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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Parts 223 and 224

[Docket No. 111025652-3245-02]

RIN 0648-XA798

Endangered and Threatened Wildlife and Plants; Proposed Endangered, Threatened, and Not Warranted Listing Determinations for Six Distinct Population Segments of Scalloped Hammerhead Sharks

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Proposed rule; request for comments.

SUMMARY: In response to a petition submitted by WildEarth Guardians and Friends of Animals to list the species as threatened or endangered, we, NMFS, have completed a comprehensive status review under the Endangered Species Act (ESA) for the scalloped hammerhead shark (Sphyrna lewini). Based on the best scientific and commercial information available, including the status review report (Miller et al., 2013), and other information available since completion of the status review report, we have determined that the species is comprised of six distinct population segments (DPSs) that qualify as species under the ESA: Northwest Atlantic and Gulf of Mexico (NW Atlantic & GOM DPS); Central and Southwest Atlantic (Central & SW Atlantic DPS); Eastern Atlantic DPS; Indo-West Pacific DPS; Central Pacific DPS; and Eastern Pacific DPS. After reviewing the best available scientific and commercial

information on the DPSs, we have determined that two DPSs warrant listing as endangered, the Eastern Atlantic and Eastern Pacific DPSs; two DPSs warrant listing as threatened, the Central & SW Atlantic and Indo-West Pacific DPSs; and two DPSs do not warrant listing at this time, the NW Atlantic & GOM DPS and the Central Pacific DPS. Any protective regulations determined to be necessary and advisable for the conservation of the threatened DPSs under ESA section 4(d) would be proposed in a subsequent Federal Register announcement. Should the proposed listings be finalized, we would also designate critical habitat for the species, to the maximum extent prudent and determinable. We solicit information to assist these listing determinations, the development of proposed protective regulations, and designation of critical habitat in the event these proposed DPSs are finally listed.

DATES: Comments on this proposed rule must be received by [insert date 60 days after date of publication in the FEDERAL REGISTER]. Public hearing requests must be requested by [insert date 45 days after publication in the FEDERAL REGISTER].

ADDRESSES: You may submit comments on this document, identified by the code NOAA-NMFS-2011-0261 by any of the following methods:

- Electronic Submissions: Submit all electronic comments via the Federal eRulemaking Portal. Go to www.regulations.gov/#!docketDetail;D=NOAA-NMFS-2011-0261, click the “Comment Now!” icon, complete the required fields, and enter or attach your comments.
- Mail: Submit written comments to Office of Protected Resources, NMFS, 1315 East-West Highway, Silver Spring, MD 20910.
- Fax: 301-713-4060, Attn: Maggie Miller

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 NMFS. 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. NMFS will accept anonymous comments (enter "N/A" in the required fields if you wish to remain anonymous). Attachments to electronic comments will be accepted in Microsoft Word, Excel, or Adobe PDF file formats only. The proposed rule and the status review report are also available electronically on the NMFS website at http://www.nmfs.noaa.gov/pr/species/fish/scallopedhammerheadshark.htm.

FOR FURTHER INFORMATION CONTACT: Maggie Miller, NMFS, Office of Protected Resources, (301) 427-8403.

SUPPLEMENTARY INFORMATION:

Background

On August 14, 2011, we received a petition from WildEarth Guardians and Friends of Animals to list the scalloped hammerhead shark (Sphyrna lewini) as threatened or endangered under the ESA throughout its entire range, or, as an alternative, to delineate the species into five DPSs (Eastern Central and Southeast Pacific, Eastern Central Atlantic, Northwest and Western Central Atlantic, Southwest Atlantic, and Western Indian Ocean) and list any or all of these DPSs as threatened or endangered. The petitioners also requested that critical habitat be designated for the scalloped hammerhead under the ESA. On November 28, 2011, we published a positive 90-day finding (76 FR 72891), announcing that the petition presented substantial scientific or commercial information indicating the petitioned action of listing the species may be warranted and explained the basis for that finding. We also announced the initiation of a status review of the species, as required by Section 4(b)(3)(a) of the ESA, and requested information to inform the agency's decision on whether the species warranted listing as endangered or threatened under the ESA.

Listing Species Under the Endangered Species Act

We are responsible for determining whether scalloped hammerhead sharks are threatened or endangered under the ESA (16 U.S.C. 1531 et seq.) To make this determination, we first consider whether a group of organisms constitutes a "species" under Section 3 of the ESA, then whether the status of the species qualifies it for listing as either threatened or endangered. Section 3 of the ESA defines species to include "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." On February 7, 1996, NMFS and the U.S. Fish and Wildlife Service (USFWS; together, the Services) adopted a policy describing what constitutes a DPS of a taxonomic species (61 FR 4722). The joint DPS policy identified two elements that must be considered when identifying a DPS: (1) the discreteness of the population segment in relation to the remainder of the species (or subspecies) to which it belongs; and (2) the significance of the population segment to the remainder of the species (or subspecies) to which it belongs. As stated in the joint DPS policy, Congress expressed its expectation that the Services would exercise authority with regard to DPSs sparingly and only when the biological evidence indicates such action is warranted.

Section 3 of the ESA defines an endangered species as "any species which is in danger of extinction throughout all or a significant portion of its range" and a threatened species as one "which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." Thus, in the context of the ESA, the Services interpret an "endangered species" to be one that is presently at risk of extinction. A "threatened species," on the other hand, is not currently at risk of extinction, but is likely to become so in the foreseeable future. In other words, a key statutory difference between a threatened and endangered species is the timing of when a species may be in danger of extinction, either now (endangered) or in the foreseeable future (threatened). The statute also requires us to determine whether any species is endangered or threatened as a result of any one or a combination of the following five factors: (A) the present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence (ESA, section 4(a)(1)(A)-(E)). Section 4(b)(1)(A) of the ESA requires us to make listing determinations based solely on the best scientific and commercial data available after conducting a review of the status of the species and after taking into account efforts being made by any State or foreign nation or political subdivision thereof to protect the species. In evaluating the efficacy of existing protective efforts, we rely on the Services' joint Policy on Evaluation of Conservation Efforts When Making Listing Decisions ("PECE"; 68 FR 15100; March 28, 2003). The PECE provides direction for consideration of conservation efforts that have not been implemented, or have been implemented but not yet demonstrated effectiveness.

Status Review

We convened a team of agency scientists to conduct the status review for the species and prepare a report. The status review report of the scalloped hammerhead shark (Miller et al., 2013) compiles the best available information on the status of the scalloped hammerhead shark as required by the ESA, provides information on discreteness and significance of populations and potential DPSs, and assesses the current and future extinction risk for these scalloped hammerhead shark populations, focusing primarily on threats related to the five statutory factors set forth above. We appointed a contractor in the Office of Protected Resources Endangered Species Division to undertake a scientific review of the biology, population status and future outlook for the scalloped hammerhead shark. Next we convened a team of biologists and shark experts (Extinction Risk Analysis (ERA) team) to conduct an extinction risk analysis for the scalloped hammerhead shark populations, using the information in the scientific review. The ERA team was comprised of a fishery biologist from NMFS Office of Protected Resources, two fishery management specialists from NMFS' Highly Migratory Species Management Division, two research fishery biologists from NMFS' Southeast Fisheries Science Center and Pacific Island Fisheries Science Center, and a fishery biologist contractor with NMFS' Office of Protected Resources, with group expertise in shark biology and ecology, population dynamics, highly migratory species management, and stock assessment science. The status review report presents the ERA team's professional judgment of the extinction risk facing each population but makes no recommendation as to the listing status of each. The status review report is available electronically at http://www.nmfs.noaa.gov/pr/species/fish/scallopedhammerheadshark.htm.

The status review report was peer reviewed by three scientists with scalloped hammerhead shark expertise from academic institutions. The peer reviewers were asked to evaluate the adequacy, appropriateness, and application of data used in the Status Review document as well to evaluate the findings made in the "Assessment of Extinction Risk" section of the report. We subsequently reviewed the status review report, its cited references, and peer review comments, and believe the status review report, upon which this proposed rule is based, provides the best available scientific and commercial information on the scalloped hammerhead shark. Much of the information discussed below on scalloped hammerhead shark biology, distribution, abundance, threats, and extinction risk is attributable to the status review report. However, we have independently applied the statutory provisions of the ESA, including evaluation of the factors set forth in Section 4(a)(1)(A)-(E); our regulations regarding listing determinations; and our DPS policy in making the proposed listing determinations.

Life History, Biology, and Status of the Petitioned Species

Taxonomy and Species Description

All hammerhead sharks belong to the family Sphyrnidae and are classified as ground sharks (Order Carcharhiniformes). Most hammerheads belong to the Genus Sphyrna with one exception, the winghead shark (E. blochii), which is the sole species in the Genus Eusphyra. The hammerhead sharks are recognized by their laterally expanded head that resembles a hammer, hence the common name "hammerhead." The scalloped hammerhead shark (Sphyrna lewini) is distinguished from other hammerheads by a marked central indentation on the anterior margin of the head, along with two more indentations on each side of this central indentation, giving the head a "scalloped" appearance. It has a broadly arched mouth and the rear margin of the head is slightly swept backward. The dentition of the hammerhead consists of small, narrow, and triangular teeth with smooth edges (often slightly serrated in larger individuals), and is similar in both jaws. The front teeth are erect while subsequent teeth have oblique cusps, and the lower teeth are more erect than the upper teeth (Bester, n.d.).

The body of the scalloped hammerhead is fusiform, with a large first dorsal fin and low second dorsal and pelvic fins. The first dorsal fin is moderately hooked with its origin over or slightly behind the pectoral fin insertions and the rear tip in front of the pelvic fin origins. The height of the second dorsal fin is less than the anal fin height and has a posterior margin that is approximately twice the height of the fin, with the free rear tip almost reaching the precaudal pit. The pelvic fins have relatively straight rear margins while the anal fin is deeply notched on the posterior margin (Compagno, 1984). The scalloped hammerhead shark generally has a uniform gray, grayish brown, bronze, or olive coloration on top of the body that shades to white on the underside with dusky or black pectoral fin tips.

<u>Current Distribution</u>

The scalloped hammerhead shark can be found in coastal warm temperate and tropical seas worldwide. In the western Atlantic Ocean, the scalloped hammerhead range extends from the northeast coast of the United States (from New Jersey to Florida) to Brazil, including the Gulf of Mexico and Caribbean Sea. In the eastern Atlantic, it can be found from the Mediterranean to Namibia. Populations in the Indian Ocean are found in the following locations: South Africa and the Red Sea to Pakistan, India, and Myanmar, and in the western Pacific the scalloped hammerhead can be found from Japan and China to New Caledonia, including throughout the Philippines, Indonesia, and off Australia. Distribution in the eastern Pacific Ocean extends from the coast of southern California (U.S.), including the Gulf of California, to Ecuador and possibly Peru (Compagno, 1984), and off waters of Hawaii (U.S.) and Tahiti. The scalloped hammerhead shark occurs over continental and insular shelves, as well as adjacent deep waters, but is seldom found in waters cooler than 22° C (Compagno, 1984; Schulze-Haugen and Kohler, 2003). It ranges from the intertidal and surface to depths of up to 450 - 512 m (Sanches, 1991; Klimley, 1993), with occasional dives to even deeper waters (Jorgensen et al., 2009). It has also been documented entering enclosed bays and estuaries (Compagno, 1984).

Movement and Habitat Use

Scalloped hammerhead sharks are highly mobile and partly migratory and are likely the most abundant of the hammerhead species (Maguire et al., 2006). These sharks have been observed making primarily short-distance migrations along continental margins as well as between oceanic islands in tropical waters, with tagging studies revealing the tendency for scalloped hammerhead sharks to aggregate around and travel to and from core areas or "hot spots" within locations (Holland et al., 1993; Kohler and Turner, 2001; Duncan and Holland, 2006; Hearn et al., 2010; Bessudo et al., 2011; Diemer et al., 2011). However, scalloped hammerhead sharks are also capable of traveling long distances (1,941 km, Bessudo et al., 2011; 1,671 km, Kohler and Turner, 2001; Hearn et al., 2010), and in many of these tagging studies the sharks were tracked leaving the study area for long periods of time, ranging from 2 weeks to several months (Hearn et al., 2010; Bessudo et al., 2011) to almost a year (324 days) (Duncan and Holland, 2006) before eventually returning, displaying a level of site fidelity to these areas.

Both juveniles and adult scalloped hammerhead sharks occur as solitary individuals, pairs, or in schools. The schooling behavior has been documented during summer migrations off the coast of South Africa as well as in permanent resident populations, like those in the East China Sea (Compagno, 1984). Adult aggregations are most common offshore over seamounts and near islands, especially near the Galapagos, Malpelo, Cocos and Revillagigedo Islands, and within the Gulf of California (Compagno, 1984; CITES, 2010; Hearn et al., 2010; Bessudo et al., 2011). Neonate and juvenile aggregations are more common in nearshore nursery habitats, such as Kāne'ohe Bay in Oahu, Hawaii, coastal waters off Oaxaca, Mexico, and Guam's inner Apra Harbor (Duncan and Holland, 2006; Bejarano-Álvarez et al., 2011). It has been suggested that juveniles inhabit these nursery areas for up to or more than a year, as they provide valuable refuges from predation (Duncan and Holland, 2006).

Diet

The scalloped hammerhead shark is a high trophic level predator (trophic level = 4.1; Cortés, 1999) and opportunistic feeder with a diet that includes a wide variety of teleosts, cephalopods, crustaceans, and rays (Compagno, 1984; Bush, 2003; Júnior et al., 2009; Noriega et al., 2011). In a study on feeding behavior in Kāne'ohe Bay, Bush (2003) found a nocturnal increase in the rate of foraging by juvenile scalloped hammerheads, with sharks consuming a mixture of crustaceans and teleosts. The alpheid and goby species were the most important prey items in their diet. Off the coast of Brazil, immature S. lewini frequently fed on reef and pelagic fish, as well as cephalopod species (Chiroteuthis sp. and Vampyroteuthis infernalis) that inhabit deep waters (Júnior et al., 2009). Stomachs of 466 S. lewini off the coast of Australia revealed the importance of bony fish as a prey item, followed by elasmobranchs, octopus and squid, and baitfish, with a positive correlation between shark length and the proportion of elasmobranchs in stomach contents (Noriega et al., 2011).

Reproduction

The scalloped hammerhead shark is viviparous (i.e., give birth to live young), with a gestation period of 9-12 months (Branstetter, 1987; Stevens and Lyle, 1989), which may be followed by a one-year resting period (Liu and Chen, 1999). Females attain maturity around 200-250 cm total length (TL) while males reach maturity at smaller sizes (range 128 – 200 cm TL). Estimates of age at maturity vary by region, ranging from 3.8 to 15.2 years, but are likely a result of differences in band interpretations in aging methodology approaches (Piercy et al., 2007). Parturition, however, does not appear to vary by region and may be partially seasonal (Harry et al., 2011), with neonates present year round but with abundance peaking during the spring and summer months (Duncan and Holland, 2006; Adams and Paperno, 2007; Bejarano-Álvarez et al., 2011; Harry et al. 2011; Noriega et al., 2011). Females move inshore to birth, with litter sizes anywhere between 1 and 41 live pups. Off the coast of northeastern Australia, Noriega et al. (2011) found a positive correlation between litter size and female shark length for scalloped hammerheads, as did White et al. (2008) in Indonesian waters. However, off the northeastern coast of Brazil, Hazin et al. (2001) found no such relationship..

Growth

Total length at birth estimates range from 313 mm TL (Chen et al., 1990) to 570 mm TL (White et al., 2008). Duncan and Holland (2006) calculated an early juvenile growth rate of 9.6 cm per year. Observed maximum sizes for male scalloped hammerheads range from 196 – 321 cm TL, with the oldest male scalloped hammerhead estimated at 30.5 years (Piercy et al., 2007). Observed maximum sizes for female scalloped hammerheads range from 217 – 346 cm TL, with the oldest female scalloped hammerhead estimated at 31.5 years (Kotas et al., 2011). Estimates of the von Bertalanffy growth parameters vary by study, location, and sex of the animal, with the following ranges: $L\infty$ = 212 to 519 cm TL, k = 0.05 to 0.25 year^{-1}, t_0 = -3.9 to -0.4 (see Miller et al., 2013).

The life history of the scalloped hammerhead shark, like most elasmobranchs, is characterized as long lived (at least 20 – 30 years), late maturing, and relatively slow growing (based on Branstetter (1990), where $k < 0.1$/year indicates slow growth for sharks), which generally contributes to a low intrinsic rate of increase. Using life history parameters from the Atlantic S. lewini populations, estimates of the intrinsic rate of increase (r) for the scalloped hammerhead shark range from 0.028 (Smith et al., 1998) to 0.157 (Cortés et al., 2010). Based on the Food and Agriculture Organization of the United Nations (FAO) productivity indices for exploited fish species (where $r < 0.14$ is considered low productivity), overall estimates of (r) values for the scalloped hammerhead shark indicate that S. lewini populations are generally vulnerable to depletion and may be slow to recover from overexploitation.

Current Status

Scalloped hammerhead sharks can be found worldwide, with no present indication of a range contraction. The oldest living S. lewini populations are found in the central Indo-West Pacific, indicating this region as the origin of the species (Duncan et al., 2006; Daly-Engel et al., 2012). During the late Pleistocene period, S. lewini underwent several dispersal events (Duncan et al., 2006). Following the closing of the Isthmus of Panama, it was suggested that gene flow occurred from west to east, with S. lewini traveling from the Atlantic Ocean into the Indo-Pacific, via southern Africa (Duncan et al., 2006).

Scalloped hammerhead sharks are both targeted and taken as bycatch in many global fisheries, with their fins a primary product for international trade. To a much lesser extent, scalloped hammerhead sharks are also caught for their meat (with Colombia, Kenya, Mexico, Mozambique, Philippines, Seychelles, Spain, Sri Lanka, China (Taiwan), Tanzania, and Uruguay identified as countries that consume hammerhead meat (Vannuccini, 1999; CITES, 2010)). However, given the fact that the meat is essentially unpalatable, due to its high urea concentration, it is thought that current volume of S. lewini traded meat and products is insignificant when compared to the volume of S. lewini fins in international trade (CITES, 2010). Unfortunately, the lack of species-specific reporting in these trade products, as well as the scarcity of information on the fisheries catching scalloped hammerhead sharks prior to the early 1970s, with only occasional mentions in historical records, makes it difficult to assess the current worldwide scalloped hammerhead shark status.

In 2007, the International Union for Conservation of Nature (IUCN) considered the scalloped hammerhead shark to be endangered globally, based on an assessment by Baum et al. (2007) and its own criteria (A2bd and 4bd), and placed the species on its "Red List." Under criteria A2bd and 4bd, a species may be classified as endangered when its "observed, estimated, inferred or suspected" population size is reduced by 50% or more over the last 10 years, any 10 year time period, or three generation period, whichever is the longer, and where the causes of reduction may not have ceased, be understood, or be reversible based on an index of abundance appropriate to the taxon and/or the actual or potential levels of exploitation. IUCN justification for the categorization includes both species-specific estimates and estimates for the entire hammerhead family that suggest declines in abundance of 50-90 percent over time periods of up to 32 years in various regions of the species' range. The IUCN inferred similar declines in areas where species-specific data are unavailable, but where there is evidence of substantial fishing pressure on the scalloped hammerhead shark. As a note, the IUCN classification for the scalloped hammerhead shark alone does not provide the rationale for a listing recommendation under the ESA, but the sources of information that the classification is based upon are evaluated in light of the standards on extinction risk and impacts or threats to the species.

Identification of Distinct Population Segments

As described above, the ESA's definition of "species" includes "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 genetic diversity among subpopulations, geographic isolation, and differences in international regulatory mechanisms provide evidence that several populations of scalloped hammerhead sharks meet the DPS Policy criteria. Therefore, prior to evaluating the conservation status for scalloped hammerhead sharks, and in accordance with the joint DPS policy, we considered: (1) the discreteness of any scalloped hammerhead shark population segment in relation to the remainder of the subspecies to which it belongs; and (2) the significance of any scalloped hammerhead shark population segment to the remainder of the subspecies to which it belongs.

<u>Discreteness</u>

The Services' joint DPS policy states that a population of a vertebrate species may be considered discrete if it satisfies either one of the following conditions: (1) it is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors (quantitative measures of genetic or morphological discontinuity may provide evidence of this separation) or (2) it is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of

Section 4(a)(1)(D) of the ESA. To inform its decisions with respect to possible scalloped hammerhead DPSs, the ERA team mainly relied on genetic data, tagging studies, and evidence of differences in the control of exploitation and management by international governmental bodies.

Although scalloped hammerhead sharks are highly mobile, this species rarely conducts trans-oceanic migrations (Kohler and Turner, 2001; Duncan and Holland, 2006; Duncan et al., 2006; Chapman et al., 2009; Diemer et al., 2011). Female scalloped hammerhead sharks may even display a level of site fidelity for reproduction purposes (Duncan et al., 2006; Chapman et al., 2009) that likely contributes to the apparent genetic discontinuity in the global scalloped hammerhead shark population (Duncan et al., 2006; Chapman et al., 2009; Daly-Engel et al., 2012). Genetics analyses for scalloped hammerhead sharks using mitochondrial DNA (mtDNA), which is maternally inherited, and microsatellite loci data, which reflects the genetics of both parents, have consistently shown that scalloped hammerhead subpopulations are genetically diverse and that individual subpopulations can be differentiated, especially those populations separated by ocean basins (Duncan et al., 2006; Chapman et al., 2009; Ovenden et al., 2011; Daly-Engel et al., 2012). Using mtDNA samples, Duncan et al. (2006) discovered no sharing of haplotypes between S. lewini in the Atlantic and those from the Pacific or Indian Ocean, proving genetic isolation by oceanic barriers. Chapman et al. (2009) further substantiated this finding in a subsequent examination of mtDNA from scalloped hammerhead shark fins, confirming the absence of shared haplotypes between S. lewini in the western Atlantic (n = 177) and those found in the Indo-Pacific (n = 275). Using microsatellite loci from 403 S. lewini samples, Daly-Engel et al. (2012) concluded that scalloped hammerhead sharks in the western and eastern

Atlantic Ocean were significantly differentiated from other populations in the Pacific and Indian Oceans, suggesting that the male sharks in the Atlantic Ocean rarely mix with scalloped hammerheads found elsewhere in the world.

Atlantic Ocean Population Segments

Further delineation within ocean basins is supported by regional and global genetic studies as well as tagging data. For example, in the Atlantic, both mitochondrial and microsatellite data indicate genetic discontinuity within this ocean basin, with distinct populations of scalloped hammerhead sharks defined by their respective coasts. Analysis of S. lewini haplotypes from samples taken off West Africa and the East Coast of the United States reveal genetic separation of these two populations and point to missing hypothetical ancestors (Duncan et al., 2006). Using biparentally-inherited DNA, Daly-Engel et al. (2012) also provided evidence of genetic structure across the Atlantic Ocean, with scalloped hammerhead samples from West Africa weakly differentiated from South Carolina samples ($F_{ST} = 0.052$, $0.05 \geq P \geq 0.01$) and significantly differentiated from Gulf of Mexico samples ($F_{ST} = 0.312$, $P \leq 0.001$). These studies confirm the genetic isolation of the eastern and western Atlantic scalloped hammerhead populations, which should be treated as separate and discrete populations (Chapman personal communication, 2012).

Finer scale delineation within the western Atlantic population is also warranted based on analysis of both maternally and bi-parentally inherited DNA; however, the boundaries of this delineation are unresolved. For example, Chapman et al. (2009) structured the western Atlantic scalloped hammerhead population into three distinct mitochondrial stocks: the northern (U.S. Atlantic and Gulf of Mexico), central (Central American Caribbean), and southern (Brazil) stocks. Daly-Engel et al. (2012), on the other hand, found significant population differentiation in between the Gulf of Mexico and the nearby South Carolina site in the western Atlantic (F_{ST} = 0.201, P < 0.001) using microsatellite fragments. This finding contrasts with Chapman et al. (2009) who did not find significant population differentiation between S. lewini in the U.S. Atlantic and the Gulf of Mexico, and Duncan et al. (2006) who found a lack of genetic structure along continental margins using mtDNA samples. Thus, although the genetic data support dividing the western Atlantic population into subpopulations, there is disagreement on where the lines should be drawn.

Since differences in genetic composition can sometimes be explained by the behavior of a species, the ERA team examined tagging data to learn more about the movements of the scalloped hammerhead populations along the western Atlantic coast. The available data corroborate the genetic findings that these populations of scalloped hammerhead sharks rarely travel long distances. In fact, the median distance between mark and recapture of 3,278 adult scalloped hammerhead sharks, tagged along the eastern U.S. coast and Gulf of Mexico, was less than 100 km (Kohler and Turner, 2001). In addition, none of these tagged sharks were tracked moving south (Kohler personal communication, 2012), indicating a potential separation of the northwest Atlantic and Gulf of Mexico population from the Central and South American population based on movement behavior (Kohler personal communication, 2012).

To further inform its decisions as to whether there is discreteness amongst the western Atlantic scalloped hammerhead subpopulations, the ERA team looked at possible differences in current conservation status and regulatory mechanisms across international boundaries. In the northwest Atlantic and Gulf of Mexico, the United States has implemented strict regulations aimed at controlling the exploitation of the sharks, including the scalloped hammerhead, with the development of fishery management plans (FMPs), requirement for stock assessments, and quota monitoring. On August 29, 2011, NMFS prohibited the taking of scalloped hammerhead sharks by the U.S. commercial highly migratory species (HMS) pelagic longline fishery and recreational fisheries for tunas, swordfish, and billfish in the Atlantic Ocean, including the Caribbean Sea and Gulf of Mexico (76 FR 53652; August 29, 2011). These comprehensive regulatory mechanisms are expected to help protect S. lewini in the northwest Atlantic and Gulf of Mexico. Although the U.S. regulations extend to the U.S. economic exclusive zone (EEZ) in the Caribbean (i.e., surrounding U.S. territories), the vast majority of the Caribbean sea, as well as waters farther south, lack regulatory measures controlling the exploitation of scalloped hammerheads. For example, Brazil, a country that has seen declines of 80 percent or more in catch per unit effort (CPUE) of scalloped hammerheads in various fisheries (FAO, 2010), does not have regulations specific to scalloped hammerhead sharks or quota monitoring of the species. Many countries in Central America are also either lacking protections for shark species or have major problems with enforcement of their respective fishery regulations (Kyne et al., 2012). Thus, the species continues to be heavily fished for by industrial and artisanal fishers in waters off Central and South America. Due to these differences in control of exploitation and regulatory mechanisms for management and conservation of this species across international boundaries, and coupled with the results from the genetic analyses and tagging studies, the ERA team concluded that the western Atlantic population is, in fact, two discrete subpopulations: the Northwest Atlantic & Gulf of Mexico population and the Central & Southwest Atlantic population. We find both of these population segments satisfy the discreteness criterion under the

DPS policy.

Indo-West Pacific Population Segments

Within the Indo-West Pacific region, a lack of genetic structure suggests frequent mixing of scalloped hammerhead populations found in these waters (Daly-Engel et al., 2012). A comparison of microsatellite loci samples from the Indian Ocean, specifically samples from the Seychelles and West Australia, as well as from South Africa and West Australia, indicated either no or weak population differentiation (Daly-Engel et al., 2012). Additionally, there was no evidence of genetic structure between the Pacific and Indian Oceans, as samples from Taiwan, Philippines, and East Australia in the western Pacific showed no population differentiation from samples in the Indian Ocean (F_{ST} = -0.018, P = 0.470) (Daly-Engel et al., 2012). Although these genetic data may imply that males of the species move widely within this region, potentially across ocean basins, tagging studies suggest otherwise. Along the east coast of South Africa, for example, S. lewini moved an average distance of only 147.8 km (data from 641 tagged scalloped hammerheads; Diemer et al., 2011). Tagging studies in other regions also suggest limited distance movements, and only along continental margins, coastlines, or between islands with similar oceanographic conditions (Kohler and Turner, 2001; Duncan and Holland, 2006; Bessudo et al., 2011). Thus, it seems more likely that the high connectivity of the habitats found along the Indian and western Pacific coasts has provided a means for this shark population to mix and reproduce without having to traverse deep ocean basins. In fact, along the east coast of Australia, Ovenden et al. (2011) found evidence of only one genetic stock of S. lewini. The samples, spanning almost 2,000 km of coastline on Australia's east coast, showed genetic homogeneity based on eight microsatellite loci and mtDNA markers, suggesting long-shore dispersal and panmixia of scalloped hammerhead sharks (Ovenden et al., 2011). No genetic subdivision existed between Indonesia and the eastern or northern coasts of Australia, suggesting this species may move widely between the connecting habitats of Australia and Indonesia (Ovenden et al., 2009; Ovenden et al., 2011).

Although the aforementioned genetic analyses suggest males of the Indo-West Pacific population appear to make longer distance coastal movements than what the Atlantic subpopulations typically exhibit (Daly-Engel et al., 2012), they have not been observed mixing with the neighboring eastern Atlantic population of sharks. The significant levels of genetic structure between S. lewini microsatellite samples from South Africa and those from West Africa samples ($F_{ST} = 0.07$, $P \leq 0.01$) corroborate this finding, with the number of migrants moving between these two locations estimated at 0.06 to 0.99 per generation (Daly-Engel et al., 2012). Thus, although connected by a continuous coastline, the genetic data indicate that the eastern Atlantic population and Indo-West Pacific populations rarely mix and qualify as discrete populations due to these genetic differences.

Pacific Ocean Population Segments

In addition to the Indo-West Pacific population, the ERA team found evidence of two other possible subpopulations of scalloped hammerheads in the Pacific Ocean: those common in the Central Pacific region and those found in the East Pacific region. The Central Pacific subpopulation of scalloped hammerheads appears to be markedly separate from other S. lewini populations within the Pacific Ocean as a consequence of physical and genetic factors. The Central Pacific population is located in the middle of the Pacific Ocean. Their range primarily encompasses the Hawaiian Archipelago, which includes the inhabited main islands in the southeast as well as the largely uninhabited Papahānaumokuākea Marine National Monument that extends from Nihoa to Kure Atoll in the northwest. Johnston Atoll is also included in this population's range due to its proximity to the Hawaiian Archipelago. In order to reach the other neighboring populations in the western and eastern Pacific, the Central Pacific scalloped hammerhead sharks would have to travel over hundreds to thousands of kilometers, overcoming various bathymetric barriers. However, as previously mentioned, tagging studies and mtDNA analyses suggest this species rarely makes long-distance oceanic migrations. Instead, the data support the assumption that this species more commonly disperses along continuous coastlines, continental margins, and submarine features, such as chains of seamounts, commonly associated with scalloped hammerhead shark "hotspots" (Holland et al., 1993; Kohler and Turner, 2001; Duncan and Holland, 2006; Hearn et al., 2010; Bessudo et al., 2011; Diemer et al., 2011). This is true even for island populations, with tagged S. lewini individuals frequently migrating to nearby islands and mainlands (Duncan and Holland, 2006; Hearn et al., 2010; Bessudo et al., 2011), but no evidence or data to support oceanic migration behavior.

For example, Bessudo et al. (2011) observed scalloped hammerhead sharks in the Eastern Tropical Pacific (ETP) and noted that although they are capable of covering long distances (i.e., 1941 km), the sharks remain within the area, moving widely around and occasionally between neighboring islands with similar oceanographic conditions. A study conducted in a nursery ground in Hawaii revealed that sharks travelled as far as 5.1 km in the same day, but the mean distance between capture points was only 1.6 km (Duncan and Holland, 2006). Another tagging study in Hawaii indicates that adult males remain "coastal" within the archipelago (Holland personal communication, 2012). The genetic data from scalloped hammerhead populations also supports this theory of limited oceanic dispersal, with significant genetic discontinuity associated with oceanic barriers but less so along continental margins (Duncan et al., 2006; Chapman et al., 2009; Daly-Engel et al., 2012). With regards to the S. lewini sharks in Central Pacific and Eastern Pacific, both microsatellite loci and mtDNA data indicate significant genetic differentiation between these two populations (Daly-Engel et al., 2011), corroborating the theory of genetic isolation due to biogeographic barriers. Thus, these genetic analyses, coupled with the tagging studies, suggest that the populations of scalloped hammerhead sharks found in the Pacific (i.e. Indo-West Pacific, Central Pacific, and East Pacific subpopulations) rarely conduct open ocean migrations (Kohler and Turner, 2001; Bessudo et al., 2011; Diemer et al., 2011; Holland personal communication, 2012) to mix or reproduce with each other.

Further separating these subpopulations, especially the Central Pacific scalloped hammerhead population from its neighboring western and eastern Pacific populations, are the differences in fisheries regulations across these international boundaries. The Central Pacific currently has many management controls in place that protect important scalloped hammerhead habitats and nursery grounds, as well as fishing regulations that control the exploitation of the species. For example, the fisheries of the Hawaiian Islands are managed by both Federal regulations, such as the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and state regulations aimed at protecting and conserving marine resources. Currently, there are no directed shark fisheries in Hawaii; however, scalloped hammerheads are sometimes caught as bycatch on Hawaiian longline gear. The Hawaii pelagic longline (PLL) fishery, which operates mainly in the Northern Central Pacific Ocean, is managed through a Fishery Ecosystem Plan (FEP) developed by the Western Pacific Regional Fishery Management Council (WPFMC) and approved by NMFS under the authority of the MSA. In an effort to reduce bycatch in this fishery, a number of gear regulations and fishery management measures have been implemented. For example, a 50-75 nm (92.6 – 138.9 km) longline fishing buffer zone exists around the Hawaiian Islands, helping to protect scalloped hammerheads from being caught near popular nursery grounds and their coastal adult habitat. Periodic closures and effort limits in the shallow-set sector of this fishery (which has a higher shark catch rate) also helps protect scalloped hammerheads in this fishery.

In addition, mandatory fishery observers have been monitoring both sectors (shallow and deep) of the limited-entry Hawaii-based PLL fishery since 1994, with observer coverage increasing in recent years to provide a more comprehensive bycatch dataset. Shark finning, a practice which involves harvesting sharks, severing their fins and returning their remaining carcasses to the sea, was banned in 2000 for the Hawaii-based longline fishery. Additionally, the U.S. Shark Conservation Act of 2010 requires that sharks lawfully harvested in Federal waters, including those located in the range of this DPS, be landed with their fins naturally attached, and additional legislation aimed at shark finning was enacted in 2010 by the State of Hawaii (State of Hawaii SB2169). In the neighboring ETP, as well as other islands and countries in the western Pacific, regulatory mechanisms are either missing, inadequate, or weakly enforced, and illegal fishing is widespread. Therefore, it is reasonable to assume that the differences in the control of exploitation and regulatory mechanisms between the Central Pacific and the surrounding countries could influence the conservation status of the scalloped hammerhead population around the Central Pacific region and thus could be considered a discrete population under the DPS policy.

In the eastern Pacific region, results from both microsatellite loci data and mtDNA confirm the genetic isolation of the eastern Pacific S. lewini population from those found in the central and western Pacific, Indian, and Atlantic Oceans ($P \leq 0.001$) (Daly-Engel et al., 2012). Nance et al. (2011) suggested that the ETP S. lewini population may actually exist as a series of small and genetically separate populations. This observed low genetic diversity in the eastern Pacific population may indicate peripatric speciation (i.e., formation of new species in isolated peripheral populations that are much smaller than the original population) from the Indo-West Pacific hammerhead population (Duncan et al., 2006). Interestingly, when compared to samples from the Gulf of Mexico, Daly-Engel et al. (2012) found high levels of allelic differentiation ($F_{ST} = 0.519$, $P \leq 0.001$), suggesting that these two populations have never mixed and thus make up the opposing ends of the S. lewini dispersal range from the Indo-West Pacific. The genetic differentiation and geographic isolation of the Eastern Pacific population from other scalloped hammerhead populations thus qualify it as a discrete population under the DPS policy.

Based on the above information on scalloped hammerhead population structuring, as well as additional information provided in the status review report, we have concluded that the following six discrete subpopulations of scalloped hammerhead sharks are present in the world: (1) Northwest Atlantic & Gulf of Mexico population segment, (2) Central & Southwest Atlantic population segment, (3) Eastern Atlantic population segment, (4) Indo-West Pacific population segment, (5) Central Pacific population segment, and (6) Eastern Pacific population segment. Each is markedly separate from the other five population segments as a consequence of genetic and/or physical factors, with some population segments also delimited by international governmental boundaries within which differences in control of exploitation, conservation status, or regulatory mechanisms exist that are significant in light of Section 4(a)(1)(D) of the ESA.

Significance

When the discreteness criterion is met for a potential DPS, as it is for the Northwest Atlantic & Gulf of Mexico, Central & Southwest Atlantic, Eastern Atlantic, Indo-West Pacific, Central Pacific, and Eastern Pacific population segments identified above, the second element that must be considered under the DPS policy is significance of each DPS to the taxon as a whole. Significance is evaluated in terms of the importance of the population segment to the overall welfare of the species. Some of the considerations that can be used to determine a discrete population segment's significance to the taxon as a whole include: (1) persistence of the population segment in an unusual or unique ecological setting; (2) evidence that loss of the population segment would result in a significant gap in the range of the taxon; and (3) evidence that the population segment differs markedly from other populations of the species in its genetic characteristics.

Based on the results from the genetic and tagging analyses mentioned previously, we believe that there is evidence that loss of any of the population segments would result in a significant gap in the range of the taxon. For example, the Indo-West Pacific region, which is hypothesized as the center of origin for S. lewini, with the oldest extant scalloped hammerhead species found in this region (Duncan et al., 2006; Daly-Engel et al., 2012), covers a wide swath of the scalloped hammerhead sharks' range (extending from South Africa to Japan, and south to Australia and New Caledonia and neighboring Island countries). However, as Daly-Engel et al. (2012) notes, the migration rate of S. lewini individuals from West Africa into South Africa is very low (0.06 individuals per generation), suggesting that in the case of an Indo-West Pacific extirpation, re-colonization from the Eastern Atlantic to the Western Indian Ocean is very unlikely. In addition, re-colonization from the Central Pacific DPS would also occur rather slowly (on an evolutionary timescale) as those individuals would have to conduct trans-oceanic migrations, a behavior that has yet to be documented in this species. The Central Pacific region, itself (extending from Kure Atoll to Johnston Atoll, and including the Hawaiian Archipelago), encompasses a vast portion of the scalloped hammerhead sharks' range in the Pacific Ocean and is isolated from the neighboring Indo-West Pacific and eastern Pacific regions by deep expanses of water. Loss of this DPS would result in a decline in the number of suitable and productive nursery habitats and create a significant gap in the range of this taxon across the Pacific Ocean. From an evolutionary standpoint, the Central Pacific population is thought to be the "stepping stone" for colonization to the isolated ETP, as Duncan et al. (2006) observed two shared haplotypes between Hawaii and the otherwise isolated ETP population. In other words, in the case of an ETP extirpation and loss of the Central Pacific population, it would require two separate and rare colonization events to repopulate the ETP population: one for the re-colonization of the Central Pacific and another for the re-colonization of the ETP. Thus, on an evolutionary timescale, loss of the Central Pacific population would result in a significant truncation in the range of the taxon.

Even those discrete population segments that share a connecting coastline, like the Northwest Atlantic & Gulf of Mexico and Central & Southwest Atlantic population segments, will not likely see individuals re-colonizing the other population segment, given that gene flow is low between these areas and tagging studies show limited distance movements by individuals along the western Atlantic coast. In addition, repopulation by individuals from the eastern Pacific to the western Atlantic, or vice versa, is highly unlikely as these animals would have to migrate through suboptimal oceanographic conditions, such as very cold waters, that are detrimental to this species' survival. Therefore, the display of weak philopatry and constrained migratory movements provides evidence that loss of any of the discrete population segments would result in a significant gap in the range of the scalloped hammerhead shark, negatively impacting the species as a whole.

In summary, the scalloped hammerhead shark population segments considered by the ERA team meet both the discreteness and significance criterion of the DPS policy. We concur with the ERA team's conclusion that there are six scalloped hammerhead shark DPSs, which comprise the global population, and are hereafter referred to as: (1) NW Atlantic & GOM DPS, (2) Central & SW Atlantic DPS, (3) Eastern Atlantic DPS, (4) Indo-West Pacific DPS, (5) Central Pacific DPS, and (6) Eastern Pacific DPS. The boundaries for each of these DPSs, as determined from the DPS analysis, are as follows (see Figure 1):

(1) NW Atlantic & GOM DPS – Bounded to the north by 40° N. latitude (lat.), includes all U.S. EEZ waters in the Northwest Atlantic and extends due east along 28° N. lat. off the coast of Florida to 30° W. longitude (long.). In the Gulf of Mexico, the boundary line includes all waters of the Gulf of Mexico, with the eastern portion bounded by the U.S. and Mexico EEZ borders.

(2) Central & SW Atlantic DPS – Bounded to the north by 28° N. lat., to the east by 30° W. long., and to the south by 36° S. lat. All waters of the Caribbean Sea are within this DPS boundary, including the Bahamas' EEZ off the coast of Florida as well as Cuba's EEZ.

(3) Eastern Atlantic DPS – Bounded to the west by 30° W. long., to the north by 40° N.

lat., to the south by 36° S. lat., and to the east by 20° E. long., but includes all waters of the Mediterranean Sea.

(4) Indo-West Pacific DPS – Bounded to the south by 36° S. lat., to the west by 15° E. long., and to the north by 40° N. lat. In the east, the boundary line extends from175° W. long. due south to 10° N. lat., then due east along 10° N. lat. to 140° W. long., then due south to 4° S. lat., then due east along 4° S. lat. to 130° W. long, and then extends due south along 130° W. long.

(5) Central Pacific DPS – Bounded to the north by 40° N lat., to the east by 140° W. long., to the south by 10° N. lat., and to the west by 175° E. long.

(6) Eastern Pacific DPS – bounded to the north by 40° N lat. and to the south by 36° S lat. The western boundary line extends from140° W. long. due south to 10° N., then due west along 10° N. lat. to 140° W. long., then due south to 4° S. lat., then due east along 4° S. lat. to 130° W. long, and then extends due south along 130° W. long.

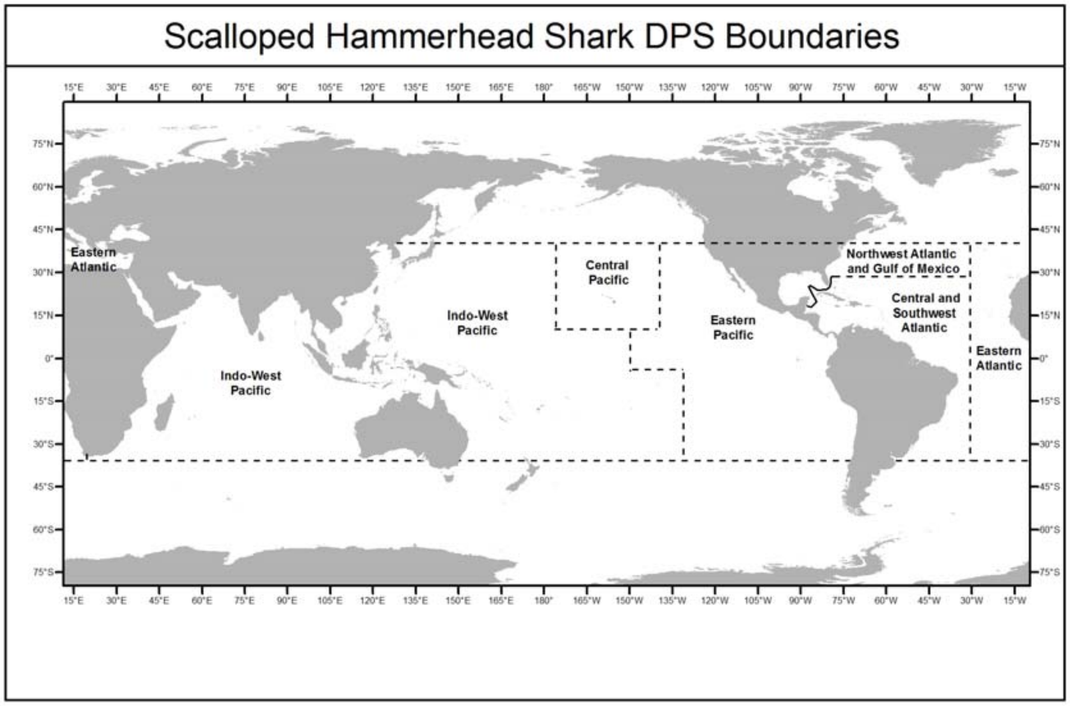

Figure 1. Map of the six scalloped hammerhead shark DPS boundaries.

Assessment of Extinction Risk

The Endangered Species Act (ESA) (Section 3) defines endangered species as "any species which is in danger of extinction throughout all or a significant portion of its range." Threatened species are "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." Neither we nor the USFWS have developed any formal policy guidance about how to interpret the definitions of threatened and endangered. We consider a variety of information and apply professional judgment in evaluating the level of risk faced by a species in deciding whether the species is threatened or endangered. We evaluate both demographic risks, such as low abundance and productivity, and threats to the species including those related to the factors specified by the ESA Section 4(a)(1)(A)-(E).

<u>Methods</u>

As we have explained, we convened an ERA team to evaluate extinction risk to the species. This section discusses the methods used to evaluate threats to each DPS and draw overall extinction risk conclusions for each. As explained further down in this notice, we have separately taken into account other conservation efforts which have the potential to reduce threats identified by the ERA team.

For purposes of the risk assessment, an ERA team comprised of fishery biologists and shark experts was convened to review the best available information on the species and evaluate the overall risk of extinction facing the scalloped hammerhead shark now and in the foreseeable future. The term "foreseeable future" was defined as the timeframe over which threats could be reliably predicted to impact the biological status of the species. After considering the life history of the scalloped hammerhead shark, availability of data, and type of threats, the ERA team decided that the foreseeable future should be defined as approximately 3 generation times for the scalloped hammerhead shark, or 50 years. (A generation time is defined as the time it takes, on average, for a sexually mature female scalloped hammerhead shark to be replaced by offspring with the same spawning capacity). This timeframe (3 generation times) takes into account the time necessary to provide for the conservation and recovery of the species. As a late-maturing species, with slow growth rate and low productivity, it would likely take more than a generation time for any conservative management action to be realized and reflected in population abundance indices (as evidenced by the slow recovery of the NW Atlantic & GOM DPS discussed below).

In addition, the foreseeable future timeframe is also a function of the reliability of available data regarding the identified threats and extends only as far as the data allow for making reasonable predictions about the species' response to those threats. The ERA team considered extending foreseeable future out to 100 years as well, but after discussion, agreed that they could not reliably predict the severity of threats, such as overutilization or inadequacy of regulatory measures, with any certainty past 50 years, given the changing nature of international and national fishery management and push towards conservation and control of illegal fishing. (As an aside, the timeframe of 3 generations is a widely used scientific indicator of biological status, and has been applied in decision making models by many other conservation management bodies, including the American Fisheries Society, the CITES, and the IUCN.)

Often the ability to measure or document risk factors is limited, and information is not quantitative or very often lacking altogether. Therefore, in assessing risk, it is important to include both qualitative and quantitative information. In previous NMFS status reviews, Biological Review Teams have used a risk matrix method to organize and summarize the professional judgment of a panel of knowledgeable scientists. This approach is described in detail by Wainright and Kope (1999) and has been used in Pacific salmonid status reviews as well as in the status reviews of many other species (see http://www.nmfs.noaa.gov/pr/species/ for links to these reviews). In the risk matrix approach, the collective condition of individual populations is summarized at the DPS level according to four demographic risk criteria: abundance, growth rate/productivity, spatial structure/connectivity, and diversity. These viability criteria, outlined in McElhany et al. (2000), reflect concepts that are well-founded in conservation biology and that individually and collectively provide strong indicators of extinction risk.

Using these concepts, the ERA team estimated the extinction risk of each scalloped hammerhead shark DPS based on current and future demographic risks by assigning a risk score to each of the four demographic criteria. The scoring for the risk criteria correspond to the following values: 1 – no or very low risk, 2 – low risk, 3 – moderate risk, 4 – high risk, and 5 – very high risk. Likewise, the ERA team performed a threats assessment for each DPS by scoring the severity of current threats to the DPS as well as predicting whether the threat will increase, decrease, or stay the same in the foreseeable future. Detailed definitions of these risk scores can be found in the status review report. The scores were tallied (mode, median, range), reviewed by the ERA team, and considered in making the overall risk determination. Although this process helps to integrate and summarize a large amount of diverse information, there is no simple way to translate the risk matrix scores directly into a determination of overall extinction risk. Other descriptive statistics, such as mean, variance, and standard deviation, were not calculated as the ERA team felt these metrics would add artificial precision or accuracy to the results.

Guided by the results from the demographics risk analyses as well as the threats assessment, the ERA team members were asked to use their informed professional judgment to make an overall extinction risk determination for each DPS now and in the foreseeable future. For this analysis, the ERA team again defined five levels of extinction risk: 1 – no or very low risk, 2 – low risk, 3 – moderate risk, 4 – high risk, and 5 – very high risk: however, the definitions differ slightly from those used in the demographic and threats assessment, and can be found in the status review report. To allow individuals to express uncertainty in determining the overall level of extinction risk facing the species, the ERA team adopted the "likelihood point" (FEMAT) method. This approach has been used in previous NMFS status reviews (e.g., Pacific salmon, Southern Resident killer whale, Puget Sound rockfish, Pacific herring, and black abalone) to structure the team's thinking and express levels of uncertainty when assigning risk categories. For this approach, each team member distributed 10 'likelihood points' among the five levels of risks. The scores were then tallied (mode, median, range) and summarized for each DPS.

Finally, the ERA team did not make recommendations as to whether the species should be listed as threatened or endangered. Rather, the ERA team drew scientific conclusions about the overall risk of extinction faced by each DPS under present conditions and in the foreseeable future based on an evaluation of the species' demographic risks and assessment of threats.

Demographic Data Reviewed by the ERA team

The amount of available data on scalloped hammerhead shark abundance and trends varies by DPS. The abundance status of the NW Atlantic & GOM DPS is likely the best understood, with over 2 decades of data available from multiple recreational and commercial sources and analyzed in a recent stock assessment by Hayes et al. (2009). Recreational catch data used in this stock assessment were collected by the NMFS Marine Recreational Fishery Statistics Survey, NMFS' Southeast Region Headboat Survey, and the Texas Parks and Wildlife Department Marine Recreational Fishing Survey. These surveys have been in operation since the early 1970s and provide estimates of total catch data and CPUE data through random-dial telephone surveys, dockside intercept sampling programs, and self-reported logbook or daily catch record surveys. As these surveys do not provide data to estimate catch in biomass, the recreational survey data was only analyzed in terms of numbers of individual sharks. Commercial catch data used in the stock assessment were collected by the NMFS Southeast Fisheries Science Center from the Pelagic Dealer Compliance database and from the Accumulated Landings Systems. Landings weights were converted into catch numbers by dividing the weight by an average weight of the individual animal as reported in the Commercial Shark Fishery Observer Program. In this way, recreational and commercial catch numbers could be directly compared. Discard estimates specifically for scalloped hammerheads are not available before 1987 or after 2001 (due to S. lewini being lumped into a larger dealer report category), so estimates for these years were based on average discards in 1987-1992 and 1993-2001, respectively. Additionally, no catch was assumed to take place prior to 1981 based on insufficient catch data available before that year. This assumption was tested through sensitivity analyses and subsequently accepted by Hayes et al. (2009).

For the stock assessment, indices of relative abundance from fishery-dependent and -

independent data were estimated for inclusion in surplus-production models to determine population projections and rebuilding probabilities. Fishery dependent indices were estimated through CPUE data provided by commercial fishery logbooks and observer programs and standardized according to the Lo method (Lo et al., 1992). Fishery-independent surveys are less biased indices of abundance and were included in the models after standardization. Fishery-independent surveys are assumed to more accurately reflect population abundance due to their standardized sampling methods that are designed not to target specific concentrations of fish. The three fishery-independent surveys that were included in the stock assessment models are: the NMFS Pascagoula longline survey, which uses a standardized, random sampling design stratified by depth and covering the western Gulf of Mexico to North Carolina along the U.S. southeastern Atlantic seaboard; the NMFS Panama city Gillnet Survey, which uses a standardized sampling design, with monofilament gillnets set at fixed stations monthly from April to October in shallow, coastal areas of the northwestern Gulf of Mexico close to the Florida panhandle; and the North Carolina longline survey, which uses a standardized sampling design, with unanchored longlines set biweekly off the central coast of North Carolina near Cape Lookout.

In addition to the stock assessment, the ERA team also considered other data sources of abundance estimates. This included a study by Ferretti et al. (2008), which provided historical records of shark catches from the Mediterranean Sea; however, the ERA team had concerns about the species-level identifications in the study. Some CPUE information, providing long-term trends data, was available from beach netting programs off the coasts of South Africa and Australia. The methods and materials from these beach protection programs have largely remained the same over the years, providing a good source of fishery-independent data. In South

Africa, the beach protection programs have been in place since the early 1950s, providing catch rates of scalloped hammerhead sharks off various beaches from 1952 to 2003. In Australia, catch data from shark control programs off the coast of Queensland is available from 1986 to 2010. Other data sources for abundance analyses include: estimates of breeding individuals and pups from a scalloped hammerhead nursery ground in Hawaii, diver sighting reports from 1992-2004 in protected waters of the eastern Pacific, and estimates of the rate of population decline in the Gulf of Tehuantepac, Mexico.

Growth and productivity analyses were primarily based on data collected from scalloped hammerhead populations in the Atlantic Ocean as there is some scientific disagreement on the aging methodology used to interpret growth bands in studies on S. lewini from the Pacific Ocean. Scalloped hammerhead sharks develop opaque bands on their vertebrae, which are used to estimate age. For some studies conducted in the eastern and western Pacific, band formation was assumed to occur bi-annually, whereas in the Atlantic, bands were assumed to form annually (see Miller et al., 2013). Although indirect age validation studies for S. lewini are still inconclusive, bomb radiocarbon and calcein methods (direct age validation methods) have been used to validate annual growth bands for two other species of Sphyrna, including the great hammerhead shark (S. mokarran) and the bonnethead shark (S. tiburo) (Parsons, 1993; Passerotti et al., 2010). Therefore, it seems more likely that the scalloped hammerhead shark undergoes annual band formation, as has been found in other chondrichthyan growth studies (Campana et al., 2002; Okamura and Semba, 2009), and this assumption was used when examining age maturity, growth, and productivity estimates.

For spatial structure/connectivity the ERA team considered the current and historical range of the taxon and the habitat requirements and physical characteristics of the habitat as documented in the scientific literature. With respect to diversity, the ERA team examined the genetic data, which provided estimates of migration rates per generation, and analyzed any potential threats of genetic bottlenecking or other ecological and human-caused factors that could substantially alter the rate of gene flow in the DPS.

Evaluation of Demographic Risks

NW Atlantic & GOM DPS

A recent assessment for the northwest Atlantic and Gulf of Mexico scalloped hammerhead shark stock concluded that the population has declined by over 80 percent since 1981 (Hayes et al., 2009). Other studies have also reported similar decreases in S. lewini populations along the western Atlantic coast. For example, Baum et al. (2003) calculated that the northwest Atlantic population of S. lewini has declined 89 percent since 1986; however, this study is controversial due to its reliance on only pelagic longline logbook data. Off the southeastern U.S. coast, Beerkircher et al. (2002) observed significant declines in nominal CPUE for S. lewini between 1981-1983 (CPUE = 13.37; Berkeley and Campos, 1988) and 1992 – 2000 (CPUE = 0.48). On a smaller scale, Myers et al. (2007) documented a 98 percent decline of the S. lewini population off the coast of North Carolina between 1972 and 2003, using standardized CPUE data from shark targeted, fishery-independent surveys. However, the authors also discovered a significant increase in juvenile scalloped hammerheads (instantaneous rate of change = 0.094) from 1989 to 2005. Comparing estimates of population size off the coast of South Carolina, Ulrich (1996) reported a 66 percent decrease between 1983-1984 and 1991-1995. Although these declines in former abundance numbers are significant, the latest stock assessment for this DPS found that population numbers have remained fairly stable since 1995 (Hayes et al., 2009). The stock assessment also predicted a 91 percent probability of the population rebuilding within 30 years under 2005 catch levels. From 2006 to 2010, the U.S. scalloped hammerhead harvest has been below this 2005 catch level. In addition, stronger management measures have been implemented in this fishery, with a scalloped hammerhead shark rebuilding plan expected in 2013, which we believe will substantially contribute to continued increases in abundance and stability of this DPS. As such, the ERA team concluded, and we agree, that the future levels of abundance of the NW Atlantic & GOM DPS alone are unlikely to contribute significantly to its risk of extinction.

The ERA team also noted that sharks, in general, have lower reproductive rates and growth rates compared to bony fishes. Estimates for the intrinsic rate of increase (r) for scalloped hammerhead sharks are relatively low, ranging from 0.028 to 0.121 (see Miller et al., 2013), suggesting general vulnerability to depletion. But compared to other chondrichthyan species, scalloped hammerhead sharks actually show a moderate rebound potential to exploitation by pelagic longline fisheries common in this DPS (Cortés et al., 2010; ICCAT, 2012).

In addition, the ERA team did not see habitat structure or connectivity as a potential risk to this DPS. Already, an extensive range of essential fish habitat (EFH) has been identified for both juveniles and adults of this DPS. EFH is the habitat necessary for spawning, breeding, feeding, and growth to maturity for a species, and NMFS, the regional fishery management councils, and other Federal agencies work together to minimize threats to these identified EFH areas. The current EFH for this DPS extends from the coastal areas in the Gulf of Mexico from Texas to the southern west coast of Florida and along the Atlantic US southeast coast from

Florida up to Long Island, NY. Scalloped hammerhead sharks of all developmental stages have been identified within this EFH range (NMFS, 2006), along the eastern Atlantic and Gulf of Mexico coast, which suggests that habitat connectivity does not appear to be a limiting factor in this DPS's survival. Habitat structure also does not appear to be a threat, with the sharks inhabiting a range of environments with varying complexity (from estuaries to open oceans). Because the shark resides in the water column, threats to changes in the physical characteristics of the water column, such as salinity, temperature, and dissolved oxygen, may pose the greatest risk to this species. Estuaries and nearshore waters are especially susceptible to pollution from anthropogenic impacts and subsequent water quality degradation. However, the species is highly mobile with no data to suggest it is restricted to any specific estuarine or shallow coastal area for use as a habitat ground. In addition, the degree to which habitat alterations have affected this shark species is not currently known (NMFS, 2009). As such, the ERA team concluded, and we agree, that habitat structure or connectivity is not a present risk to this DPS.

Central & SW Atlantic DPS

The ERA team noted that specific abundance numbers for this DPS are unavailable but likely similar to, and probably worse than, those found in the NW Atlantic & GOM DPS, mainly due to the observed intensive fishing pressure on this DPS. In the late 1990s, Amorim et al. (1998) remarked that heavy fishing by longliners led to a decrease in this population off the coast of Brazil. According to the FAO global capture production database, Brazil reported a significant increase in catch of S. lewini during this period, from 30 mt in 1999 to 508 mt by 2002, before decreasing to a low of 87 mt in 2009. Documented heavy inshore fishing has also led to significant declines of adult female S. lewini abundance (up to 90 percent) (CITES, 2010) as well as targeted fishing of and reported decreases in juvenile and neonate scalloped hammerhead populations (Vooren et al., 2005; Kotas et al., 2008). Information from surface longline and bottom gillnet fisheries targeting hammerhead sharks off southern Brazil indicates declines of more than 80 percent in CPUE from 2000 to 2008, with the targeted hammerhead fishery abandoned after 2008 due to the rarity of the species (FAO, 2010). The population abundance in the Caribbean is unknown as catch reporting is sporadic and not normally recorded down to the species level.

However, unlike the NW Atlantic & GOM DPS, exploitation of this DPS continues to go largely unregulated. In Central America, a lack of resources has led to poor enforcement of fishery regulations as well as frequent incidences of illegal fishing (further discussed in the Inadequacy of Existing Regulatory Mechanisms section). In Brazilian waters, there are very few fishery regulations that help protect hammerhead populations. For example, the minimum legal size for a scalloped hammerhead caught in Brazilian waters is 60 cm total length; however, S. lewini pups may range from 38 cm to 55 cm. As the pup sizes are very close to this minimum limit, the legislation is essentially ineffective, and as such, large catches of both juveniles and neonates have been documented from this region (Silveira et al., 2007; Kotas et al., 2008; CITES, 2010). Although Brazil has implemented other measures aimed at protecting species that use inshore areas as nursery grounds, such as by limiting gillnets and closing off certain fishing areas, unlike the management measures in the NW Atlantic & GOM DPS, these regulations are poorly enforced. Because of the lack of enforced fishery regulations, fishers continue to take large numbers of all ages of scalloped hammerhead sharks from inshore and coastal waters of this DPS. These threats, which have contributed to the decline in abundance of this DPS, and will continue to do so into the foreseeable future, are discussed in more detail below. Given the scalloped hammerhead shark's low intrinsic productivity, the observed downward trends in reported catches and population numbers, and continued threat from bycatch and directed catch in weakly regulated commercial and recreational fisheries, the ERA team concluded, and we agree, that the DPS' current and future levels of abundance are likely to contribute significantly to its risk of extinction.

Eastern Atlantic DPS

Abundance numbers for this DPS are unavailable or unreliable, but population trends likely reflect those found in the NW Atlantic & GOM DPS based on the similar fishing effort of longline fleets in this area (Zeeberg et al. 2006; CITES, 2010). One study that the ERA team reviewed used historical records to estimate declines of > 99.99 percent in both biomass and abundance of scalloped hammerhead sharks over the past 100 years in the Mediterranean Sea (Ferretti et al., 2008). However, the ERA team voiced concerns regarding the species identification in the records, as many of the hammerheads found in the Mediterranean Sea are actually the similarly-looking smooth, not scalloped, hammerhead shark. Recently, Sperone et al. (2012) confirmed the presence of both S. lewini and S. zyganea around southern Italy, providing evidence that the species can still be found in the Mediterranean Sea.

According to data provided to the FAO, S. lewini abundance off the coast of Mauritania has declined by 95 percent since 1999, with evidence of a decrease in average size of the shark since 2006 (FAO, 2013). Abundance trends from off the coast of other western African countries are not available but likely similar to the situation off Mauritania (FAO, 2013). The status of other stocks from this region may also provide a likely picture of the scalloped hammerhead shark population in this region. According to the latest FAO report on the State of World Fisheries and Aquaculture, most of the pelagic stocks and demersal fish from the Eastern Central Atlantic are considered fully exploited to overexploited (FAO, 2012). In addition, many of the shrimp stocks range between fully and overexploited and the commercially important octopus and cuttlefish stocks in this region are deemed overexploited. Some stocks, such as the white grouper in Senegal and Mauritania, are even considered to be in severe condition. Driving this exploitation is the increasing need for protein resources in this region, both as a trade commodity and as a dietary staple. In fact, many people in Sub-Saharan Africa depend on fish for protein in their diet, with fish accounting for around 22 percent of their protein intake (Heck and Béné, 2005). This proportion increases to over 50 percent in many of the poorer African countries, where other animal protein is scarce, and in West African coastal countries, where fishing has driven the economy for many centuries (Heck and Béné, 2005). For example, fish accounts for 47 percent of protein intake in Senegal, 62 percent in Gambia, and 63 percent in Sierra Leone and Ghana (Heck and Béné, 2005). With this reliance on fish stocks for dietary protein as well as a sole source of income for many people in this region, it is not surprising that the FAO reports that "the Eastern Central Atlantic has 43 percent of its assessed stocks fully exploited, 53 percent overexploited and 4 percent non-fully exploited, a situation warranting attention for improvement in management." (FAO, 2012)

With evidence to suggest that large artisanal fisheries are taking substantial amounts of juvenile scalloped hammerhead sharks from these waters, and reports of fisheries even specializing in catching sphyrnid species (CITES, 2010), it is highly likely that this DPS' status is similar to the status of other fish stocks in this region (i.e., fully to overexploited). Thus, taking into consideration the species' low intrinsic rate of productivity, the largely unregulated catch of the species off West Africa with indications of abundance declines and possible size truncation, threats from overexploitation and poor management, and the rising demand for food/protein in this region (projected to double by 2020; World Bank, 2012), the ERA team concluded, and we agree, that future abundance levels of this DPS are likely to contribute significantly to its risk of extinction. These threats, which have contributed to the decline in abundance of this DPS, and will continue to do so into the foreseeable future, are discussed in more detail below.

Indo-West Pacific DPS

Beach protection programs in the Indo-West Pacific region have provided valuable fishery-independent data that reveal drastic declines in this scalloped hammerhead shark population since the early 1950s. Specifically, declines of 99 percent, 86 percent, and 64 percent have been estimated for S. lewini from catch rates in shark nets deployed off the beaches of South Africa from 1952-1972, 1961-1972, and 1978-2003, respectively (Dudley and Simpfendorfer, 2006; Ferretti et al., 2010). Estimates of the decline in Australian hammerhead abundance range from 58-85 percent (Heupel and McAuley 2007; CITES, 2010). CPUE data from the northern Australian shark fishery indicate declines of 58-76 percent in hammerhead abundance in Australia's northwest marine region from 1996-2005 (Heupel and McAuley, 2007). Data from protective shark meshing programs off beaches in New South Wales (NSW) and Queensland also suggest significant declines in hammerhead populations off the east coast of Australia. From 1973 to 2008 , the number of hammerheads caught per year in NSW beach nets decreased by more than 90 percent, from over 300 individuals to fewer than 30 (Reid and Krogh, 1992; Williamson, 2011). Similarly, data from the Queensland shark control program indicate declines of around 79 percent in hammerhead shark abundance between the years of 1986 and 2010, with S. lewini abundance fluctuating over the years but showing a recent decline of 63 percent between 2005 and 2010 (QLD DEEDI, 2011). Although these studies provide evidence of declining local populations, there is a high degree of uncertainty regarding the overall population size given the expansive range of this DPS.

Additionally, the ERA team noted that the coastal habitats of this DPS, especially around the island nations of the western Pacific, are less connected than those of the other DPSs that have a contiguous coastline. But since the western Pacific islands are relatively close together or connected by various submarine features, the ERA team felt that these areas are easily accessible to this DPS and therefore should pose minimal ecological risk. Overall, the ERA team recognized that the total abundance for this species in the entire region is not well known, but the available data confirm localized depletions of populations. This information, coupled with the species' low intrinsic rate of productivity, led the ERA team to conclude that the abundance in the foreseeable future may decline to a level that would not provide the DPS adequate resilience to environmental or anthropogenic perturbations. We agree with the ERA team's findings.

Central Pacific DPS

Abundance in this DPS is perceived to be high based on shark pup data from this region as well as personal observations from NMFS fishery scientists in the Pacific Islands Fishery Science Center. In Kāne'ohe Bay, a large nursery ground in Oahu, Hawaii, estimates of 7700 ± 2240 SD scalloped hammerhead sharks are born per year, which suggests that between 180 and 660 adult female sharks use this area annually as a birthing ground (Duncan and Holland, 2006).

Growth rate of these pups is estimated to be 9.6 cm per year (Duncan and Holland, 2006). Although Clarke (1971) observed high predation on the pups by adult scalloped hammerheads, the author noted that the pup population remained high and suggested that either the pup population is significantly larger than previously thought, or that new births are compensating for the mortality of the pups in this nursery ground.

With respect to spatial structure and connectivity, this DPS has a high degree of isolation. However, while the population is limited in its connection to other coastal habitat areas, the fragmented habitats that are within this DPS are traversable, connected by various submarine features like seamounts and guyots. In addition, a number of suitable nursery grounds have been identified within this DPS. Thus, although the isolation of the DPS in the middle of the Pacific Ocean may pose a moderate risk to the species, the ERA team concluded, and we agree, that high abundance numbers and ample suitable nursery habitats protect the scalloped hammerhead shark population from extinction, with current levels of abundance unlikely to contribute significantly to this DPS' risk of extinction now or in the foreseeable future.

Eastern Pacific DPS

The ERA team commented that there are few good abundance data from this region; however, reports of substantial legal and illegal takes of S. lewini, and observed declines in scalloped hammerhead abundance and overall shark abundance, including in protected waters, suggest significant reductions in abundance of this species. Scalloped hammerhead sharks of all age classes are caught in substantial numbers by fisheries operating in this region (Perez-Jimenez et al., 2005; Román-Vedesoto and Orozco-Zöller 2005; INP, 2006; Bizarro et al., 2009; Arriatti, 2011). Some artisanal fisheries primarily target juvenile S. lewini (Arriatti, 2011), while other fisheries, like the tuna purse seine fisheries, catch significant numbers of the sharks as bycatch (Román-Vedesoto and Orozco-Zöller, 2005). In the Gulf of Tehuantepac, in Pacific southeastern Mexico, it is estimated that the scalloped hammerhead population is currently decreasing by 6 percent per year (INP, 2006). From 1996-2001, CPUE of all sharks in the Gulf of Tehuantepac declined by around 46 percent, and for S. lewini, CPUE declined to nearly zero in 2001 (INP, 2006). Farther south, in the Costa Rica EEZ, analysis of survey research and catch data from 1991-1992 and 1999-2000 indicate a decline of 58 percent in relative pelagic shark abundance (Arauz et al., 2004). In Costa Rica's Pacific mahi-mahi targeted longline fishery, the mean CPUE (per 1,000 hooks) of S. lewini between 1999 and 2008 was low (0.041 ± 0.279); however, the majority of the fishing effort was concentrated in pelagic waters (from 19.5 to 596.2 km offshore) (Whoriskey et al., 2011). More troubling are the diver reports of S. lewini populations in the protected waters around Cocos Island National Park. Analysis of these reports indicate declines of 71 percent in this protected S. lewini population, and suggest substantial fishing on this population by illegal, unreported, and unregulated (IUU) fishing vessels (Myers et al., n.d.). Furthermore, landings data from the Pacific Mexican coast suggest a possible size truncation of this S. lewini population, with larger animals less common in 2007-2009 landings compared to those from 1998-1999 (Bizarro et al., 2009). The removal of larger, and hence, likely mature animals can decrease the productivity of the population, particularly for slow-growing, long-lived species such as the scalloped hammerhead shark. From an evolutionary standpoint, Nance et al. (2011) calculated that this DPS has undergone significant declines (1-3 orders of magnitude) from its ancestral population, with the onset of decline occurring approximately 3600 to 12,000 years ago. Thus, given the observed decreases in population and possible size truncation, low intrinsic productivity of the species, and evidence of significant legal and illegal fishing of this DPS, suggesting a need for better fisheries management or enforcement, the ERA team concluded, and we agree, that the current abundance may be at a level that contributes significantly to the DPS' risk of extinction now and in the foreseeable future. These threats (significant legal and illegal fishing), which have contributed to the decline in abundance of this DPS, and will continue to do so into the foreseeable future, are discussed in more detail below.

Summary of Factors Affecting the Six DPSs of Scalloped Hammerhead Sharks

As described above, section 4(a)(1) of the ESA and NMFS implementing regulations (50 CFR 424) state that we must determine whether a species is endangered or threatened because of any one or a combination of the following 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) inadequacy of existing regulatory mechanisms; or (5) other natural or man-made factors affecting its continued existence. The ERA team evaluated whether and the extent to which each of the foregoing factors contributed to the overall extinction risk of the six DPSs. The status report identifies the most serious individual threat(s) to a DPS' persistence. It also identifies those threats that, in combination with others, were thought to contribute significantly to the risk of a DPS' extinction. This section briefly summarizes the ERA team's findings and our conclusions regarding threats to scalloped hammerhead sharks with occasional focus on threats specific to individual DPSs. More details can be found in the status review report (Miller et al., 2013).

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

The ERA team identified habitat destruction as a potential threat to the scalloped hammerhead shark, but did not find evidence to suggest that it is presently contributing significantly to any of the DPS's risks of extinction. Currently, scalloped hammerhead sharks are found worldwide, residing in coastal warm temperate and tropical seas and rarely in waters cooler than 22° C (Compagno, 1984; Schulze-Haugen and Kohler, 2003). They occur over continental and insular shelves and adjacent deep waters, but can also be found in intertidal and surface waters and depths of up to 450 to 512 m (Sanches, 1991; Klimley, 1993). Estuaries and coastal embayments have been identified as particularly important nursery areas for scalloped hammerhead sharks range wide, while offshore waters contain important spawning and feeding areas. The vertical habitat of scalloped hammerheads in the Gulf of California may extend even farther to include areas of cold hypoxic waters (Jorgensen et al., 2009), indicating an ability to tolerate large fluctuations in temperature and dissolved oxygen concentrations.

In the U.S. EEZ, the MSA requires NMFS to identify and describe EFH in FMPs, minimize the adverse effects of fishing on EFH, and identify actions to encourage the conservation and enhancement of EFH. Towards that end, NMFS has funded two cooperative survey programs intended to help delineate shark nursery habitats in the Atlantic and Gulf of Mexico. The Cooperative Atlantic States Shark Pupping and Nursery Survey and the Cooperative Gulf of Mexico States Shark Pupping and Nursery Survey are designed to assess the geographical and seasonal extent of shark nursery habitat, determine which shark species use these areas, and gauge the relative importance of these coastal habitats for use in EFH determinations. Results from the surveys indicate the importance of estuarine, nearshore, and coastal waters of South Carolina, Georgia, Atlantic Florida, Florida Panhandle, and Alabama as potential nursery habitats for scalloped hammerhead sharks along the eastern U.S. Coast and

Gulf of Mexico. Since the scalloped hammerhead EFH is defined as the water column or attributes of the water column, NMFS determined that there are minimal or no cumulative anticipated impacts to the EFH from gear used in HMS and non-HMS fisheries, basing its finding on an examination of published literature and anecdotal evidence (NMFS, 2006).

Likewise, scalloped hammerhead shark habitat in the other DPSs is similar to what is found in the NW Atlantic & GOM DPS, characterized primarily by the water column attributes. For example, Zeeberg et al. (2006) noted an increase in abundance of hammerhead bycatch in pelagic trawlers operating in the Mauritania EEZ during the summer months, which suggested frequent use of these waters as habitat areas by scalloped hammerheads. However, bycatch probability decreased significantly during the winter and spring, as trade wind-induced upwellings caused sea surface temperatures to drop from summer maximums of 30^{o} C to 18 ^{o} C, indicating sea surface temperature as a significant habitat determinant. Likewise, Bessudo et al. (2011) found that the depth at which scalloped hammerhead sharks commonly swam around Malpelo Island in the Eastern Pacific coincided with the thermocline, the temperature-based transition layer between the mixed layer at the surface and the deep water layer. The authors also suggested that scalloped hammerhead seasonal movements to and from the island of Malpelo are linked to oceanographic conditions, with seasonal environmental signals triggering the migratory movements (Bessudo et al., 2011).

To date, no studies have looked at habitat alteration effects on scalloped hammerhead shark populations. However, any modifications would most likely affect S. lewini nursery habitats as these waters are usually shallower, located closer inshore, and thus are more susceptible to anthropogenic inputs than the offshore habitats. Examples of identified scalloped hammerhead pupping grounds include the Tárcoles River in the Gulf of Nicoya, Guam's Apra Harbor, Kāne'ohe Bay in Oahu, Hawaii, and coastal waters off Oaxaca, Mexico and the Republic of Transkei. These waters are or may be used by humans for a variety of purposes that often result in degradation of these and adjacent habitats, posing threats, either directly or indirectly, to the biota they support (NMFS, 2006). These effects, either alone or in combination with effects from other activities within the ecosystem, may contribute to the decline of the species or degradation of the habitat. The ERA team specifically noted that the increased industrialization seen within the scalloped hammerhead shark range could result in loss of coastal and nearshore habitats and higher pollutants in waters used by the scalloped hammerhead shark. For example, in Costa Rica, the increased industrialization and subsequent waste from commercial, industrial, and transportation activities, as well as coffee production and cattle farming, has led to the accumulation of heavy metals near the mouth of a river frequently used as a scalloped hammerhead shark nursery ground (Zanella et al., 2009). High concentrations of heavy metals damage the epithelial gill cells of sharks and cause respiratory system failure (de Boeck et al., 2002); however, such effects to S. lewini have not yet been reported in this area or elsewhere in the species' range. Although severe pollution and the degradation of water quality may be serious threats to S. lewini nursery and juvenile habitats range wide, the ERA team also noted that this species usually prefers more turbid and murkier waters. Data from Kāne'ohe Bay in Hawaii show that juvenile scalloped hammerheads prefer to aggregate in deeper water during the day, where the habitat is composed mainly of mud and silt (Duncan and Holland, 2006). Areas of higher hammerhead shark abundance also corresponded to locations of greater turbidity and higher sedimentation and nutrient flow (Duncan and Holland, 2006). This was also true of scalloped hammerheads in the Eastern Pacific, with large adult schools gathering on the sides of islands where the current was strongest, and juvenile scalloped hammerheads frequenting shallow, turbid waters at the mouth of rivers (Garro et al., 2009; Zanella et al., 2009). As such, characteristics usually associated with coastal habitat degradation (such as runoff, siltation, eutrophication, etc.) could actually enhance some of the habitat for this species to a degree, creating more sediment and nutrient rich waters.

Because the scalloped hammerhead range is mainly comprised of open ocean environments occurring over broad geographic ranges, large-scale impacts such as global climate change that affect ocean temperatures, currents, and potentially food chain dynamics, are most likely to pose the greatest threat to this species. Additionally, the scalloped hammerhead shark is highly mobile within the range of its DPS, and there is no evidence to suggest its access to essential habitat is restricted within any of the DPSs. It also does not participate in natal homing, which would essentially restrict the species to a specific nursery ground, but rather has been found utilizing artificially enlarged estuaries as nursery habitats located 100 to 600 km from established nursery grounds (Duncan et al., 2006). Also, based on a comparison of S. lewini distribution maps from 1984 (Compagno, 1984) and 2012 (Bester, n.d.), and current reports of scalloped hammerhead catches in FAO fishing areas, there is no evidence to suggest a range contraction for any DPS based on habitat degradation. Overall, using the best available information, there is no evidence to suggest there exists a present or threatened destruction, modification, or curtailment of the scalloped hammerhead shark's habitat or range and we conclude that it is unlikely that this factor is contributing on its own or in combination with other factors to the extinction risk of any of the six DPSs evaluated.

Overutilization for Commercial, Recreational, Scientific or Educational Purposes

The ERA team identified overutilization for commercial and/or recreational purposes as a moderate to major threat contributing to extinction risk for all six scalloped hammerhead shark DPSs. Scalloped hammerhead sharks are targeted by industrial, commercial, artisanal and recreational fisheries, and caught as bycatch in many other fisheries, including pelagic longline tuna and swordfish fisheries and purse seine fisheries. Unfortunately, significant catches of scalloped hammerheads have and continue to go unrecorded in many countries. In addition, scalloped hammerheads are likely under-reported in catch records, as many records do not account for discards (example: where the fins are kept but the carcass is discarded) or reflect dressed weights instead of live weights. Also, many catch records do not differentiate between the hammerhead species, or shark species in general, and thus species-specific population trends for scalloped hammerheads are not readily available. Thus, the lack of catch data on scalloped hammerhead sharks makes it impossible to estimate rates of fishing mortality for many of the DPSs, or conduct detailed quantitative analyses of the effects of fishing on the scalloped hammerhead populations. Nonetheless, there is little doubt that overfishing has played a major role in the decline of scalloped hammerhead sharks, and many other shark species for that matter, around the world (Lack and Sant, 2011).

Estimates of worldwide catches of sphyrnids are reported in the FAO Global Capture Production dataset mainly at the family level, but a select number of countries have reported down to the species level. Total catches of the hammerhead family have increased since the early 1990s (prior years were not reported), from 377 mt in 1991 to a current peak of 5,786 mt in 2010. This rise is in contrast to the catches of S. lewini, which have decreased, for the most part, since reaching a maximum of 798 mt in 2002, suggesting a possible decline in population abundance. However, only seven countries have reported S. lewini data in this FAO database, which is by no means an accurate representation of worldwide S. lewini landings data. Additionally, these FAO data do not include discard mortalities. In order to gain a better estimate of the global shark catch, the ERA team reviewed a study by Clarke et al. (2006a, 2006b), which analyzed 1999 - 2001 Hong Kong fin trade auction data in conjunction with species-specific fin weights and genetic information. Scalloped hammerhead sharks are popular in the international fin trade due to their large fins with a high fin needle content (a gelatinous product used to make shark fin soup), and subsequently fetch a high commercial price (Abercrombie et al., 2005). These fins are found under the second most traded fin category in the Hong Kong market. Applying a Bayesian statistical method to the trade auction data, it was estimated that between 1 and 3 million smooth and scalloped hammerhead sharks, with an equivalent biomass of 60 – 70 thousand mt, are traded annually (Clarke et al., 2006b). These estimates are significantly higher than the catches reported to FAO, and suggest that FAO catch data should only be used as coarse estimates. To put these numbers into perspective, Hayes et al. (2009) estimated the virgin, or unfished, population size (in 1981) of the Northwest Atlantic and Gulf of Mexico scalloped hammerhead stock to be in the range of 142,000 – 169,000 individuals.

Given the high exploitation rates and vulnerability of the scalloped hammerhead shark to overfishing, the ERA team identified overutilization, especially for the international fin trade, as the most severe threat to the global scalloped hammerhead shark population. With respect to each DPS, the severity of this threat to its risk of extinction is briefly explained below.

NW Atlantic & GOM DPS

The ERA team identified the threat of overutilization by commercial and recreational fisheries as a moderate risk to the extinction of the NW Atlantic & GOM DPS of scalloped hammerhead sharks, but projected the threat to decrease in the foreseeable future. In the Atlantic U.S., scalloped hammerhead sharks are considered a highly migratory species (HMS), with this DPS managed as part of the U.S. Atlantic HMS fisheries. These scalloped hammerhead sharks are mainly caught by directed shark permit holders using bottom longline gear. To a lesser degree they are caught as bycatch in longline and coastal gillnet fisheries. In the recreational fisheries sector, scalloped hammerheads became a popular target species of fishers in the last several decades following the release of the movie "Jaws" (Hayes et al., 2009). Data from multiple sources indicate that the NW Atlantic & GOM DPS has experienced severe declines over the past few decades. It is likely that these scalloped hammerhead sharks were overfished beginning in the early 1980s and experienced periodic overfishing from 1983 to 2005 (Jiao et al., 2011).

In October 2009, Hayes et al. (2009) produced a stock assessment for the U.S. Northwest Atlantic and Gulf of Mexico population of scalloped hammerhead sharks, which NMFS reviewed and deemed appropriate for the basis of U.S. management decisions. The stock assessment incorporated both recreational and commercial catch information as well as discard estimates since 1981, and developed abundance indices from fishery-dependent and –independent surveys. From 1981- 1990, a total of 181,544 scalloped hammerhead sharks from the NW Atlantic & GOM DPS were estimated as caught, primarily by recreational fishers. In fact, the recreational fishery sector accounted for over 90 percent of this harvest. However, as the demand for shark products grew (including meat, cartilage, and the highly prized fins), so did the commercial shark fishery in the Atlantic, which saw expansion throughout the late 1970s and the 1980s (NMFS, 2006). Specifically, tuna and swordfish vessels started to retain a greater proportion of their shark incidental catch, and some directed fishery effort expanded as well. Subsequently, catches accelerated through the 1980s and shark stocks, especially the scalloped hammerhead shark, began to show signs of decline (NMFS, 2006). After 1993, the estimated harvest of scalloped hammerhead sharks decreased dramatically from 22,330 to 4,554 individuals; however, it should be noted that it was at this time when NMFS implemented an FMP for Sharks of the Atlantic Ocean. Due to the concern over the possibility of the Atlantic shark resource being overfished, the 1993 Shark FMP established quotas, monitoring measures, and a rebuilding plan for the large coastal shark fishery (NMFS, 1993). In the following years, NMFS continued to revise these quotas based on the latest stock assessment data, and developed stronger management measures for the fishery, which likely explains the decrease in catch of scalloped hammerhead sharks. Since 1993, the harvest of scalloped hammerhead sharks has remained below 7,800 individuals, with the average annual harvest of this DPS from 1995-2005 only about a quarter of the pre-1990 levels (Hayes et al., 2009).

Using two forms of a surplus-production model, a logistic (Schaefer, 1954) and Fox (1970) model, Hayes et al. (2009) calculated annual fishing mortality (F), maximum sustainable yield (MSY), and the size (N) of both the unfished and fished scalloped hammerhead shark population in the U.S. Northwest Atlantic and Gulf of Mexico. Both models showed that overfishing is likely occurring ($F > F_{MSY}$) with a greater than 95 percent probability that the population is overfished ($N < N_{MSY}$). The logistic model estimated a population size in 2005 to be 35 percent (CI = 19 - 87 percent) of the population at MSY, with an estimated F of 114 percent (CI = 43 - 397 percent) of F_{MSY}, whereas the Fox model estimated the population size to be 45 percent (CI = 18 - 89 percent) of N_{MSY} and F to be 129 percent (CI = 54 - 341percent) of F_{MSY}. Both models estimated a depletion of around 83 percent from the virgin population size (in 1981). However, under a constant catch at the 2005 harvest level, the probability that the stock of scalloped hammerheads will rebuild within 30 years was estimated to be 91 percent (with rebuilding defined as reaching a population size greater than N_{MSY}).

Since 2005, the catches of this DPS have remained fairly low in all U.S. fishery sectors. In the Atlantic HMS fishery, an average of 25 vessels landed 181 hammerhead sharks per year from 2005 to 2009 on pelagic longline gear (based on logbook data). In bottom longline (BLL) hauls, observed catches of scalloped hammerhead sharks have varied by year. In 2007, 39 individuals were observed in the BLL catch. This number increased to 539 individuals in 2009, and then dropped 1 year later to 328, with S. lewini comprising ≤ 2.8 percent of the total number of sharks caught in the BLL hauls. However, comparisons of these catches should be made with caution, as the number of participating vessels, hauls, and trips vary greatly by year. In the gillnet fishery, the scalloped hammerhead shark is no longer a frequently caught bycatch species. In 2010, 4 drift gillnet vessels were observed making 14 sets on 8 trips. Out of the total 2,728 sharks caught during these trips, scalloped hammerhead sharks comprised only 1.2 percent (n = 33). In the sink gillnet fishery, 17 vessels were observed making 281 sets on 53 trips in 2010. A total of 3,131 sharks were caught, with scalloped hammerhead sharks comprising only 0.6 percent of this total (n = 19) (Passerotti et al., 2011). Recreational harvest of scalloped hammerhead sharks has also seen a decrease from the 1980s and early 1990 numbers, likely due to the establishment of bag limits beginning in 1993, and regulations limiting this fishery to only rod and reel and handline gear in 2003.

The ERA team ranked the threat of overutilization as a moderate risk, one that would contribute significantly to risk of extinction only in combination with other factors, such as low and decreasing abundance or inadequate regulatory mechanisms. However, given the increase in management of the fishery since the early 1990s, the subsequent infrequent occurrence of the species in fishing gear, the stable abundance numbers, and the fact that both the U.S. commercial and recreational harvest of this DPS have been below the recommended rebuilding catch levels since 2005 (which will allow abundance levels to increase in the foreseeable future), the ERA team concluded, and we agree, that the available data suggest that the current threat of overutilization by commercial and recreational fisheries has been greatly reduced, minimized by the effectiveness of the existing fishery management measures, and by itself will not contribute significantly to this DPS' risk of extinction in the foreseeable future.

Central & SW Atlantic DPS

The ERA team identified the threat of overutilization by industrial/commercial fisheries as a high risk and overutilization by artisanal fisheries as a moderate risk to the extinction of the Central & SW Atlantic DPS, with the threat projected to increase in the foreseeable future. Brazil, the country that reports one of the highest scalloped hammerhead landings in South America, maintains heavy industrial fishing of this species off its coastal waters. In the ports of Rio Grande and Itajai, annual landings of hammerhead sharks have fluctuated over the years, but have reached significantly high numbers. For example, in 1992, reported landings were approximately 30 mt but increased rapidly to 700 mt in 1994. From 1995 to 2002, catches decreased but fluctuated between 100 - 300 mt (Baum et al., 2007). FAO global capture production statistics from Brazil show a significant increase in catch of S. lewini, from 30 mt in 1999 to 262 mt in 2000. In 2001 and 2002, catches almost doubled to 507 mt and 508 mt, respectively, before decreasing to 87 mt in 2009.

High numbers of hammerhead sharks have also been removed by longliners fishing off the coast of South America. Data from a tuna fishery based in Santos City, São Paulo State, Brazil, revealed that although longliners mainly target tuna, sharks have become popular as incidental take (Amroim et al., 1998). In fact, from 1983 - 1994 Santos longliners began targeting sharks at least part of the time during their trips, and by 1993, sharks comprised approximately 60 percent of the total longline catch. The total hammerhead yield (includes S. lewini and S. zyganea) increased slightly from 1972 (7 mt) to 1988 (79 mt), and then more significantly to a maximum of 290 mt in 1990 (as did the number of longliners catching sharks). During the study period (from 1974 -1997), S. lewini catch was reported throughout the year and represented approximately 60 percent of the total hammerhead yield. After 1990, hammerhead yield exhibited a decreasing trend (to 59 mt in 1996), but this may have been a result of a change in gear from traditional Japanese longline to monofilament longline (Amorim et al., 1998). However, despite this change in gear, a follow-up study conducted from 2007-2008 found that São Paulo State longliners were still targeting sharks, and that the catch was dominated by shark species (catch composition: sharks = 49.2 percent, swordfish = 35.5 percent, billfish, tuna, other =15.3 percent) (Amorim et al., 2011). By weight, hammerheads represented only 6.3 percent of the total shark catch, or 37.7 mt, a decrease from the previously reported yield in 1996. Of the 376 hammerhead sharks caught, 131 (or 35 percent) were S. lewini (Amorim et al., 2011).

S. lewini is also commonly landed by artisanal fishers in the Central and Southwest

Atlantic, with concentrated fishing effort in nearshore and inshore waters, areas likely to be used as nursery grounds. In the Caribbean, specific catch and landings data are unavailable; however, S. lewini is often a target of artisanal fisheries off Trinidad and Tobago and Guyana, and anecdotal reports of declines in abundance, size, and distribution shifts of sharks suggest significant fishing pressure on overall shark populations in this region (Kyne et al., 2012). Additionally, Chapman et al. (2009) recently linked S. lewini fins from Hong Kong fin traders to the Central American Caribbean region, suggesting the lucrative fin trade may partially be driving the artisanal and commercial fishing of this DPS. Farther south, in Brazil, artisanal fisheries make up about 50 percent of the fishing sector, with many fishers focusing their efforts inshore on schools of hammerheads. Between 1993 and 2001, adult female S. lewini abundance in Brazil decreased by 60 – 90 percent due to this inshore fishing pressure (CITES, 2010). In 2004, Brazil recognized this threat of S. lewini overutilization in its waters and subsequently added the species to its list of over-exploited species (Normative Instruction MMA n° 05); however, this listing does not carry with it any prohibitions on fishing for the species. Thus, given the available data on catch trends, yields, fishing effort, and fin trade incentives, the ERA team concluded, and we agree, that the threat of overutilization alone is likely to contribute significantly to risk of extinction for the Central & SW Atlantic DPS.

Eastern Atlantic DPS

The ERA team identified the threat of overutilization by industrial/commercial fisheries as a high risk to the extinction of the Eastern Atlantic DPS, with the threat projected to increase in the foreseeable future. Although species-specific data are unavailable from this region, hammerheads are a large component of the bycatch in the European pelagic freezer-trawler fishery that operates off Mauritania. Between 2001 and 2005, 42 percent of the retained pelagic megafauna bycatch from over 1,400 freezer-trawl sets consisted of hammerhead species (S. lewini, S. zygaena, and S. mokarran) (Zeeberg et al., 2006). Of concern, especially as it relates to abundance and recruitment to the population, is the fact that around 75 percent of the hammerhead catch were juveniles of 0.50 – 1.40 m in length (Zeeberg et al., 2006).

In 2009, the European Union (EU) ranked second in the world for landings of sharks, rays, and chimaeras (according to FAO catch statistics), with landings estimated at 112,329 mt. The total amount of hammerhead sharks landed was 227 mt, with Spanish vessels responsible for 78 percent of the catch (178 mt), followed by Portugal (37 mt) (Shark Alliance, 2012). Although these vessels fish all over the world, they likely concentrate efforts in the Atlantic. In 2005, 85 percent of the overall reported Spanish shark catches were from the Atlantic Ocean (Shark Alliance, 2007), suggesting the Eastern Atlantic DPS of scalloped hammerhead sharks may be at risk from overutilization by these top EU shark fishing nations.

The threat of overutilization by artisanal fisheries was identified as a moderate risk to the extinction of the scalloped hammerhead shark, but is projected to increase under the weakly regulated and enforced fisheries of West Africa to match the increasing demand for food/protein in this region. In fact, estimates of per capita fish consumption is expected to increase from 2011 – 2021 in all continents except for Africa, where the population is growing faster than the supply (FAO, 2012). In the Sub Regional Fisheries Commission (SRFC) member countries (Cape-Verde, Gambia, Guinea, Guinea-Bissau, Mauritania, Senegal, and Sierra Leone), the population is predicted to increase from 35 million (in 2007) to around 76 million by 2050 (Diop and Dossa, 2011). The fact that around 78.4 percent of the population currently lives within 100 km of the coast means that there will likely be higher demand and fishing pressure on marine resources as the population continues to grow (Diop and Dossa, 2011). Already, around 96 percent of the fish stocks in the Eastern Central Atlantic are considered fully to overexploited (FAO, 2012). Because many of these West African countries depend on fish for dietary protein but also, as it relates to scalloped hammerhead sharks, as a source of income, the threat of overutilization is not likely to decrease.

According to FAO (2012), Africa is the continent with the highest proportion of its fleet operating in inland waters (42 percent), suggesting juveniles and neonates of this DPS may be in the most danger. And, in fact, large artisanal fisheries in Mauritania have been documented fishing great quantities of juvenile scalloped hammerhead sharks using driftnets and fixed gillnets (CITES, 2010), with S. lewini also caught in large numbers in the sciaenid fishery operating in this region. In 2010, the first year that it provided capture production statistics to FAO, Mauritania reported a total catch of 257 mt of S. lewini, the highest amount reported by any one country since 2003.

According to Diop and Dossa (2011), shark fishing has occurred in the SRFC member countries for around 30 years. Shark fisheries and trade in this region first originated in Gambia, but soon spread throughout the region in the 1980s and 1990s, as the development and demand from the worldwide fin market increased. From 1994 to 2005, shark catch reached maximum levels, with a continued increase in the number of boats, better fishing gear, and more people entering the fishery, especially in the artisanal fishing sector. Before 1989, artisanal catch was less than 4,000 mt (Diop and Dossa, 2011). However, from 1990 to 2005, catch increased dramatically from 5,000 mt to over 26,000 mt, as did the level of fishing effort (Diop and Dossa, 2011). Including estimates of bycatch from the industrial fishing fleet brings this number over 30,000 mt in 2005 (however, discards of shark carcasses at sea were not included in bycatch estimates, suggesting bycatch may be underestimated) (Diop and Dossa, 2011). In the SRFC region, an industry focused on the fishing activities, processing, and sale of shark products became well established. However, since 2005, there has been a significant and ongoing decrease in shark landings, with an observed extirpation of some species, and a scarcity of others, such as large hammerhead sharks (Diop and Dossa, 2011), indicating overutilization of the resource. From 2005 to 2008, shark landings dropped by more than 50 percent (Diop and Dossa, 2011). In 2010, the number of artisanal fishing vessels that landed elasmobranches in the SRFC zone was estimated to be around 2,500 vessels, with 1,300 of those specializing in catching sharks (Diop and Dossa, 2011).

Although species-specific data from this region are relatively poor, due to the lack of detailed catch reporting in many of the developing African countries, the ERA team concluded, and we agree, that the available commercial information, observations on fishing activities, and catch trends suggest that the threat of overutilization alone is likely to contribute significantly to risk of extinction for the Eastern Atlantic DPS.

Indo-West Pacific DPS

The ERA team identified the threat of overutilization by industrial/commercial and artisanal fisheries as a high risk to the extinction of the Indo-West Pacific DPS, with the threat projected to increase in the foreseeable future. High levels of commercial fishing that target sharks or catch them as bycatch occur in this DPS. Unfortunately, few studies on the specific abundance of S. lewini have been conducted in this DPS, making it difficult to determine the rate of exploitation of this species. One study, off the coast of Oman, found S. lewini to be among the most commonly encountered species in commercial landings from 2002 to 2003 (Henderson et al., 2007). However, in 2003, S. lewini experienced a notable decline in relative abundance and, along with other large pelagic sharks, was displaced by smaller elasmobranch species (a trend also reported by informal interviews with fisherman) (Henderson et al., 2007). Off East Lombok, in Indonesia, data provided to the FAO also suggest potential declines in the population as the proportion of scalloped hammerheads in the Tanjung Luar artisanal shark longline fishery catch decreased from 15 percent to 2 percent over the period of 2001 to 2011 (FAO, 2013). Additionally, CPUE data from South Africa and Australia shark control programs indicate significant declines (over 90 percent) of local scalloped hammerhead populations in this DPS, most likely a result from overharvesting, although it should be noted that these shark control programs were also assessed to have at least a medium causative impact on these localized depletions.

In other waters of this DPS, such as off the coasts of Maldives, Kenya, Mauritius, Seychelles, and the United Republic of Tanzania, shark populations are presumed to be fully to over-exploited (de Young, 2006). Likely contributing to the overexploitation of shark populations is the vast number of tuna fisheries prevalent within the range of this DPS, which are known to take substantial amounts of sharks as bycatch. In the Republic of the Marshall Islands EEZ, the tuna fishery alone accounted for annual longline catches ranging from 1,583 to 2,274 mt of sharks (over the period of 2005-2009) (Bromhead et al., 2012). The tuna purse seine fleet is also very active in this region and contributes to the incidental catch of scalloped hammerhead sharks. The recent addition of fleets entering the Western and Central Pacific Fishery

Commission (WCPFC) tropical fishery have brought the number of purse seine vessels up to 280, the highest it has been since 1972 (Williams and Terawasi, 2011). This is especially troubling given the species' susceptibility to being caught in large numbers in purse seine nets (Román-Verdesoto and Orozco-Zöller, 2005), although recent WCPFC observer data suggest otherwise (SPC, 2010). In fact, the WCPFC observer data, collected from 1994-2009, indicate that longline sets may pose more of a threat to non-target shark species than purse-seine sets in this convention area, but in terms of hammerhead sharks, observers reported only negligible catch but with high rates of finning in both types of sets (SPC, 2010). However, some fisheries operating in the WCPFC Convention Area have not been observed, such as the Chinese Taipei small scale tuna longline fleet, which reported a significant catch of 365 mt (preliminary estimate) of scalloped hammerhead sharks in the Convention Area in 2010 (Shark Year Magazine, 2011), and suggests reliance on observer data alone may not be a good indicator of scalloped hammerhead catch in this region.

Currently, the exact extent of fishing on this DPS by WCPFC vessels is unknown, as the WCPFC has only just recently designated hammerheads as key shark species for data collection (WCPFC, 2011) and many Cooperating Commission Member (CMM) and Cooperating Non-Member fleets have yet to provide this catch data, including fleets from among the top 20 countries reporting Pacific shark catches to the FAO. As of 2012, the CMMs that reported specific catches of hammerheads from 2011 in the WCPFC convention area included Australia, Papua New Guinea, Fiji, Chinese Taipei, and the European Union. The European Union reported only negligible catch of hammerheads, with Fiji and Australia reporting zero catches of scalloped hammerhead sharks. Papua New Guinea, which currently has an active shark longline fishery that is managed separately from its tuna longline fishery, reported catch from its domestic shark fishery to the WCPFC. This shark fishery operates entirely within Papua New Guinea's national waters, and is limited to 9 vessels, setting 1,200 hooks per day with a total allowable catch of 2,000 mt dressed weight per year (Usu et al., 2012). This fishery has seen substantial expansion since 2000, when there was only one active vessel with a reported catch of 143 sharks. However, in the last 4 years, an average of 7 vessels has actively fished for sharks, with an average catch of 56,528 sharks (Usu et al., 2012). In 2011, there were 9 active shark longline vessels, reporting the highest overall effort yet (27,934 hundred hooks), and subsequently reporting the highest catches of sharks to date (1,479.66 mt) (Usu et al., 2012). Hammerhead shark species comprised only 1.5 percent of the catch (22.34 mt), which was a decrease of 43 percent from the previous year and suggests that the intensive and targeted shark fishing effort may be contributing to the hammerhead population decline in these waters.

Many fisheries in this region are also driven primarily by the lucrative trade in shark fins. For example, in northern Madagascar, Robinson and Sauer (2011) documented an artisanal fishery that targets sharks primarily for their fins and discards the carcasses. Two shark families comprised the majority of the artisanal landings: Carcharhinidae accounted for 69 percent of the species and Sphyrnidae accounted for 24 percent (Robinson and Sauer, 2011). S. lewini was the most common species in the Sphyrnidae landings. In addition, many of these fishers operated in water shallower than 100 m and, consequently, over 96 percent of their scalloped hammerhead catch was comprised of immature individuals (Robinson and Sauer, 2011). Similarly, the shark fisheries operating in Antongil Bay in northeastern Madagascar commonly land only fins, rather than whole sharks, with the scalloped hammerhead shark as the most represented species in the shark fishery (Doukakis et al., 2011). Both adults, including pregnant females, and juveniles are harvested in the small and large-mesh artisanal gillnet and traditional beach seine fisheries, suggesting largely unregulated and targeted fishing of scalloped hammerhead sharks in a potential breeding ground (Doukakis et al., 2011).

Furthermore, four of the top five exporters of shark fins to Hong Kong (Singapore, Taiwan, Indonesia, and the United Arab Emirates) are located in this DPS' range. In 2008, these countries accounted for around 34 percent (or 3,384 mt) of the total exports of shark fins (both frozen and dried). Therefore, with the increased number of tuna fleets, evidence of declines in shark catch and populations in this DPS range, as well as the popularity of the scalloped hammerhead shark in the fin trade, the ERA team agreed that the threat of overutilization alone is likely to contribute significantly to the risk of extinction of the Indo-West Pacific DPS.

Central Pacific DPS

The ERA team identified the threat of overutilization by industrial/commercial fisheries as a moderate risk to the extinction of the Central Pacific DPS, with the threat projected to remain the same in the foreseeable future. Currently, scalloped hammerheads in this region are mainly caught as bycatch by pelagic longline and purse seine fleets. The Hawaii-based pelagic longline fishery has been in operation since approximately 1917, and underwent considerable expansion in the late 1980s to become the largest fishery in the state (Boggs and Ito, 1993). This fishery currently targets tunas and billfish and catches are frequently documented by mandatory observers (100 percent coverage for shallow-set sector and 25 percent for deep-set sector). From 1995-2006, the observer data indicated a very low catch of scalloped hammerhead sharks (56 individuals on 26,507 sets total, both fishery sectors combined). More recent observer data (2009

- 2011) from this fishery confirm that scalloped hammerhead sharks continue to be a very rare catch, commensurate with the earlier time period (Walsh et al., 2009; Walsh personal communication, 2012). In non-longline catch, hammerhead shark species are also rare, with a total of 11 sharks caught from 1990 - 1994 and 1995 - 1999, 6 caught from 2000 - 2004, 17 caught from 2005 -2009, and 6 caught from 2010 - 2011 (Seki and Kokubun personal communication, 2012). Although the ERA team identified overutilization by commercial fisheries as a threat, it ranked it as a moderate risk, one that would contribute significantly to risk of extinction only in combination with other factors, such as low and decreasing abundance or inadequate regulatory mechanisms. We do not believe that the observed low catch of this DPS is due to low population numbers since, as previously mentioned, abundance is high in this area due in part to the DPS' productive nursery grounds. Therefore, the low catch of S. lewini is likely due to the strict management and regulation of these commercial fisheries within this DPS range (see The Inadequacy of Existing Regulatory Mechanisms section below). As such, we conclude that the available data suggest that the threat of overutilization by commercial fisheries is ameliorated by high population abundance and effective existing management measures. We also agree with the ERA team's finding that the adequacy of regulatory mechanisms in minimizing the extinction risk of this DPS will only increase in the next 50 years, making it unlikely that the threat of overutilization will be a greater risk to the DPS' continued existence in the foreseeable future.

Eastern Pacific DPS

The ERA team identified the threat of overutilization by industrial/commercial fisheries and artisanal fisheries as a high risk to the extinction of the Eastern Pacific DPS, with the threat projected to increase in the foreseeable future. Although abundance data are lacking in this area, information from commercial and artisanal fisheries suggests heavy exploitation of this DPS. As an example, in central Mexico, the shark fishery, which began in the early 1940s, grew from catches of less than 5,000 mt in the early 1960s to catches of 25,000 mt in the late 1970s, and reached maximum exploitation in the 1980s and 1990s (Pérez-Jiménez et al., 2005). During this time, scalloped hammerheads were an important small shark species that was routinely caught on the southern coast of Sinaloa (Pérez-Jiménez et al., 2005; Bizzarro et al., 2009). From 1998-1999, scalloped hammerhead sharks comprised 54.4 percent of the elasmobranch catch and 43.1 percent of the total recorded catch (n =1,584 S. lewini individuals) based on surveys from 28 Sinaloa artisanal fishing sites (Bizzarro et al., 2009). In 2006, elasmobranch landings from this area comprised 16.5 percent of the national elasmobranch production, the most of any Mexican state, indicating S. lewini as a popular fished species in the Mexican shark fishery. S. lewini is also an important shark species in the artisanal fisheries operating elsewhere along the Mexican Pacific coast. From 2004 to 2005, S. lewini comprised 64 percent of the artisanal shark catch south of Oaxaca, Mexico (CITES, 2012). In the Gulf of Tehuantepec, scalloped hammerhead sharks constitute the second most important shark species targeted by Mexican fishers, comprising around 29 percent of the total shark catch from this region (INP, 2006). In fact, from 1996 to 2003, a total of 10,919 individual scalloped hammerhead sharks were landed from this area and brought to port in the Mexican state of Chiapas (INP, 2006), where S. lewini and C. falciformis represent 89.3 percent of the shark catch (CITES, 2012).

In Ecuador, sharks are mainly caught as incidental catch in a variety of fishing gear, including pelagic and bottom longlines, and drift and set gill nets, with scalloped hammerheads used primarily for the fin trade. A recent study by Jacquet et al. (2008) found that Ecuadorian mainland shark landings have been grossly underestimated. Through a reconstruction of catches by small-scale and industrial fishers using government reports and grey literature, Jacquet et al. (2008) estimated Ecuador mainland landings to be 6,868 mt (average) per year from 1979-2004, with small-scale fisheries representing 93 percent of the total landings. For the period of 1991-2004, the reconstructed estimates were 3.6 times greater than what was reported to the FAO. For the years following the study, Ecuadorian records from small-scale fisheries show significantly lower catches of the hammerhead complex and no clear trend. In 2004, total combined landings from ten of Ecuador's main small-scale fishing ports were approximately 149 mt. In 2005, this number decreased by about 67 percent to 49 mt but subsequently increased in the following years to reach a peak of 327 mt in 2008. In 2009, landings decreased again by around 71 percent, but tripled the following year to reach approximately 304 mt of hammerhead sharks in 2010 (INP, 2010).

In Costa Rica, shark catches reported by the artisanal and longline fisheries have shown a dramatic decline (approximately 50 percent) after reaching a maximum of 5,000 mt in 2000 (SINAC, 2012). According to the Costa Rican Institute of Fishing and Aquaculture, the estimated total catch of S. lewini by the coastal artisanal and longline fleet from 2004 - 2007 was 823 mt, which represented 3 percent of the national Costa Rican total catch of sharks for these years (SINAC, 2012).

Of major concern is that many of the artisanal fishers from the Eastern Pacific region are targeting schools of immature S. lewini due to the profitability of the younger shark meat (Arriatti, 2011), and likely negatively affecting recruitment to this DPS. In Panama, directed artisanal fishing for hammerheads has been documented in coastal nursery areas, with artisanal gillnet fishery catches dominated by neonate and juvenile S. lewini (Arriatti, 2011). Likewise, in Costa Rica, many of the identified nursery grounds for scalloped hammerheads are also popular elasmobranch fishing grounds and are heavily fished by gillnets (Zanella et al., 2009). From 2006 to 2007, artisanal fishers operating in the Gulf of Nicoya (central Pacific coast of Costa Rica) landed a total of 253 scalloped hammerhead sharks. The average total length of these sharks ranged from 75.45 – 87.92 cm, significantly below the maturity sizes that have been documented for this species (Zanella et al., 2009). In "Tres Marias" Islands and Isabel Island in the Central Mexican Pacific, Perez-Jimenez et al. (2005) found artisanal fishery catches dominated by immature individuals. Out of 1,178 females and 1,331 males caught from 1995-1996 and 2000-2001, less than 1 percent were mature (Perez-Jimenez et al., 2005). On the coast of Chiapas in Mexico, neonates (≤ 60cm TL) comprised over 40 percent of the Port of Madero catch from 1996 - 2003 (INP, 2006). Seasonal surveys conducted in Sinaloa, Mexico from 1998 - 1999 depict an active artisanal fishery that primarily targets early life stages of S. lewini, with only four specimens (out of 1,515) measuring > 200 cm stretched TL (Bizzarro et al., 2009). A comparison of landing sizes from this region between 1998 - 1999 and 2007 - 2008 revealed a significant decrease in S. lewini size, indicating a possible truncation of the size of the local population (Bizzarro et al., 2009). In Michoacán, hammerheads represent 70 percent of the catch, with fishing effort concentrated in breeding areas and directed towards juveniles and pregnant females (CITES, 2012) and reports of the artisanal fisheries filleting the embryos of S. lewini for domestic consumption (Smith et al., 2009). Overall, the data suggest heavy fishing pressure in scalloped hammerhead nursery areas by artisanal fisheries, with substantial takes of juveniles and neonates, and possibly pregnant females, of this DPS, which is likely to have devastating effects on the stock structure and size of the population, especially given the low productivity of the species.

Large numbers of scalloped hammerhead sharks are also caught as bycatch in industrial purse seine fisheries operating in the eastern Pacific (Román-Verdesoto and Orozco-Zöller, 2005). Since 1993, observers placed by the Inter-American Tropical Tuna Commission (IATTC) regional fishery management organization (RFMO) have recorded shark bycatch data onboard large purse seiners in the eastern Pacific. Unfortunately, much of this data is aggregated under the category of "sharks," especially data collected prior to 2005. In an effort to improve species identifications in these data, a 1-year shark characteristics sampling program was conducted to quantify at-sea observer misidentification rates. Román-Verdesoto and Orozco-Zöller (2005) used the program results and IATTC observer field notes to provide summaries of the spatial distributions, size composition, and species identification of the IATTC-observed bycatch of sharks in the eastern Pacific Ocean tuna purse-seine fishery. From 1993 to 2004, hammerhead sharks were caught in high numbers as bycatch and were most susceptible to the floating-objects type of purse seine set (Román-Verdesoto and Orozco-Zöller, 2005). From 2001 to 2003, their observed numbers in the tuna purse seine sets increased by approximately 166 percent to reach a maximum of 1,898 individuals. Although specific data on scalloped hammerhead numbers are unavailable, results from the 1-year sampling program suggest that scalloped hammerhead sharks may comprise around 54 percent of the total hammerhead bycatch (Román-Verdesoto and Orozco-Zöller, 2005). The IATTC observer data also revealed that the majority of the bycatch consisted of large hammerhead individuals (>150 cm TL).

Given the available data on catch trends and the heavy fishing effort targeting both juveniles and adults of the species, the ERA team concluded, and we agree, that the threat of overutilization by industrial/commercial and artisanal fisheries alone was likely to contribute significantly to risk of extinction for the Eastern Pacific DPS.

Competition, Disease, and Predation

The ERA team also wanted to examine whether competition, disease, and predation were potential threats to the scalloped hammerhead shark, but after reviewing the available data, ranked these factors as "no or very low risks," meaning these factors are unlikely to contribute significantly to any of the DPS' risk of extinction, either by themselves or in combination with other factors. Scalloped hammerhead sharks are apex predators and opportunistic feeders, with a diet composed of a wide variety of items, including teleosts, cephalopods, crustaceans, and rays (Compagno, 1984; Bush, 2003; Júnior et al., 2009; Noriega et al., 2011). Although there may be some prey species that have experienced population declines, no information exists to indicate that depressed populations of these prey species are negatively affecting the scalloped hammerhead shark abundance. Additionally, discovery of a possibly cryptic species of Sphyrna sp. was reported in the northwestern Atlantic (mainly from coastal North Carolina, South Carolina, and Florida) and most recently in the western South Atlantic (Southern Brazil) (Abercrombie et al., 2005; Quattro et al., 2006; Pinhal et al., 2012). This cryptic species is closely related to and morphologically very similar to the scalloped hammerhead shark (S. lewini); however, little is known about the life history or abundance of this species. Although it may compete for similar resources as the scalloped hammerhead shark, there are currently no available data to indicate it as a threat to the scalloped hammerhead shark's existence.

Furthermore, no information has been found to indicate that disease is a factor in scalloped hammerhead shark abundance. These sharks likely carry a range of parasites, such as external leeches (Stilarobdella macrotheca) and copepods (Alebion carchariae, A. elegans, Nesippus crypturus, Kroyerina scotterum); however, they have often been observed visiting parasite cleaning stations (Bester, n.d.) and no data exist to suggest these parasites are affecting S. lewini abundance.

Predation is also not thought to be a major threat to scalloped hammerhead abundance numbers. The most significant predator on scalloped hammerhead sharks is likely humans; however larger sharks, including adult S. lewini, are known to prey upon injured or smaller scalloped hammerheads. In Kāne'ohe Bay, Oahu, Clarke (1971) observed high predation on pups by adult scalloped hammerheads. Clarke (1971) also noted that the pup population remained high and suggested that new births may compensate for pup mortalities. Subsequently, Duncan and Holland (2006) examined mortality rates in this bay and estimated juvenile attrition to be 0.85 to 0.93 for the first year of life (includes both natural and fishing mortality, as well as emigration), a relatively high rate for a nursery habitat. However, the authors concluded that weight loss, and not predation, significantly contributed to the high natural mortality of the shark pups, and suggested the popularity of the nursery ground was due to its value as a refuge from predation. In the northwestern Pacific, Liu and Chen (1999) estimated a significantly lower attrition rate for age zero S. lewini sharks (0.558/year), with natural mortality rates decreasing even further to 0.279/year for sharks aged 1 – 15 years. The ERA team noted that there are no major predators of adult scalloped hammerhead sharks.

Based on the available data, we conclude that it is unlikely that the threats of competition, disease, or predation is contributing on its own or in combination with other factors to the extinction risk of any of the six DPSs evaluated.

The Inadequacy of Existing Regulatory Mechanisms

The ERA team evaluated existing regulatory mechanisms to determine whether they may be inadequate to address threats to each of the scalloped hammerhead DPSs. Existing regulatory mechanisms may include Federal, state, and international regulations. Below is a brief description and evaluation of current and relevant domestic and international management measures that affect each scalloped hammerhead shark DPS. More information on these domestic and international management measures can be found in the status review report (Miller et al., 2013).

NW Atlantic & GOM DPS

The Atlantic HMS Management Division within NMFS develops regulations for Atlantic HMS fisheries, and primarily coordinates the management of Atlantic HMS fisheries in Federal waters (domestic) and the high seas (international), while individual states establish regulations for HMS in state waters. The NMFS Atlantic HMS Management Division currently manages 39 species of sharks (excluding spiny dogfish, which is managed jointly by the New England and Mid-Atlantic Fishery Management Councils, and smooth dogfish, which will be managed by the HMS Management Division) under the Consolidated HMS FMP (NMFS, 2006). The management of these sharks is divided into four species groups: large coastal sharks (LCS), small coastal sharks (SCS), pelagic sharks, and prohibited sharks. The LCS complex is further divided into sandbar sharks and non-sandbar sharks, with different management measures for each group. Scalloped hammerhead sharks are currently managed within the non-sandbar LCS complex with established acceptable biological catch levels to control harvest.

Every year, NMFS monitors the different commercial shark quota complexes and will close the fishing season for each fishery after 80 percent of the respective quota has been landed or is projected to be landed. The non-sandbar LCS commercial quota is split between the Gulf of Mexico and the Atlantic regions. One way that NMFS controls and monitors this commercial harvest is by requiring U.S. commercial Atlantic HMS fishers who fish for or sell scalloped hammerhead sharks to have a Federal Atlantic Directed or Incidental shark limited access permit. These permits are administered under a limited access program, and NMFS is no longer issuing new shark permits. Currently, 214 U.S. fishers are permitted to target sharks managed by the HMS Management Division in the Atlantic Ocean and Gulf of Mexico, and an additional 285 fishers are permitted to land sharks incidentally. A directed shark permit allows fishers to retain 36 LCS, including scalloped hammerhead sharks, per vessel per trip whereas an incidental permit allows fisherman to retain up to 3 LCS, including scalloped hammerhead sharks, per vessel per trip. These limits apply to all gear; however, starting in 2011, pelagic longline fishers have been prohibited from retaining, possessing, or landing any hammerhead sharks, including scalloped hammerhead sharks, due to Recommendation 10-08 from the International Commission for the Conservation of Atlantic Tunas (ICCAT) (76 FR 53652; August 29, 2011). In addition to permitting and trip limit requirements, logbook reporting or carrying an observer onboard may be required for selected commercial fishers. The head may be removed and the shark may be gutted and bled, but the shark cannot be filleted or cut into pieces while onboard the vessel.

Scalloped hammerhead sharks may also be retained recreationally with either rod and reel or handline gear. Scalloped hammerheads that are kept in the recreational fishery must have a minimum size of 54 inches (4.5 feet) fork length, and only one shark, which could be a scalloped hammerhead, may be kept per vessel per trip. When NMFS implemented ICCAT's Recommendation 10-08, NMFS prohibited hammerhead sharks, including scalloped hammerhead sharks, from being retained, possessed, or landed by recreational fishermen if there is a tuna, swordfish, or billfish onboard the vessel (76 FR 53652; August 29, 2011). Since 2008, recreational fishers have been required to land all sharks with their head, fins, and tail naturally attached.

Individual state fishery management agencies have authority for managing fishing activity in state waters, which usually extends from zero to three nautical miles (5.6 km) off the coast in most cases, and zero to nine nautical miles (16.7 km) off Texas and the Gulf coast of Florida. In the case of federally permitted shark fishers, fishers are required to follow Federal regulations in all waters, including state waters, unless the state has more restrictive regulations. To aid in enforcement and reduce confusion among fishers, in 2010, the Atlantic States Marine Fisheries Commission, which regulates fisheries in state waters from Maine to Florida, implemented a Coastal Shark Fishery Management Plan that mostly mirrors the Federal regulations for sharks, including scalloped hammerhead sharks. States in the Gulf of Mexico and territories in the Caribbean Sea have also implemented regulations that are mostly the same as the Federal regulations for sharks, including scalloped hammerhead sharks. However, the state of Florida, which has the largest marine recreational fisheries in the United States and the greatest number of HMS angling permits, recently went even further than Federal regulations to protect the scalloped hammerhead shark by prohibiting the harvest, possession, landing, purchasing, selling, or exchanging any or any part of a hammerhead shark (including scalloped, smooth, and great hammerheads) caught in its waters (Florida Fish and Wildlife Conservation Commission, effective January 1, 2012).

The ERA team determined, and we agree, that existing domestic management measures implemented under U.S. Federal and state authorities are adequate to substantially reduce the primary threats contributing to the extinction risk of the NW Atlantic & GOM DPS. The existing regulatory mechanisms, which strictly manage and control exploitation of the species by commercial and recreational fisheries, are likely to contribute significantly to stabilizing and increasing abundance of this DPS. Based on an analysis of recreational and commercial catch and landings data from the early 1980s through 2005, the Hayes et al. (2009) stock assessment showed that a total allowable catch (TAC) of 2,853 scalloped hammerhead sharks would allow for a greater than 70 percent probability of rebuilding the stock within 10 years, an 85 percent probability of rebuilding within 20 years, and a 91 percent probability of rebuilding within 30 years. Under existing Federal shark regulations, the average total scalloped hammerhead shark mortality from 2006 - 2010 was less than this Hayes et al. (2009) TAC recommendation, suggesting current regulatory measures are adequate to protect the scalloped hammerhead shark from risk of extinction. Furthermore, because NMFS made an "overfished" and "overfishing" status determination of the scalloped hammerhead stock (76 FR 23794; April 28, 2011), it is mandated to implement additional conservation and management measures by 2013, providing additional protection for the scalloped hammerhead shark stock from overexploitation. Proposed conservation efforts are evaluated below in accordance with ESA Section 4(b)(1)(A).

Although the ERA team considered the threat of inadequate regulatory measures as a low risk to the extinction of this scalloped hammerhead shark population, it expressed concerns about the level of IUU fishing of this DPS. Since the mid-1990s, the U.S. Coast Guard has documented Matamoros Mexican vessels illegally fishing in the area surrounding South Padre Island, Texas (Brewster-Geisz and Eytcheson, 2005). The Mexican IUU fishers use gillnet and longline gear to catch sharks for the fin trade, the majority of which are blacktips and hammerheads. Based on data from 2000 - 2005, Brewster-Geisz and Eytcheson (2005) estimated that Mexican fishers are illegally catching anywhere from 3 to 56 percent of the total U.S. Atlantic commercial shark quota, and between 6 and 108 percent of the Gulf of Mexico regional commercial quota, indicating a high degree of uncertainty in these estimates. Updated data since 2005 show a decrease in the number of detected incursions (Brewster-Geisz et al., 2010); however, the extent of IUU fishing on the scalloped hammerhead sharks in the Gulf of Mexico remains unknown. In 2012, Mexico established an annual shark fishing prohibition in its jurisdictional Gulf of Mexico waters (from May 1 to June 30) (DOF, 2012), which may also help deter future IUU fishing by its fishers, at least during the prohibitive period.

Central & SW Atlantic DPS

In addition to its jurisdiction in NW Atlantic & GOM DPS waters, the United States also has jurisdiction over a very small portion of this DPS range, specifically the U.S. EEZ around Puerto Rico and the U.S. Virgin Islands (as defined in 50 CFR 622.2), where Federal fishing laws apply. NMFS recently published an amendment to the Consolidated HMS FMP which specifically addresses Atlantic HMS fishery management measures in the U.S. Caribbean territories (77 FR 59842; Oct. 1, 2012). Due to substantial differences between some segments of the U.S. Caribbean HMS fisheries and the HMS fisheries that occur off the mainland of the

United States (including permit possession, vessel size, availability of processing and cold storage facilities, trip lengths, profit margins, and local consumption of catches), NMFS implemented measures to better manage the traditional small-scale commercial HMS fishing fleet in the U.S. Caribbean Region. Among other things, this rule created an HMS Commercial Caribbean Small Boat (CCSB) permit, which: allows fishing for and sales of big eye, albacore, yellowfin, and skipjack tunas, Atlantic swordfish, and Atlantic sharks within local U.S. Caribbean market; collects HMS landings data through existing territorial government programs; authorizes specific gears; is restricted to vessels less than or equal to 45 feet (13.7 m) length overall all; and may not be held in combination with any other Atlantic HMS vessel permits. However, at this time, fishers who hold the CCSB permit are prohibited from retaining Atlantic sharks, and are restricted to fishing with only rod and reel, handline, and bandit gear under the permit. Both the CCSB and Atlantic HMS regulations will help protect scalloped hammerhead sharks, but only within the U.S. EEZ around Puerto Rico and the U.S. Virgin Islands and from fishers under U.S. jurisdiction.

Many other foreign commercial and artisanal fisheries operate within the range of this DPS, with little to no regulatory oversight, and thus existing regulations are likely inadequate to reduce the most significant threats to the scalloped hammerhead shark population. For example, artisanal gillnet fisheries, known for their substantial bycatch problems, are still active in Central America, with many allowed to operate in inshore nursery areas. Due in large part to the number of sovereign states found in this region, the management of shark species in Central America and the Caribbean remains largely disjointed, with some countries lacking basic fisheries regulations (Kyne et al., 2012). Other countries lack the capabilities to enforce what has already been implemented. The Organization of the Fisheries and Aquaculture Section of the Central American Isthmus (OSPECA) was formed to address this situation by assisting with the development and coordination of fishery management measures in Central America. OSPECA recently approved a common regional finning regulation for eight member countries from the Central American Integration System (SICA) (Belize, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Nicaragua, and Panama). The regulation specifically requires sharks to be landed with fins still attached for vessels fishing in SICA countries or in international waters flying a SICA country flag. If fins are to be traded in a SICA country, they must be accompanied by a document from the country of origin certifying that they are not the product of finning (Kyne et al., 2012). Other Central American and Caribbean country-specific regulations include the banning or restriction of longlines in certain fishing areas (Bahamas, Belize, Panama), seasonal closures (Guatemala), shark fin bans (Colombia, Mexico, Venezuela) and the prohibition of shark fishing (Bahamas and Honduras). Unfortunately, enforcement of these regulations is weak, with many reports of illegal and unregulated fishing activities. For example, in May 2012, the Honduran navy seized hundreds of shark fins from fishers operating illegally within the borders of its shark sanctuary. As Kyne et al. (2012) reports, it is basically common practice to move shark fins across borders for sale in countries where enforcement is essentially lacking in this region.

In South America, Brazil has also banned finning, but continues to find evidence of IUU fishing in its waters. In Belém in May 2012, the Brazilian Institute of Environmental and Renewable Natural Resources (IBAMA) seized around 7.7 mt of illegally obtained dried shark fins intended for export to China (Nickel, 2012). A few months later, IBAMA confiscated more than 5 mt of illegal shark fins in Rio Grande do Norte (Rocha de Medeiros, 2012), suggesting current regulations and enforcement are not adequate to deter or prevent illegal shark finning. In fact, it is estimated that illegal fishing constitutes 32 percent of the Southwest Atlantic region's catch (based on estimates of illegal and unreported catch averaged over the years of 2000 to 2003; Agnew et al., 2009).

In addition, heavy industrial fishing off the coast of Brazil, with the use of drift gillnets and longlines, remains largely unregulated, as does the intensive artisanal fishery which accounts for about 50 percent of the fishing sector. Brazil currently has regulations limiting the extension of pelagic gillnets and prohibiting trawls in waters less than 3 nautical miles (5.6 km) from the coast; however, as is the case with many regulations affecting this DPS, inadequate enforcement of these laws has led to continued fishing in these inshore nursery areas and resultant observed declines in both adult and juvenile scalloped hammerhead abundance (Amorim et al., 1998; Kotas, 2008; CITES, 2010). Brazil is also presently working on implementing new regulations to enforce recent ICCAT recommendations (Hazin personal communication, 2012). ICCAT is the RFMO responsible for the conservation of tunas and tuna-like species in the Atlantic Ocean and its adjacent seas, and, as mentioned previously, adopted Recommendation 10-08 prohibiting the retention of hammerheads caught in association with ICCAT-managed fisheries. Each Contracting Party to ICCAT is responsible for implementing this recommendation. Many countries within the Central & SW Atlantic DPS range are Contracting Parties to ICCAT, including Brazil, Venezuela, Panama, Honduras, Nicaragua, Belize, Trinidad & Tobago, Barbados, and St Vincent & the Grenadines. ICCAT Recommendation 10-08 includes a special exception for developing coastal States, allowing them to retain hammerhead sharks for local consumption provided that they report their catch data to ICCAT, endeavor not to increase catches of hammerhead sharks, and take the necessary measures to ensure that no hammerhead parts enter international trade. As this exception allows hammerheads to be retained under certain circumstances, it may provide a lesser degree of protection for hammerhead sharks in the developing coastal States that choose to take advantage of the exception.

Given the information above, the ERA team ranked both IUU fishing and the inadequacy of current regulatory mechanisms as moderate risks. We agree that these factors, in combination with others (such as overutilization and low species productivity), likely contribute significantly to the Central & SW Atlantic DPS risk of extinction.

Eastern Atlantic DPS

The ICCAT convention area also covers the range of the Eastern Atlantic DPS, providing some protection for scalloped hammerheads; however, again, given the special exception available to developing coastal States for local consumption, Recommendation 10-08 provides a lesser degree of protection for hammerhead sharks in those fisheries. Given this exception, the management measures that may be implemented to achieve the ICCAT recommendation may not be adequate to protect the shark from overutilization. Within the range of this DPS, many of the countries that would qualify under this exemption, mainly those countries along the west coast of Africa, also have weak or poorly enforced country-specific shark fisheries regulations. In other words, these countries will be able to continue fishing for scalloped hammerhead sharks with little to no regulation on the harvest of the species and existing regulatory mechanisms in these areas are not considered adequate to control or reduce the primary threats to this DPS.

In Europe, the European Parliament recently passed a proposal prohibiting the removal of shark fins by all vessels in EU waters and by all EU-registered vessels operating anywhere in the world. Previously, the EU prohibited shark finning, but allowed fins and bodies to be landed in different ports, resulting in enforcement difficulties, and allowed justified exceptions and special permits for finning, essentially diminishing the effectiveness of the finning ban. In 2009, the EU accounted for up to 17 percent of the global shark catch, and is the largest exporter of shark products to markets in mainland China and Hong Kong. Therefore, in an effort to close the loopholes in the original shark fin regulations and discourage the wasteful practice of finning, the European Parliament passed the proposal requiring fins be attached to landed sharks. This proposal is expected to be approved by member states, which will make the draft law definitive.

Many individual European countries have already implemented measures to stop the practice of finning and conserve shark populations. For example, England and Wales banned finning in 2009 and no longer issue special permits for finning exceptions. France prohibits on-board processing of sharks, and Spain recently passed a regulation in 2011 that prohibits the capture, injury, trade, import and export of scalloped hammerhead sharks, with a periodic evaluation of their conservation status. Given that Spain is Europe's top shark fishing nation, accounting for 7.3 percent of the global shark catch, and was the world's largest exporter of shark fins to Hong Kong in 2008, this new regulation should provide significant protection for scalloped hammerhead sharks from Spanish fishing vessels.

Although regulations in Europe appear to be moving towards the sustainable use and conservation of shark species, these strict and enforceable regulations do not extend farther south in the Eastern Atlantic, where the majority of scalloped hammerhead sharks are caught. Some western African countries have attempted to impose restrictions on shark fishing; however, these regulations either have exceptions, loopholes, or poor enforcement. For example, Mauritania has created a 6,000 km^2 coastal sanctuary for sharks and rays, prohibiting targeted shark fishing in this region; however, sharks, such as the scalloped hammerhead, may be caught as bycatch in nets. Many other countries, such as Namibia, Guinea, Cape-Verde, Sierra Leone, and Gambia, have shark finning bans, but even with this regulation, scalloped hammerhead sharks are may be caught with little to no restrictions on harvest numbers. According to Diop and Dossa (2011), fishing in the SRFC region now occurs year-round, including during shark breeding season, and, as such, both pregnant and juvenile shark species may be fished, with shark fins from fetuses included on balance sheets at landing areas. Many of these state-level management measures also lack standardization at the regional level (Diop and Dossa, 2011), which weakens some of their effectiveness. For example, Sierra Leone and Guinea both require shark fishing licenses; however, these licenses are much cheaper in Sierra Leone, and as a result, fishers from Guinea fish for sharks in Sierra Leone (Diop and Dossa, 2011). Also, although many of these countries have recently adopted FAO recommended National Plans of Action – Sharks, their shark fishery management plans are still in the early implementation phase, and with few resources for monitoring and managing shark fisheries, the benefits to sharks from these regulatory mechanisms (such as reducing the threat of overutilization) have yet to be realized (Diop and Dossa, 2011).

In addition, reports of IUU fishing are prevalent in the waters off West Africa and account for around 37 percent of the region's catch, the highest regional estimate of illegal fishing worldwide (Agnew et al., 2009; EJF, 2012). From January 2010 to July 2012, the UK-based non-governmental organization Environmental Justice Foundation (EJF) conducted a surveillance project in southern Sierra Leone to determine the extent of IUU fishing in waters off West Africa (EJF, 2012). The EJF staff received 252 reports of illegal fishing by industrial vessels in inshore areas, 90 percent of which were bottom trawlers, with many vessels exporting their catches to Europe and East Asia (EJF, 2012). The EJF (2012) surveillance also found these pirate industrial fishing vessels operating inside exclusion zones, using prohibited fishing gear, refusing to stop for patrols, attacking local fishers and destroying their gear, and fleeing to neighboring countries to avoid sanctions. Due to a lack of resources, many West African countries are unable to provide effective or, for that matter, any enforcement, with some countries even lacking basic monitoring systems. These deficiencies further increase the countries' susceptibility to IUU fishing, resulting in heavy unregulated fishing pressure and likely overexploitation of their fisheries.

Overall, the ERA team ranked the inadequacy of existing regulatory measures and IUU fishing as moderate risks to the entire Eastern Atlantic DPS. However, since this DPS is most abundant off waters of West Africa, we conclude that the threats concentrated in this area would not be greatly minimized by increased conservation measures within European waters. The available data suggest that illegal fishing is a serious and rampant problem in West African waters, and with lack of enforcement of existing regulations and weak management of the fisheries in this area, as evidenced by the observed substantial and largely unregulated catches of both adult and juvenile hammerheads by artisanal fishers in this region, we agree with ERA team's findings and conclude that the combination of both the inadequacy of existing regulatory measures and IUU fishing are contributing significantly to the risk of extinction of this DPS. The ERA team concluded that the threat of IUU fishing is also projected to increase as current regulatory mechanisms are expected to remain the same in the foreseeable future. We agree that the threat of IUU fishing is likely to increase in the next 50 years without effective fishery management regulations and enforcement in this DPS range.

Indo-West Pacific DPS

Multiple RFMOs cover the Indo-West Pacific DPS area, including the Indian Ocean Tuna Commission in the Indian Ocean and the WCPFC in the western Pacific. Currently, these RFMOs require the full utilization of any retained catches of sharks, with a regulation that onboard fins cannot weigh more than 5 percent of the weight of the sharks. These regulations are aimed at curbing the practice of shark finning, but do not prohibit the fishing of sharks. In addition, these regulations may not even be effective in stopping finning of scalloped hammerheads, as a recent study found the scalloped hammerhead shark to have an average wet-fin-to-round-mass ratio of only 2.13 percent (n=81; Biery and Pauly, 2012). This ratio suggests that fishing vessels operating in these RFMO convention areas would be able to land more scalloped hammerhead shark fins than bodies and still pass inspection. There are no scalloped hammerhead-specific RFMO management measures in place for this region, even though this DPS is heavily fished. Subsequently, this species has seen population declines off the coasts of South Africa and Australia, so much so that in 2012, New South Wales listed it as an endangered species.

Few countries within the Indian Ocean have regulations aimed at controlling the exploitation of shark species. Off northern Madagascar, where there is an active artisanal fin fishery, sharks are an open access resource, with no restrictions on gear, established quotas, or fishing area closures (Robinson and Sauer, 2011). On the other hand, Oman, Seychelles, Australia, South Africa, and Taiwan all have measures to prevent the waste of shark parts and discourage finning. The Maldives have even designated their waters as a shark sanctuary. However, many of the top shark fishing nations and world's exporters of fins are located within the range of this DPS, and have little to no regulation (or enforcement) of their shark fisheries. For example, Indonesia, which is the top shark fishing nation in the world, does not currently have restrictions pertaining to shark fishing or finning. Indonesian small-scale fisheries, which account for around 90 percent of the total fisheries production, are not required to have fishing permits (Varkey et al., 2010), nor are their vessels likely to have insulated fish holds or refrigeration units (Tull, 2009), increasing the incentive for shark finning by this sector (Lack and Sant, 2012). Ultimately, their fishing activities remain largely unreported (Varkey et al., 2010), which suggests that the estimates of Indonesian shark catches are greatly underestimated. In fact, in Raja Ampat, an archipelago in Eastern Indonesia, Varkey et al. (2010) estimated that 44 percent of the total shark catch in 2006 was unreported (including small-scale and commercial fisheries unreported catch and IUU fishing).

Although Indonesia adopted an FAO recommended shark conservation plan (National Plan of Action – Shark) in 2010, due to budget constraints, it can only focus its implementation of key conservation actions in one area, East Lombok (Satria et al. 2011). The current Indonesian regulations that pertain to sharks are limited to those needed to conform to international agreements (such as trade controls for certain species listed by CITES (e.g. whale shark) or prescribed by RFMOs) (Fischer et al., 2012). Due to this historical and current absence of shark management measures, especially in the small-scale fisheries sector, many of the larger shark species in Indonesian waters have already been severely overfished. In the late 1990s, Indonesian fishers noticed this decline in shark species and began moving south from the South China Sea and Gulf of Thailand to the waters of northern Australia in order to hunt for shark fins (Field et al., 2009). After 2001, Australian Customs patrol reported a large increase in the number of IUU vessel sightings, mainly from Indonesia, with a peak occurring in late 2005 and early 2006 (Field et al., 2009). During 2006, more than 4,000 small traditional vessels were spotted by aerial surveys, with an average of 22 IUU vessels fishing per day (Field et al., 2009). Since this peak, there has been a decline in IUU fishing in Australian waters, thought to be due to exhaustion of stocks in easily accessible regions near the Australian EEZ, as well as international government agreements and domestic policies (Field et al., 2009). Between July 2008 and June 2012, only 60 Indonesian vessels targeting sharks were apprehended (Lack and Sant, 2012). Because illegal shark fishing is often unreported, there is a lack of information available on the species composition of the IUU shark catch. However, using a small collection of shark fins that were confiscated from IUU fishers in northern Australian waters, the Commonwealth Scientific and Industrial Research Organisation identified that 8.8 percent of the illegal fins belonged to S. lewini. Only one other shark species, the whitecheek shark (Carcharhinus dussumieri), was a source of more fins (27.9 percent) (Lack and Sant, 2008).

In addition to within the Australian EEZ, IUU fishing, especially for shark fins, has been reported in other waters throughout this DPS range. The following are documented cases of IUU fishing as compiled by Paul (2009). In 2008, off the coast of Africa, a Namibian-flagged fishing vessel was found fishing illegally in Mozambican waters, with 43 mt of sharks and 4 mt of shark fins onboard. In 2009, a Taiwanese-flagged fishing trawler was found operating illegally in the South Africa EEZ with 1.6 mt of shark fins onboard without the corresponding carcasses. Also in 2009, 250 trawlers were found to be poaching sharks in coastal areas in the Bay of Bengal with the purpose of smuggling the sharks to Myanmar and Bangkok by sea. There are also reports of traders exploiting shark populations in the Arabian Gulf due to the lack of United Arab Emirates enforcement of finning regulations. In the Western Pacific, in 2007, a Taiwanese-flagged tuna boat was seized in Palau for IUU fishing and had 94 shark bodies and 650 fins onboard. In 2008, a Chinese-flagged fishing vessel was arrested by the Federated States of Micronesia (FSM) National Police for fishing within the FSM's EEZ. Based on the number of fins found onboard, there should have been a corresponding 9,000 bodies; however, only 1,776 finned shark bodies were counted.

In Somalia, it is estimated that around 700 foreign-owned vessels are operating in Somali waters without proper licenses, and participating in unregulated fishing for highly-valued species like sharks, tunas, and lobsters (HSTF, 2006). A study that provided regional estimates of illegal fishing (using FAO fishing areas as regions) found the Western Central Pacific (Area 71) and Eastern Indian Ocean (Area 57) regions to have relatively high levels of illegal fishing (compared to the rest of the regions), with illegal and unreported catch constituting 34 and 32 percent of the region's catch, respectively (Agnew et al., 2009).

Due to the historical exploitation of shark stocks, current levels of IUU fishing, and noticeable decline in shark stocks, many Pacific Island countries have created shark sanctuaries in their respective waters, including Tokelau, Palau, Marshall Islands, American Samoa, Cook Islands, and French Polynesia; however, enforcement in these waters has proven difficult. Due to the small size of these Pacific Island countries, many simply lack the resources to effectively patrol their expansive oceanic territory. For example, the country of Palau has only one patrol boat to enforce fishing regulations in its 604,000 km^2 of ocean waters (Turagabeci, 2012). Because of the relatively weak enforcement and potential for large catches of sharks in protected waters, IUU vessels are known to fish in these areas, as mentioned above, and have been found removing thousands of pounds of shark products from these waters (Paul, 2009; AFP, 2012; Turagabeci, 2012). So although the creation of shark sanctuaries is on the rise, especially in areas of known S. lewini nursery grounds and “hot spots” in this DPS’ range, the protections that they afford the Indo-West Pacific DPS may be minimal if IUU fishing is not controlled. Thus, the ERA team ranked the threat of IUU fishing as a high risk and the inadequacy of current regulatory mechanisms as a moderate risk to the extinction of the Indo-West Pacific DPS now. The ERA team predicted that regulatory measures may increase in the foreseeable future, especially in nations that currently lack fishing regulations, but that the threat of IUU fishing of this DPS will remain the same. We agree with the ERA team’s findings. Although nations may implement new, or further strengthen existing, fishery management measures that may help protect this DPS from overutilization, without effective enforcement of these regulations, the benefits of these measures may not be realized.

Central Pacific DPS

Significant fishery management measures in the Central Pacific help to protect this DPS from overfishing. As there are no directed shark fisheries on this DPS, the biggest threat to the scalloped hammerhead sharks comes from the Hawaii-based pelagic longline fishery. This fishery, the largest in the state, currently targets tunas and billfish and is managed under the auspices of the WPFMC. Due to the mostly unregulated historical take that occurred in this fishery, and the demand to continue fishery operations, the WPFMC implemented strict management controls for this fishery. Although scalloped hammerheads are only caught as bycatch in this longline fishery, the measures that regulate their operations have helped to protect this species from population declines. Some of these regulations include mandatory observers, designated longline buffer zones, areas of prohibited fishing, and periodic closures and effort limits. Since 1995, an observer program has been in place with targeted coverage of 25 percent in the deep-set longline sector and 100 percent in the shallow-set sector. This program has provided valuable information on the number of scalloped hammerheads caught as bycatch in the fishery. Since many protected species can also be found in this DPS' range, the regulations aimed at minimizing interactions with these species also protects scalloped hammerhead sharks. For example, the Northwestern Hawaiian Island (NWHI) Protected Species Zone prohibits longline fishing within a 50 nautical mile (92.6 km) radius from the centers of the Northwestern Hawaiian Islands and atolls. Commercial fishing is also prohibited within the boundaries of the Marine National Monuments. Around the Main Hawaiian Islands, areas have been designated as closed to longline fishing year-round or open only at certain times of the year. These regulations are strongly enforced, with catch and bycatch of species regularly monitored.

Additionally, several regulatory mechanisms ban the practice of finning, which offer a level of protection to this DPS from overutilization for the shark fin trade. The U.S. Shark Conservation Act of 2010 requires that sharks lawfully harvested in Federal waters, including those located in the range of this DPS, and be landed with their fins naturally attached. In 2000, Hawaii made it unlawful to harvest or land shark fins in the state or territorial waters of the state. These regulatory measures have effectively reduced the harvest of sharks from the DPS and export of shark fins from the region to Hong Kong (Clarke et al., 2007). Additionally, in July

2010, the State of Hawaii enacted additional legislation aimed at curbing shark finning (State of Hawaii SB2169), which may further reduce this threat.

Overall, the strict management of the Hawaii-based pelagic longline fisheries, the additional implemented measures aimed at minimizing protected species interactions, and the current catch data from observers and scientists suggest the regulations in place in this region are adequate to protect the Central Pacific DPS from the threat of extinction. Therefore, the ERA team ranked the threat of inadequate current regulatory mechanisms as a low risk and felt it was unlikely to contribute significantly to this DPS' risk of extinction.

Eastern Pacific DPS

Similar to the RFMO regulations found in the Indo-West Pacific DPS, the RFMO that covers the Eastern Pacific DPS area, the Inter-American Tropical Tuna Commission (IATTC), requires the full utilization of any retained catches of sharks, with a regulation that onboard fins cannot weigh more than 5 percent of the weight of the sharks. Again, these regulations are aimed at curbing the practice of shark finning, but do not prohibit the fishing of sharks, and, as mentioned previously, the fin-to-carcass ratio of 5 percent may not even be effective in protecting scalloped hammerhead sharks from being finned. Although there are no scalloped hammerhead-specific RFMO management measures in place for this DPS, many of the measures implemented by the IATTC are aimed at protecting non-target species caught by tuna purse-seine vessels. In addition, the IATTC encourages the release of live sharks, especially juveniles that are caught incidentally and are not used for food and/or subsistence in fisheries for tunas and tuna-like species. The IATTC also monitors fishing activities, recommending maximum catch limits for longline vessels based on recent stock assessment data and issuing closures to purse-seine vessels in the convention area. Since hammerheads are frequently a bycatch species in purse-seine nets, these closures should provide extra protection for the Eastern Pacific DPS.

In the west-coast based U.S. fisheries, hammerheads are rarely caught. This is likely due to the fact that the core scalloped hammerhead range is located to the south and west of the U.S. West Coast EEZ (Compagno, 1984). Additionally, recent regulations that prohibit shallow longline sets, restrict specific types of fishing gear, and close various areas to fishing have also contributed to the rare catch of hammerheads in the U.S. Pacific fisheries. In 2004, NMFS issued a final rule that prohibited shallow longline sets on the high seas in the Pacific Ocean by vessels managed under the FMP for U.S. West Coast Fisheries for HMS. Vessels under this FMP, however, are permitted to target tunas with deep-set longline gear in the high seas zone outside the U.S. EEZ, but the number participating is small. During the 2009/2010 fishing season, fewer than three vessels, with 100 percent observer coverage, participated in this deep-set pelagic longline fishery (PFMC, 2011). The California/Oregon drift gillnet fishery is another U.S. west-coast based fishery where hammerheads may be caught as bycatch. In this fishery, target species are mainly swordfish and common thresher sharks. The majority of fishing effort takes place from August through January within the southern California Bight, as this fishery is closed from August 15th to November 15th, in an area of approximately 213,000 square miles (551,670 km^2) off the coasts of central California up to Central Oregon for the protection of leatherback sea turtles. Additional closures of this fishery take place from February 1st to April 30th within 25 nautical miles (46.3 km) of the coast, and from May 1st to August 14th within 75 nautical miles (138.9 km). Even during the peak fishing season, observer data indicate that hammerheads are rarely caught in this fishery. From 1990-2012, a total of 8,310 sets were observed with only 50 hammerhead sharks caught over this time period. However, none of the hammerhead sharks were identified as S. lewini (SWRO, 2012).

In addition, in January 2011, the U.S. Shark Conservation Act of 2010 was signed into law, effectively banning the practice of shark finning within the U.S. EEZ or on the high seas by U.S. fishing vessels. Previously, the U.S. Pacific fisheries lacked a fins-attached policy, but with the passage of the U.S. Shark Conservation Act, all sharks must be landed with fins naturally attached. Thus, the U.S. regulatory measures aimed at managing the Pacific fisheries, including the Pacific longline and gillnet fisheries, appear adequate to protect this DPS from overutilization by the U.S. west-coast based fisheries.

Many of the Central American countries in the Eastern Pacific also have regulatory mechanisms in place with regard to sharks; however, some are stronger than others. For example, Colombia, Costa Rica, and El Salvador prohibit shark finning. Panama requires industrial fishers to land sharks with fins naturally attached but artisanal fishers may separate the fins from the carcass, as long as they satisfy the 5 percent weight rule. These regulations may help to deter finning, but they do not protect sharks from overfishing.

Although Ecuador has banned directed fishing for sharks in its waters, sharks caught in “continental” (i.e., not Galapagos) fisheries may be landed if bycaught. Panama still allows directed artisanal gillnet fishing for juvenile and adult sharks, including S. lewini (Arriatti, 2011), as does the Mexican State of Sinaloa, where the most popular gear in the elasmobranch fishery are bottom set gillnets and longlines (Bizzarro et al., 2009). Bottom fixed gillnets are also allowed in the artisanal fishery around “Tres Marias” Island and Isabel Island in the Central Mexican Pacific, with bycatch dominated by juvenile S. lewini (Perez-Jimenez et al., 2005).

Although Mexico is working towards promoting a sustainable shark and ray fishery, the current legislation (NOM-029-PESCA-2006) allows artisanal fishers to target hammerheads with longlines within 10 nm from the shore and reduces the competition with larger commercial longline vessels, which are subsequently restricted to waters 20 nm or more from the shore. The restriction of these larger commercial longline vessels will be beneficial to the artisanal fleet. However, given the artisanal fleets' already substantial fishing effort on sharks (artisanal vessels contribute 40 percent of the marine domestic production and comprise up to 80 percent of the elasmobranch fishing effort; Cartamil et al., 2011), this increase in fishing opportunity may further threaten the Eastern Pacific DPS, especially since 62 percent of the total Mexican domestic shark production comes from the Pacific Ocean (NOM-029-PESCA-2006). In addition, many of the new regulations are not well understood by current Mexican fishers, with very few fishers found to be in compliance with them (Cartamil et al., 2011). Mexico also recently prohibited shark fishing in its Pacific Ocean waters; however, the prohibition period only lasts 3 months (from May 1 to July 31) (DOF, 2012).

More restrictive regulations, such as complete moratoriums on shark fishing, can be found in this DPS range around Honduras and in the Eastern Tropical Pacific Seascape. The Eastern Tropical Pacific Seascape, a two million square kilometer region that encompasses the national waters, coasts, and islands of Colombia, Costa Rica, Ecuador, and Panama, was created to support marine conservation and sustainable use of resources. The Seascape includes the Galapagos, Cocos, and Malpelo Islands, and, although designated as a shark sanctuary, there is evidence of illegal fishing by both local fishers and industrial longliners within many of these marine protected areas. For example, in Cocos Island National Park, off Costa Rica, a "no take" zone was established in 1992, yet populations of S. lewini continued to decline by an estimated 71 percent from 1992 to 2004 (Myers et al., n.d.). From 1998-2004, Jacquet et al. (2008) found Ecuadorian shark fin exports exceeded mainland catches by 44 percent (average of 3,850 mt per year), and suggested that this discrepancy may have been a result of illegal fishing on protected Galapagos sharks. In 2004, this concern over illegal fishing around the Galapagos Islands prompted a ban on the exportation of fins, but only resulted in the establishment of new illegal trade routes and continued exploitation of the scalloped hammerhead shark (CITES, 2010). In 2007, Paul (2009) reports of a sting operation by the Ecuadorian Environmental Police and the Sea Shepherd Conservation Society which resulted in the seizure of 19,018 shark fins that were being smuggled over the border on buses from Ecuador to Peru. The fins were believed to come from protected sharks in the Galapagos Islands. More recently, in November 2011, Colombian environmental authorities reported a large shark massacre in the Malpelo wildlife sanctuary. The divers counted 10 illegal Costa Rican trawler boats in the wildlife sanctuary and estimated that as many as 2,000 sharks may have been killed for their fins (Brodzinsky, 2011).

Although shark finning is discouraged in the waters of this DPS, the ERA team voiced concerns about the allowed use of fishing gear that is especially effective at catching schools of scalloped hammerhead sharks within inshore and nursery areas in this DPS range. Thus, the ERA team ranked the threat of inadequate current regulatory mechanisms as a moderate risk. Additionally, without stronger enforcement, especially in the marine protected areas in the Eastern Tropical Pacific, the inadequacy of existing regulatory mechanisms will continue to enable the IUU fishing, which was ranked as a threat contributing significantly to this DPS' risk of extinction now and projected to increase in the foreseeable future. We agree with the ERA team's findings.

Other Natural or Man-Made Factors Affecting Its Continued Existence

Many sharks are thought to be biologically vulnerable to overexploitation based on their life history parameters. As mentioned previously, the scalloped hammerhead shark is no exception, with relatively low estimated productivity values ($r = 0.028 – 0.121$; Miller et al., 2013). Contributing to the scalloped hammerhead's biological vulnerability is the fact that these sharks are obligate ram ventilators (they must keep moving to ensure a constant supply of oxygenated water) and suffer very high at-vessel fishing mortality in bottom longline fisheries (Morgan and Burgess, 2007; Macbeth et al., 2009). From 1994-2005, NMFS observers calculated that out of 455 scalloped hammerheads caught on commercial bottom longline vessels in the northwest Atlantic and Gulf of Mexico, 91.4 percent were dead when brought aboard (Morgan and Burgess, 2007). Size did not seem to be a factor influencing susceptibility, as 70 percent of the young S. lewini (0 - 65 cm), 95.2 percent of the juveniles (66 - 137 cm), and 90.9 percent of the adults (>137 cm) suffered at-vessel fishing mortality. Soak time of the longline had a positive effect on the likelihood of death (Morgan and Burgess, 2007), with soak times longer than 4 hours resulting in > 65 percent mortality (Morgan et al., 2009). When soak time was shortened to 1hour, S. lewini at-vessel fishing mortality decreased to 12 percent (Lotti, 2011). Lotti (2011) also found that at-vessel fishing mortality was negatively correlated with S. lewini length ($p = 0.0032$) and dissolved oxygen ($p = 0.003$), with male scalloped hammerheads showing a higher probability of suffering from at-vessel mortality compared to females ($p = 0.0265$).

Sphyrna spp. also suffer high mortality in beach net programs (Reid and Krogh, 1992;

Dudley and Simpfendorfer, 2006). In a study examining the protective shark mesh program in New South Wales, Australia, Sphyrna spp. was the taxonomic group with the lowest net survival rates. The nets used in the protective mesh program were 150 m long and 6 m deep, with a mesh size of 50 – 60 cm and soak time generally between 12 and 48 hours. Out of the 2,031 hammerheads caught by this program (from 1972 - 1990), only 1.7 percent were alive when cleared from the nets (Reid and Krogh, 1992). Thus, due to the scalloped hammerhead's high at-vessel fishing mortality on a variety of fishing gear, and the difficulty of implementing or enforcing measures to mitigate this mortality, the ERA team ranked this biological vulnerability as contributing significantly to the risk of extinction of each of the scalloped hammerhead shark DPSs. We agree that the species' high at-vessel mortality may be a significant threat to the species, but only in combination with other factors, such as low abundance, heavy fishing pressure, or inadequate regulatory mechanisms that do not take into account this biological vulnerability in the development of fishery management measures. Therefore, we conclude that the scalloped hammerhead's high at-vessel fishing mortality contributes a greater risk of extinction that may be cause for concern to those DPSs where abundance is low and decreasing and overutilization and/or regulatory mechanisms are significant threats (i.e., Central & SW Atlantic DPS, Eastern Atlantic DPS, Indo-West Pacific DPS, and Eastern Pacific DPS).

Another threat the ERA team identified as affecting the continued existence of S. lewini is the shark's schooling behavior. This schooling behavior increases the shark's likelihood of being caught in large numbers. For example, fishers in Costa Rica were documented using gillnets in shallow waters to target schools of juveniles and neonates in these nursery areas (Zanella et al., 2009). In Brazil, schools of neonates and juveniles are caught in large numbers by coastal gillnets and recreational fishers in inshore waters, and subsequently their abundance has significantly decreased over time (CITES, 2010). Off South Africa, Dudley and Simpfendorfer (2006) reported significant catches of newborn S. lewini by prawn trawlers, with estimates of 3,288 sharks in 1989, and 1,742 sharks in 1992. This schooling behavior also makes the species a popular target for illegal fishing activity, with fishers looking to catch large numbers of scalloped hammerhead sharks (both adult and juveniles) quickly and with relatively little effort. In the Malpelo wildlife sanctuary, divers had reported sightings of schools of more than 200 hammerhead sharks before the sanctuary became a recent target of IUU fishing vessels (Brodzinsky, 2011). Because this schooling behavior provides greater access to large numbers of scalloped hammerheads, the likelihood of this species being overfished greatly increases. Thus, the ERA team ranked the schooling behavior as a moderate risk for most of the DPSs, a factor that, in combination with others, such as IUU fishing, contributes significantly to the DPS' risk of extinction. In the Eastern Pacific DPS, the ERA team ranked this schooling behavior as a high risk based on reports of frequent IUU fishing on scalloped hammerhead schools in protected waters and the evidence of heavy inshore fishing pressure on schools of juveniles and neonates in nursery grounds. We agree with the ERA team's findings.

Overall Risk Summary

NW Atlantic & GOM DPS

The ERA team concluded, and we agree, that the NW Atlantic & GOM DPS is at a "low" risk of extinction throughout all of its range, now and in the foreseeable future. Although the ERA team had some concerns about the significant decline in absolute abundance from fisheries, they concluded that the population has a high likelihood of rebuilding because of stronger fishery management measures and is unlikely to be at risk of extinction due to trends in abundance, productivity, spatial structure or diversity now or in the foreseeable future. Likelihood points attributed to the current level of extinction risk categories are as follows: No or Very Low Risk (6/50), Low Risk (20/50), Moderate Risk (17/50), High Risk (7/50). None of the team members placed a likelihood point in the “Very high risk” category for the overall level of extinction risk now or in the foreseeable future, indicating their strong certainty that the DPS is not, nor will it be, at a very high risk of extinction. Likelihood points attributed to the other categories for the level of extinction risk in the foreseeable future are as follows: No or Very Low Risk (11/50), Low Risk (26/50), Moderate Risk (12/50), High Risk (1/50). Based on the likelihood point distributions, the team was fairly certain that the DPS currently has a low to moderate risk of extinction. However, the difference of only three likelihood points separating these two risk categories indicates a level of uncertainty as to the severity of the current threats and demographic risks. This level of uncertainty diminishes in the foreseeable future, with the increased number and majority of likelihood points for the low risk category.

Central & SW Atlantic DPS

The ERA team concluded, and we agree, that the Central & SW Atlantic DPS is at a “moderate” risk of extinction throughout all of its range, now and in the foreseeable future. The ERA team agreed that the DPS is on a trajectory approaching a level of abundance and productivity that places its current and future persistence in question. Given the combination of threats including the inadequacy of current regulatory mechanisms, the reports of heavy fishing, the high at-vessel mortality rate, and the projected increase of commercial, artisanal, and IUU fishing, the team does not envision a reversal of demographic trends in the foreseeable future that would lessen its risk of extinction. Likelihood points attributed to the categories for the current level of extinction risk are as follows: Low Risk (8/50), Moderate Risk (25/50), High Risk (14/50), and Very High Risk (3/50). None of the team members placed a likelihood point in the "No or very low risk" category for the overall level of extinction risk now or in the foreseeable future, indicating their strong certainty that the DPS is, and will continue to be, at some risk of extinction. Likelihood points attributed to the other categories for the level of extinction risk in the foreseeable future are as follows: Low Risk (8/50), Moderate Risk (20/50), High Risk (15/50), and Very High Risk (7/50). Based on the likelihood point distributions, the team was fairly certain that the DPS has a moderate risk of extinction now, receiving half of the votes, but expressed some uncertainty regarding the future level of extinction risk, increasing the number of likelihood points in the high and very high risk categories.

Eastern Atlantic DPS

The ERA team concluded, and we agree, that the Eastern Atlantic DPS is at a "high" risk of extinction throughout all of its range, now and in the foreseeable future. The ERA team had serious concerns regarding the level of overutilization and lack of regulatory mechanisms in the Eastern Atlantic DPS. Although Spain and other EU countries have implemented new regulations aimed at protecting this species in the Atlantic, these management measures are lacking in the West African region where enforcement of existing measures is weak and IUU fishing is rampant. There is no evidence of this situation in western Africa changing in the foreseeable future, as resources are very limited. Thus, the ERA team concluded that overutilization by artisanal, industrial, and IUU fishing in this area is creating a DPS that is at or near a level of abundance and productivity that places its current and future persistence in question throughout its entire range. Likelihood points attributed to the categories for the current level of extinction risk are as follows: No or Very Low Risk (1/50), Low Risk (6/50), Moderate Risk (14/50), High Risk (18/50), and Very High Risk (11/50). Likelihood points attributed to the other categories for the level of extinction risk in the foreseeable future are as follows: Low Risk (7/50), Moderate Risk (14/50), High Risk (20/50), and Very High Risk (9/50). None of the team members placed a likelihood point in the “No or very low risk” category for the overall level of extinction risk in the foreseeable future, indicating their strong certainty that the DPS will be at some risk of extinction. Based on the likelihood point distributions, the team was less certain about the current risk of extinction for this DPS, with the moderate risk category separated from the high risk category by only four likelihood points. However, in the foreseeable future, the team expressed increased certainty that the DPS would be at a high risk of extinction with more likelihood points added to this category while the moderate risk category remained the same.

Indo-West Pacific DPS

The ERA team concluded, and we agree, that the Indo-West Pacific DPS is at a “moderate” risk of extinction throughout all of its range, now and in the foreseeable future. The ERA team was mainly concerned about the level of overutilization and limited regulatory mechanisms in the Indo-West Pacific DPS and concluded that the DPS is exhibiting a trajectory indicating that it is approaching a level of abundance and productivity that places its current and future persistence in question throughout its entire range. Given the inadequacy of current regulatory mechanisms, the reports of heavy fishing, increased industrialization, high at-vessel mortality rate, and the projected increase of commercial, artisanal, and IUU fishing, the team does not envision a reversal of demographic trends in the foreseeable future that would reduce its risk of extinction throughout all or a significant portion of its range. Likelihood points attributed to the categories for the current level of extinction risk are as follows: Low Risk (4/50), Moderate Risk (20/50), High Risk (17/50), and Very High Risk (9/50). None of the team members placed a likelihood point in the "No or very low risk" category for the overall level of extinction risk now or in the foreseeable future, indicating their strong certainty that the DPS is, and will continue to be, at some risk of extinction. Likelihood points attributed to the other categories for the level of extinction risk in the foreseeable future are as follows: Low Risk (3/50), Moderate Risk (19/50), High Risk (16/50), and Very High Risk (12/50). Based on the likelihood point distributions, the team was fairly certain that the DPS has a moderate to high risk of extinction. However, the difference of only three likelihood points separating these two risk categories indicates a level of uncertainty as to the severity of the current and future threats and demographic risks. In addition, three likelihood points were moved to the very high risk category in the foreseeable future. The team thought the DPS was at a moderate risk of extinction, but were concerned that the situation could actually be worse in the future.

Central Pacific DPS

The ERA team concluded, and we agree, that the Central Pacific DPS is at a "no or very low" risk of extinction throughout all of its range, now and in the foreseeable future. Although the ERA team had concerns regarding the threat of overutilization by commercial fisheries in combination with the scalloped hammerhead's tendency to school, they felt that the current abundance and productivity of this DPS, along with the number of suitable nursery grounds and effective management measures, provided ample protection from extinction for this DPS. Likelihood points attributed to the categories for the current level of extinction risk are as follows: No or Very Low Risk (24/50), Low Risk (19/50), and Moderate Risk (7/50). None of the team members placed a likelihood point in the “High risk” or “Very High Risk” categories for the overall level of extinction risk now or in the foreseeable future, indicating their strong certainty that the DPS is not, nor will it be, at a high risk of extinction. Likelihood points attributed to the other categories for the level of extinction risk in the foreseeable future are as follows: No or Very Low Risk (27/50), Low Risk (17/50), and Moderate Risk (6/50). Based on the likelihood point distributions, the team was fairly certain that this DPS is at a no or very low risk of extinction now and in the foreseeable future.

Eastern Pacific DPS

The ERA team concluded, and we agree, that the Eastern Pacific DPS is at a “high” risk of extinction throughout all of its range, now and in the foreseeable future. The ERA team had strong concerns regarding the level of overutilization and limited regulatory mechanisms or enforcement of fishery regulations in the Eastern Pacific, and concluded that the DPS is at or near a level of abundance and productivity that places its current and future persistence in question throughout its entire range. Likewise, the present threats, which include heavy fishing, IUU fishing, and overutilization by industrial/commercial and artisanal fisheries, coupled with the behavioral and biological aspects that increase S. lewini’s susceptibility and mortality to certain fishing gear, will only serve to exacerbate the demographic risks currently faced by the DPS in the foreseeable future. Likelihood points attributed to the current level of extinction risk categories are as follows: Low Risk (6/50), Moderate Risk (17/50), High Risk (21/50), and Very High Risk (5/50). None of the team members placed a likelihood point in the “No or very low risk” category for the overall level of extinction risk now or in the foreseeable future, indicating their strong certainty that the DPS is, and will continue to be, at some risk of extinction. Likelihood points attributed to the other categories for the level of extinction risk in the foreseeable future are as follows: Low Risk (4/50), Moderate Risk (15/50), High Risk (21/50), and Very High Risk (10/50). Based on the likelihood point distributions, the team was fairly certain that the DPS has a moderate to high risk of extinction, with the high risk category receiving more of the votes. In addition, five likelihood points were moved to the very high risk category in the foreseeable future, indicating increased concern for this DPS.

Efforts Being Made to Protect Scalloped Hammerhead Sharks

Section 4(b)(1)(A) of the ESA requires the Secretary of Commerce to take into account "*** efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species, whether by predator control, protection of habitat and food supply, or other conservation practices, within any area under its jurisdiction or on the high seas." The ESA therefore directs us to consider all conservation efforts being made to conserve the species. The joint USFWS and NOAA Policy on Evaluation of Conservation Efforts When Making Listing Decisions ("PECE Policy", 68 FR 15100; March 28, 2003) further identifies criteria we use to determine whether formalized conservation efforts that have yet to be implemented or to show effectiveness contribute to making listing unnecessary, or to list a species as threatened rather than endangered. In determining whether a formalized conservation effort contributes to a basis for not listing a species, or for listing a species as threatened rather than endangered, we must evaluate whether the conservation effort improves the status of the species under the ESA. Two factors are key in that evaluation: (1) for those efforts yet to be implemented, the certainty that the conservation effort will be implemented and (2) for those efforts that have not yet demonstrated effectiveness, the certainty that the conservation effort will be effective. The following is a review of the major conservation efforts and an evaluation of whether these efforts are reducing or eliminating threats by having a positive conservation benefit and thus improving the status of the scalloped hammerhead shark DPSs.

U.S. Fishery Management: Amendment 5 to the Consolidated HMS FMP

On April 28, 2011, NMFS determined that the Northwest Atlantic and Gulf of Mexico scalloped hammerhead shark stock was overfished and experiencing overfishing (76 FR 23794; April 28, 2011). Under National Standard (NS) 1 of the MSA and implementing regulations (50 CFR 600.310), NMFS is required to "prevent overfishing while achieving, on a continuing basis, the OY [optimum yield] from each fishery for the U.S. fishing industry." In order to accomplish this, NMFS must determine the MSY and specify status determination criteria to allow a determination of the status of the stock. In cases where NMFS has determined that a fishery is overfished, the MSA, Section 304, mandates that NMFS notify the appropriate Fishery Management Council and request that the Council take action. The Council must then take action within 2 years to end overfishing and rebuild the stock in the shortest time possible. The NMFS Atlantic HMS Management Division is responsible for managing scalloped hammerhead sharks, and is thus responsible for taking appropriate action to end overfishing and rebuild the fishery. Given this statutory mandate, there is a certainty that NMFS will implement conservation and management measures by 2013 that will provide for the rebuilding of the scalloped hammerhead shark stock. NMFS is currently in the process of finalizing Amendment 5 to the Consolidated HMS FMP (proposed on November 26, 2012, 77 FR 70552; public comment period closed February 12, 2013), which will prescribe management measures and implementing regulations to conserve the scalloped hammerhead shark NW Atlantic & GOM DPS.

The second criterion of the PECE policy is the evaluation that the conservation effort will be effective. The specific conservation effort that is trying to be achieved is the rebuilding of the Northwest Atlantic and Gulf of Mexico scalloped hammerhead shark stock. The conservation effort is achieved when the current biomass (B) levels of the stock are equal to B_{MSY}. B_{MSY} is the level of stock abundance at which harvesting the resource can be sustained on a continual basis at the level necessary to support MSY. Stocks are considered healthy when F (fishing caused mortality) is less than or equal to 0.75 F_{MSY} and B is greater than or equal to B_{OY} (B_{OY} = approximately 1.25 to 1.30 B_{MSY}; the biomass level necessary to produce OY on a continuing basis). Specifically, NMFS will establish annual catch limits and accountability measures for the scalloped hammerhead shark stock to allow for rebuilding of the stock. With fishery rebuilding plans, there is an explicit time frame for achieving this conservation effort, which will be stated in the Amendment to the FMP. Usually, rebuilding targets are set at 10 years unless the biology of the stock of fish, other environmental conditions, or management measures under an international agreement in which the United States participates, dictate otherwise. Then the specified time period for rebuilding may be adjusted upward by one mean generation time. The rebuilding plans are based on quantifiable, scientifically valid parameters and the progress of the stock is monitored and reported on as stock assessments are conducted. Although Amendment 5 has not yet been finalized, examination of previous rebuilding plans for Atlantic coastal shark species may provide insight into the effectiveness of these regulatory measures.

Section 304(e)(7) of the Magnuson-Stevens Act requires that the Secretary review rebuilding progress at routine intervals that may not exceed 2 years, and thus every year NMFS tracks the biomass trends for overfished stocks to monitor this rebuilding progress. Overall, the total number of stocks that have been rebuilt under a rebuilding plan since 2001 is 26 (approximately 11 percent of the total number of managed stocks, and 34 percent of the stocks that have/had rebuilding plans). Of the 21 stocks managed by the 2006 Consolidated HMS FMP, around half are currently under a rebuilding plan. Two HMS stocks have rebuilt since being under a rebuilding plan: Atlantic swordfish, which was rebuilt in year 9 of a 10-year plan, and the Atlantic blacktip shark, which is thought to have been rebuilt in year 5 of a 39-year plan (however, this stock may have never been overfished).

The status of the sandbar shark stock may provide a better comparison to the potential success rate of the scalloped hammerhead shark rebuilding plan. The sandbar shark used to be managed as part of the LCS complex; however, enough data were available to conduct a separate stock assessment of the species. In 2006, the results of the sandbar shark stock assessment showed that the stock was overfished with overfishing occurring. Using the available scientific information, NMFS published Amendment 2 to the 2006 Consolidated HMS FMP, establishing the rebuilding plan for the sandbar shark. Management measures in the implementing regulations included separating the sandbar shark from the LCS complex and setting specific quotas and retention limits for the species that would allow it to rebuild. Specifically, NMFS allowed sandbar retention only by vessels with shark research permits, and the limits depended upon research objectives. The success of this rebuilding plan can be seen in the latest SouthEast Data, Assessment, and Review (SEDAR 21) of the sandbar shark stock (finalized in 2011), which determined that the sandbar shark stock was still overfished but no longer experiencing overfishing. In addition, it was also determined that the current total allowable catch (TAC) for the fishery could result in a greater than 70 percent probability of rebuilding by the current rebuilding date of 2070. Similar to the sandbar shark, NMFS is working to develop a rebuilding plan that will set specific quota and retention limits for scalloped hammerhead sharks and allow for the recovery of these sharks in the Northwest Atlantic and Gulf of Mexico. Based on the criteria in the PECE policy, in our judgment the Amendment 5 to the Consolidated HMS FMP is a conservation effort with high certainty of implementation and is highly likely to be sufficiently effective to substantially reduce the overutilization of the NW Atlantic & GOM scalloped hammerhead shark DPS. Overutilization of this DPS by commercial and recreational fisheries was identified as a primary threat presenting a moderate risk of extinction to the DPS currently, but was expected to decrease in risk severity in the foreseeable future. We anticipate that the foregoing conservation measures will benefit the status of the species in the foreseeable future, thereby further decreasing its extinction risk from the threat of overutilization identified by the ERA team.

Shark Fin Bans

The concern regarding the practice of finning and its effect on global shark populations has been growing both domestically and internationally. In the United States, California, Oregon, Washington, and Hawaii have already passed legislation banning the sale, possession, and distribution of shark fins. The support for this legislation from the public, as well as conservation groups, has prompted many other states to follow suit, with proposals for similar bills. Likewise, in Canada, Bill C-380 was introduced in December of 2011, and would prohibit the import or attempt to import shark fins that are not attached to the rest of the shark carcass into Canada.

The push to stop shark finning and curb the trade of shark fins is also evident overseas and most surprisingly in Asian countries, where the demand for shark fin soup is highest. Taiwan, the third top exporter of shark fins to Hong Kong in 2008, banned the practice of shark finning at sea in 2012. Likewise, many hotels in Taiwan, such as the W Taipei, the Westin Taipei, and the Silks Palace at National Palace Museum, also vowed to stop serving shark fin dishes as part of their menus. In November of 2011, the Chinese restaurant chain South Beauty removed shark fin soup from its menus, and in 2012, the luxury Shangri-La Hotel chain joined this effort, banning shark fin from its 72 hotels, most of which are found in Asia. Effective January 1, 2012, the Peninsula Hotel chain stopped serving shark fin and related products. This ban covers the Chinese restaurant and banqueting facilities at The Peninsula hotels in Hong Kong, Shanghai, Beijing, Tokyo, Bangkok, and Chicago. Many supermarket chains in Asia also vowed to halt the sale of shark fin products. In 2011, ColdStorage, a chain with several outlets in Singapore, banned the sale of shark fin from its stores, and in 2012, the Singapore supermarket chains FairPrice and Carrefour stated they would also stop selling shark fin in outlets in the city-state. Many of these bans have just recently been implemented, and thus their effect on reducing the threat of S. lewini overutilization is unknown.

While there seems to be a growing trend to prohibit and discourage shark finning domestically and internationally, it is difficult to predict at this time whether the trend will be effective in reducing the threat of IUU fishing to any particular DPS. We do not find these to be conservation measures that we consider effective in reducing current threats to the any of the DPSs as we evaluate whether listing is warranted.

Convention on International Trade in Endangered Species of Wild Fauna and Flora

CITES is an international agreement between governments that regulates international trade in wild animals and plants. It encourages a proactive approach and the species covered by CITES are listed in appendices according to the degree of endangerment and the level of protection provided. Appendix I includes species threatened with extinction; trade in specimens of these species is permitted only in exceptional circumstances. Appendix II includes species not necessarily threatened with extinction, but for which trade must be controlled to avoid exploitation rates incompatible with species survival. Appendix III contains species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade.

In 2012, S. lewini was submitted for inclusion on CITES Appendix III by Costa Rica, and is now effectively listed in the appendix. An Appendix III listing allows international trade of the species, but provides a means of gathering trade data and other relevant information. For example, the export of S. lewini specimens from Costa Rica requires a CITES export permit issued by the Costa Rica CITES Management Authority. For the export of S. lewini specimens from any other country, a CITES certificate of origin by the Management Authority of that country is required. This conservation effort will allow Costa Rica to gain better international cooperation in controlling trade of S. lewini both into and out of the country. This type of tracking information will also provide previously unavailable data on the origin of S. lewini specimens, including fins, currently being traded in the global market and allow for a better determination of the degree of exploitation and use of this species by domestic and foreign fishing fleets. Although this CITES listing will likely provide us with better data in the future to assess the status of DPSs, it is not a conservation measure that we consider effective in reducing current threats to the any of the DPSs as we evaluate whether listing is warranted.

Other Conservation Efforts

There are many other smaller national and international organizations with shark-focused goals that include advocating the conservation of sharks through education and campaign programs and conducting shark research to fill data gaps regarding the status of shark species. These organizations include: the Pew Environment Group, Oceana, Ocean Conservancy, Shark Trust, Bite-Back, Shark Project, Pelagic Shark Research Foundation, Shark Research Institute, and Shark Savers. More information on the specifics of these programs and groups can be found on their websites. All of these conservation efforts and non-regulatory mechanisms are beneficial to the persistence of the scalloped hammerhead shark. The implementation of many of these efforts, especially the shark research programs as well as the CITES Appendix III listing, will help to fill current data gaps in S. lewini abundance and utilization records. However, it is too soon to tell whether the collective conservation efforts of non-governmental organizations targeting finning practices and promoting public awareness of declines in shark populations will be effective in reducing the threats, particularly those related to overutilization of the scalloped hammerhead DPSs. Much of the data on shark catches and exports since implementation of these conservation efforts is not yet available.

Proposed Determinations

Section 4(b)(1) of the ESA requires that NMFS 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. We have reviewed the best available scientific and commercial information including the petition, the status review report

(Miller et al., 2013), and other published and unpublished information, and we have consulted with species experts and individuals familiar with scalloped hammerhead sharks.

For the reasons stated above, and as summarized below, we conclude that: (1) scalloped hammerhead sharks in the NW Atlantic & GOM, Central & SW Atlantic, Eastern Atlantic, Indo-West Pacific, Central Pacific, and Eastern Pacific meet the discreteness and significance criteria for DPSs; (2) the Eastern Atlantic and Eastern Pacific scalloped hammerhead shark DPSs are in danger of extinction throughout their ranges; (3) the Central & SW Atlantic and Indo-West Pacific scalloped hammerhead shark DPSs are likely to become endangered throughout their ranges in the foreseeable future; and (4) the NW Atlantic & GOM and Central Pacific scalloped hammerhead shark DPs are not in danger of extinction or likely to become so throughout all of their ranges in the foreseeable future.

Scalloped hammerhead sharks occurring in the NW Atlantic & GOM are discrete and significant from other members of their species based on the following: (1) genetic differences between this population and those scalloped hammerhead sharks inhabiting waters of the Pacific, Indian, and eastern Atlantic oceans; (2) tagging studies that show limited distance movements, with no tagged sharks observed in Central America or Brazil, supporting the conclusion that the NW Atlantic & GOM population is isolated from other populations; (3) significant U.S. fishery management measures for this population that separate it from scalloped hammerheads found in the Central & SW Atlantic (with the exception of those in the U.S. EEZ Caribbean), with differences in control of S. lewini exploitation and regulatory mechanisms of significance across these international boundaries; and (4) evidence that a loss of this segment would result in a significant gap in the range of the taxon (from New Jersey to Florida and throughout the GOM), with tagging and genetic studies that suggest the segment would unlikely be rapidly repopulated through immigration.

Scalloped hammerhead sharks occurring in the Central & SW Atlantic are discrete and significant from other members of their species based on the following: (1) genetic differences between this population and those scalloped hammerhead sharks inhabiting waters of the Pacific, Indian, and eastern Atlantic oceans; (2) tagging studies that suggest limited distance migrations along coastlines, continental margins, and submarine features with no observed mixing between the Central & SW Atlantic population and the NW Atlantic & GOM population, supporting the conclusion of isolation from other populations; (3) fishery management measures that are lacking in this DPS compared to NW Atlantic & GOM DPS (with the exception of U.S. EEZ Caribbean), with differences in control S. lewini exploitation and regulatory mechanisms of significance across these international boundaries; and (4) evidence that a loss of this segment would result in a significant gap in the range of the taxon (from Caribbean to Uruguay), with oceanographic conditions that would act as barriers to re-colonization, and tagging and genetic studies that suggest the segment would unlikely be rapidly repopulated through immigration.

Scalloped hammerhead sharks occurring in the Eastern Atlantic are discrete and significant from other members of their species based on the following: (1) genetic differences between this population and those scalloped hammerhead sharks inhabiting waters of the Pacific, Indian, and western Atlantic oceans; (2) tagging studies that suggest limited distance migrations along coastlines, continental margins, and submarine features, with genetic studies that show migration around the southern tip of Africa is rare (i.e., no mixing with those sharks found in the Indian Ocean), supporting the conclusion of isolation from other populations; and (4) evidence that loss of this segment would result in a significant gap in the range of the taxon (from Mediterranean Sea to Namibia), with oceanographic conditions that would act as barriers to re-colonization, and tagging and genetic studies that suggest the segment would unlikely be rapidly repopulated through immigration.

Scalloped hammerhead sharks occurring in the Indo-West Pacific are discrete from other members of their species based on the following: (1) genetic differences between this population and those scalloped hammerhead sharks inhabiting waters of the Eastern Pacific and Atlantic oceans; (2) tagging and genetic studies that show limited distance migrations and support isolation from other populations, but suggest males mix readily along coastlines and continental margins in this DPS due to the high connectivity of habitat; (3) fishery management measures that are lacking in this DPS compared to those found in the Central Pacific DPS range, with differences in control of S. lewini exploitation and regulatory mechanisms of significance across international boundaries; and (4) evidence that loss of this segment would result in a significant gap in the range of the taxon (from South Africa to Japan and south to Australia and New Caledonia and neighboring Island countries), with oceanographic conditions that would act as barriers to re-colonization, and tagging and genetic studies that suggest the segment would unlikely be rapidly repopulated through immigration.

Scalloped hammerhead sharks occurring in the Central Pacific are discrete from other members of their species based on the following: (1) genetic differences between this population and those scalloped hammerhead sharks inhabiting waters of the Eastern Pacific and Atlantic oceans; (2) tagging studies that show limited distance migrations, with adults remaining "coastal" within the archipelago, and separated from other populations by bathymetric barriers, supporting the conclusion of isolation from other populations; (3) significant U.S. fishery management measures for this DPS that separate it from the Indo-West Pacific DPS, with differences in control of S. lewini exploitation and regulatory mechanisms of significance across international boundaries; and (4) evidence that loss of this segment would result in a significant gap in the range of the taxon (from Kure Atoll to Johnston Atoll, including the Hawaiian Archipelago) and valuable and productive nursery grounds, with oceanographic conditions that would act as barriers to re-colonization, and tagging and genetic studies that suggest this segment would unlikely be rapidly repopulated through immigration.

Scalloped hammerhead sharks occurring in the Eastern Pacific are discrete from other members of their species based on the following: (1) genetic differences between this population and those scalloped hammerhead sharks inhabiting waters of the Indo-West Pacific, Central Pacific, and Atlantic oceans; (2) tagging studies that suggest wide movements around island and occasional long-distance dispersals between neighboring islands with similar oceanographic conditions, but isolation from other DPSs by bathymetric barriers and oceanographic conditions, supporting the conclusion of isolation from other populations; and (4) evidence that loss of this segment would result in a significant gap in the range of the taxon (from southern CA, USA to Peru), with oceanographic conditions that would act as barriers to re-colonization, and tagging and genetic studies that suggest the segment would unlikely be rapidly repopulated through immigration.

The ESA does not define the terms "significant portion of its range" (SPOIR) or "foreseeable future." With regard to SPOIR, we (NMFS and U.S. Fish and Wildlife Service, or, the Services) have proposed a "Draft Policy on Interpretation of the Phrase 'Significant Portion of Its Range' in the Endangered Species Act's Definitions of 'Endangered Species' and 'Threatened Species'" (76 FR 76987; December 9, 2011), which is consistent with our past practice as well as our understanding of the statutory framework and language. While the Draft Policy remains in draft form, the Services are to consider the interpretations and principles contained in the Draft Policy as non-binding guidance in making individual listing determinations, while taking into account the unique circumstances of the species under consideration.

The Draft Policy provides that: (1) if a species is found to be endangered or threatened in only a significant portion of its range, the entire species is listed as endangered or threatened, respectively, and the Act's protections apply across the species' entire range; (2) a portion of the range of a species is "significant" if its contribution to the viability of the species is so important that, without that portion, the species would be in danger of extinction; (3) the range of a species is considered to be the general geographical area within which that species can be found at the time FWS or NMFS makes any particular status determination; and (4) if the species is not endangered or threatened throughout all of its range, but it is endangered or threatened within a significant portion of its range, and the population in that significant portion is a valid DPS, we will list the DPS rather than the entire taxonomic species or subspecies.

Given that the scalloped hammerhead shark is a highly mobile species, with very few restrictions governing its movements within each DPS, we did not find any evidence to suggest that a portion of any single DPS' range had increased importance over another with respect to the species' survival within each respective DPS. The ERA team initially considered the islands in the Central Pacific as a potential SPOIR, given their numerous nursery grounds and likelihood as a population source for the region. However, upon further review, the ERA team found that this area qualified as a DPS and analyzed it as such. In addition, the available data did not indicate any portion of any DPS range as being more significant than another. Potentially important aspects of a DPS range, such as identified nursery grounds or "hot spots" of aggregations, were represented elsewhere in the range, suggesting that if the population in a specific nursery ground or "hot spot" disappeared, the DPS would not be in danger of extinction throughout its range. There was no evidence of any DPS being limited to a specific nursery ground or schooling location. In fact, Duncan et al. (2006) provided mtDNA data that argued against strong natal homing behavior by the species, and instead suggested that the habitat characteristics of the nursery area were more important than the location. Since available nursery habitat was not identified as a limiting factor in any of the DPSs, we did not consider this as a significant portion of range. Thus, when making our determinations, we considered the status of each DPS throughout its entire range as no SPOIRs could be identified.

With respect to the term "foreseeable future," we accepted the ERA team's definition and rationale of 50 years as reasonable for the reliable prediction of threats to the biological status of the species. That rationale was provided in detail above.

As discussed, we have independently reviewed and evaluated the best available scientific and commercial information related to the status of each DPS, including the demographic risks and trends and the multiple threats related to the factors set forth in the ESA Section 4(a)(1)(A)-(E). As we explained, no portion of any DPS's range is considered significant and we therefore have determined that no DPS is threatened or endangered in a significant portion of its range. Our determinations set forth above and summarized below are thus based on the status of each

DPS across its entire range. Based on our evaluation of the status of each DPS and the threats to its persistence we predicted the likelihood that each DPS is in danger of extinction throughout all of its range now and in the foreseeable future. We considered each of the statutory factors to determine whether it presented an extinction risk to each DPS on its own. We also considered the combination of those factors to determine whether they collectively contributed to the extinction of each DPS. As required by the ESA, Section 4(b)(1)(a), we also took into account efforts to protect scalloped hammerhead sharks by states, foreign nations and others and evaluated whether those efforts provide a conservation benefit to each DPS and reduced threats to the extent that a DPS did not warrant listing or could be listed as threatened rather than endangered. Our conclusions and proposed listing determinations are based on a synthesis and integration of the foregoing information, factors and considerations.

Below are the summaries of our proposed determinations:

We have determined that the Eastern Atlantic DPS of scalloped hammerhead sharks is currently in danger of extinction throughout all of its range. Factors supporting this conclusion include overutilization, inadequacy of existing regulatory mechanisms and other natural or manmade factors, specifically: (1) low productivity rates; (2) high susceptibility to overfishing, especially given its schooling behavior; (3) significant historical removals of sharks, including scalloped hammerheads, by artisanal and industrial fisheries, with directed shark fisheries still in operation and heavy fishing pressure despite evidence of species' extirpations and declines of large hammerheads; (4) high at-vessel mortality rate associated with incidental capture in fisheries (resulting in further reduction of population productivity and abundance); (5) popularity of the species in the shark fin trade; and (6) inadequate regulatory mechanisms along the coast of

West Africa, with severe enforcement issues leading to heavy IUU fishing. Therefore, we propose to list the Eastern Atlantic DPS of scalloped hammerhead sharks as endangered.

We have determined that the Eastern Pacific DPS of scalloped hammerhead sharks is also currently in danger of extinction throughout all of its range. Factors supporting this conclusion include overutilization, inadequacy of existing regulatory mechanisms and other natural or manmade factors, specifically : (1) reduced abundance, declining population trends and catch, and evidence of size truncation; (2) low productivity rates; (2) high susceptibility to overfishing, especially given its schooling behavior, with artisanal fisheries targeting juveniles of the species in inshore and nursery areas; (3) high at-vessel mortality rate associated with incidental capture in fisheries (resulting in further reduction of population productivity and abundance); (4) popularity of the species in the shark fin trade and importance in Mexican artisanal fisheries; and (5) limited regulatory mechanisms and weak enforcement in many areas, leading to IUU fishing of the species, especially in protected waters. Therefore, we propose to list the Eastern Pacific DPS of scalloped hammerhead sharks as endangered.

We have determined that the Central & SW Atlantic DPS of scalloped hammerhead sharks is not presently in danger of extinction, but likely to become so in the foreseeable future throughout all of its range. Factors supporting a conclusion that this DPS is not presently in danger of extinction include: (1) low productivity rates but moderate rebound potential to pelagic longline fisheries common in this DPS; (2) ICCAT recommendations slated for implementation (or already implemented) by Contracting Parties that offer protection for this species from ICCAT fishing vessels; (3) regulations that limit the extension of pelagic gillnets and trawls, shark fin bans, and prohibitions on shark fishing or the retention of scalloped hammerhead sharks; and (4) evidence that sharks are still present in significant enough numbers to be caught by commercial and artisanal fisheries. Factors supporting a conclusion that the DPS is likely to become in danger of extinction in the foreseeable future include overutilization, inadequacy of existing regulatory mechanisms and other natural or manmade factors, specifically: (1) decreasing catch trends suggesting population decline, (2) high susceptibility to overfishing, especially given its schooling behavior, with artisanal fisheries catching large numbers of juveniles in inshore and nursery areas; (3) high at-vessel mortality rate associated with incidental capture in fisheries (resulting in further reduction of population productivity and abundance); (4) popularity of the species in the shark fin trade; and (5) limited regulatory mechanisms and/or weak enforcement in some areas, leading to IUU fishing of the species. Therefore, we propose to list the Central & SW Atlantic DPS of scalloped hammerhead sharks as threatened.

We have determined that the Indo-West Pacific DPS of scalloped hammerhead sharks is not presently in danger of extinction, but likely to become so in the foreseeable future throughout all of its range. Factors supporting a conclusion that this DPS is not presently in danger of extinction include: (1) relatively high reported catches of the species off the coasts of South Africa and Queensland, Australia; (2) still observed throughout the entire range of this DPS with the overall population size uncertain given the expansive range of this DPS; and (3) current regulations that prevent the waste of shark parts and discourage finning in this region, with the number of shark sanctuaries on the rise in the Western Pacific. Factors supporting a conclusion that the DPS is likely to become in danger of extinction in the foreseeable future include overutilization, inadequacy of existing regulatory mechanisms and other natural or manmade factors, specifically: (1) decreases in CPUE of sharks off the coasts of South Africa and Australia and in longline catch in Papua New Guinea and Indonesian waters, suggesting localized population declines, (2) high susceptibility to overfishing, especially given its schooling behavior, in artisanal fisheries and industrial/commercial fisheries; (3) high at-vessel mortality rate associated with incidental capture in fisheries (resulting in further reduction of population productivity and abundance); (4) popularity of the species in the shark fin trade; and (5) inadequate regulatory mechanisms and/or weak enforcement of current regulations in many areas, resulting in frequent reports of IUU fishing of the species. Therefore, we propose to list the Indo-West Pacific DPS of scalloped hammerhead sharks as threatened.

We conclude that the NW Atlantic & GOM DPS of scalloped hammerhead sharks is not presently in danger of extinction, nor is it likely to become so in the foreseeable future throughout all of its range. Factors supporting this conclusion include: (1) abundance numbers for this DPS that are lower than historical levels but seem to have been constant over the past few years, with a high probability of population recovery under recent catch levels; (2) significant fishery management measures that are in place, including both state and Federal regulations, with scalloped hammerhead-specific sustainability, conservation, and rebuilding goals; (3) extensive EFH for the species that has been designated along the range of this DPS, with no evidence of habitat loss or destruction; and (4) low productivity rates for the species but moderate rebound potential to pelagic longline fisheries within the range of this DPS. We determined that the comprehensive science-based management of this DPS and enforceable and effective regulatory structure as discussed previously in this proposed rule significantly minimize this DPS' extinction risk from threats of overutilization and IUU fishing to the point where we do not find this DPS in danger of extinction now or in the foreseeable future. Under current fishery management, the DPS has a high probability of rebuilding within 50 years, and considering formalized conservation efforts, such as Amendment 5 to the HMS FMP and implementing regulations, we find that these regulatory mechanisms are likely to further reduce the significant threats to this DPS (primarily overexploitation by commercial and recreational fisheries, exacerbated by the species' high at-vessel fishing mortality) and benefit the conservation status of the DPS. Therefore, we conclude that listing the NW Atlantic & GOM scalloped hammerhead shark DPS as threatened or endangered under the ESA is not warranted at this time.

We also conclude that the Central Pacific DPS of scalloped hammerhead sharks is not presently in danger of extinction, nor is it likely to become so in the foreseeable future throughout all of its range. Factors supporting this conclusion include: (1) abundance numbers for this DPS that are perceived to be high; (2) ample productive nursery grounds that are present in the range of this DPS, with no evidence of habitat loss or destruction; (3) low productivity rates for the species but data that show it is rarely caught in Hawaiian-based fisheries; and (4) significant fishery management measures that are in place, including both state and Federal regulations, that protect the species from extinction. We determined that the high population abundance of this DPS and effective existing fishery management measures and regulatory structure, reflected in the rare catch of this DPS in fisheries operating within its range, minimized the threat of overutilization by commercial fisheries to the point where this DPS is not currently at risk of extinction. In addition, we find that regulatory mechanisms will likely only increase in their strength and effectiveness in minimizing the extinction risk of this DPS in the next 50 years, making it unlikely that the threat of overutilization will be a significant risk to this DPS' continued existence in the foreseeable future. Therefore, we conclude that listing the Central Pacific scalloped hammerhead shark DPS as threatened or endangered under the ESA is not warranted at this time.

Effects of Listing

Conservation measures provided for species listed as endangered or threatened under the ESA include recovery plans and actions (16 U.S.C. 1536(f)); concurrent designation of critical habitat if prudent and determinable (16 U.S.C. §1533(a)(3)(A)); Federal agency requirements to consult with NMFS and to ensure its actions do not jeopardize the species or result in adverse modification or destruction of critical habitat should it be designated (16 U.S.C. §1536); 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 such plan would not promote the conservation of the species.

Identifying Section 7 Consultation Requirements

Section 7(a)(2) (16 U.S.C. §1536(a)(2)) of the ESA and NMFS/FWS regulations require Federal agencies to confer with us 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, Federal agencies must consult on any action they authorize, fund, or carry out if those actions may affect the listed species or its critical habitat and ensure that such actions do not jeopardize the species or result in adverse modification or destruction of critical habitat should it be designated. Examples of Federal actions that may affect scalloped hammerhead shark DPSs include, but are not limited to:

alternative energy projects, discharge of pollution from point sources, non-point source pollution, contaminated waste and plastic disposal, dredging, pile-driving, water quality standards, vessel traffic, aquaculture facilities, military activities, and fisheries management practices.

Critical Habitat

Critical habitat is defined in section 3 of the ESA (16 U.S.C. 1532(3)) as: (1) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the ESA, on which are found those physical or biological features (a) essential to the conservation of the species and (b) that may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by a species at the time it is listed upon a determination that such areas are essential for the conservation of the species. "Conservation" means the use of all methods and procedures needed to bring the species to the point at which listing under the ESA is no longer necessary. Section 4(a)(3)(a) of the ESA (16 U.S.C. 1533(a)(3)(A)) requires that, to the extent prudent and determinable, critical habitat be designated concurrently with the listing of a 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. If we determine that it is prudent and determinable, we will publish a proposed designation of critical habitat for scalloped hammerhead sharks in a separate rule. Public input on features and areas that may meet the definition of critical habitat for the Central & SW Atlantic, Indo-West Pacific, and Eastern Pacific DPS is invited. These DPSs are the only DPSs proposed for listing that occur in U.S. waters or its territories.

Take Prohibitions

Because we are proposing to list the Eastern Pacific and Eastern Atlantic DPSs as endangered, all of the take prohibitions of section 9(a)(1) of the ESA (16 U.S.C. §1538(a)(1)) will apply to those particular species if they become listed as endangered. 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.'' These prohibitions apply to all persons, organizations and entities subject to the jurisdiction of the United States, including in the United States, its territorial sea, or on the high seas.

In the case of threatened species, ESA section 4(d) requires the Secretary to issue regulations deemed necessary and appropriate for the conservation of the species. We have flexibility under section 4(d) to tailor protective regulations based on the needs of and threats to the species. The section 4(d) protective regulations may prohibit, with respect to threatened species, some or all of the acts which section 9(a) of the ESA prohibits with respect to endangered species. We will evaluate protective regulations pursuant to section 4(d) for the threatened scalloped hammerhead shark DPSs and propose any considered necessary and advisable for conservation of these species in a future rulemaking. In order to inform our consideration of appropriate protective regulations for these DPSs, we seek information from the public on the threats to the Central & SW Atlantic DPS and the Indo-West Pacific DPS and possible measures for their conservation.

<u>Identification of Those Activities That Would Constitute a Violation of Section 9 of the ESA</u>

On July 1, 1994, NMFS and FWS 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, specific activities that 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 following types of activities are those that may be most likely to violate the section 9 prohibitions against "take" of the scalloped hammerhead shark Eastern Atlantic and Eastern Pacific DPSs include, the following: (1) importation of fins or any part of a scalloped hammerhead shark; (2) exportation of fins or any part of a scalloped hammerhead shark; (3) take of fins or any part of a scalloped hammerhead shark, including fishing for, capturing, handling, or possessing scalloped hammerhead sharks or fins; (4) sale of fins or any part of a scalloped hammerhead shark; (5) delivery of fins or any part of a scalloped hammerhead shark; and (6) any activities that may impact the water column attributes in scalloped hammerhead nursery grounds (e.g. development and habitat alterations, point and non-point source discharge of persistent contaminants, toxic waste and other pollutant disposal). We emphasize that whether a violation results from a particular activity is entirely dependent 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.

Role of 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. Independent specialists were selected from the academic and scientific community for this review. All peer reviewer comments were addressed prior to dissemination of the final status review report and publication of this proposed rule.

On July 1, 1994, the NMFS and USFWS published a series of policies regarding listings under the ESA, including a policy for peer review of scientific data (59 FR 34270). The intent of the peer review policy is to ensure that listings are based on the best scientific and commercial data available. Prior to a final listing, NMFS will solicit the expert opinions of three qualified specialists selected from the academic and scientific community, Federal and state agencies, and the private sector on listing recommendations to ensure the best biological and commercial information is being used in the decision-making process, as well as to ensure that reviews by recognized experts are incorporated into the review process of rulemakings developed in accordance with the requirements of the ESA.

Public Comments Solicited on Listing

To ensure that the final action resulting from this proposal will be as accurate and effective as possible, we solicit comments and suggestions from the public, other governmental agencies, the scientific community, industry, environmental groups, and any other interested parties. Comments are encouraged on this proposal (See DATES and ADDRESSES). Specifically, we are interested in information regarding: (1) the proposed scalloped hammerhead DPS delineations; (2) the population structure of scalloped hammerhead sharks; (3) habitat within the range of the proposed for listing DPSs that was present in the past, but may have been lost over time; (4) biological or other relevant data concerning any threats to the scalloped hammerhead shark DPSs we propose for listing; (5) the range, distribution, and abundance of these scalloped hammerhead shark DPSs; (6) current or planned activities within the range of the scalloped hammerhead shark DPSs we propose for listing and their possible impact on these DPSs; (7) recent observations or sampling of the scalloped hammerhead shark DPSs we propose for listing; and (8) efforts being made to protect the scalloped hammerhead shark DPSs we propose to list. We are also specifically interested in information regarding the Indo-West Pacific DPS, mainly the population structure, range, distribution, and recent observations or sampling of scalloped hammerhead sharks around the Western Pacific Islands.

Public Comments Solicited on Critical Habitat

We request quantitative evaluations describing the quality and extent of habitats for the Central & SW Atlantic, Eastern Pacific, and Indo-West Pacific DPSs, as well as information on areas that may qualify as critical habitat for these proposed DPSs. Specific areas that include the physical and biological features essential to the conservation of these DPSs, where such features may require special management considerations or protection, should be identified. 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 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 CFR424.12(b)). Areas outside the occupied geographical area should also be identified, if such areas themselves are 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 waters 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 exclude from a critical habitat designation those particular areas 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. For features and areas potentially qualifying as critical habitat, we also request information describing: (1) Activities or other threats to the essential features or activities that could be affected by designating them as critical habitat; 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 seek information regarding the conservation benefits of designating areas within waters under U.S. jurisdiction as critical habitat. In keeping with the guidance provided by OMB (2000; 2003), we seek information that would allow the monetization of these effects to the extent possible, as well as information on qualitative impacts to economic values.

Data reviewed may include, but are not limited to: (1) scientific or commercial publications; (2) administrative reports, maps or other graphic materials; (3) information received from experts; and (4) comments from interested parties. Comments and data particularly are sought concerning: (1) maps and specific information describing the amount, distribution, and use type (e.g., foraging or migration) by the proposed scalloped hammerhead shark DPSs, 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; (6) whether specific unoccupied areas may be essential to provide additional habitat areas for the conservation of the proposed DPSs; and (7) potential peer reviewers for a proposed critical habitat designation, including persons with biological and economic expertise relevant to the species, region, and designation of critical habitat. We seek information regarding critical habitat for the proposed scalloped hammerhead shark DPSs as soon as possible, but no later than [INSERT DATE 90 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER].

Public Hearings

If requested by the public by [insert date 45 days after publication in the FEDERAL REGISTER], hearings will be held regarding the proposed scalloped hammerhead shark DPSs. If 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).

Classification

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), we have 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).

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.

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 223

Endangered and threatened species, Exports, Imports, Transportation.

50 CFR Part 224

Endangered and threatened species, Exports, Imports, Transportation.

Dated: March 28, 2013.

Alan D. Risenhoover,

Director, Office of Sustainable Fisheries,

performing the functions and duties of the

Deputy Assistant Administrator for Regulatory Programs,

National Marine Fisheries Service.

For the reasons set out in the preamble, 50 CFR parts 223 and 224 are proposed to be amended as follows:

PART 223—THREATENED MARINE AND ANADROMOUS SPECIES

1. 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).

2. In § 223.102, paragraphs (c)(30) and (c)(31) are added to read as follows:

§ 223.102 Enumeration of threatened marine and anadromous species.

* * * * *

Species[1]		Where Listed	Citation(s) for listing determination(s)	Citation(s) for critical habitat designation(s)
Common name *******	Scientific name			
(c) * * *				
(30) Scalloped hammerhead shark – Central & SW Atlantic DPS	Sphyrna lewini	Central and Southwest Atlantic Distinct Population Segment. The boundaries for this DPS are as follows: bounded to the north by 28° N. lat., to the east by 30° W. long., and to the south by 36° S. lat. Includes all waters of the Caribbean Sea, comprising the Bahamas’ EEZ off the coast of Florida as well as Cuba’s EEZ.	[INSERT FR CITATION & DATE WHEN PUBLISHED AS A FINAL RULE]	

(31) Scalloped hammerhead shark – Indo-West Pacific DPS	Sphyrna lewini	Indo-West Pacific Distinct Population Segment. The boundaries for this DPS are as follows: bounded to the south by 36° S. lat., to the west by 15° E. long., and to the north by 40° N. lat. In the east, the boundary line extends from175° W. long. due south to 10° N. lat., then due east along 10° N. lat. to 140° W. long., then due south to 4° S. lat., then due east along 4° S. lat. to 130° W. long, and then extends due south along 130° W. long.	[INSERT FR CITATION & DATE WHEN PUBLISHED AS A FINAL RULE]	
* * * * * * *				

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

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PART 224—ENDANGERED MARINE AND ANADROMOUS SPECIES

3. 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.

4. Amend the table in § 224.101 by adding an entry for Scalloped hammerhead shark – Eastern Atlantic DPS, and by adding an entry for Scalloped hammerhead shark – Eastern Pacific DPS at the end of the table in § 224.101(a) to read as follows:

§ 224.101 Enumeration of endangered marine and anadromous species

* * * * *

(a) * * *

Species[1]		Where Listed	Citation(s) for listing determination(s)	Citation(s) for critical habitat designation(s)
Common name *******	Scientific name			
Scalloped hammerhead shark – Eastern Atlantic DPS	Sphyrna lewini	Eastern Atlantic Distinct Population Segment. The boundaries for this DPS are as follows: Bounded to the west by 30° W. long., to the north by 40° N. lat., to the south by 36° S. lat., and to the east by 20° E. long., but includes all waters of the Mediterranean Sea.	[INSERT FR CITATION & DATE WHEN PUBLISHED AS A FINAL RULE]	NA
Scalloped hammerhead shark – Eastern Pacific DPS	Sphyrna lewini	Eastern Pacific Distinct Population Segment. The boundaries for this DPS are as follows: bounded to the north by 40° N lat. and to the south by 36° S lat. The western boundary line extends from140° W. long. due south to 10° N., then due west along 10° N. lat. to 140° W. long., then due south to 4° S. lat., then due east along 4° S. lat. to 130° W. long, and then extends due south along 130° W. long.	[INSERT FR CITATION & DATE WHEN PUBLISHED AS A FINAL RULE]	NA

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

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