islands of Japan in 2001 revealed the presence of marine debris (*e.g.,* plastic bag pieces, plastic blocks, monofilament lines, Styrofoam pieces) in the majority of the turtles (Sako and Horikoshi, 2003).

d. Effects of Climate Change and Natural Disasters

Over the long term, Central West Pacific turtle populations could be affected by the alteration of thermal sand characteristics (from global warming), resulting in the reduction or cessation of male hatchling production (Camiñas, 2004; Hawkes *et al.,* 2009; Kasparek *et al.,* 2001; Poloczanska *et al.,* 2009). Further, a significant rise in sea level would restrict green turtle nesting habitat in the Central West Pacific. Coastal erosion has been identified as a high risk in the CNMI due to the existence of concentrated human population centers near erosion-prone zones, coupled with the potential increasing threat of erosion from sea level rise (CNMI Coastal Resources Management Office, 2011). In the FSM, Yap State's low coralline atolls are extremely vulnerable to rises in sea levels and will be adversely affected if rises occur (NMFS and USFWS, 1998). These risks are high for all beaches in the Central West Pacific. Interestingly, Barnett and Adger (2003) identified projected increases in sea-surface temperature, and not sea level rise, as the greatest long-term risk of climate change to atoll morphology and thus to atoll countries like those in the Central West Pacific. They state that coral reefs, which are essential to the formation and maintenance of the islets located around the rim of an atoll, are highly sensitive to sudden changes in sea-surface temperature. Thus, climate change impacts could have profound long-term impacts on green turtle nesting in the Central West Pacific, but it is not possible to project the impacts at this point in time.

Natural environmental events such as cyclones and hurricanes may affect green turtles in the Central West Pacific DPS. These storm events have been shown to cause severe beach erosion with likely negative effects on hatching success at many green turtle nesting beaches, especially in areas already prone to erosion. Shoreline erosion occurs naturally on many islands in the atolls of the Marshall Islands due to storms, sea level rise from the El Niño–Southern Oscillation, and currents (NMFS and USFWS, 1998). Some erosion of nesting beaches at Oroluk was reported in 1990 after passage of Typhoon Owen (NMFS and USFWS, 1998). However, effects of these natural events may be exacerbated by climate change. While sea turtles have survived past eras that have included significant temperature fluctuations, future climate change is expected to happen at unprecedented rates, and if turtles cannot adapt quickly they may face local to widespread extirpations (Hawkes *et al.,* 2009). Impacts from global climate change induced by human activities are likely to become more apparent in future years (IPCC, 2007).

In summary, within Factor E, we find that fishery bycatch continues to threaten this DPS. In addition, changes likely to result from climate change and natural disasters are increasing threats to this DPS.

C. Conservation Efforts for the Central West Pacific DPS

Very few areas that host important green turtle nesting or foraging aggregations have been designated as protected areas within the Central West Pacific. However, at least one country, Palau, has site-specific conservation for sea turtle habitat protection. Two nationally mandated protected areas, Ngerukewid Islands Wildlife Preserve and Ngerumekaol Spawning Area, exist within Koror State, and restrictions are placed on entry and fishing within established boundaries.

Marine debris is a problem on some green turtle nesting beaches and foraging areas in the Central West Pacific, in particular on the nesting beaches of the CNMI (Palacios, 2012a; 2012b) and in the nearshore foraging areas of the FSM, Marshall Islands, and Palau (NMFS and USFWS, 1998; Eberdong and Klain, 2008). Organized beach clean-ups on some CMNI beaches have been conducted to help mitigate this impact (Palacios, 2012b).

Overall, it appears that international and national laws to protect green turtles may be insufficient or not implemented effectively to address the needs of green turtles in the Central West Pacific. This minimizes the potential success of existing conservation efforts.

D. Extinction Risk Assessment and Findings for the Central West Pacific DPS

The Central West Pacific DPS is characterized by a relatively small nesting population spread across a relatively expansive area roughly 2,500 miles wide (Palau to the Marshall Islands) and 2,500 miles long (Ogasawara, Japan to the Solomon Islands). This DPS is dominated by insular nesting. Fifty-one known nesting sites were analyzed, although many had very old data (20–30 years old). Sixteen sites were identified but numbers of nesting females were ''unquantified,'' and another 21 had fewer than 100 nesting females. Only two sites had more than 1,000 nesting females (1,412 and 1,301). Further study of this DPS would improve our understanding of it.

The limited available information on trends suggests a nesting population decrease in some areas, an increase in one Japanese nesting site, and unknown trends in others. The second largest nesting site in this DPS (Chichijima, Japan) shows positive growth. The dispersed location of nesting sites and lack of concentration of nesting provides a level of habitat diversity and population resilience which reduces overall extinction risk, as does widely varied nesting seasons; however, the contribution of this characteristic to such diversity and resilience is reduced by the small size of many of these sites and the threats faced in each of the nesting and foraging areas.

Human populations are growing rapidly in many areas of the insular Pacific and this expansion is accompanied by threats to green turtle nesting habitat resulting from coastal development and construction, beachfront lighting, degradation of waters and seagrass beds off of populated areas, and sand extraction. Destructive fishing methods (use of dynamite and poisons) not only incidentally capture green turtles, but also deplete invertebrate and fish populations and thus alter ecosystem dynamics. Fishery bycatch, particularly bycatch mortality of green turtles from longline, pole and line, and purse seine fisheries, continue as threats to this DPS. In addition, legal and illegal harvest of green turtles and eggs for human consumption remains a significant threat in many areas of this DPS. Finally, changes likely to result from climate change and natural disasters could have profound long-term impacts on green turtle nesting in the Central West Pacific.

Although regulatory mechanisms are in place that should address direct and incidental take of Central West Pacific green turtles, these regulatory mechanisms are insufficient or are not being implemented effectively to address the population trajectories of green turtles.

For the above reasons, we propose to list the Central West Pacific DPS as endangered. Based on its low nesting abundance and exposure to increasing threats, we find that this DPS is presently in danger of extinction throughout its range.

XIV. Southwest Pacific DPS

A. Discussion of Population Parameters in the Southwest Pacific DPS

The range of the Southwest Pacific DPS extends from the western boundary of Torres Strait, to the eastern tip of Papua New Guinea and out to the offshore coordinate of 13° S., 171° E.; the eastern boundary runs from this point southeast to 40° S., 176° E.; the southern boundary runs along 40° S. from 142° E. to 176° E.; and the western boundary runs from 40° S., 142° E north to Australian coast then follows the coast northward to Torres Strait (Figure 2).

Green turtle nesting is widely dispersed throughout the Southwest Pacific Ocean at 12 total nesting sites, although it should be noted that, perhaps more so than in other DPSs, proximate nesting beaches were grouped for analysis because nesting populations are small, with the exception of a few sites, including Raine Island, where the majority (>90 percent) of the nesting in the northern GBR occurs. While it would be possible to split the nesting aggregations into more than 100 different sites, because many of the most recent estimates are aggregated (Limpus, 2009), we followed this tendency and aggregated nesting within broad regional areas. The bulk of this DPS nests within Australia's Great Barrier Reef World Heritage Area and eastern Torres Strait. The northern GBR and Torres Strait support some of the world's highest concentrations of nesting (Chaloupka *et al.,* 2008a). Nesting abundance in the northern GBR is not directly counted throughout the nesting season largely because of the remoteness of the site and the sheer numbers of turtles that may nest on any given night. Raine Island, with estimates of annual nesting females varying from 4,000–89,000 (Seminoff *et al.,* 2004; NMFS and U.S. FWS, 2007; Chaloupka *et al.,* 2008a; Limpus, 2009) (note the Status Review used an estimate of 25,000 nesting females), Moulter Cay, with 15,965 nesting females (Limpus *et al.,* 2003; Limpus, 2009), and the rest of the Capricorn Bunker Group with 31,249 nesting females (Limpus, 2009) represent the three sites with >10,000 nesting females. Heron Island is the index nesting beach for the southern GBR, and nearly every nesting female on Heron Island has been tagged since 1974 (Limpus and Nicholls, 2000). Heron Island (4,891 nesting females; Chaloupka *et al.,* 2008a; Limpus, 2009), Bramble Cay in the northern GBR (1,660; Limpus *et al.,* 2003; Limpus 2009), and Huon, Leleizour and Fabre in New Caledonia (1,777; Limpus, 2009) represent the sites with 1,001–5,000 nesting females. There are three sites with 501–1,000: The Coral Sea (all sites; 1,000; Limpus, 2009), No. 8 Sandbank in northern GBR (637; Limpus *et al.,* 2003; Limpus 2009), and other northern GBR sites, including Murray Islands, other outer islands, most inner shelf cays and the mainland coast (535; Limpus 2009). Bamboo Bay in Vanuatu (165; MacKay and Petro, 2013) and No. 7 Sandbank in the northern GBR represent the two sites with nesting females in the 101–500 category. The rest of the southern GBR (represented here as one site) is unquantified.

The Raine Island and Heron Island sites both have high inter-annual variability and slightly increasing linear trends. These were the only two nesting areas for which 15 or more years of recent data are available for annual nesting female abundance, one of the standards for performing a PVA in the Status Review. Both show a continued increasing trend, though the Raine Island PVA indicates that there is a 9.1 percent probability that this population will fall below the trend reference point (50 percent decline) at the end of 100 years, and a 0.4 percent probability that it will fall below the absolute abundance reference (100 females per year) at the end of 100 years. However, extra caution must be used when interpreting results of the Raine Island PVA, because it only represents females observed during one sampling event on one night. The Heron Island PVA indicates that there is a 17.5 percent probability that the magnitude of adult females associated with Heron Island nesting will fall below the trend reference point (50 percent decline) at the end of 100 years, and an 8.3 percent probability that this population will fall below the absolute abundance reference (100 females per year) at the end of 100 years. It should be noted that PVA modeling has important limitations, and does not fully incorporate other key elements critical to the decision making process such as spatial structure or threats. It assumes all environmental and anthropogenic pressures will remain constant in the forecast period and it relies on nesting data alone.

Although long robust time series are not available for New Caledonia, recent and historical accounts do not suggest a significant decline in abundance of green turtles nesting in New Caledonia (Maison *et al.,* 2010). The trend at Vanuatu has not been documented (Maison *et al.,* 2010).

With regard to spatial structure, genetic sampling in the Southwest Pacific DPS has been extensive for larger nesting sites along the GBR, the Coral Sea, and New Caledonia; however, there are several smaller nesting sites in this region that still need to be sampled (*e.g.* Solomon Islands, Vanuatu, Tuvalu, and Papua New Guinea). Within this DPS, four regional genetic stocks have been identified in the Southwest Pacific Ocean; northern GBR, southern GBR, Coral Sea (Dethmers *et al.,* 2006; Jensen, 2010), and New Caledonia (Dethmers *et al.,* 2006; Dutton *et al.,* 2014). Mixed stock analysis of foraging grounds shows that green turtles from multiple nesting beach origins commonly mix in foraging grounds along the GBR and Torres Strait regions (Jensen, 2010), but with the vast majority originating from nesting sites within the GBR. There is evidence of low frequency contribution from nesting sites outside the range of the DPS at some foraging areas.

With regard to diversity and resilience, nesting beach monitoring along with flipper and satellite tagging show the spatial structure of this DPS is largely consistent with viable populations. Nesting can occur year-round in the most northerly nesting sites, but a distinct peak occurs in late December to early January for all Australian nesting sites. Foraging is widely dispersed throughout the range of this DPS (Limpus, 2009). There are various factors that lead to resilience in nesting in the Southwest Pacific DPS: it is widely dispersed throughout the region, there is more than one major nesting site, there is evidence of some connectivity between nesting sites within each of the four regional stocks but no connectivity among regional stocks, and there is continental and insular nesting. Nesting, however, is not evenly distributed throughout the range of the DPS, and some of the densest nesting occurs on Raine Island, which has habitat-based threats.

B. Summary of Factors Affecting the Southwest Pacific DPS

1. Factor A: The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

a. Terrestrial Zone

Destruction and modification of green turtle nesting habitat in the Southwest Pacific DPS result from beach erosion, beach pollution, removal of native vegetation, and planting of non-native vegetation, as well as natural environmental change (Limpus, 2009). Coastal development and construction, placement of erosion control structures and other barriers to nesting, and vehicular traffic minimally impact green turtles in this DPS (Limpus, 2009). Artificial light levels have increased significantly for green turtles in minor nesting sites of the northern GBR and remained relatively constant for the mainland of Australia (part of southern GBR) south of Gladstone (Kamrowski *et al.,* 2014). Most of the nests at the documented nesting sites within this DPS occur within the protected habitat, but there is still concern about the viability of nesting habitat (Limpus, 2009). Total productivity is limited by reduced nesting and hatching success, which at Raine Island appear to be depressed due to habitat issues. At Raine Island, mean nesting success (*i.e.,* probability that a clutch will be laid when a turtle comes ashore for a nesting attempt) can be as low as 3.3 percent (Limpus *et al.,* 2007). Reduced recruitment can be caused by flooding of egg chambers by ground water, dry collapsing sand around egg chambers, and underlying rock which prevents appropriately deep egg chambers (Limpus *et al.,* 2003). In the 1996 to 1997 breeding season, for example, flooding of nests caused a near total loss of viable eggs, and flooding has been a regular event in subsequent years (Limpus *et al.,* 2003; Limpus, 2009). Death of nesting females occurs on Raine Island when they enter the elevated interior of the island due to crowding on the beach and return along a different route, encountering hazards such as small cliffs, over which they wander and roll onto their backs. Nightly mortality ranges from 0 to over 70 per night and is highest when nesting the previous night exceeds 1,000 (Limpus *et al.,* 2003). Understanding the root cause of changes to Raine Island nesting habitat is challenging and is the aim of several Australian and State Government research and monitoring projects. These habitat-based threats (particularly related to hatchling production) constitute serious threats to this DPS, given the large abundance of turtles nesting in the northern GBR.

b. Neritic/Oceanic Zones

Threats to habitat in the neritic and/or oceanic zones in the Southwest Pacific DPS include fishing practices, channel dredging, and marine pollution, although the internesting habitat adjacent to the nesting sites with the highest documented nesting levels in this DPS is protected by the Great Barrier Reef Coastal Marine Park and the adjacent Great Barrier Reef Marine Park (Limpus, 2009). Protection for marine turtles in the Great Barrier Reef World Heritage area has been increasing since the mid-1990s (Dryden *et al.,* 2008).

In summary, we find that the Southwest Pacific DPS of the green 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. Groundwater intrusion on high density beaches, artificial lighting, fishery practices, channel dredging, and marine pollution are continual threats to the persistence of this DPS.

2. Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Southwest Pacific DPS turtles are vulnerable to harvest throughout Australia and neighboring countries such as New Caledonia, Fiji, Vanuatu, Papua New Guinea, and Indonesia (Limpus, 2009). Cumulative annual harvest of green turtles that nest in Australia may be in the tens of thousands, and it appears likely that historical native harvest may have been in the same order of magnitude (Limpus, 2009). The Australian Native Title Act (1993) gives Aboriginal and Torres Strait Islanders a legal right to hunt sea turtles in Australia for traditional, communal, non-commercial purposes (Limpus, 2009). Although indigenous groups, governments, wildlife managers and scientists work together with the aim of sustainably managing turtle resources (Maison *et al.,* 2010 citing K. Dobbs, Queensland Parks Authority, pers. comm., 2010), traditional harvest remains a threat to green turtle populations. However, quantitative data are not sufficient to assess the degree of impact of harvest on the persistence of this DPS.

3. Factor C: Disease or Predation

Low levels of FP-associated turtle herpes virus is common in green turtles in some but not all semi-enclosed waters like Moreton Bay and Repulse Bay in Australia, more infrequent in nearshore open waters, and rare in off-shore coral reef habitats (Limpus, 2009). Mortality and recovery rates from this virus are not quantified but stranded, infected turtles are regularly encountered in south Queensland (Limpus, 2009).

Primary hatchling and egg predators of this DPS include crabs, birds, fish, and mammals. The magnitude of egg predation is not well documented, but within Australia the highest levels of vertebrate predation on eggs occur in other species, primarily loggerheads (Environment Australia, 2003). In Vanuatu, nest predation by feral dogs is a primary threat (Maison *et al.,* 2010). Survivorship of hatchlings in the southern GBR during the transition from nest to sea (accounting for crab and bird predation) may be quite high (Limpus, 1971), but survivorship of hatchlings as they transition across the reef flat from the water's edge to deep water is likely considerably lower (Gyuris, 1994 as cited in Limpus, 2009). Similar survivorship estimates are not available for the northern GBR, but survival during the nest to sea transition is expected to be low and variable, depending on the predator assemblage. Although many birds co-occur with sea turtle hatchlings in the northern GBR, only some birds, like the rufous night heron (*Nycticorax caledonicus*), are important predators (Limpus *et al.,* 2003). Terrestrial crabs that occur throughout the northern GBR have been observed feeding on turtle hatchlings and eggs, but crabs are generally of low density (Limpus *et al.,* 2003). Shark predation on hatchlings as well as adults has been documented (Limpus *et al.,* 2003).

Although disease and predation are known to occur, quantitative data are not sufficient to assess the degree of impact of these threats on the persistence of this DPS.

4. Factor D: Inadequacy of Existing Regulatory Mechanisms

Regulatory mechanisms are in place throughout the range of the DPS that address the direct capture of green turtles within this DPS. There are regulations, within this DPS, that specially address the harvest of green turtles while a few regulations are limited in that they only apply to certain times of year or allow for traditional use. Australia, New Caledonia and Vanuatu, the only countries with nesting aside from the Coral Sea Islands, which are a territory of Australia, have laws to protect green turtles. National protective legislation generally regulates intentional killing, possession, and trade (Limpus, 2009; Maison *et al.,* 2010). In addition, at least 17 international treaties and/or regulatory mechanisms apply to the conservation of green turtles in the Southwest Pacific DPS.

The majority of nesting beaches (and often the associated internesting habitat) are protected in Australia, which is the country with the vast majority of the known nesting.

In Australia, the conservation of green turtles is governed by a variety of national and territorial legislation. Conservation began with 1932 harvest restrictions on turtles and eggs in Queensland in October and November, south of 17° S., and by 1968 the restriction extended all year long for all of Queensland (Limpus, 2009). As described in the preceding section, other conservation efforts include sweeping take prohibitions, implementation of bycatch reduction devices and safer dredging practices, improvement of shark control devices, and safer dredging practices, and the development of community based management plans with Indigenous groups. Australia has undertaken extensive marine spatial planning to protect nesting turtles and internesting habitat surrounding important nesting sites. The GBR's listing on the United Nations Educational, Scientific and Cultural Organization's World Heritage List in 1981 has increased the protection of habitats within the GBR World Heritage Area (Dryden *et al.,* 2008).

In New Caledonia, 1985 fishery regulations contained some regional sea turtle conservation measures, and these were expanded in 2008 to include the EEZ, the Main Island, and remote islands (Maison *et al.,* 2010). In Vanuatu, new fisheries regulations in 2009 prohibit the take, harm, capture, disturbance, possession, sale, purchase of or interference, import, or export of green turtles Maison *et al.,* 2010).

There are several regulatory mechanisms in place that should address incidental take of green turtles within this DPS; however, these regulatory mechanisms are not realizing their full potential because they are not enforced at the local level. The analysis of these existing regulatory mechanisms assumed that all would remain in place at their current levels.

The inadequacy of existing regulatory mechanisms to address impacts to nesting beach habitat and overutilization is a continuing concern for this DPS. Other threats with inadequate regulatory mechanisms include incidental bycatch in fishing gear, boat strikes, port dredging, debris, national defense, and toxic compounds. Lack of implementation or enforcement by some nations renders regulatory mechanisms less effective than if they were implemented in a more consistent manner across the target region. It is unlikely that bycatch 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 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.

The Status Review did not reveal regulatory mechanisms in place to specifically address threats to nesting beaches, eggs, hatchlings, juveniles, and adults through harvest and incidental harm occur throughout the range of the Southwest Pacific DPS. Some threats, such as inundation of nests at Raine Island and sea level rise, cannot be controlled through individual national legislation and persist as a threat to this DPS.

5. Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

a. Incidental Bycatch in Fishing Gear

Incidental capture in artisanal and commercial fisheries is a threat to the survival of green turtles in the Southwest Pacific Ocean. The primary gear types involved in these interactions include trawl fisheries, longlines, drift nets, and set nets. These are employed by both artisanal and industrial fleets, and target a wide variety of species including prawns, crabs, sardines, and large pelagic fish.

Nesting turtles of the Southwest Pacific DPS are vulnerable to the Queensland East Coast Trawl Fisheries and the Torres Strait Prawn Fishery, and to the extent other turtles forage west of Torres Strait, they are also vulnerable (Limpus, 2009). In 2000, the use of TEDs in the Northern Australian Prawn Fishery became mandatory, due in part to several factors: (1) Objectives of the Australian Recovery Plan for Marine Turtles, (2) requirements 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.,* 2002).

Australian and international longline fisheries capture green turtles. Precise estimates of international capture of Southwest Pacific Ocean DPS green turtles by the international longline fleet are not available, but they are thought to be larger than the Australian component (DEWHA, 2010). In addition to threats from prawn trawls, green turtles may face threats from other fishing gear (summarized from Limpus, 2009). Take of green turtles in gill nets (targeting barramundi, salmon, mackerel, and shark) in Queensland and the Northern Territory has been observed but not quantified. Untended ''ghost'' fishing gear that has been intentionally discarded or lost due to weather conditions may entangle and kill many hundreds of green turtles annually.

b. Shark Control Programs

Green turtles are captured in shark control programs, but protocols are in place to reduce the impact. The Queensland Shark Control Program is managed by the Queensland Department of Primary Industries and Fisheries (Limpus, 2009) and has been operating since 1962 (Gribble *et al.,* 1998). In 1992, their operations began to be modified to reduce mortality of non-target species (Gribble *et al.,* 1998). Observed green turtle annual mortality during 1998–2003 was 2.7 per year (Limpus, 2009). Green turtles have been captured in the New South Wales shark-meshing program since 1937, but total capture for all turtle species from 1950 through 1993 is roughly five or fewer turtles per year (Krogh and Reid, 1996).

Post-release survival does not appear to have been monitored in any of the monitoring programs.

c. Boat Strikes and Port Dredging

The magnitude of mortality from boat strikes may be in the high tens to low hundreds per year in Queensland (Limpus, 2009). This threat affects juvenile and adult turtles and may increase with increasing high-speed boat traffic in coastal waters. The magnitude of mortality from port dredging in Queensland may be in the order of tens of turtles or less per year (Limpus, 2009).

d. Toxic Compounds and Marine Debris

Toxic compounds and bioaccumulative chemicals threaten green turtles in the Southwest Pacific DPS. Poor health conditions (debilitation and death) have been reported in the southern Gulf of Carpentaria for green turtles, many of which had unusual black fat (Kwan and Bell, 2003; Limpus, 2009). Heavy metal concentrations have also been reported in Australia (Dight and Gladstone, 1994; Reiner, 1994; Gordon *et al.,* 1998; Limpus, 2009), but the health impact has not been quantified. The magnitude of mortality from ingestion of synthetic material in Queensland is expected to be at least tens of turtles annually (Limpus, 2009).

e. Effects of Climate Change and Natural Disasters

Green turtle populations could be affected by the effects of climate change on nesting grounds (Fuentes *et al.,* 2011) as well as in marine habitats (Hamann *et al.,* 2007; Hawkes *et al.,* 2009). Potential effects of climate change include changes in nest site selection, range shifts, diet shifts, and loss of nesting habitat due to sea level rise (Hawkes *et al.,* 2009; Poloczanska *et al.,* 2009). Climate change will likely also cause higher sand temperatures leading to increased feminization of surviving hatchlings (*i.e.,* changes in sex ratio), and some beaches will likely experience lethal incubation temperatures that will result in losses of complete hatchling cohorts (Glen and Mrosovsky, 2004; Fuentes *et al.,* 2010; Fuentes *et al.,* 2011). While sea turtles have survived past eras that have included significant temperature fluctuations, future climate change is expected to happen at unprecedented rates, and if turtles cannot adapt quickly they may face local to widespread extirpations (Hawkes *et al.,* 2009). Impacts from global climate change induced by human activities are likely to become more apparent in future years (IPCC, 2007).

In a study of the northern GBR nesting assemblages, Bramble Cay and Milman Islet were vulnerable to sea-level rise, and almost all sites in the study were expected to be vulnerable to increased temperatures by 2070 (Fuentes *et al.,* 2011). Similar data are not available for other nesting sites.

The Southwest Pacific DPS contains some atolls, as well as coral reef areas that share some ecological characteristics with atolls. Barnett and Adger (2003) state that coral reefs, which are essential to the formation and maintenance of the islets located around the rim of an atoll, are highly sensitive to sudden changes in sea-surface temperature. Thus, climate change impacts could have long-term impacts on green turtle ecology in the Southwest Pacific DPS, but it is not possible to project the impacts at this point in time.

In summary, within Factor E, we find that fishery bycatch that occurs throughout the range of the DPS, particularly bycatch mortality of green turtles from pelagic longline, drift nets, set net, and trawl fisheries, is a continued risk to this DPS. Additional threats from boat strikes, marine pollution, changes likely to result from climate change, and cyclonic storm events are pose an increasing risk to the persistence of this DPS.

C. Conservation Efforts for the Southwest Pacific DPS

Conservation efforts for the Southwest Pacific DPS have resulted in sweeping take prohibitions, implementation of bycatch reduction devices, improvement of shark control devices, and safer dredging practices. Australia, in particular, has undertaken extensive marine spatial planning to protect nesting turtles and internesting habitat surrounding some of the largest and most important nesting sites in the DPS.

D. Extinction Risk Assessment and Findings for the Southwest Pacific DPS

The Southwest Pacific DPS is characterized by relatively high levels of green turtle nesting abundance (>80,000 nesting females) and contains the GBR, the largest coral reef system in the world, as well as continental coastline, islands, and atolls. The trends in nesting female abundance at the two index beaches (Raine Island and Heron Island, Australia) are stable or increasing. The spatial structure of this DPS extends over a large geographic area, with several large nesting sites spread within the range of this DPS, and includes both continental and insular nesting, thereby providing a level of habitat diversity and population resilience. This region has high genetic diversity resulting from a mix of highly divergent lineages, some of which are among the oldest lineages found in *C. mydas.* There are concerns about climate change in general and the nesting habitat at Raine Island in particular, where nests are sometimes flooded and nesting female mortality can range from 1–70 per night due to overcrowding.

The threats to this Southwest Pacific DPS include directed harvest, incidental bycatch in fisheries, shark control programs, boat strikes, port dredging, debris, activities associated with national defense, disease, predation, toxic compounds, and climate change. Conservation efforts have resulted in sweeping take prohibitions, implementation of bycatch reduction devices, improvement of shark control devices, and safer dredging practices. Australia, in particular, has undertaken extensive marine spatial planning to protect nesting turtles and internesting habitat surrounding important nesting sites. In the southern GBR threats are well managed, harvest is low, and the population increasing; however, in the northern GBR there are concerns for Raine Island and harvest is a cause for concern. In the Coral Sea there are few known threats and it is remote and well managed from human threats. Although the DPS shows strength in many of the critical elements, there are still concerns about numerous threats including climate change and habitat degradation.

For the above reasons, we propose to list the Southwest Pacific DPS as threatened. We do not find the DPS to be in danger of extinction presently because of high nesting abundance and geographically widespread nesting at a diversity of sites; however, the continued threats are likely to endanger the DPS within the foreseeable future.

XV. Central South Pacific DPS

A. Discussion of Population Parameters for the Central South Pacific DPS

The range of the Central South Pacific DPS extends north and east of New Zealand to include a longitudinal expanse of 7,500 km—from Easter Island, Chile in the east to Fiji in the west, and encompasses American Samoa, French Polynesia, Cook Islands, Fiji, Kiribati, Tokelau, Tonga, and Tuvalu. Its open ocean polygonal boundary endpoints are (clockwise from the northwest-most extent): 9° N., 175° W. to 9° N., 125° W. to 40° S., 96° W. to 40° S., 176° E., to 13° S., 171° E., and back to 9° N., 175° W. (Figure 2).

Nesting occurs sporadically throughout the geographic distribution of the DPS at low levels. Green turtles departing nesting grounds within the range of this DPS travel throughout the South Pacific Ocean. Post-nesting green turtles tagged in the early 1990s from Rose Atoll returned to foraging grounds in Fiji and French Polynesia (Craig *et al.,* 2004). Nesting females tagged in French Polynesia migrated west after nesting to various sites in the western South Pacific (Tuato'o-Bartley *et al.,* 1993). In addition to nesting beaches, green turtles are found in coastal waters (White and Galbraith, 2013; White, 2013), but in-water information for this DPS is particularly limited.

Based on available data, we estimate there are approximately 2,800 nesting females in this DPS at 59 nesting sites. The most abundant nesting area was Scilly Atoll, French Polynesia, which in the early 1990s was estimated to host 300–400 nesting females annually (Balazs *et al.,* 1995), and has an estimated total nesting female abundance of 1,050 breeding females, roughly one-third of all nesting females in the DPS (although this number is dated, it is used in the Status Review as it is the most recent data and the best available). However, Scilly Atoll was last monitored in the early 1990s (Balazs *et al.,* 1995), and abundance has reportedly declined as a result of commercial exploitation (Conservation International Pacific Islands Program, 2013). There are six other sites with 101–500 nesting females according to the best available data, although the estimate for Nukunonu, Tokelau is from the 1970s. Many nesting areas (21 of 58, or 36 percent) only have qualitative information that nesting is present, indicating that there is still much to learn about green turtle nesting in this region. As these unquantified nesting sites most likely each have a female abundance in the 1–100 range, their collective sum is probably fewer than 700 nesting females. Historical baseline nesting information in general is not widely available in this region, but exploitation and trade of green turtles throughout the region is well-known (Groombridge and Luxmoore, 1989).

No long-term monitoring programs are currently available at beaches in this population, and no single site has had standardized surveys for even 5 continuous years. Most nesting areas are in remote, low-lying atolls that are logistically difficult to access. Partial and inconsistent monitoring from the largest nesting site in this DPS, Scilly Atoll, suggests significant nesting declines from persistent and illegal commercial harvesting (Petit, 2013). Historically, 100–500 females nested annually at Canton Island, Kiribati (Balazs, 1975b) but, as of 2002, it had an estimated 29 nesting females. Nesting abundance is reported to be stable to increasing at Tongareva Atoll (White and Galbraith, 2013). It is also reported to be stable to increasing at Rose Atoll, Swains Atoll, Tetiaroa, Tikehau, and Maiao. However, these sites are of relatively low abundance and in sum represent less than 16 percent of the population abundance at Scilly Atoll alone.

With regard to spatial structure, genetic sampling in the Central South Pacific is limited and many of the small isolated nesting sites that characterize this region have not been covered. Mitochondrial DNA studies indicate there are at least two genetic stocks in American Samoa and French Polynesia (Dutton *et al.,* 2014), which have unique haplotypes (Dutton *et al.,* 2014). Flipper tag returns and satellite tracking studies demonstrate that post-nesting turtles travel the complete geographic breadth of the range of this DPS, from French Polynesia in the east to Fiji in the west, and sometimes even slightly beyond (Tuato'o-Bartley *et al.,* 1993; Craig *et al.,* 2004; Maison *et al.,* 2010; White, 2012), even as far as the Philippines (Trevor, 2009). Limited demographic information suggests a low level of population structuring within this DPS (Tuato'o-Bartley *et al.,* 1993; Craig *et al.,* 2004; White, 2012; White and Galbraith, 2013).

With regard to diversity and resilience, the Central South Pacific has a broad geographical area, but the nesting sites themselves exhibit little diversity. Most nesting sites are located in low-lying coral atolls or oceanic islands and thus are subject to loss of habitat due to sea level rise. Local nesting density is sparse spatially, typically spread over >10 km stretches of beach and is also low in terms of abundance. Only one nesting site (Scilly Atoll with 1,050 females; Balazs *et al.,* 1995) has a nesting female abundance exceeding 250, and this estimate is 20 years old. Foraging areas are mostly coral reef ecosystems, with seagrass beds in Tonga and Fiji being a notable exception.

B. Summary of Factors Affecting the Central South Pacific DPS

1. Factor A: The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

a. Terrestrial Zone

Nesting in the Central South Pacific DPS is geographically widespread with the majority of nesting sites being remote and not easily accessed, and at low-lying oceanic islands or coral atolls. The largest nesting site for this DPS is believed to be at Scilly Atoll in French Polynesia. Balazs *et al.* (1995) report that the earliest human settlement at Scilly Atoll in French Polynesia appears to have occurred around 1952. It is unclear how much of an effect human habitation of the atoll has had, or is having, on the nesting habitat for the turtle.

In the populated islands of American Samoa, such as Tutuila, continuous incremental loss of habitat has occurred due to varied activities of human populations (Tuato'o-Bartley *et al.,* 1993; NMFS and USFWS, 1998; Saili, 2005). Indeed, human population growth and attendant village expansion and development on Tutuila Island have resulted in decreasing usage of some Tutuila beaches by nesting turtles and pre-emption of some green turtle nesting beaches (Tuato'o-Bartley *et al.,* 1993). Turtles on Tutuila, possibly disoriented by land-based lights, are subject to mortality from cars (A. Tagarino, American Samoa DMWR, pers. comm., 2013). Lighting is a potential problem affecting the quality of the nesting habitat on Ofu nesting beach as well (Tagarino, 2012). The main nesting site in American Samoa is Rose Atoll, which is uninhabited and therefore without current threats to terrestrial habitat.

In Samoa, degradation of habitat through coastal development and natural disasters as cited in SPREP (SPREP, 2012) remains a threat (J. Ward, Ministry of Natural Resources and Environment, Samoa, pers. comm., 2013).

In Kiribati, historical destruction (bulldozing) of the vegetation zone next to the nesting beach on Canton Island in the Phoenix Islands occurred during World War II and may have negatively affected the availability of a portion of nesting beach area (Balazs, 1975). The remoteness of these islands and minimal amount of study of sea turtles in this area makes recent information on nesting beach condition and threats difficult to obtain.

In the Cook Islands, the major nesting site for green turtles, Tongareva Atoll, is uninhabited and there are not likely threats related to development or human disturbance (White, 2012b). However, elsewhere in the Cook Islands, sand extraction (for building purposes) and building developments are reported as potential threats to sea turtles; for instance, the best potential site at Tauhunu motu on Manihiki appears to be no longer used for nesting (White, 2012a). Weaver (1996) notes that sea turtles are negatively affected in Fiji by modification of nesting beaches. Coastal erosion in Tonga and Tuvalu is reported as a major problem for turtle nesting (Alefaio and Alefaio, 2006; Bell *et al.,* 2010).

b. Neritic/Oceanic Zones

Little is known regarding the status of the foraging habitat and threats found in French Polynesia (Balazs *et al.,* 1995). NMFS and USFWS (1998) noted that degradation of coral reef habitats on the south side of Tutuila Island, American Samoa is occurring due to sedimentation from erosion on agricultural slopes and natural disasters. Ship groundings are also potential threats to habitat in American Samoa. For example, a ship grounded at Rose Atoll in 1993, damaging reef habitat and spilling 100,000 gallons of fuel and other contaminants (USFWS, 2014). In the nearby neighboring country of Samoa, coastal and marine areas have been negatively impacted by pollution (Government of Samoa, 1998).

Fiji appears to be an important foraging area for green turtles of this DPS. Sea turtles have been negatively affected by alteration and degradation of foraging habitat and to some extent pollution or degradation of nearshore ecosystems (Batibasaga *et al.,* 2006). Jit (2007) also suggests that sea turtles in Fiji are threatened by degradation of reefs and seagrass beds. Given that turtles outside of Fiji appear to use this foraging habitat, negative effects to this foraging area have important implications for the entire DPS. Tourism development on the eastern coast of Viti Levu could negatively impact sea turtle foraging sites (Jit, 2007).

In Tonga, marine habitat is being affected by anthropogenic activities. Heavy sedimentation and poor water quality have killed patch reefs; high nutrients and high turbidity are negatively impacting seagrasses; and human activities are negatively impacting mangroves (Prescott *et al.,* 2004).

Although Palmyra Atoll is now protected, it was altered by U.S. military activities during World War II through dredging, connection, and expansion of islets (Sterling *et al.,* 2013).

In summary, as to Factor A, we find that the Central South Pacific DPS of the green turtle is negatively affected by ongoing changes in both its terrestrial and marine habitats as a result of land and water use practices. Pollution persists and loss of beach due to coastal development is significant threats to this DPS.

2. Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Human consumption has had a significant impact on green turtles in the Central South Pacific DPS. Hirth and Rohovit (1992) report that exploitation of green turtles for eggs, meat, and parts has occurred throughout the South Pacific Region, including American Samoa, Cook Islands, Fiji Islands, French Polynesia, and Kiribati. Allen (2007) notes that in Remote Oceania (which includes this DPS) sea turtles were important in traditional societies but, despite this, have experienced severe declines since human colonization approximately 2,800 years ago. At western contact, some of the islands supported sizable human populations resulting in intense pressures on local coastal fisheries.

At Scilly Atoll in French Polynesia local residents (approximately 20 to 40 people) are allowed to take 50 adults per year from a nesting population that could be as low as 300–400 (M. S. Allen, 2007; Balazs *et al.*, 1995). Balazs *et al.* (1995) reported that declines in nesting green turtles at the important areas of Scilly, Motu-one, and Mopelia, among the highest density nesting sites in the DPS, have occurred due to commercial exploitation for markets in Tahiti, as well as exploitation due to human habitation. Illegal harvest of sea turtles has been reported for French Polynesia by Te Honu Tea (2007). Brikke (2009) conducted a study on Bora Bora and Maupiti islands and reported that sea turtle meat remains in high demand and that fines are rarely imposed.

Directed take in the marine environment has been a significant source of mortality in American Samoa, and turtle populations have seriously declined (Tuato'o-Bartley *et al.,* 1993; NMFS and USFWS, 1998). Although take of sea turtle eggs or sea turtles is illegal (the ESA applies in this territory), turtles from American Samoa migrate to other countries (*e.g.,* Fiji, Samoa, French Polynesia) where turtle consumption is legal or occurs illegally (Craig, 1993; Tuato'o-Bartley *et al.,* 1993).

Turtles have been traditionally harvested for food and shells in the country of Samoa, and over-exploitation of turtles has negatively affected local populations (Government of Samoa, 1998). Unsustainable harvest (direct take for meat) remains a major threat to green turtles in Samoa (J. Ward, Government of Samoa, pers. comm. 2013).

In Fiji, Weaver (1996) identified the contemporary harvest and consumption of turtles by humans for eggs, meat, and shells as a significant threat for sea turtles. This includes commercial harvest, as well as subsistence and ceremonial harvest. In Kiribati (*e.g.,* Phoenix Islands), an unknown number of turtles are caught as bycatch on longlines and eaten (Obura and Stone, 2002). Poaching has been reported for Caroline Atoll, but to what extent it currently occurs is unknown (Teeb'aki, 1992).

In Tonga, Bell *et al.* (1994) report that collection of eggs for subsistence occurs. Prescott *et al.* (2004) and Havea and MacKay (2009) also note that it is still a practice on islands where turtles nest. Bell *et al.* (2009) report that in Tonga sea turtles are harvested and live turtles are often seen transported from outer islands to the main island, Tongatapu. It is unclear if this harvest is sustainable, especially given the increased catch rates in Tungua for the commercial market (Havea and MacKay, 2009).

In Tuvalu, harvest of sea turtles for their meat has been cited as a major threat (Alefaio and Alefaio, 2006; Ono and Addison, 2009). In the Cook Islands, turtles are sometimes killed during nesting at Palmerston and Rakahanga, while nesting and fishing on Nassau, and while nesting at Manihiki, Tongareva, and probably at other atolls (White, 2012). In Tokelau, Balazs (1983) reported human take of both sea turtle eggs from nests and adult males and females while copulating, nesting, or swimming (by harpoon).

In summary, within Factor B current legal and illegal collection of eggs and harvest of turtles throughout the Central South Pacific DPS persist as a threat to this DPS. The threat to the stability of green turtle populations posed by harvesting nesting females is particularly significant due to the small number of nesting females within this DPS.

3. Factor C: Disease or Predation

While FP is recorded elsewhere in the Pacific, it does not appear to be a threat in the Central South Pacific DPS (Utzurrum, 2002; A. Tagarino, American Samoa DMWR, pers. comm., 2013). The best available data suggest that current nest and hatchling predation on several Central South Pacific DPS nesting beaches and in-water habitats is a potential threat to this DPS.

Predation of green turtles (*e.g.,* by sharks) occurs in French Polynesia; however, the extent of such predation is unknown. In American Samoa, Polynesian rats (*Rattus exultans*) were an issue at Rose Atoll prior to a 1993 eradication (USFWS, 2014), but no longer appear to be a problem. Crabs are reported to eat hatchlings at Rose Atoll (Ponwith, 1990; Balazs, 1993; Pendleton pers. comm., USFWS, 2013). On Swains Island, feral pig activity has been documented and may be a threat to nests on the island (Tagarino and Utzurrum, 2010). Predation of green turtles by sharks has been reported at Rose Atoll and Palmyra Atoll; however, the extent of such predation is unknown (Graeffe, 1873; Sachet, 1954; Balazs, 1999; Sterling *et al.,* 2013). The main threat to wildlife on Rose Atoll is thought to be the introduction (or possible reintroduction) of exotic species (K. Van Houtan, NMFS, pers. comm., 2013).

In Samoa, feral animal predation on turtle nests and eggs remains a threat (SPREP, 2012; J. Ward, Government of Samoa, pers. comm., 2013). In other areas, predation is likely a contributing threat to green turtles. Introduced animals, including feral cats, rats, and feral pigs, are reported problems for wildlife (Teeb'aki, 1992) and may threaten green turtles on certain islands in Kiribati such as Kiritimati. In Tokelau, identified predators that may constitute a terrestrial threat to turtles include hermit crabs, ghost crabs, Polynesian rats, frigate birds (*Fregata ariel, F. minor*), and reef herons (*Egretta sacra;* Balazs, 1983). Feral pigs, rats, crabs, possibly some sea birds, and large fish are potential predators of sea turtles (eggs and hatchlings) in the Cook Islands (White, 2012). Pigs are reported on Mauke, although their impact on sea turtles is unquantified (Bradshaw and Bradshaw, 2012).

Although predation is known to occur, quantitative data are not sufficient to assess the degree of impact of these threats on the persistence of this DPS.

4. Factor D: Inadequacy of Existing Regulatory Mechanisms

Lack of regulatory mechanisms and/or adequate implementation and enforcement is a threat to the Central South Pacific DPS. The analysis of these existing regulatory mechanisms assumed that all would remain in place at their current levels. Regulatory mechanisms that address the direct capture of green turtles for most of the countries within this DPS specifically address the harvest of green turtles, while a few regulations are limited in that they only apply during certain times of the year or allow for traditional harvest.

Numerous countries have reserves (French Polynesia, Kiribati, Samoa, and the U.S. Pacific Remote Islands Marine National Monument), national legislation, and/or local regulations protecting turtles. These include the foreign Cook Islands, Fiji, French Polynesia, Kiribati, Pitcairn Islands, Samoa, Tonga, Tuvalu, and the U.S. territories of Wake, Baker, Howland and Jarvis Islands, Kingman Reef and Palmyra Atoll. In some places such as Tokelau and Wallis and Futuna, information on turtle protection was either unclear or could not be found. At least 17 international treaties and/or regulatory mechanisms apply to the conservation of green turtles in the Central South Pacific DPS.

Green turtles in American Samoa are fully protected under the ESA. Green turtles are also protected by the Fishing and Hunting Regulations for American Samoa (24.0934), which prohibit the import, export, sale, possession, transport, or trade of sea turtles or their parts and take (as defined by the ESA) and carry additional penalties for violations at the local government level (Maison *et al.,* 2010). Additionally, an American Samoa Executive Order in 2003 established the territorial waters of American Samoa as a sanctuary for sea turtles and marine mammals, in 2003; American Samoa declared its submerged lands a Whale and Turtle Sanctuary. It is not known how effective implementation of these protections is in American Samoa. The NOAA National Marine Sanctuary of American Samoa is comprised of six protected areas, covering 35,175 km^2 of nearshore coral reef and offshore open ocean waters across the Samoan Archipelago. Additionally, Rose Atoll Marine National Monument was established in 2009 and encompasses the Rose Atoll National Wildlife Refuge. These protected areas should provide some level of protection for green turtles and their habitat; however the effectiveness of these monuments for this species is unknown.

Regulatory mechanisms are apparently inadequate to curb a continued loss of nesting habitat and degradation of foraging habitat due to human activities and coastal development on populated islands of American Samoa, Samoa, Tonga, Tuvalu, Fiji, and the Cook Islands. Turtles continue to be harvested for food and shells, and are used in commercial, subsistence, and ceremonial capacities. Rudrud (2010) suggests that traditional laws in Polynesia may have historically limited green turtle consumption to certain people (chiefs, priests) or special ceremonies. However, as the societies of this region have been affected by Western culture and modernization of traditions have been altered; traditional laws have lost their effectiveness in limiting negative effects of harvest on sea turtles.

There are protected areas, within this DPS, that should provide some level of protection for green turtles and their habitat; however the effectiveness of these monuments for this species is unknown. The Status Review did not reveal regulatory mechanisms in place to specifically address coastal development, marine pollution, sea level rise, and effects of climate change that continue to contribute to the extinction risk of this DPS.

5. Factor E: Other Natural or Manmade Factors Affecting its Continued Existence

a. Incidental Bycatch in Fishing Gear

Incidental capture in artisanal and commercial fisheries is a significant threat to the survival of green sea turtles throughout the Central South Pacific DPS. The primary gear types involved in these interactions include longlines and nets.

Incidental capture in line, trap, or net fisheries presents a threat to sea turtles in American Samoa (Tagarino, 2011). Subsistence gill nets have been known to occasionally catch green turtles. Additionally, longline fishing is considered a threat to Central South Pacific green turtles. In 2010, the American Samoa longline fishery was estimated to have interacted with an average of 33 green turtles annually, with a 92 percent mortality rate, triggering reinitiation of a section 7 consultation; the current incidental take statement allows 45 green sea turtle interactions (41 mortalities) every three years (*http://www.fpir.noaa.gov/Library/PUBDOCs/biological_opinions/622-NMFS-ASLL_Am_to_Pelagics_FMP_Biop_FINAL_9-16-10.pdf*).

In Fiji, green turtles are killed in commercial fishing nets; however, the exact extent and intensity of this threat is unknown (Rupeni *et al.* 2002). Jit (2007) and McCoy (2008) report that green turtle bycatch is occurring in longline tuna fisheries in Fiji. The exact level of interaction with green turtles is unclear.

In the Cook Islands, longline fishery regulations require fishers to adopt the use of circle hooks and to follow ''releasing hooked turtles'' guidelines (Goodwin, 2008), although it is unclear how effective these regulations are. McCoy (2008) suggests that sea turtle bycatch is occurring in tuna fisheries in the Cook Islands; however, no information is provided on possible extent of sea turtle take or the species that are possibly taken.

b. Marine Debris and Pollution

Direct or indirect disposal of anthropogenic waste introduces potentially lethal materials into green turtle foraging habitats. Green turtles will ingest plastic, monofilament fishing line, and other marine debris (Bjorndal *et al.,* 1994), and the effects may be lethal or non-lethal, resulting in varying effects that may increase the probability of death (Balazs, 1985; Carr, 1987; McCauley and Bjorndal, 1999). Marine debris presents a threat to green turtles in American Samoa (Aeby *et al.,* 2008; USFWS, 2014; Tagarino *et al.,* 2008). It is potentially hazardous to adults and hatchlings and is present at Rose Atoll (USFWS, 2014). It is also a threat at nearby inhabited islands.

Pago Pago Harbor in American Samoa is seriously polluted, and uncontrolled effluent contaminants have impaired water quality in some coastal waters (Aeby *et al.,* 2008). Effects to coastal habitat (*e.g.,* reefs) from sedimentation related to development and runoff are significant potential threats in American Samoa, and human population pressures place strains on shoreline resources (Aeby *et al.,* 2008).

Ship groundings (*e.g.,* at Rose Atoll in 1993) that damage reef habitat and spill fuel and other contaminants, degradation of coastal waters due to silt-laden runoff from land and nutrient enrichment from human discharges and wastes, and contamination by heavy metals and other contaminants are threats to green turtles in American Samoa (NMFS and USFWS, 1998; USFWS, 2014).

In Fiji, Weaver (1996) identified potential threats to sea turtles from heavy metals and industrial waste, organic loadings in coastal areas, plastic bags, and leachate poisoning of seagrass foraging areas. In the Cook Islands, White (2012) noted possible issues with oil, tar, or toxic chemicals and terrestrial run-off into lagoons at Rarotonga, and Bradshaw and Bradshaw (2012) note pollution (*e.g.,* accumulation of plastics on the beach) on Mauke (M.White, unpubl. data, *www.honucookislands.com*).

c. Effects of Climate Change and Natural Disasters

Climate change has the potential to greatly affect green turtles. Potential impacts of climate change on green turtles include loss of beach habitat 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 (Fish *et al.,* 2005, 2008; Hawkes *et al.,* 2009; Poloczanska *et al.,* 2009). Impacts from global climate change induced by human activities are likely to become more apparent in future years (IPCC, 2007).

A recent study of 27 atoll islands in the central Pacific (including Kiribati and Tuvalu), demonstrated that 14 percent of islands decreased in area over a 19–60 year time span (Webb and Kench, 2010). This occurred in a region considered most vulnerable to sea-level rise (Nicholls and Cazenave, 2010) during a period in which sea-levels rose 2 mm per year.

Catastrophic natural environmental events, such as cyclones or hurricanes, may affect green turtles in the Central South Pacific Ocean, and may exacerbate issues such as decreased available habitat due to sea level rise. These types of events may disrupt green turtle nesting activity (Van Houtan and Bass, 2007), even if just on a temporary scale.

In summary, within Factor E, we find that incidental fishery bycatch, interactions with recreational and commercial vessels, marine pollution as well as the increasing threat of climate change, and major storm events are expected to be an increasing threat to the persistence of this DPS.

C. Conservation Efforts for the Central South Pacific DPS

There are many islands and atolls in the range of this DPS spread across an expansive area. Conservation efforts, such as establishment of protected areas, exist that are beneficial to green turtles.

It is unclear how well conservation efforts such as protected areas and the national legislation relating to green turtles are working. It appears that the remoteness of some of the areas is providing the most conservation protection for certain threats.

D. Extinction Risk Assessment and Findings for the Central South Pacific DPS

The Central South Pacific DPS is characterized by geographically widespread nesting at very low levels of abundance, mostly in remote low-lying oceanic atolls. Nesting is reported in 57 different locations, although some abundance numbers are 20 years old or older. By far the highest nesting abundance estimate is from Scilly Atoll, French Polynesia (1,050 nesting females), but this estimate is from 1991 data and abundance of nesting females has reportedly significantly declined in the past 30 years as a result of commercial exploitation. There are also no long-term monitoring programs that have been active in this DPS for even a 5-year period. While the dispersed location of nesting sites might provide a level of habitat diversity and population resilience which reduces overall extinction risk, this contribution is reduced by the low population size of these sites (only Scilly Atoll has over 225 nesting females) and overall population size of fewer than 3,000 nesting females.

Chronic and persistent illegal harvest is a concern in the Central South Pacific DPS, and sea level rise is a threat that is expected to increase in the future. Indeed, climate change may affect this DPS more than any other because nearly all nesting sites exist on low-lying atolls. Sea level rise is expected to exacerbate beach erosion, inundations, and storm surge on small islands (IPCC, 2007). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the intensity of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Kennedy *et al.,* 2002; Meehl *et al.,* 2007).

For the above reasons, we propose to list the Central South Pacific DPS as endangered. Based on its low nesting abundance and exposure to increasing threats, we find that this DPS is presently in danger of extinction throughout its range.

XVI. Central North Pacific DPS

A. Discussion of Population Parameters for the Central North Pacific DPS

The range of the Central North Pacific DPS covers the Hawaiian Archipelago and Johnston Atoll. It is bounded by a four-sided polygon with open ocean extents reaching to 41° N., 169° E. in the northwest corner, 41° N., 143° W. in the northeast, 9° N., 125° W. in southeast, and 9° N., 175° W. in the southwest (Figure 2). The Hawaiian Archipelago is the most geographically isolated island group on the planet. From 1965 to 2013, 17,536 green turtles were tagged, including all post-pelagic size classes from juveniles to adults. With only three exceptions, the 7,360 recaptures of these tagged turtles have been made within the Hawaiian Archipelago. The three outliers involved a recovery in Japan, one in the Marshall Islands and one in the Philippines.

The principal nesting site for green turtles in the Central North Pacific DPS is FFS, where 96 percent of the population (3,710 of 3,846 nesting females) currently nests (Balazs, 1980; Lipman and Balazs, 1983). However, nesting was historically abundant at various sites across the archipelago as recently as 1920 (Kittinger *et al.,* 2013), and remnant nesting aggregations may have existed in the MHIs as recently as the 1930s, but were no longer present in the 1970s (Balazs, 1976). Current nesting by green turtles occurs in low numbers (3–36 nesting females at any one site) throughout the Northwest Hawaiian Islands (NWHI) at Laysan, Lisianski, Pearl and Hermes Reef, and very uncommonly at Midway. Since 2000, green turtle nesting on the MHI has been identified in low numbers (1–24) on seven islands (Frey *et al.,* 2013; Kittinger *et al.,* 2013; NMFS Pacific Islands Fisheries Science Center, unpublished data, 2013). Green turtles in the Central North Pacific DPS bask on beaches throughout the NWHI and in the MHI.

Since nesting surveys were initiated in 1973, there has been a marked increase in annual green turtle nesting at East Island, FFS, where approximately 50 percent of the nesting on FFS occurs (Balazs and Chaloupka, 2004, 2006). During the first 5 years of monitoring (1973–1977), the mean annual nesting abundance was 83 females, and during the most recent 5 years of monitoring (2009–2012), the mean annual nesting abundance was 464 females (Balazs and Chaloupka, 2006; G. Balazs, NMFS, unpublished data). This increase over the last 40 years corresponds to an annual increase of 4.8 percent.

Information on in-water abundance trends is consistent with the increase in nesting (Balazs, 2000; Balazs *et al.,* 2005; Balazs *et al.,* 1996). This linkage is to be expected since genetics, satellite telemetry, and direct observation show that green turtles from the nesting beaches in the FFS nesting site remain resident to foraging pastures throughout the archipelago (Balazs, 1976; Craig and Balazs, 1995; Keuper-Bennett and Bennet, 2000; P. Dutton, NMFS, pers. comm., 2013). The number of immature green turtles residing in foraging areas of the eight MHI has increased (Balazs *et al.,* 1996). In addition, although the causes are not totally clear, there has been a dramatic increase in the number of basking turtles in the Hawaiian Islands over the last 2 decades, both in the southern foraging areas of the main islands (Balazs *et al.,* 1996) as well as at northern foraging areas at Midway Atoll (Balazs *et al.,* 2005).

With regard to spatial structure, genetic sampling in the Central North Pacific DPS has been extensive and representative, given that there are few nesting populations in this region. Results of mtDNA analysis indicate a low level of spatial structure with regard to minor nesting around the MHI and the NWHI, and the same haplotypes occur throughout the range of the DPS. Within the NWHI, studies show no significant differentiation (based on mtDNA haplotype frequency) between FFS and Laysan Island (P. Dutton, NMFS, pers. comm., 2013). An analysis by Frey *et al.* (2013) of the low level of scattered nesting on the MHI (Moloka‘i, Maui, O‘ahu, Lana‘i and Kaua‘i; mtDNA and nDNA) showed that nesting in the MHI might be attributed to a relatively small number of females that appear to be related to each other, and demographically isolated from FFS. Frey *et al.* (2013) suggest that the nesting population at the MHI may be the result of a few recent founders that originated from the FFS breeding population. Demographic studies of green turtles do not reveal any structuring of traits within the DPS.

With regard to diversity and resilience, because nesting in the Central North Pacific DPS is unusually concentrated at one site, there is little diversity in nesting areas. Balazs (Balazs, 1980) reported that the distribution of green turtles in the Hawaiian Archipelago has been reduced within historical times, and Kittinger *et al.* (2013) suggest that a significant constriction in the spatial distribution of important reproduction sites presents a challenge to the population's future and makes this DPS highly vulnerable. Further, the primary nesting site, FFS, is a low-lying coral atoll that is susceptible to erosion, geomorphological changes and sea level rise, and has already lost significant nesting area (Baker *et al.,* 2006).

B. Summary of Factors Affecting the Central North Pacific DPS

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

a. Terrestrial Zone

In Hawai‘i, most nesting currently occurs in the NWHI, although nesting is increasing in the MHI, as is basking of green turtles. Coastal development and construction, vehicular and pedestrian traffic, beach pollution, tourism, and other human related activities are current threats to nesting and basking habitat in the MHI. These threats will affect more green turtles in this DPS if nesting increases in the MHI. Human populations are growing rapidly in many areas of the insular Pacific, including Hawai‘i, and this expansion is exerting increased pressure on limited island resources.

Climatic changes in the NWHI pose threats through reduction in area of nesting beaches critical to this DPS (Baker *et al.,* 2006). Baker *et al.* (2006) examined the potential effects of sea level rise in the NWHI and found that the primary nesting area for the Central North Pacific population will be negatively impacted by sea level rise through possible loss of nesting habitat. For example, Whale-Skate Island at French Frigate Shoals was formerly a primary green turtle nesting site for this DPS, but the island has subsided and is no longer available for nesting (Kittinger *et al.,* 2013). Trig, Gin, and Little Gin could lose large portions of their area, concentrating nesting even further at East Island (Baker *et al.,* 2006).

b. Neritic/Oceanic Zones

Impacts to the quality of coastal habitats in the MHI are a threat to this DPS and are expected to continue and possibly increase with an increasing human population and annual influx of millions of tourists. Loss of foraging habitat or reduction in habitat quality in the MHI due to nearshore development is a threat to this DPS. Marina construction, beach development, siltation of forage areas, contamination of forage areas from anthropogenic activities, resort development or activities, increased vessel traffic, and other activities are all considered threats to this population and its habitat (Bowen *et al.,* 1992; NMFS and USFWS, 1998; Friedlander *et al.,* 2006; Wedding and Friedlander, 2008; Wedding *et al.,* 2008; Van Houtan *et al.,* 2010). Seagrass and coral reef habitat of Moloka‘i has been degraded from upland soil erosion and siltation, and coral reefs of Hawai‘i, Kaua‘i, Lana‘i, Maui, and O‘ahu have been degraded by sedimentation, sewage, or coastal construction (NMFS and USFWS, 1998). In general, MHI coral reefs have suffered from land-based sources of pollution, overfishing, recreational overuse, and alien and invasive species (Friedlander *et al.,* 2005). Vessel groundings (mechanical damage to habitat and reef-associated organisms) and related release of contaminants (*e.g.,* fuel, hazardous substances, etc.) are a threat to Central North Pacific green turtle habitat (Keller *et al.,* 2009). It is difficult to predict the exact number or severity of vessel groundings expected in any future year, but key nesting and foraging habitat for green sea turtles occurs in the areas of the MHI and the NWHI where commercial and recreational boating occurs (Keller *et al.,* 2009).

During the last century, habitat on Johnston Atoll was affected by military activities such as nuclear testing and chemical weapons incineration. The lingering effects of these activities include water contamination from nutrients, dioxins, plutonium, and a subsurface plume of PCB-contaminated petroleum product (Balazs, 1985).

In summary, within Factor A, we find that the loss of nesting beach habitat is a threat to the DPS in the NWHI. We find that coastal development and construction, vehicular and pedestrian traffic, beach pollution, tourism, and other human related activities are threats in the MHI. Climate change, marina construction, contamination of forage areas from anthropogenic activities, resort development or activities, increased vessel traffic are significant, increasing threats posing a risk to the persistence of this DPS.

2. Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Harvest of green turtles has been illegal since green turtles were listed under the ESA in 1978. It is possible that human take today is underreported, as anecdotal information suggests that some degree of illegal take occurs throughout the MHI. The extent of such take is unknown; however, it is believed that current illegal harvest of green turtles for human consumption continues in a limited way, although Federal and State cooperative efforts and existing legislation appear to be minimizing the threat.

3. Factor C: Disease or Predation

The FP disease affects green turtles found in the Central North Pacific Ocean (Francke *et al.,* 2013). This disease results in internal and/or external tumors (fibropapillomas) that may grow large enough to hamper swimming, vision, feeding, and potential escape from predators. FP appears to have peaked in some areas of Hawai‘i, remained the same in some regions, and increased in others (Van Houtan *et al.,* 2010). Environmental factors may be significant in promoting FP, and eutrophication (increase in nutrients) of coastal marine ecosystems may promote this disease (Van Houtan *et al.,* 2010). FP remains an important concern in some green turtle populations. This is particularly true given the continued, and possibly future increasing, human impacts to, and eutrophication of, coastal marine ecosystems that may promote this disease. However, its effects on reproductive effort are uncertain.

Ghost crabs (*Ocypode* spp.) prey on hatchlings at FFS (Niethammer *et al.,* 1997) at approximately 5 percent (Balazs, 1980). Large grouper (*Epinephelus tauvina*), sea birds, and sharks are documented natural predators of green turtles in Hawai‘i; however, the extent of predation is unknown (Balazs, 1995; Balazs and Kubis, 2007; Francke, 2013).

Mongoose, rats, dogs, feral pigs, and cats—all introduced species—that exist on the MHI are known to prey on eggs and hatchlings, although the impact on the current low level of nesting is unclear (nesting in the MHI is extremely low compared to historical levels). If nesting in the MHI increases, the importance of the threat from these potential predators would increase.

4. Factor D: Inadequacy of Existing Regulatory Mechanisms

Regulatory mechanisms that protect green turtles are in place and include State, Federal, and international laws. The analysis of these existing regulatory mechanisms assumed that all would remain in place at their current levels. Numerous Federal and State governmental and non-governmental efforts at public education, protection and monitoring of green turtles contribute to the conservation of the Central North Pacific DPS. At least 16 international treaties and/or regulatory mechanisms apply to the conservation of green turtles in the Central North Pacific.

Nesting occurs exclusively within the United States. Monitoring and protective efforts are ongoing for both nesting areas (in the NWHI and where nesting is occurring in the MHI) and in nearshore waters. Regulatory mechanisms in U.S. jurisdiction are in place through the ESA, MSA and the State of Hawai‘i that currently address direct and incidental take of Central North Pacific green turtles, and these regulatory mechanisms have been an important factor in the encouraging trend in this DPS.

The Pacific Remote Islands Marine National Monument was established in January 2009, and is cooperatively managed by the Secretary of Commerce (NOAA) and the Secretary of the Interior (USFWS), with the exception of Wake Island and Johnston Atoll, which are currently managed by the Department of Defense. The areas extend 92.6 km from the mean low water lines around emergent islands and atolls and include green turtle habitat. Commercial fishing is prohibited within the limits of the Monument, and recreational fishing requires a permit. On September 27, 2014, President Obama issued Presidential Proclamation 9173 to expand the Pacific Remote Islands Monument to incorporate waters and submerged lands at Jarvis Island, Wake Island, and Johnston Atoll to the seaward limit of the U.S. Exclusive Economic Zone (EEZ). Proclamation 9173 prohibits commercial fishing in expanded areas of the Monument, and directs the Secretaries of Interior and Commerce to ensure that recreational and non-commercial fishing continue to be managed as sustainable activities in the Monument. The protected areas provide some protection to sea turtles and their habitat through permitted access and its remoteness.

A commercial ban on turtle harvest was put into place by the State of Hawai‘i in 1974, 4 years before the green turtle was listed under the ESA. Since 1978, green turtles have been protected by the ESA. They are also protected by the Hawai‘i Revised Statutes, Chapter 195D (Hawai‘i State Legislature, accessed Sept. 10, 2010) and Hawai‘i Administrative Rules, 13–124 (Hawai‘i Administrative Rules, accessed Sept. 10, 2010), which adopt the same definitions, status designations, and prohibitions as the ESA and carry additional penalties for violations at the State government level. These two statutes have been, and currently are, key tools in efforts to recover and protect this DPS, and both have provided for comprehensive protection and recovery activities that have been sufficiently effective to improve the status of green turtles in Hawai‘i significantly. The ESA and Hawai‘i statutes are not, however, redundant. For example, the ESA requires Federal agencies to consult with the Services on their actions that may affect green turtles.

Current monitoring, conservation efforts, and legal enforcement have been effective and promote the persistence of the Central North Pacific DPS, which occurs almost exclusively in U.S. waters. It is important to note, however, that the analysis by the SRT did not consider the scenario in which current laws or regulatory mechanisms were not continued. Under the ESA, regulatory measures provide protections that are not provided entirely by State protections. For instance, if the DPS was delisted and the protections of the ESA were no longer in place, many on-the-ground conservation and monitoring actions and, importantly, financial resources that are afforded by the ESA (*e.g.,* section 6) would not continue. In addition, the taking of green turtles in the United States requires authorization under sections 7 or 10 of the ESA and their implementing regulations. For example, activities that affect green turtles and do not involve Federal agencies, such as coastal development, construction, and research, must comply with section 10 of the ESA to avoid violating the statute. Section 10 permits require avoiding, minimizing, and mitigating impacts to green turtles to the extent possible. Federal actions (*i.e.,* those authorized, funded, or carried out by Federal agencies), are subject to consultation with the Services under section 7 of the ESA; those resulting in take of green turtles are required to minimize effects. These actions include, but are not limited to, federally regulated fisheries and management and research activities within the federally-protected Papahānaumokuākea Marine National Monument in the NWHI.

The threat of bycatch in international fisheries is not adequately regulated, although bycatch in domestic Federal fisheries has been addressed to a greater extent. In addition, some threats to the species, such as climate change, are either not able to be regulated under the ESA, or not regulated sufficiently to control or even slow the threat.

The Status Review did not reveal regulatory mechanisms in place to specifically address marine pollution, sea level rise, and effects of climate change that continue to contribute to the extinction risk of this DPS.

5. Factor E: Other Natural or Manmade Factors Affecting its Continued Existence

a. Incidental Bycatch in Fishing Gear

The SRT identified incidental capture in fisheries as a significant threat to green turtles of the Central North Pacific DPS. The primary gear types involved in these interactions include longlines and nets. These are employed by both artisanal and industrial fleets, and target a variety of species.

i. Longline Fisheries

Pacific longline fisheries capture green turtles as bycatch in longline gear (line, hooks), and these interactions can result in mortality (NMFS, 2012). U.S. longline fisheries are required to comply with sea turtle mitigation measures (50 CFR 665.812), including the use of circle hooks, dehookers, line clippers, and crewmember training, that have reduced green sea turtle interactions to negligible levels. However, while exact numbers are not available, it is estimated that, at a minimum, 100 green turtles from the Central North Pacific DPS are captured and killed annually by foreign longlines (NMFS, 2012).

ii. Gillnet Fisheries

Interactions between Central North Pacific green turtles and nearshore fisheries in the MHI can result in entanglement, injury, and mortality. Balazs *et al.* (1987) documented sea turtle mortality resulting from bycatch in fishing gear over 25 years ago in Hawai'i. While gill nets are regulated by the state of Hawai'i, fishers are only required to inspect them completely every two hours, so entanglement and drowning does occur (NMFS, 2012). Each year green sea turtles are incidentally entangled in net gear, some of these resulting in mortality (*e.g.,* Francke, 2013); however the reported strandings in the MHI are believed to be a smaller subset of the actual level of interaction with this gear.

iii. Other Gear Types

Hook-and-line fishing from shore or boats also hooks and entangles green turtles (Francke *et al.,* 2013; NMFS, 2012). Interactions with nearshore recreational fisheries are identified in the NMFS stranding database as those turtles that strand as a result of interactions with fish hooks and fishing line. Nearshore fishery interactions have increased over time (Francke, 2013; Francke et al., 2013; Ikonomopoulou *et al.,* 2013). While current public outreach efforts by NMFS and its partners attempt to reduce the magnitude of impact on green turtles from hook-and-line fishing, injury or mortality from the hooking or from the effects of line remaining on turtles that are cut free or break the line remains an issue (*http://pifscblog.wordpress.com/2013/06/07/marine-turtle-response-achieves-significant-milestone/*).

b. Marine Debris and Pollution

The ingestion of and entanglement in marine debris is another anthropogenic threat to Central North Pacific green turtles throughout their range. Marine debris is common in the MHI and a direct threat to sea turtles (Wedding and Friedlander, 2008). Stranding information for this DPS shows that entanglement in lost or discarded fishing line is one of the causes of green turtle strandings and mortality in the MHI. In the NWHI, marine debris is also a threat in the terrestrial and marine environment. In 1996, it was estimated that between 750 and 1,000 tons of marine debris were on reefs and beaches in the NWHI, and the source of much of the debris is fishing nets discarded or lost in the northeastern Pacific Ocean (Keller *et al.,* 2009). Turtles in the MHI encounter pollution as a result of coastal development, runoff, and waste water (point source and non-point source pollution; Friedlander *et al.,* 2008).

c. Vessel Interactions

As in other parts of the world, boating activities are a threat to turtles within this DPS (Francke *et al.,* 2013). Chaloupka *et al.* (2008b) report that 2.5 percent of green turtle strandings (N = 3,745) were caused by boat strike in the Hawaiian Archipelago from 1982 to 2003. Additionally, boat traffic has been shown to exclude green turtles from preferred coastal foraging pastures (Seminoff *et al.,* 2002c), which may negatively affect their nutritional intake.

Vessel groundings (mechanical damage to habitat and reef-associated organisms) and related release of contaminants (*e.g.,* fuel, hazardous substances, etc.) are a threat not only to Central North Pacific green turtle habitat, but directly to the turtles themselves. Thirteen reported vessel groundings have occurred in the NWHI in the last 60 years (Keller *et al.,* 2009). Vessel traffic and presence can also have negative effects through habitat damage from anchors, waste discharge, light and noise (Keller *et al.,* 2009).

d. Effects of Climate Change

As in other areas of the world, climate change and sea level rise have the potential to negatively affect green turtles in the Central North Pacific DPS. Climate change influences on water temperatures, ocean acidification, sea level and related changes in coral reef habitat, wave climate and coastal shorelines are expected to continue (Friedlander *et al.,* 2008). Keller *et al.* (2009) suggest that sea level rise, changing storm dynamics, sea surface temperatures, and ocean acidification are key threats for the NWHI, and that evidence of sea level rise has already begun to adversely affect terrestrial and ocean habitat. Tiwari *et al.* (2010) argued that East Island itself is still not yet at carrying capacity, in the sense of crude nesting area and current nesting densities. Yet entire islands have been submerged in recent history (*i.e.,* Whale-Skate in the late 1990s), resulting in the loss of a primary nesting site at FFS (Baker *et al.,* 2006). It is likely that sea level rise will lead to increased erosion of nesting beaches and significant loss of habitat (Baker *et al.,* 2006; IPCC, 2007); however, it remains unclear how nesting habitat loss and natal homing traits will influence future nesting in this DPS.

As temperatures increase, there is concern that incubation temperatures could reach levels that exceed the thermal tolerance for embryonic development, thus increasing embryo and hatchling mortality (Balazs and Kubis, 2007; Fuller *et al.,* 2010). Niethammer *et al.* (Niethammer 1997) note that given that the FFS nesting colony is on the northern extreme of green turtle breeding range, small changes in beach conditions (*e.g.,* microhabitats of nests) may have severe consequences on nesting. Changes in global temperatures could also affect juvenile and adult distribution patterns. Possible changes to ocean currents and dynamics may result in negative effects to natural dispersal during a complex life cycle (Van Houtan and Halley, 2011), and possible nest mortality linked to erosion may result from increased storm frequency (Van Houtan and Bass, 2007) and intensity (Keller *et al.,* 2009).

While sea turtles have survived past eras that have included significant temperature fluctuations, future climate change is expected to happen at unprecedented rates, and if turtles cannot adapt quickly they may face local to widespread extirpations (Hawkes *et al.,* 2009). Impacts from global climate change induced by human activities are likely to become more apparent in future years (IPCC, 2007).

e. Effects of Spatial Structure

While the nesting population trajectory in the Central North Pacific DPS is positive and encouraging, the DPS exhibits moderately low levels of abundance (3,846 nesting females), and more than 96 percent of nesting occurs at one site in the NWHI (FFS). Therefore, survival of this DPS is currently highly dependent on successful nesting at FFS (Niethammer *et al.,* 1992). The concentrated nature and relatively small size of the nesting population make it vulnerable to random variation and stochasticities in the biological and physical environment, including natural catastrophes, as well as changes in climate and resulting effects such as sea level rise. This increases its risk of extinction, even though the DPS may currently have positive population growth (*e.g.,* Meffe *et al.,* 1994; Primack, 1998; Balazs and Kubis, 2007; Hunter and Gibbs, 2007). That said, aside from sea level rise, FFS is relatively isolated from anthropogenic threats, as it occurs within the Papahānaumokuākea Marine National Monument, a remote Monument that has controlled access for activities that occur within it. The regional range expansion into nesting areas in the MHI provide increased spatial diversity and may buffer against the loss of nesting sites at FFS; however, nesting areas in the MHI are exposed to anthropogenic threats.

Within Factor E, we find that incidental bycatch in fishing gear, marine pollution, interactions with recreational and commercial vessels, climate change, beach driving, and major storm events all negatively affect green turtles in the Central North Pacific DPS. The consideration of climate change, and the fact that the one isolated atoll, where approximately 96 percent of green turtles within this DPS nest, is extremely vulnerable to sea level rise, increase the risk of extinction for this DPS.

C. Conservation Efforts for the Central North Pacific DPS

The State of Hawai‘i's efforts to conserve green turtles include: Wildlife regulations; coordination of stranding response and specimen storage on the islands of Maui, Hawai‘i, and Kaua‘i; issuance and management of special activity permits; statewide outreach and education activities; and nest monitoring on Maui (Department of Land and Natural Resources, 2013). Hawai‘i Division of Aquatic Resources staff responds to stranded turtle reports and issues special use permits to researchers and educators. The Division of Conservation and Resources Enforcement investigates reports of illegal poaching, provides support and security at some nest sites and strandings, and addresses complaints from the public regarding turtle disturbances.

With regard to conservation areas, the Papahānaumokuākea Marine National Monument in the NWHI is a conservation area established in 2006 that encompasses coral reefs, islands and shallow water environments. It comprises several previously existing Federal conservation areas, including the NWHI Coral Reef Ecosystem Reserve, Midway Atoll National Wildlife Refuge, Hawaiian Islands National Wildlife Refuge, NWHI Marine Refuge, State Seabird Sanctuary at Kure Atoll and the Battle of Midway National Memorial. The Monument is administered jointly by three co-trustees: NOAA, the USFWS, and the State of Hawai‘i. The Monument's mission is to carry out seamless integrated management to ensure ecological integrity and achieve strong, long-term protection and perpetuation of NWHI ecosystems, Native Hawaiian culture, and heritage resources for current and future generations. Commercial fishing is prohibited in the Monument and all other human activities require a permit.

Overall, conservation efforts have been successful in this DPS, as exhibited by the increasing trend in the green turtle population.

D. Extinction Risk Assessment and Findings for the Central North Pacific DPS

The Central North Pacific DPS is characterized by geographically concentrated nesting (96 percent of nesting occurs at one location) and moderately low levels of abundance (3,846 nesting females). Such a low number is the result of chronic historical exploitation, which extirpated 80 percent of historically major nesting grounds (Kittinger *et al.,* 2013). The DPS is geographically and chronologically well-sampled, with no sites where nesting is unquantified, and very little chance there are undocumented nesting locations. Time series analysis of nesting female abundance over 40 years at FFS shows a marked increase in nesting since surveys were initiated in 1973, with an encouraging annual rate of increase of 4.8 percent. However, 96 percent of nesting now occurs at one atoll (FFS)—where sea level rise is a significant concern—and no more than 40 females nest at any of the other 11 sites. Information on in-water abundance trends is consistent with the increase in nesting.

The Status Review indicates that the DPS shows strength in its population trend, but that there are concerns about overall abundance, spatial structure, and diversity/resilience. Indeed, in spite of the positive trends in the last few decades, the unprecedented concentration of nesting at one site and moderately low population size raise serious concerns about the resilience of this DPS, particularly its ability to adapt to future climate scenarios. Ninety-eight percent of the population nests are low lying atolls (96 percent nesting in a single low-lying atoll), making them extremely vulnerable to sea level rise—some effects of which have already been witnessed. Keller *et al.* (2009) suggest that sea level rise, changing storm dynamics, sea surface temperatures, and ocean acidification are key threats for the NWHI. Current and projected maps of four islands in the NWHI predicted a sea level rise ranging from 9 cm to 88 cm by 2100, with a projected loss of nesting beach at approximately 15 to 26 percent (IPCC, 2001). Further, sea level rise is expected to continue at a rate exceeding that observed during 1971–2010 as a result of increased ocean warming and increased loss of glacier and ice sheet mass (IPCC, 2013). Baker *et al.* (2006) examined the potential effects of sea level rise in the NWHI and found that the primary nesting area for the Central North Pacific population is threatened by sea level rise through possible loss of nesting habitat. They note that one formerly significant nesting site—Whale-Skate Island—is now completely submerged. They further note that the islets of Trig, Gin and Little Gin could lose large portions of their area, concentrating nesting even further at East Island. In contrast, Tiwari *et al.* (2010) argued that East Island itself is still not yet at carrying capacity, in the sense of crude nesting area and current nesting densities. It remains unclear how catastrophic nesting habitat loss and natal homing traits will influence future nesting in this DPS. Habitat degradation resulting from the release of contaminants contained in landfills and other areas of the NWHI could also occur as the islands erode or are flooded from sea level rise (Keller *et al.,* 2009). Other effects of climate change include increasing temperatures at nesting beaches that may affect hatchling sex ratios and embryonic development (Balazs and Kubis, 2007; Fuller *et al.,* 2010b). Making this an even greater concern is that climate change and the resultant sea level rise are difficult to regulate and certainly cannot be sufficiently regulated through the ESA to slow its effects.

In summary, despite an upward trend in population abundance, the Central North Pacific DPS is characterized by geographically concentrated nesting and low levels of abundance (3,846 nesting females). The lack of redundancy in nesting sites and the low nesting numbers at these sites lead to low resilience within this DPS. The consideration of climate change, and the fact that the one isolated atoll, where approximately 96 percent of green turtles within this DPS nest, is extremely vulnerable to sea level rise, increase the risk of extinction.

For the above reasons, we propose to list the Central North Pacific DPS as threatened. We do not find the DPS to be in danger of extinction presently because of the increasing nesting trend; however, the continued threats coupled with a small and narrowly distributed nesting population are likely to endanger the DPS within the foreseeable future.

XVII. East Pacific DPS

A. Discussion of Population Parameters for the East Pacific DPS

The range of the East Pacific DPS extends from the California/Oregon border (41 °N) southward along the Pacific coast of the Americas to central Chile (40 °S). Green turtles originating from this DPS regularly strand along the shoreline of Oregon and Washington. The northern and southern boundaries of this DPS extend from the aforementioned locations in the United States and Chile to 142 °W and 96 °W, respectively. The offshore boundary of this DPS is a straight line between these two coordinates. This DPS encompasses the Revillagigedos Archipelago, Mexico and the Galápagos Archipelago, Ecuador (Figure 2). The East Pacific DPS also includes the Mexican Pacific coast breeding population, which is currently listed as endangered (43 FR 32800, July 28, 1978).

Green turtle nesting is widely dispersed in the Eastern Pacific Ocean. We identified 40 total nesting sites for which abundance information is available, although there are sporadic nesting events in other areas with undocumented abundance. The largest nesting aggregation is found in Colola, Michoacán, Mexico, with 11,588 nesting females, or nearly 58 percent of the total nesting population (Delgado-Trejo and Alvarado-Figueroa, 2012). The second largest site is in the Galápagos Islands, Ecuador, where nesting at the four primary nesting sites (Quinta Playa and Barahona (Isabela Island), Las Bachas (Santa Cruz Island), and Las Salinas (Baltras Island)) has been stable to slightly increasing since the late 1970s, and was last estimated at 3,603 nesting females in 2005 (Zàrate *et al.,* 2006; Zàrate, unpubl. data). Other nesting areas are found in Michoácan, including Bahia Maruata (1,149; Delgado-Trejo and Alvarado-Figueroa, 2012) and Motin de Oro (240; Delgado-Trejo and Alvarado-Figueroa, 2012); Clarion and Socorro Islands in the Revillagigedos Archipelago, Mexico (500; Blanco and Santidrián, 2011); and 26 sites throughout the Pacific Coast of Costa Rica, including Playa San Jose in the Bat Islands (498; L. Fonseca, unpubl. data), Playa Colorada (498; L. Fonseca, unpubl. data), Nombre Jesus (450; Blanco and Santidrián, 2011), Playa Cabuyal (273; P. Santidrián-Tomillo, Leatherback Trust, pers. comm., 2013), Playa Zapotillal (150; Blanco and Santidrián, 2011) and Playa Nancite (123; Fonseca *et al.,* 2011). Low level nesting (fewer than 100 nesting females) occurs elsewhere in Mexico, Costa Rica, mainland Ecuador, Colombia, Guatemala, and Peru, although the last two are unquantified (G. Tiburcios-Pintos, Minicipio de Los Cabos, pers. comm., 2012; S. Kelez, ecOceanica, pers. comm., 2012).

Nesting at the largest beach in the range of this DPS (Colola, Michoacán, Mexico) has shown an upward trend since 1996. The observed increase at Colola may have resulted from the onset of nesting beach protection in 1979—as is suggested by the similarity in timing between the onset of beach conservation and the age-to-maturity for green turtles in Pacific Mexico. The initial upward turn in annual nesting was seen in 1996, about 17 years after the initiation of a nesting beach protection program (Cliffton *et al.,* 1982; Alvarado-Díaz *et al.,* 2001), and growth data from the Gulf of California suggest that green turtles in this DPS mature at 15–25 years (Seminoff *et al.,* 2002a). Although not a clear cause of the increasing nesting trend, the consistency in timing is nonetheless compelling. The presidential decree protecting all sea turtles of Mexico (Pesca, 1990) certainly helped the situation, but this occurred much later than the start of nesting beach conservation. It is more likely that this national legislation has had its greatest positive impact at the foraging areas, where green turtle hunting was once rampant.

With regard to spatial structure, genetic sampling in the eastern Pacific has been extensive and the coverage in this region is substantial considering the relatively low population sizes of most eastern Pacific nesting sites. Within this DPS there is significant population substructuring. Four regional genetic stocks have been identified in the eastern Pacific (P. Dutton, NMFS, unpubl. data): Revillagigedos Archipelago (Mexico), Michoacán (Mexico), Costa Rica, and the Galápagos Islands (Ecuador). There is a relatively high level of spatial structure and the presence of rare/unique haplotypes at each nesting site stock. Green turtles from multiple nesting beach origins commonly mix at feeding areas in the Gulf of California (Nichols, 2003; P. Dutton, NMFS, unpubl. data). A recent study using nuclear single nucleotide polymorphisms (a DNA sequence variation occurring commonly within a population) and microsatellite markers investigated the genetic stock structure among five Pacific green turtle nesting populations. They found significant structure between their two eastern Pacific sample sites (Galápagos and Mexico), suggesting that male-mediated gene flow between regional nesting stocks is limited (Roden *et al.,* 2013).

Flipper tag recoveries show 94 tag returns from foraging areas that were applied at two primary nesting sites, Michoacán Mexico and the Galápagos Islands, Ecuador. Two apparent groupings suggest some North/South structure. Forty-nine satellite tracks of green turtles in the eastern Pacific show apparent track clustering in Northwest Mexico to Southern United States, and in the Southeast Pacific, from the Galápagos Islands to the high seas and to the Central American mainland. There are too few satellite tracks to provide solid information on spatial structure. Within-region variation in demographic features also suggests a level of spatial structure for the East Pacific DPS. Among all nesting assemblages in the East Pacific DPS, the Revillagigedos Islands stands out as uniquely different from the remaining areas.

With regard to diversity and resilience, the East Pacific DPS has substantial nesting at both insular and continental nesting sites. The presence of year round nesting at some sites, and non-overlapping nesting seasons at others, suggest that the nesting phenology of green turtles in this DPS may help buffer in geologic time against climate change, both in terms of increased mean incubation temperatures on beaches and in terms of impact to storms and other seasonal events. The nesting season in Michoacán runs from October through January (Alvarado-Díaz and Figueroa, 1990); in the Revillagigedos Islands nesting occurs from March through November with a peak in April/May (Awbrey *et al.,* 1984; Brattstrom, 1982) and in the Galápagos, nesting occurs year-round with a peak from January to March (Zárate *et al.,* 2013). Year-round nesting has also been confirmed for some areas in Costa Rica.

There is a range of beach shade levels depending on the nesting beach. At some sites such as those in the Revillagigedos Islands and beaches in Mexico, the beaches have little vegetation and nests are commonly laid in full-sun areas. On the other hand, the beaches in Costa Rica are highly shaded and nests are commonly deposited deep in the coastal scrub bushes and trees. There are also intermediate sites, such as those in the Galápagos, which have a mix of full sun and shade sites on any given beach. While the exposed beaches are more likely to suffer from the impacts of climate change, those in shaded areas may be subjected to less heating.

B. Summary of Factors Affecting the East Pacific DPS

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

a. Terrestrial Zone

The largest threat on nesting beaches in the East Pacific DPS is reduced availability of habitat due to heavy armament and subsequent erosion. In addition, while nesting beaches in Costa Rica, Revillagigedos Islands, and the Galápagos Islands are less affected by coastal development than green turtle nesting beaches in other regions around the Pacific, several of the secondary green turtle nesting beaches in México suffer from coastal development. For example, effects of coastal development are especially acute at Maruata, a site with heavy tourist activity and foot traffic during the nesting season (Seminoff, 1994). Nest destruction due to human presence is also a threat to nesting beaches in the Galapágos Islands (Zárate *et al.,* 2006). However, such threats vary by site (Zárate, 2012). Insular sites have very low levels of human interference at nesting beaches, although turtles may be affected in foraging areas. The low impacts at insular nesting sites suggest that these areas may serve as nesting refugia if management regimes change and/or poaching at continental sites increases.

b. Neritic/Oceanic Zones

With respect to environmental degradation in the marine environment, coastal habitats along the continental and insular shores of the eastern Pacific are relatively pristine, although green turtles in San Diego Bay, at the north edge of their range, have high levels of contaminants (Komoroske *et al.,* 2011; 2012). However, the nutrient flow and structure within seagrass communities in many coastal areas are likely modified today due to the depletion of green turtles which, during times of higher abundance, would have been keystone consumers in these habitats (Bjorndal, 1980; Thayer *et al.,* 1992; Seminoff *et al.,* 2012b). Although the impacts of ongoing and proposed human activities are difficult to quantify, recent human population increases in many areas underscore the need to develop and implement management strategies that balance development and economic activities with the needs of green turtles.

In summary, within Factor A we find that the East Pacific DPS of the green turtle is negatively affected by ongoing changes in both its terrestrial and marine habitats as a result of land and water use practices. We also find that coastal development, beachfront lighting, and heavy foot traffic consistently affect hatchlings and nesting turtles on a small portion of this DPS.

2. Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

In some countries and localities within the range of the East Pacific DPS, harvest of green turtle eggs is legal, while in others it is illegal but persistent due to lack of enforcement. The impact of egg harvest is exacerbated by the high monetary value of eggs, consistent market demand, and severe poverty in many of the countries in the Eastern Pacific Region where sea turtles are found. Egg harvest is a major conservation challenge at several sites in Costa Rica, including Nombre de Jesus and Zapotillal Beaches, where 90 percent of the eggs were taken by egg collectors during one particular study (Blanco, 2010). Egg harvest is also believed to occur at unprotected nesting sites in Mexico, Guatemala, El Salvador, and Nicaragua (NMFS and USFWS, 2007). Indeed, green turtles are hunted in many areas of northwest Mexico despite legal protection (Nichols *et al.,* 2002; Seminoff *et al.,* 2003; J. Seminoff, NMFS, pers. obs., 2012). Mancini and Koch (2009) describe a black market that killed tens of thousands of green turtles each year in the Eastern Pacific Region.

Sea turtles were, and continue to be, harvested primarily for their meat, although other products have served important non-food uses. Sea turtle oil was for many years used as a cold remedy and the meat, eggs and other products have been highly-valued for their aphrodisiacal qualities, beliefs that strongly persist in the countries bordering the East Pacific DPS.

3. Factor C: Disease or Predation

FP is virtually non-existent in green turtles within the East Pacific DPS (Koch *et al.,* 2007), and predation occurs at low levels. In the Galápagos Islands there is depredation on eggs and hatchlings by feral pigs (*Sus* sp.) and beetles (order Coleoptera), although predation levels are not reported (Zárate *et al.,* 2003; 2006). There are accounts of jaguars (*Panthera onca*) killing adult female green turtles (L. Fonseca, National University of Costa Rica, unpubl. data, 2009) at beaches in Costa Rica, but this is not a major problem for the DPS.

4. Factor D: Inadequacy of Existing Regulatory Mechanisms

The following countries have laws to protect green turtles: Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Peru, and the United States. In addition, at least 10 international treaties and/or regulatory mechanisms apply to the conservation of green turtles in the East Pacific DPS. Overall, regulatory mechanisms for green turtles in the East Pacific DPS are inconsistent. While there are numerous substantive and/or improving conservation efforts, especially on the primary nesting beaches, and this may be reflected in the recent increases in the number of nesting females, many concerns remain due to limited enforcement of existing laws and marine protected areas as well as extensive fishery bycatch, especially in coastal waters. The analysis of existing regulatory mechanisms assumed that all would remain in place at their current levels; however, some regulatory mechanisms, including laws and international treaties, are not realizing their full potential because they are not enforced adequately in all countries occupied by the DPS.

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 beaches, 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. 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 1978 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.

Bycatch has not been thoroughly evaluated but it is largely known that most fishermen either improperly implement TEDs or remove them entirely from their trawls. As was the case with sea turtle meat and egg collection, an almost total lack of enforcement of bycatch mitigation measures by local authorities only helps to confound the problem. Additionally, TEDs are not a requirement for artisanal shrimping boats which, with today's technology, are becoming more 'industrial' in ability and have been reported to catch large numbers of sea turtles. It is unlikely that bycatch 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 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.

The Status Review did not reveal regulatory mechanisms in place to specifically address impacts to the nesting beach, marine pollution, sea level rise, and effects of climate change that continue to contribute to the extinction risk of this DPS.

5. Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

a. Incidental Bycatch in Fishing Gear

Incidental capture in artisanal and commercial fisheries is a significant threat to the survival of green turtles throughout the Eastern Pacific Ocean. The primary gear types involved in these interactions include longlines, drift nets, set nets, and trawl fisheries. These are employed by both artisanal and industrial fleets, and target a wide variety of species including tunas (*Thunnus* sp.), sharks (class Chondrichthyes), sardines (*Sardinella* sp.), swordfish (*Xiphias gladius*), and mahi mahi (*Coryphaena hippurus*).

In the Eastern Pacific Ocean, particularly areas in the southern portion of the range of this DPS, significant bycatch has been reported in artisanal gill net and longline shark and mahi mahi fisheries operating out of Peru (Kelez *et al.,* 2003; Alfaro-Shigueto *et al.,* 2006) 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. During an observer program in 2003/2004, 588 sets were observed during 60 trips, and 154 sea turtles were taken as bycatch. Green turtles were the second most common sea turtle species in these interactions. In many cases, green turtles 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.

Koch *et al.* (2006) reported green turtle bycatch-related dead strandings numbering in the hundreds in Bahia Magdalena. In Baja California Sur, Mexico, from 2006–2009 small-scale gill-net fisheries caused massive green turtle mortality at Laguna San Ignacio, where Mancini *et al.* (2012) estimated that over 1,000 turtles were killed each year in nets set for guitarfish.

Bycatch in coastal areas occurs principally in shrimp trawlers, gill nets and bottom longlines (*e.g.,* Orrego and Arauz, 2004). However, since 1996, all countries from Mexico to Ecuador declared the use of TEDs as mandatory for all industrial fleets to meet the requirements to export shrimp to the United States under the U.S. Magnuson-Stevens Fishery Conservation and Management Act (Helvey and Fahy, 2012). Since then, bycatch has not been thoroughly evaluated but it is widely believed that most fishers either improperly implement TEDs or remove them entirely from their trawls.

Additionally, TEDs are not required for artisanal shrimping boats, which with today's technology, are becoming more 'industrial' in ability and have been reported to catch large numbers of sea turtles (A. Zavala, Universidad de Sinaloa, pers. comm., 2012). Bottom-set longlines and gill nets, both artisanal and industrial, also interact frequently with sea turtles, and can have devastating mortality rates, such as has been the case in artisanal fisheries of Baja California, Mexico (Peckham *et al.,* 2007). In purse seine fisheries, which typically target tuna and other large pelagic fish species, the highest rate of turtles are captured with ''log sets'' around natural floating objects or Fish Aggregation Devices (Hall, 1998).

b. Pollution

Other threats such as debris ingestion (Seminoff *et al.,* 2002c) and boat strikes (P. Dutton, NMFS, pers. comm., 2012; NMFS stranding records, unpubl.) also affect green turtles in the Eastern Pacific. Red tide poisoning is also a threat to this species (Delgado-Trejo and Alvarado-Figueroa, 2012).

c. Effects of Climate Change and Natural Disasters

Effects of climate change include, among other things, sea surface temperature increases, the alteration of thermal sand characteristics of beaches (from warming temperatures), which could result in the reduction or cessation of male hatchling production (Hawkes *et al.,* 2009; Poloczanska *et al.,* 2009), and a significant rise in sea level, which could significantly restrict green turtle nesting habitat. While sea turtles have survived past eras that have included significant temperature fluctuations, future climate change is expected to happen at unprecedented rates, and if turtles cannot adapt quickly they may face local to widespread extirpations (Hawkes *et al.,* 2009). Impacts from global climate change induced by human activities are likely to become more apparent in future years (IPCC, 2007). However, at the primary nesting beach in Michoacán, Mexico (Colola), the beach slope aspect is extremely steep and the dune surface at which the vast majority of nests are laid is well-elevated. This site is likely buffered against short-term sea level rise as a result of climate change. In addition, many nesting sites are along protected beach faces, out of tidal surge pathways. For example, multiple nesting sites in Costa Rica and in the Galápagos Islands are on beaches that are protected from major swell coming in from the ocean.

Within Factor E, we find that fishery bycatch that occurs throughout the eastern Pacific Ocean, particularly bycatch mortality of green turtles from nearshore gill net fisheries, is a significant threat to the persistence of this DPS.

C. Conservation Efforts for the East Pacific DPS

There are a multitude of NGOs and conservation networks whose efforts are raising awareness about sea turtle conservation.

Protection of green turtles is provided by local marine reserves throughout the region. In addition, sea turtles may benefit from the following broader regional efforts: (1) The Eastern Tropical Pacific (ETP) Marine Corridor (CMAR) Initiative supported by the governments of Costa Rica, Panama, Colombia, and Ecuador, which is a voluntary agreement to work towards sustainable use and conservation of marine resources in these countries' waters; (2) the ETP Seascape Program managed by Conservation International that supports cooperative marine management in the ETP, including implementation of the CMAR; (3) the IATTC and its bycatch reduction efforts that are among the world's finest for regional fisheries management organizations; (4) the IAC, which is designed to lessen impacts on sea turtles from fisheries and other human impacts; and (5) the Permanent Commission of the South Pacific (Lima Convention), which has developed an ''Action Plan for Sea Turtles in the Southeast Pacific.''

There are indications that wildlife enforcement branches of local and national governments are stepping up their efforts to enforce existing laws, although successes in stemming sea turtle exploitation through legal channels are few and far between.

D. Extinction Risk Assessment and Findings for the East Pacific DPS

The East Pacific DPS is characterized by moderate levels of green turtle nesting abundance (>20,000 nesting females) occurring in three primary regions, with Mexico having the largest number of nesting females at several sites (13,664 nesting females), followed by the Galápagos, Ecuador (3,603 nesting females), and Costa Rica (2,826 nesting females distributed among 26 nesting sites). Although trend information is lacking for the vast majority of sites, 25 years of monitoring at Michoacán, Mexico—the largest nesting aggregation in this DPS—shows an increasing trend since the population's low point in the mid-1980s. In addition to Mexico, data from the Galápagos Archipelago suggest a stable trend, and the largest-ever nesting numbers reported in Costa Rica suggest this site may be on the increase as well.

Genetic and demographic data show some substructuring among the populations, and nesting is well-distributed in the East Pacific DPS, occurring from the tip of the Baja California Peninsula to northern Peru. Such a broad latitudinal range may be advantageous to green turtles in this DPS in the face of global climate change. Likewise, with year round nesting at several sites and non-overlapping nesting seasons at others, it appears that this DPS may benefit from nesting season temporal diversity in relation to population resilience. Lastly, nesting at both continental and insular sites provides a degree of diversity as well as resilience, with some insular sites providing relatively threat-free nesting refugia within this DPS's range.

Nevertheless, green turtles continue to be affected by a variety of threats within the range of the East Pacific DPS. These include harvest of eggs and turtles for food and non-food uses, bycatch in coastal and offshore marine fisheries gear, coastal development, beachfront lighting, and heavy foot traffic. Although the situation has improved to some extent, the harvest of turtles and their eggs continues throughout much of the range, although more problematic outside of the Galápagos Islands, particularly in Central America (egg harvest) and Mexico (harvest of foraging turtles). Mortality from diseases such as FP is not a problem in the Eastern Pacific, but depredation by natural predators is a very large concern, particularly in the Galápagos and, to a lesser extent, in Costa Rica. Green turtle interactions and mortalities with coastal and offshore fisheries in the eastern Pacific region are of concern and are considered an impediment to green turtle recovery in the East Pacific DPS. Yet despite these concerns, the largest nesting sites appear to be increasing.

Conservation actions, national laws, and international instruments have provided the foundation for what appears to be an ongoing population recovery in the region, particularly in Mexico, although work remains to ensure continued recovery. Further, our analysis did not consider the scenario in which current laws or regulatory mechanisms were not continued. Given the conservation dependence of the species, without mechanisms in place to continue conservation efforts and funding streams in this DPS, some threats could increase and population trends could be affected.

For the above reasons, we propose to list the East Pacific DPS as threatened. We do not find the DPS to be in danger of extinction presently because of high nesting abundance and increasing trends; however, the continued threats from coastal and offshore fisheries are likely to endanger the DPS within the foreseeable future.

XVIII. Proposed Determinations

Section 4(b)(1) of the ESA requires that the Services make listing determinations based solely on the best scientific and commercial data available after conducting a review of the status of the species and taking into account those efforts, if any, being made by any state or foreign nation, or political subdivisions thereof, to protect and conserve the species (16 U.S.C. 1533(b)(1)). We have reviewed the best available scientific and commercial information, including information included in the petition, the status review report, and other published and unpublished information; and we have consulted with species experts and individuals familiar with green turtles and their habitat.

Based on the best available scientific and commercial information, we identify 11 green turtle DPSs: Central North Pacific, North Atlantic, Mediterranean, South Atlantic, Southwest Indian, North Indian, East Indian-West Pacific, Central West Pacific, Southwest Pacific, Central South Pacific, and East Pacific. We find that the purposes of the Act would be furthered by managing this wide-ranging species as separate units under the DPS authority, in order to allow for enhanced protections where needed. Based on a review of the five factors contained in ESA section 4(a)(1), we find that the best available science supports the listing status of ''endangered'' for three of the DPSs and therefore conclude that the species as a whole no longer meets the definition of a ''threatened species'' throughout its range. We propose to remove the current species-wide listing and to list 11 DPSs as threatened or endangered. We propose to list the North Atlantic, South Atlantic, Southwest Indian, North Indian, East Indian-West Pacific, Southwest Pacific, Central North Pacific, and East Pacific DPSs as threatened, and the Mediterranean, Central West Pacific, and Central South Pacific DPSs as endangered for the reasons described above for each DPS.

Regarding the February 16, 2012 petition from the Association of Hawaiian Civic Clubs to identify the Hawaiian green turtle population as a DPS and ''delist'' the DPS under the

ESA, as described above we conclude that the petitioned entity qualifies as a DPS (Central North Pacific DPS), but that the DPS should be listed as threatened for the reasons discussed above. We therefore deny the petition seeking its delisting.

XIX. Significant Portion of the Range

Under the ESA and our implementing regulations, a species may warrant listing if it is endangered or threatened throughout all or a significant portion of its range. See the Final Policy on Interpretation of the Phrase ''Significant Portion of Its Range'' in the Endangered Species Act's Definitions of ''Endangered Species'' and ''Threatened Species'' (79 FR 37577, July 1, 2014). Under that policy, we only need to consider whether listing may be appropriate on the basis of the ''significant portion of its range'' language if the rangewide analysis does not lead to a determination to list as threatened or endangered. Because we have determined that each DPS of green turtle is either threatened or endangered throughout all of its range, no portion of its range can be ''significant'' for purposes of the definitions of ''endangered species'' and ''threatened species.''

XX. Effects of Listing

Conservation measures provided for species listed as endangered or threatened under the ESA include, but are not limited to, recovery plans and actions (prepared pursuant to 16 U.S.C. 1536(f)) and the actions recommended in them; designation of critical habitat if prudent and determinable (16 U.S.C. 1533(a)(3)(A)(i)); Federal agency requirements to consult with the Services and to ensure its actions are not likely to jeopardize the continued existence of the species or result in the destruction or adverse modification of designated critical habitat (16 U.S.C. 1536(a)(2)); and prohibitions on taking (16 U.S.C. 1538). Recognition of the species' plight through listing promotes conservation actions by Federal and state agencies, foreign entities, private groups, and individuals. Should the proposed listings be made final, a recovery plan or plans may be developed, unless we find that such plan would not promote the conservation of the species.

A. Identifying Section 7 Conference and Consultation Requirements

Section 7(a)(4) (16 U.S.C. 1536(a)(4)) of the ESA and its implementing regulations (50 CFR 402) require Federal agencies to confer with the Services on actions likely to jeopardize the continued existence of species proposed for listing, or that result in the destruction or adverse modification of proposed critical habitat. If a proposed species is ultimately listed, section 7(a)(2) requires Federal agencies to consult with the Services on any action they authorize, fund, or carry out if those actions may affect the listed species or its critical habitat; Federal agencies must insure that such actions are not likely to jeopardize the continued existence of the species or result in destruction or adverse modification of designated critical habitat (16 U.S.C. 1536(a)(2); 50 CFR 402). Because green turtles are currently listed throughout their range, requirements for initiating consultation will not change if the current listing is reclassified and revised to reflect recognition of multiple DPSs. Examples of Federal actions that affect green turtles include, but are not limited to: Dredging and channelization, beach and nearshore construction, pile-driving, water quality standards, power plants, vessel traffic, military activities, and fisheries management practices.

B. 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 Secretary that such areas are essential for the conservation of the species (16 U.S.C. 1532(5)).'' Section 3(3) of the ESA 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 Act are no longer necessary (16 U.S.C. 1532(3)).''

Section 4(a)(3)(A)(i) of the ESA, as amended, and implementing regulations (50 CFR 424.12(a)), require that, to the maximum extent prudent and determinable, the Secretary shall designate critical habitat at the time the species is determined to be an endangered or threatened species. Designations of critical habitat must be based on the best scientific data available and must take into consideration the economic, national security, and other relevant impacts of specifying any particular area as critical habitat (16 U.S.C. 1533(b)(2)). The Services' regulations (50 CFR 424.12(a)(1)) state that the designation of critical habitat is not prudent when one or both of the following situations exist: (1) The species is threatened by taking or other human activity, and identification of critical habitat can be expected to increase the degree of threat to the species, or (2) such designation of critical habitat would not be beneficial to the species.

The identification and mapping of critical habitat is not expected to increase the degree of threat from human activity, such as take of turtles or eggs. In the absence of finding that the designation of critical habitat would increase threats to a species, a finding that designation may be prudent is warranted if there are any benefits to a critical habitat designation. Here, the potential benefits of designation would include (1) Triggering consultation under section 7 of the ESA for Federal actions in unoccupied designated critical habitat; (2) focusing conservation activities on the most essential features and areas; (3) providing educational benefits to State or county governments or private entities; and (4) preventing people from causing inadvertent harm to the species.

Because we have determined that the designation of critical habitat will not likely increase the degree of threat to the species and may provide some measure of benefit, we determine that designation of critical habitat may be prudent for the green turtle, subject to review of information in connection with the designation.

Our regulations (50 CFR 424.12(a)(2)) state that critical habitat is not determinable when one or both of the following situations exists: (1) Information sufficient to perform required analysis of the impacts of the designation is lacking; or (2) the biological needs of the species are not sufficiently well known to permit identification of an area as critical habitat. At this point, we are still in the process of acquiring the information needed to assess the critical habitat designation. Accordingly, we find designation of critical habitat to be not determinable at this time.

A final regulation designating critical habitat is generally due concurrently with a final regulation listing a species as endangered or threatened (16 U.S.C. 1533(b)(6)(C)). The statute does not mandate that the proposed rule to designate critical habitat has to be published concurrent with the proposed listing rule, and thus a proposed rule designating critical habitat may be published following the proposed listing rule (but at least 90 days before the intended effective date of the rule (16 U.S.C. 1533(b)(5)(A)). Upon a finding that designation of critical habitat is not determinable, the Services have an additional year to finalize a proposed critical habitat designation (16 U.S.C. 1533(b)(6)(C)(ii)). In effect, then, the Services have up to one year following final listing of the species to finalize a critical habitat designation where such habitat is initially not determinable. To ensure that the Services may make a timely proposal based on the best scientific and commercial information available, we invite public input on features and areas that may meet the definition of critical habitat for the DPSs proposed for listing that occur in U.S. waters or its territories. These include the North Atlantic (southeastern United States and Puerto Rico), South Atlantic (U.S. Virgin Islands), Central South Pacific (American Samoa), Central West Pacific (CNMI and Guam), Central North Pacific, and East Pacific DPSs (California).

The Services previously designated critical habitat for green turtles in waters surrounding Culebra Island, Puerto Rico from the mean high water line seaward to 3 nautical miles (5.6 km; 63 FR 46693, September 2, 1998). These waters include Culebra's outlying Keys, including Cayo Norte, Cayo Ballena, Cayos Geniquí, Isla Culebrita, Arrecife Culebrita, Cayo de Luis Peña, Las Hermanas, El Mono, Cayo Lobo, Cayo Lobito, Cayo Botijuela, Alcarraza, Los Gemelos, and Piedra Steven, and are within the range of the North Atlantic DPS.

The ESA does not speak directly to the status of designated critical habitat when the agency later amends a species listing by dividing it into constituent DPSs. Notably, critical habitat does not lose its biological and conservation relevance to the relevant listed DPS (here, the North Atlantic) simply because the species listing is amended. Moreover, carrying forward an existing critical habitat designation can enhance the protection provided to the listed DPS because the carried-forward designation protects habitat features essential to the species' recovery from destruction or adverse modification in section 7 consultations. Given that Congress has not spoken directly to this issue in the statute, we find that the benefits of designated critical habitat, the ESA's broad purpose to conserve the ecosystems upon which endangered and threatened species depend, and taking a reasonable precautionary approach, the ESA should be construed to provide in these circumstances for keeping existing critical habitat designation in place as a transitional matter until the designation is re-promulgated or amended through a further rulemaking. Therefore, critical habitat remains in effect for the listed North Atlantic DPS in order to preserve its conservation value, as the designated critical habitat continues to support the DPS's important biological functions (*e.g.*, foraging habitat, developmental habitat, and shelter/refuge from predators). The Services have not designated critical habitat within the range of the other ten green turtle DPSs.

C. Take Prohibitions

All of the take prohibitions of section 9(a)(1) of the ESA (16 U.S.C. § 1538(a)(1)) will automatically apply to the three DPSs proposed to be listed as endangered, the Mediterranean, Central West Pacific and Central South Pacific, if the proposal to list them as endangered is finalized. These include prohibitions against importing, exporting, engaging in foreign or interstate commerce, or ''taking'' of the species. ''Take'' is defined under the ESA as ''to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct (16 U.S.C. § 1532(19)).'' These prohibitions apply to any ''person'' (as defined by the ESA) subject to the jurisdiction of the United States, including in the United States, its territorial sea, or on the high seas. Certain exceptions apply to employees of the Services, other Federal land management agencies, and State conservation agencies. In addition, 50 CFR part 224.104 would apply to the proposed endangered DPSs. Some of the current provisions apply only to areas in the Gulf of Mexico and U.S. Atlantic; however, future provisions may apply to any endangered DPS, without regard to its geographic boundaries.

In the case of threatened species, ESA section 4(d) authorizes the Secretary to issue regulations deemed necessary and appropriate for the conservation of species. The Services already have in place take prohibitions and exceptions that apply to threatened species of sea turtles, set forth at 50 CFR 17.42(b), 223.205, 223.206, and 223.207. These existing take prohibitions and exceptions will continue to remain in effect and apply to those DPSs listed as threatened, which are the North Atlantic, South Atlantic, Southwest Indian, North Indian, East Indian-West Pacific, Southwest Pacific, Central North Pacific, and East Pacific DPSs.

Pursuant to section 10 of the ESA, we may issue permits to carry out otherwise prohibited activities involving endangered and threatened wildlife under certain circumstances. Regulations governing permits are codified at 50 CFR 17.22 and 50 CFR 223.206. With regard to endangered wildlife, a permit may be issued for the following purposes: For scientific purposes, to enhance the propagation or survival of the species, and for incidental take in connection with otherwise lawful activities. There are also certain statutory exemptions from the prohibitions, which are found in sections 9 and 10 of the ESA.

D. Identification of Those Activities That Would Constitute a Violation of Section 9 of the ESA

On July 1, 1994, the Services published a policy (59 FR 34272) that requires us to identify, to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of section 9 of the ESA. The intent of this policy is to increase public awareness of the effect of a listing on proposed and ongoing activities within a species' range. We will identify, to the extent known at the time of the final rule, those specific activities that, although they may appear to pose impacts to the species, will not be considered likely to result in violation of section 9, as well as activities that will be considered likely to result in violation. Based on currently available information, we conclude that the activities most likely to violate the section 9 prohibitions against ''take'' of endangered green turtle DPSs include, but are not limited to, the following: (1) Importation or exportation of any part of a green turtle or green turtle eggs; (2) directed take of green turtles, including fishing for, capturing, handling, or possessing green turtles, eggs, or parts; (3) sale of green turtles, eggs, or parts; (4) destruction or modification of green turtle habitat, including nesting beaches, beaches used for basking, and developmental, foraging habitat, and migratory habitat that actually kills or injures green turtles (50 CFR 222.102); and (5) indirect take of green turtles in the course of otherwise lawful activities, such as fishing, dredging, coastal construction, vessel traffic, and discharge of pollutants. We emphasize that whether a violation results from a particular activity depends upon the facts and circumstances of each incident. The mere fact that an activity may fall within one of these categories does not mean that the specific activity will cause a violation; due to such factors as location and scope, specific actions may not result in direct or indirect adverse effects on the species. Further, an activity not listed may in fact result in a violation. We also emphasize that because the green turtle is currently listed, we do not anticipate changes in the activities that would constitute a violation of section 9. Possible exceptions include those actions affecting the breeding populations in Florida and the Pacific coast of Mexico, which were heretofore listed as endangered. Under the final rule, these populations would become part of the threatened North Atlantic and East Pacific DPSs, respectively, and therefore will be protected by the existing protective regulations.

XXI. Peer Review

The intent of the peer review policy is to ensure that listings are based on the best scientific and commercial data available. 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. To satisfy our requirements under the OMB Bulletin, we obtained independent peer review of the status review report from 15 independent specialists in the academic and scientific community. All peer reviewer comments were addressed prior to dissemination of the final status review report and publication of this proposed rule.

XXII. Classification

A. National Environmental Policy Act

The 1982 amendments to the ESA, in section 4(b)(1)(A), restrict the information that may be considered when assessing species for listing. Based on this limitation of criteria for a listing decision and the opinion in *Pacific Legal Foundation* v. *Andrus*, 657 F. 2d 829 (6th Cir. 1981), NOAA has concluded that ESA listing actions are not subject to the environmental assessment requirements of the National Environmental Policy Act (See NOAA Administrative Order 216–6). Similarly, USFWS has determined that environmental assessments and environmental impact statements, as defined under the authority of the National Environmental Policy Act, need not be prepared in connection with regulations pursuant to section 4(a) of the ESA. USFWS published a notice outlining its reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244).

B. Executive Order 12866, Regulatory Flexibility Act, and Paperwork Reduction Act

As noted in the Conference Report on the 1982 amendments to the ESA, economic impacts cannot 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 proposed rule is exempt from review under Executive Order 12866. This proposed rule does not contain a collection-of-information requirement for the purposes of the Paperwork Reduction Act.

C. Executive Order 13132, Federalism

In accordance with E.O. 13132, we determined that this proposed rule does not have significant Federalism effects and that a Federalism assessment is not required. In keeping with the intent of the Administration and Congress to provide continuing and meaningful dialogue on issues of mutual state and Federal interest, this proposed rule will be given to the relevant state agencies in each state in which the species is believed to occur, and those states will be invited to comment on this proposal. We have considered, among other things, Federal, State, and local conservation measures. As we proceed, we intend to continue engaging in informal and formal contacts with the State, and other affected local or regional entities, giving careful consideration to all written and oral comments received.

List of Subjects

50 CFR Part 17

Endangered and threatened wildlife and plants.

50 CFR Parts 223 and 224

Endangered and threatened species, Exports, Imports, Transportation.

Dated: March 11, 2015.

Samuel D. Rauch III,

Deputy Assistant Administrator for Regulatory Programs, National Marine Fisheries Service.

Dated: February 25, 2015.

Stephen Guertin,

Acting Director, U.S. Fish and Wildlife Service.

For the reasons set out in the preamble, 50 CFR parts 17, 223, and 224 are proposed to be amended 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; 1531–1544; and 4201–4245, unless otherwise noted.

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

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) The ''List of Endangered and Threatened Wildlife'' is provided below:

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
*	*	*	*	*	*	*	
REPTILES							
*	*	*	*	*	*	*	
Sea turtle, green (Central North Pacific DPS).	*Chelonia mydas*	Central North Pacific Ocean.	Green sea turtles originating from the Central North Pacific Ocean, bounded by the following coordinates: 41° N., 169° E. in the northwest; 41° N., 143° W. in the northeast; 9° N., 125° W. in the southeast; and 9° N., 175° W. in the southwest.	T	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE].*	NA	17.42(b), 223.205, 223.206, 223.207

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
Sea turtle, green (Central South Pacific DPS).	*Chelonia mydas*	Central South Pacific Ocean.	Green sea turtles originating from the Central South Pacific Ocean, bounded by the following coordinates: 9° N., 175° W. in the northwest; 9° N., 125° W. in the northeast; 40° S., 96° W. in the southeast; 40° S., 176° E. in the southwest; and 13° S., 171° E. in the west.	E	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE].*	NA	224.104
Sea turtle, green (Central West Pacific DPS).	*Chelonia mydas*	Central West Pacific Ocean.	Green sea turtles originating from the Central West Pacific Ocean, bounded by the following coordinates: 41° N., 146° E. in the northwest; 41° N., 169° E. in the northeast; 9° N., 175° W. in the east; 13° S., 171° E. in the southeast; along the northern coast of the island of New Guinea; and 4.5° N., 129° E. in the west.	E	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE].*	NA	224.104
Sea turtle, green (East Indian-West Pacific DPS).	*Chelonia mydas*	Eastern Indian and Western Pacific Oceans.	Green sea turtles originating from the Eastern Indian and Western Pacific Oceans, bounded by the following lines and coordinates: 41° N. Lat. in the north, 41° N., 146° E. in the northeast; 4.5° N., 129° E. in the southeast; along the southern coast of the island of New Guinea; along the western coast of Australia (west of 142° E. Long.); 40° S. Lat. in the south; and 84° E. Long. in the east.	T	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE].*	NA	17.42(b), 223.205, 223.206, 223.207
Sea turtle, green (East Pacific DPS).	*Chelonia mydas*	East Pacific Ocean	Green sea turtles originating from the East Pacific Ocean, bounded by the following lines and coordinates: 41° N., 143° W. in the northwest; 41° N. Lat. in the north; along the western coasts of the Americas; 40° S. Lat. in the south; and 40° S., 96° W. in the southwest.	T	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE].*	NA	17.42(b), 223.205, 223.206, 223.207
Sea turtle, green (Mediterranean DPS).	*Chelonia mydas*	Mediterranean Sea	Green sea turtles originating from the Mediterranean Sea, bounded by 5.5° W. Long. in the west.	E	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE].*	NA	224.104
Sea turtle, green (North Atlantic DPS).	*Chelonia mydas*	North Atlantic Ocean	Green sea turtles originating from the North Atlantic Ocean, bounded by the following lines and coordinates: 48° N. Lat. in the north, along the western coasts of Europe and Africa (west of 5.5° W. Long.); north of 19° N. Lat. in the east; 19° N., 63.5° W. in the south; 10.5° N., 77° W. in the west; and along the eastern coasts of the Americas (north of 7.5° N., 77° W.).	T	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE].*	226.208	17.42(b), 223.205, 223.206, 223.207
Sea turtle, green (North Indian DPS).	*Chelonia mydas*	North Indian Ocean	Green sea turtles originating from the North Indian Ocean, bounded by: Africa and Asia in the west and north; 84° E. Long. in the east; and the equator in the south.	T	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE].*	NA	17.42(b), 223.205, 223.206, 223.207

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
Sea turtle, green (South Atlantic DPS).	*Chelonia mydas*	South Atlantic Ocean	Green sea turtles originating from the South Atlantic Ocean, bounded by the following lines and coordinates: along the northern and eastern coasts of South America (east of 7.5° N., 77° W.); 10.5° N., 77° W. in the west; 19° N., 63.5° W. in the northwest; 19° N. Lat. in the northeast; 40° S., 19° E. in the southeast; and 40° S. Lat. in the south.	T	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE].*	NA	17.42(b), 223.205, 223.206, 223.207
Sea turtle, green (Southwest Indian DPS).	*Chelonia mydas*	Southwest Indian Ocean	Green sea turtles originating from the Southwest Indian Ocean, bounded by the following lines: the equator to the north; 84° E. Long. to the east; 40° S. Lat. to the south; and 19° E. Long (and along the eastern coast of Africa) in the west.	T	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE].*	NA	17.42(b), 223.205, 223.206, 223.207
Sea turtle, green (Southwest Pacific DPS).	*Chelonia mydas*	Southwestern Pacific Ocean	Green sea turtles originating from the Southwestern Pacific Ocean, bounded by the following lines and coordinates: along the southern coast of the island of New Guinea and the Torres Strait (east of 142° E Long.); 13° S., 171° E. in the northeast; 40° S., 176° E. in the southeast; and 40° S., 142° E. in the southwest.	T	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE].*	NA	17.42(b), 223.205, 223.206, 223.207
*	*	*	*	*	*	*	

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(e) by revising the entry ''Sea turtle, green'' under Sea Turtles to read as follows:

§ 223.102 Enumeration of threatened marine and anadromous species.

* * * * *

(e) The threatened species under the jurisdiction of the Secretary of Commerce are:

Species [1]			Citation(s) for listing determination(s)	Critical habitat	ESA Rules
Common name	Scientific name	Description of listed entity			
*	*	*	*	*	*
SEA TURTLES [2]					
Sea turtle, green (Central North Pacific DPS).	*Chelonia mydas*	Green sea turtles originating from the Central North Pacific Ocean, bounded by the following coordinates: 41° N., 169° E. in the northwest; 41° N., 143° W. in the northeast; 9° N., 125° W. in the southeast; and 9° N., 175° W in the southwest.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE].*	NA	17.42(b), 223.205, 223.206, 223.207.

Species [1]			Citation(s) for listing determination(s)	Critical habitat	ESA Rules
Common name	Scientific name	Description of listed entity			
Sea turtle, green (East Indian-West Pacific DPS).	*Chelonia mydas*	Green sea turtles originating from the Eastern Indian and Western Pacific Oceans, bounded by the following lines and coordinates: 41° N. Lat. in the north, 41° N., 146° E. in the northeast; 4.5° N., 129° E. in the southeast; along the southern coast of the island of New Guinea; along the western coast of Australia (west of 142° E. Long.); 40° S. Lat. in the south; and 84° E. Long. in the east.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE]*.	NA	17.42(b), 223.205, 223.206, 223.207.
Sea turtle, green (East Pacific DPS).	*Chelonia mydas*	Green sea turtles originating from the East Pacific Ocean, bounded by the following lines and coordinates: 41° N., 143° W. in the northwest; 41° N. Lat. in the north; along the western coasts of the Americas; 40° S. Lat. in the south; and 40° S., 96° W. in the southwest.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE]*.	NA	17.42(b), 223.205, 223.206, 223.207.
Sea turtle, green (North Atlantic DPS).	*Chelonia mydas*	Green sea turtles originating from the North Atlantic Ocean, bounded by the following lines and coordinates: 48° N. Lat. in the north, along the western coasts of Europe and Africa (west of 5.5° W. Long.); north of 19° N. Lat. in the east; 19° N., 63.5° W. in the south; 10.5° N., 77° W. in the west; and along the eastern coasts of the Americas (north of 7.5° N., 77° W.).	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE]*.	226.08	17.42(b), 2223.205, 223.206, 223.207.
Sea turtle, green (North Indian DPS).	*Chelonia mydas*	Green sea turtles originating from the North Indian Ocean, bounded by: Africa and Asia in the west and north; 84° E. Long. in the east; and the equator in the south.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE]*.	NA	17.42(b), 223.205, 223.206, 223.207.
Sea turtle, green (South Atlantic DPS).	*Chelonia mydas*	Green sea turtles originating from the South Atlantic Ocean, bounded by the following lines and coordinates: along the northern and eastern coasts of South America (east of 7.5° N., 77° W.); 10.5° N., 77° W. in the west; 19° N., 63.5° W. in the northwest; 19° N. Lat. in the northeast; 40° S., 19° E. in the southeast; and 40° S. Lat. in the south.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE]*.	NA	17.42(b), 223.205, 223.206, 223.207.
Sea turtle, green (Southwest Indian DPS).	*Chelonia mydas*	Green sea turtles originating from the Southwest Indian Ocean, bounded by the following lines: the equator to the north; 84° E. Long. to the east; 40° S. Lat. to the south; and 19° E. Long (and along the eastern coast of Africa) in the west.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE]*.	NA	17.42(b), 223.205, 223.206, 223.207.
Sea turtle, green (Southwest Pacific DPS).	*Chelonia mydas*	Green sea turtles originating from the Southwestern Pacific Ocean, bounded by the following lines and coordinates: along the southern coast of the island of New Guinea and the Torres Strait (east of 142° E Long.); 13° S., 171° E. in the northeast; 40° S., 176° E. in the southeast; and 40° S., 142° E. in the southwest.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE]*.	NA	17.42(b), 223.205, 223.206, 223.207.
*	*	*	*	*	* *

[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(h) by revising the entry for ''Sea turtle, green'' under Sea Turtles to read as follows:

§ 224.101 Enumeration of endangered marine and anadromous species.

* * * * *

(h) The endangered species under the jurisdiction of the Secretary of Commerce are:

Species[1]			Citation(s) for listing determination(s)	Critical habitat	ESA rules
Common name	Scientific name	Description of listed entity			
*	*	*	*	*	*
SEA TURTLES[2]					
Sea turtle, green (Central South Pacific DPS).	*Chelonia mydas*	Green sea turtles originating from the Central South Pacific Ocean, bounded by the following coordinates: 9° N., 175° W. in the northwest; 9° N., 125° W. in the northeast; 40° S., 96° W. in the southeast; 40° S., 176° E. in the southwest; and 13° S., 171° E. in the west.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE].*	NA	224.104
Sea turtle, green (Central West Pacific DPS).	*Chelonia mydas*	Green sea turtles originating from the Central West Pacific Ocean, bounded by the following coordinates: 41° N., 146° E. in the northwest; 41° N., 169° E. in the northeast; 9° N., 175° W. in the east; 13° S., 171° E. in the southeast; along the northern coast of the island of New Guinea; and 4.5° N., 129° E. in the west.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE].*	NA	224.104
Sea turtle, green (Mediterranean DPS).	*Chelonia mydas*	Green sea turtles originating from the Mediterranean Sea, bounded by 5.5° W. Long. in the west.	*[INSERT FR CITATION WHEN PUBLISHED AS A FINAL RULE].*	NA	224.104
*	*	*	*	*	*

[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.

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