proposed collection of information; (c) ways to enhance the quality, utility, and clarity of the information to be collected; and (d) ways to minimize the burden of the collection of information on respondents, including through the use of automated collection techniques or other forms of information technology.

Comments submitted in response to this notice will be summarized and/or included in the request for OMB approval of this information collection; they also will become a matter of public record.

Dated: June 23, 2016.

Sarah Brabson,

NOAA PRA Clearance Officer.

[FR Doc. 2016–15215 Filed 6–27–16; 8:45 am]

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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[Docket No. 150506425–6516–02]

RIN 0648–XD941

Endangered and Threatened Wildlife and Plants; Notice of 12-Month Finding on Petition To List the Smooth Hammerhead Shark as Threatened or Endangered Under the Endangered Species Act

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

ACTION: Notice of 12-month finding and availability of status review document.

SUMMARY: We, NMFS, announce a 12-month finding on a petition to list the smooth hammerhead shark (*Sphyrna zygaena*) as threatened or endangered under the Endangered Species Act (ESA). We have completed a comprehensive status review of the smooth hammerhead shark in response to this petition. Based on the best scientific and commercial information available, including the status review report (Miller 2016), we have determined that the species does not warrant listing at this time. We conclude that the smooth hammerhead shark is not currently in danger of extinction throughout all or a significant portion of its range and is not likely to become so within the foreseeable future.

DATES: This finding was made on June 28, 2016.

ADDRESSES: The status review report for the smooth hammerhead shark is available electronically at: *http://www.fisheries.noaa.gov/pr/species/fish/smooth-hammerhead-shark.html.* You may also receive a copy by submitting a request to the Office of Protected Resources, NMFS, 1315 East-West Highway, Silver Spring, MD 20910, Attention: Smooth Hammerhead Shark 12-month Finding.

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

SUPPLEMENTARY INFORMATION:

Background

On April 27, 2015, we received a petition from Defenders of Wildlife to list the smooth hammerhead shark (*Sphyrna zygaena*) as threatened or endangered under the ESA throughout its entire range, or, as an alternative, to list any identified Distinct Population Segment (DPS) as threatened or endangered. The petitioners also requested that critical habitat be designated for the smooth hammerhead under the ESA. In the case that the species does not warrant listing under the ESA, the petition requested that the species be listed based on its similarity of appearance to the listed DPSs of the scalloped hammerhead shark (*Sphyrna lewini*). On August 11, 2015, we published a positive 90-day finding (80 FR 48053) 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 smooth 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.

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'' is not currently at risk of extinction, but is likely to become so in the foreseeable future. The 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: The present or threatened destruction, modification, or curtailment of its habitat or range; overutilization for commercial, recreational, scientific, or educational purposes; disease or predation; the inadequacy of existing regulatory mechanisms; or 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 domestic 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) for any conservation efforts that have not been implemented, or have been implemented but not yet demonstrated effectiveness.

Status Review

The status review for the smooth hammerhead shark was conducted by a NMFS biologist in the Office of

Protected Resources (Miller 2016). The status review examined the entire species' status throughout its range and also evaluated if any portion of the smooth hammerhead shark's range was significant as defined by the Services Significant Portion of its Range (SPR) Policy (79 FR 37578; July 1, 2014).

In order to complete the status review, information was compiled on the species' biology, ecology, life history, threats, and status from information contained in the petition, our files, a comprehensive literature search, and consultation with experts. We also considered information submitted by the public in response to our petition finding. In assessing extinction risk of the smooth hammerhead shark, we considered the demographic viability factors developed by McElhany *et al.* (2000). The approach of considering demographic risk factors to help frame the consideration of extinction risk has been used in many of our status reviews, including for Pacific salmonids, Pacific hake, walleye pollock, Pacific cod, Puget Sound rockfishes, Pacific herring, scalloped and great hammerhead sharks, and black abalone (see *http://www.nmfs.noaa.gov/pr/species/* for links to these reviews). In this approach, the collective condition of individual populations is considered at the species level according to four viable population descriptors: Abundance, growth rate/productivity, spatial structure/connectivity, and diversity. These viable population descriptors reflect concepts that are well-founded in conservation biology and that individually and collectively provide strong indicators of extinction risk (NMFS 2015b).

The status review report was subjected to independent peer review as required by the Office of Management and Budget Final Information Quality Bulletin for Peer Review (M–05–03; December 16, 2004). The status review report was peer reviewed by three independent specialists selected from the academic and scientific community, with expertise in shark biology, conservation and management, and knowledge of smooth hammerhead sharks. The peer reviewers were asked to evaluate the adequacy, appropriateness, and application of data used in the status review, including the extinction risk analysis. All peer reviewer comments were addressed prior to dissemination of the final status review report and publication of this determination.

We subsequently reviewed the status review report, its cited references, and peer review comments, and believe the status review report, upon which this 12-month finding is based, provides the best available scientific and commercial information on the smooth hammerhead shark. Much of the information discussed below on smooth hammerhead shark biology, distribution, abundance, threats, and extinction risk is attributable to the status review report. However, in making the 12-month finding determination, we have independently applied the statutory provisions of the ESA, including evaluation of the factors set forth in Section 4(a)(1)(A)–(E) and our regulations regarding listing determinations. The status review report is available on our Web site (see **ADDRESSES** section) and the peer review report is available at *http://www.cio.noaa.gov/services_programs/prplans/PRsummaries.html.* Below is a summary of the information from the report and our analysis of the status of the smooth hammerhead shark. Further details can be found in Miller (2016).

Description 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 (*Eusphyra blochii*), which is the sole species in the Genus *Eusphyra.* The smooth hammerhead was first described in 1758 by Karl Linnaeus and named *Squalus zygaena;* however, this name was later changed to the current scientific species name of *Sphyrna zygaena* (Linneaus 1758) (Bester n.d.).

The hammerhead sharks are recognized by their laterally expanded head that resembles a hammer (hence the common name ''hammerhead''). In comparison to the other hammerhead sharks, the head of the smooth hammerhead shark has a scalloped appearance but a rounded un-notched anterior margin (which helps to distinguish it from scalloped hammerhead sharks) and depressions opposite each nostril. The smooth hammerhead also has a ventrally located and strongly arched mouth with smooth or slightly serrated teeth (Compagno 1984). The body of the shark is fusiform, lacks a mid-dorsal ridge, and has a moderately tall and hooked first dorsal fin and a lower second dorsal fin that is shorter than the notched anal fin (Compagno 1984; Bester n.d.). The color of the smooth hammerhead shark ranges from a dark olive to greyish-brown and fades into a white underside, which is different than most other hammerhead species whose colors are commonly brown (Bester n.d.).

Range and Habitat Use

The smooth hammerhead shark is a circumglobal species, found worldwide in temperate to tropical waters between 59 °N. and 55 °S. latitudes (CITES 2013). It is thought to be the hammerhead species most tolerant of temperate waters (Compagno 1984). In the northwestern Atlantic Ocean, the range of the smooth hammerhead shark extends from Nova Scotia, Canada to Florida, and partly into the Caribbean; however, the species is said to be rare in Canadian waters and only found offshore in the Gulf Stream (Fisheries and Oceans Canada 2010). Additionally, its presence off the Caribbean Islands cannot be confirmed, although these waters are noted to be part of its range in Compagno (1984). In the southwestern Atlantic, the smooth hammerhead shark range extends from Brazil to southern Argentina, and in the eastern Atlantic Ocean, smooth hammerhead sharks can be found from the British Isles to equatorial West Africa and throughout the Mediterranean Sea (Compagno 1984; Bester n.d).

In the Indian Ocean, the shark is found off the coasts of South Africa, within the Persian Gulf, along the southern coast of India, Sri Lanka, and off Indonesia, and along the western and southern coasts of Australia. Its range in the western and central Pacific extends from Japan to Vietnam, including the southeast coast of Australia and waters off New Zealand, the Hawaiian Islands and American Samoa. In the northeastern Pacific, the smooth hammerhead shark range extends from northern California to the Nayarit state of Mexico, and in the southeastern Pacific, the species can be found from Panama to Chile, but is generally rare in Chilean waters (Brito 2004).

The smooth hammerhead shark is a coastal-pelagic and semi-oceanic species and generally occurs close inshore and in shallow waters, most commonly in depths of up to 20 m (CITES 2013). However, the species may also be found over continental and insular shelves to offshore areas in depths as great as 200 m (Compagno 1984; Ebert *et al.* 2013; Bester n.d.). Smooth hammerhead sharks are highly mobile and may undergo seasonal migrations (toward cooler waters in the summer and the reverse in the winter), with juveniles (of up to 1.5 m in length) occasionally forming large aggregations during these migrations (Compagno 1984; Diemer *et al.* 2011; Ebert *et al.* 2013; Bester n.d.).

Adult smooth hammerhead sharks, on the other hand, are generally solitary (Compagno 1984). Based on available tagging data, the species is able to travel significant distances, with various studies showing estimates of total distance travelled of around 919 km (Kohler and Turner 2001), more than 1,609 km (SWFSC 2015), and around 2,220 km (Clarke *et al.* 2015).

Diet and Feeding

The smooth hammerhead shark is a high trophic level predator (trophic level = 4.2; Cortés (1999)) and opportunistic feeder that consumes a variety of teleosts, small sharks (including its own species), dolphins, skates and stingrays, sea snakes, crustaceans, and cephalopods (Nair and James 1971; Compagno 1984; Bornatowski *et al.* 2007; Masunaga *et al.* 2009; Rogers *et al.* 2012; Galvan-Magana *et al.* 2013; Bornatowski *et al.* 2014; Sucunza *et al.* 2015). Skates and stingrays, in particular, tend to comprise the majority of the species' diet in inshore locations (Nair and James 1971; Bester n.d.), whereas in coastal and shelf waters, cephalopods appear to be an important prey item (Bornatowski *et al.* 2007; Bornatowski *et al.* 2014).

Growth and Reproduction

The general life history characteristics of the smooth hammerhead shark are that of a long-lived, slow-growing, and late maturing species. The average size of a smooth hammerhead shark ranges between 2.5–3.5 m in length, but individuals can reach maximum lengths of 5 m and weights of 880 pounds (400 kg) (CITES 2013; Bester n.d.). Based on observed and estimated sizes of smooth hammerhead sharks from both the Atlantic and Pacific oceans, females appear to reach sexual maturity between 250 cm and 290 cm total length (TL). Males are considered sexually mature at smaller sizes than females, with estimates of 210–250 cm TL from the Atlantic and 250–260 cm TL in the western Pacific. More recent data from the eastern Pacific (specifically the Gulf of California) estimate much smaller maturity sizes for smooth hammerhead sharks, with 50 percent of females and males of the population maturing at 200 cm and 194 cm TL, respectively (Nava Nava and Fernando Marquez-Farias 2014). Longevity of the species is unknown but thought to be at least 20 years (Bester n.d.), with female and male smooth hammerhead sharks aged up to 18 years and 21 years, respectively, from the eastern equatorial Atlantic Ocean (Coelho *et al.* 2011).

The smooth hammerhead shark is viviparous (*i.e.,* give birth to live young), with a gestation period of 10–11 months (White *et al.* 2006) and an assumed annual reproductive periodicity; however this has yet to be verified (Clarke *et al.* 2015). Possible pupping grounds and nursery areas for this species (based on the presence of pregnant females, neonates, and juveniles) include the Gulf of California, Gulf of Guinea, Strait of Sicily, coastal and inshore waters off Baja California, Venezuela, southern Brazil, Uruguay, Morocco, the southern and eastern cape of South Africa, Kenya (including Ungwana Bay), and New Zealand (Sadowsky 1965; Castro and Mejuto 1995; Buencuerpo *et al.* 1998; Arocha *et al.* 2002; Celona and Maddalena 2005; Costa and Chaves 2006; Bizzarro *et al.* 2009; Cartamil *et al.* 2011; Coelho *et al.* 2011; Diemer *et al.* 2011; CITES 2013; Kyalo and Stephen 2013; Bornatowski *et al.* 2014; Nava Nava and Fernando Marquez-Farias 2014). Litter sizes range from around 20 to 50 live pups, with an average of around 33 pups, and length at birth is estimated to be between 49–64 cm. The smooth hammerhead shark is estimated to grow an average of 25 cm per year over the first 4 years of its life before slowing down later in its life (Coelho *et al.* 2011).

Demography

Although there are very few age/growth studies, based on the best available data, smooth hammerhead sharks exhibit life-history traits and population parameters that place the species towards the faster growing end along the ''fast-slow'' continuum of population parameters that have been calculated for 38 species of sharks by Cortés (2002, Appendix 2). In an Ecological Risk Assessment study of 20 species caught in Atlantic pelagic fisheries, Cortés *et al.* (2012) found that the smooth hammerhead shark ranked among the most productive species (with the 4th highest productivity rate; r = 0.225) and had one of the lowest vulnerabilities to pelagic longline fisheries. Based on these estimates, smooth hammerhead sharks can be characterized as having ''medium'' productivity (based on categorizations in Musick (1999)), with demographic parameters that provide the species with moderate resilience to exploitation.

Population Structure

Due to sampling constraints, very few studies have examined the population structure of the smooth hammerhead shark. Using mitochondrial DNA (which is maternally inherited) Naylor *et al.* (2012) found only a single cluster of smooth hammerhead sharks (in other words, no evidence to suggest matrilineal genetic partitioning of the species). This analysis, however, suffered from low sample size, based on only 16 specimens, but covered the longitudinal distribution of the species (Naylor *et al.* 2012). In contrast, Testerman (2014) analyzed both mitochondrial control region sequences (mtCR; n=303, 1,090 base pair) and 15 nuclear microsatellite loci (n=332) from smooth hammerhead sharks collected from 8 regional areas: Western North Atlantic (n=21); western South Atlantic (n=55); western Indian Ocean (n=63); western South Pacific (n=44); western North Pacific (n=11); eastern North Pacific (n=55); eastern Tropical Pacific (n=15); and eastern South Pacific (n=6). Results from the analysis of mitochondrial DNA indicated significant genetic partitioning, with no sharing of haplotypes, between the Atlantic and Indo-Pacific basins (mtCR φ_{ST}=0.8159) (Testerman 2014). Analysis of the nuclear DNA also showed significant genetic structure between ocean basins (nuclear F_{ST}=0.0495), with the Atlantic and Indo-Pacific considered to comprise two genetically distinct populations (Testerman 2014). However, additional studies are needed to further refine the population structure of the smooth hammerhead shark and confirm the above results, including, as Testerman (2014) suggests, using samples from individual smooth hammerhead sharks of known size class and gender.

Species Finding

Based on the best available scientific and commercial information described above, we determined that *Sphyrna zygaena* is a taxonomically-distinct species and, therefore, meets the definition of ''species'' pursuant to section 3 of the ESA. Below, we evaluate whether *Sphyrna zygaena* warrants listing under the ESA as an endangered or threatened species throughout all or a significant portion of its range.

Assessment of Extinction Risk

The 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. For the term ''foreseeable future,'' we define it as the timeframe over which identified threats could be reliably predicted to impact the biological status of the species. For the assessment of extinction risk for smooth hammerhead sharks, the ''foreseeable future'' was considered to extend out several decades. Given the species' life history traits, with longevity estimated to be greater than 20 years, maturity at around 8 years, and generation time at around 13 years, it would likely take several decades (*i.e.,* multiple generations) for any recent management actions to be realized and reflected in population abundance indices (*e.g.,* impact of declining shark fin trade). Furthermore, as the main potential operative threat to the species is overutilization by commercial and artisanal fisheries (discussed below), this timeframe (*i.e.,* several decades) would allow for reliable predictions regarding the impact of current levels of fishery-related mortality on the biological status of the species. As depicted in the very limited available catch per unit effort (CPUE) time-series data, trends in the species' abundance can manifest within this time horizon.

In evaluating the level of risk faced by a species in deciding whether the species is threatened or endangered, it is important to consider both the demographic risks facing the species as well as current and potential threats that may affect the species' status. To this end, a demographic risk analysis was conducted for the smooth hammerhead shark and considered alongside the information on threats to the species, including those related to the factors specified by the ESA Section 4(a)(1)(A)–(E). Specific methods on the demographic risk analysis can be found in the status review report, but each demographic factor was ultimately assigned one of three qualitatively-described levels of risk: ''very low or low risk,'' ''medium risk,'' or ''high risk'' (Miller 2016). The information from this demographic risk analysis in conjunction with the available information on threats (summarized below) was interpreted using professional judgement to determine an overall risk of extinction for *S. zygaena.* Because species-specific information is insufficient, a reliable, quantitative model of extinction risk could not be conducted as this time. The qualitative reference levels of ''low risk,'' ''moderate risk'' and ''high risk'' were used to describe the overall assessment of extinction risk, with detailed definitions of these risk levels found in the status review report (Miller 2016).

Evaluation of Demographic Risks

Abundance

Current and accurate abundance estimates are unavailable for the smooth hammerhead shark. With respect to general trends in population abundance, multiple studies indicate that smooth hammerhead sharks may have experienced population declines over the past few decades, although these studies suffer from very low sample sizes and a lack of reliable data due to the scarcity of the smooth hammerhead sharks in the fisheries data. Catch records also generally fail to differentiate between the *Sphyrna* species. As such, many of the available studies examining abundance trends have, instead, looked at the entire hammerhead shark complex (scalloped, smooth, and great hammerhead sharks combined). However, attributing the observed declines from these studies to the smooth hammerhead shark population could be erroneous, especially given the distribution and proportion of *S. zygaena* compared to other hammerhead species. As smooth hammerhead sharks tend to occur more frequently in temperate waters compared to other *Sphyrna* species, they are likely to be impacted by different fisheries, which may explain the large differences in the proportions that *S. zygaena* comprise in the available commercial and artisanal ''hammerhead'' catch. In fact, based on the available information (discussed in more detail in the section *Overutilization for Commercial, Recreational, Scientific or Educational Purposes*), the proportion of smooth hammerhead sharks compared to the other hammerhead species in the fisheries data ranges from <1 percent to 100 percent, depending on the region, location, and timing of the fishing operations. As such, using other *Sphyrna* spp. abundance indices estimated from fisheries data to describe the status of *S. zygaena* is likely highly inaccurate. Therefore, we gave greater weight to the available abundance data that could explicitly or reasonably be attributed to smooth hammerhead sharks in our evaluation of the level of risk posed by current abundance.

Unlike the scalloped hammerhead shark, and to a lesser extent, the great hammerhead shark, NMFS fishery scientists note that there are hardly any data for smooth hammerhead sharks, particularly in U.S. Atlantic waters (personal communication J. Carlson). Hayes (2007) remarks that the species rarely occurs throughout the majority of U.S. Atlantic waters, and is thought to be less abundant than scalloped or great hammerhead sharks. Due to these data deficiencies, no official stock assessment has been conducted (or accepted) by NMFS for the species in this region. However, two preliminary species-specific stock assessments of the U.S. Atlantic smooth hammerhead shark population (Hayes 2007; Jiao *et al.* 2011) were available for review. These stock assessments used surplus-production models, which are common for dealing with data-poor species, and are useful when only catch and relative abundance data are available (Hayes *et al.* 2009). Given the limited amount and low quality of available data on smooth hammerhead sharks in the U.S. Northwest Atlantic, the only CPUE dataset with sufficient sample size that could be used as an index of relative abundance for these stock assessments was the U.S. Pelagic Longline (PLL) Logbook dataset. Results from the Hayes (2007) stock assessment estimated a virgin population size of smooth hammerhead sharks to be anywhere between 51,000 and 71,000 individuals in 1982 and a population size in 2005 of around 5,200 individuals. While these estimates translate to a decline of around 91 percent in abundance, based on the modeled trajectory in the stock assessment (Hayes 2007), abundance appears to have stabilized in recent years. In fact, the Jiao *et al.* (2011) stock assessment model indicated that after 2001, the risk of overfishing of the species was very low. It is important to note, though, that the abundance estimates from these stock assessments are very crude, hampered by significant uncertainty and based on a single index that may not adequately sample coastal sharks.

Within the Mediterranean region, rough estimates of the declines in abundance and biomass of smooth hammerhead sharks range from 96 to 99 percent (Celona and Maddalena 2005; Ferretti *et al.* 2008). Similar to the previous studies, these findings are hindered by a lack of reliable data and sufficient sample sizes. Yet, despite the uncertainty in magnitude of decline, Celona and de Maddalena (2005) provide a detailed review of historical and recent anecdotal accounts and catch records from select areas off Sicily that indicate a strong likelihood that smooth hammerheads have been fished to the point where they are now extremely rare. Additionally, information from the Mediterranean Large Elasmobranchs Monitoring (MEDLAM) program, as well as data from more expansive sampling of Mediterranean fleets operating throughout the region, also indicate a species that is presently only sporadically recorded (Megalofonou *et al.* 2005; Baino *et al.* 2012). Given the extent of the observed decline and evidence of the current rarity of the species, current abundance levels within this region are likely placing the species at a high risk of extirpation in the Mediterranean from anthropogenic perturbations.

In the Indian Ocean, data on trends in smooth hammerhead shark abundance are available from only two studies conducted in waters off South Africa. As such, the results are not likely indicative of the status of the species throughout this region. Furthermore, based on the findings from the two studies, the trend in the species' abundance within South African waters is unclear. For example, one study, which consisted of a 25-year tagging survey (conducted from 1984–2009) off the eastern coast of South Africa, concluded that the abundance of smooth hammerhead sharks (based on their availability for tagging) peaked in 1987 (n=468 tagged) and declined thereafter (Diemer *et al.* 2011). In contrast, a 25-year time series of annual CPUE of smooth hammerhead sharks in beach protective nets set off the KwaZulu-Natal beaches showed no significant trend, with the authors finding no evidence of a change in the mean or median size of *S. zygaena* in the nets over the time period (1978–2003) (Dudley and Simpfendorfer 2006).

Off New South Wales (NSW), Australia, CPUE data from a shark meshing (bather protection) program was lumped for a hammerhead complex (scalloped, smooth, and great hammerhead sharks), although the majority of the hammerhead catch was assumed to comprise *S. zygaena* given the species' tolerance of temperate waters (Reid and Krogh 1992; Reid *et al.* 2011; Williamson 2011). The data indicate that hammerhead sharks may have declined by around 85 percent over the past 35 years (Reid *et al.* 2011); however, changes in the methods and level of effort of the program since its inception have complicated these long-term analyses. Since 2009, annual catches of smooth hammerhead sharks in the nets have remained fairly stable.

Overall, with only a few regional studies providing limited information on the present abundance of the smooth hammerhead shark, the magnitude of declines and the current global abundance of the smooth hammerhead shark remains unclear. While the species may be at higher risk of extirpation in the Mediterranean, elsewhere throughout its range, trends and estimates in abundance do not indicate that the species' global abundance is so low, or variability so high, that it is at risk of global extinction due to environmental variation, anthropogenic perturbations, or depensatory processes, now or in the foreseeable future. In fact, many of the available regional studies suggest potentially stable populations. We therefore conclude that, at this time, the best available information on current abundance and trends indicates a low demographic risk to the species.

Growth Rate/Productivity

Sharks, in general, have lower reproductive and growth rates compared to bony fishes; however, smooth hammerhead sharks exhibit life-history traits and population parameters that place the species towards the faster growing end along a spectrum of shark species (Cortés 2002, Appendix 2). Cortés *et al.* (2012) found that the smooth hammerhead shark ranked among the most productive species when compared to 20 other species of sharks. Based on the estimate of its intrinsic rate of population increase (r=0.225), smooth hammerhead sharks can be characterized as having ''medium'' productivity (Musick 1999) with moderate resilience to exploitation. Given the available information, with no evidence of declining population trends, it is unlikely that the species' average productivity is below replacement to the point where the species is at risk of extinction from low abundance. Additionally, the limited amount of information on the demography and reproductive traits of the smooth hammerhead shark throughout its range precludes identification of any shifts or trends in per capita growth rate. As such, we conclude that, at this time, the best available information on growth rate/productivity indicates a low demographic risk to the species.

Spatial Structure/Connectivity

The smooth hammerhead shark range is comprised of open ocean environments occurring over broad geographic ranges. There is very little information on specific habitat (or patches) used by smooth hammerhead sharks. For example, habitat deemed necessary for important life history functions, such as spawning, breeding, feeding, and growth to maturity, is currently unknown for this species. Although potential nursery areas for the species have been identified in portions of its range, there is no information that these areas are at risk of destruction or directly impacting the extinction risk of smooth hammerhead populations.

Although dispersal rates for the species are currently unknown, there is no reason to believe that they are low within the range of *S. zygaena.* While the available data suggest a potentially patchy distribution for the species, given the relative absence of physical barriers within their marine environments (compared with terrestrial or river systems) and the shark's highly migratory nature (with tracking studies that indicate its ability to move long distances), it is unlikely that insufficient genetic exchange or an inability to find and exploit available resource patches are risks to the species. It is also unknown if there are source-sink dynamics at work that may affect population growth or species' decline. Thus, there is insufficient information that would support the conclusion that spatial structure and connectivity pose significant risks to this species. As such, we conclude that, at this time, the best available information on spatial structure/connectivity indicates a very low demographic risk to the species.

Diversity

There is no evidence that the species is at risk due to a substantial change or loss of variation in genetic characteristics or gene flow among populations. Smooth hammerhead sharks are found in a broad range of habitats and appear to be well-adapted and opportunistic. There are no restrictions to the species' ability to disperse and contribute to gene flow throughout its range, nor is there evidence of a substantial change or loss of variation in life-history traits, population demography, morphology, behavior, or genetic characteristics. There is also no information to suggest that natural processes that cause ecological variation have been significantly altered to the point where the species is at risk. As such, we conclude that, at this time, the best available information on diversity indicates a very low demographic risk to the species.

Summary of Factors Affecting the Smooth Hammerhead Shark

As described above, section 4(a)(1) of the ESA and NMFS implementing regulations (50 CFR 424.11(c)) state that we must determine whether a species is endangered or threatened because of any one or a combination of the following factors: The present or threatened destruction, modification, or curtailment of its habitat or range; overutilization for commercial, recreational, scientific, or educational purposes; disease or predation; inadequacy of existing regulatory mechanisms; or other natural or man-made factors affecting its continued existence. We evaluated whether and the extent to which each of the foregoing factors contribute to the overall extinction risk of the global smooth hammerhead population, with ''significant'' defined as increasing the risk to such a degree that affects the species' demographics (*i.e.,* abundance, productivity, spatial structure, diversity) either to the point where the species is strongly influenced by stochastic or depensatory processes or is on a trajectory toward this point. This section briefly summarizes our findings and conclusions regarding threats to the smooth hammerhead shark and their impact on the overall extinction risk of the species. More details can be found in the status review report (Miller 2016).

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

Currently, smooth hammerhead sharks are found worldwide, residing in temperate to tropical seas. While the exact extent of the species' global range is not well known, based on the best available data, there does not appear to be any indication of a curtailment of range due to habitat destruction or modification. In the Mediterranean (specifically the Adriatic, Tyrrhenian, Ligurian, and Ionian Seas, Strait of Sicily, and Spanish Mediterranean waters) the species was previously thought to be ''functionally extinct'' based on the absence of the species in records after 1995 (as noted in Ferretti *et al.* 2008); however, recent studies provide evidence of the species' continued existence in this portion of its range, specifically within the Ionian and Tyrrhenian Seas and Strait of Sicily (Celona and de Maddalena 2005; Sperone *et al.* 2012). As such, we do not find this to be an indication of a curtailment of the species' range.

Additionally, there is very little information on habitat utilization of smooth hammerhead sharks. Because the smooth hammerhead range is 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, may pose a threat to this species. Although studies on the impacts of climate change specific to smooth hammerhead sharks have not been conducted, results from a recent vulnerability assessment of Australia's Great Barrier Reef shark and ray species to climate change indicate that the closely related great and scalloped hammerhead sharks have a low overall vulnerability to climate change (Chin *et al.* 2010). These findings were, in part, based on the species' low vulnerabilities to each of the assessed climate change factors (*i.e.,* water and air temperature, ocean acidification, freshwater input, ocean circulation, sea level rise, severe weather, light, and ultraviolet (UV) radiation) (Chin *et al.* 2010). While this is a very broad analysis of potential climate change impacts on hammerhead species, no further information specific to the direct effects of climate change on *S. zygaena* populations could be found. Furthermore, given the highly migratory and opportunistic behavior of the smooth hammerhead shark, these sharks likely have the ability to shift their range or distribution to remain in an environment conducive to their physiological and ecological needs, providing the species with some resilience to the effects of climate change. Therefore, while climate change has the potential to pose a threat to sharks in general, including through changes in currents and ocean circulation and potential impacts to prey species, there is presently no information to suggest climate change is a significant threat negatively affecting the status of the smooth hammerhead shark or its habitat.

Overutilization for Commercial, Recreational, Scientific or Educational Purposes

In general, there is very little information on the historical abundance, catch, and trends of smooth hammerhead sharks, with only occasional mentions in fisheries records. Although more countries and regional fisheries management organizations (RFMOs) are working towards improving reporting of species-specific data, catches of hammerhead sharks have gone and continue to go unrecorded in many countries outside the United States. Much of the available data on the exploitation of the smooth hammerhead shark come primarily from localized study sites and over small periods of time; thus, it is difficult to extrapolate this information to the global population. Further complicating the analysis is the fact that data are often aggregated for the entire hammerhead complex. As stated previously, to use a hammerhead complex or other hammerhead species as a proxy for estimates of smooth hammerhead utilization and abundance could be erroneous, especially given the more temperate distribution and generally smaller proportion of *S. zygaena* in the fisheries catch compared to other hammerhead species. Therefore, more weight is given to the analyses of the available species-specific fisheries information compared to hammerhead complex data in determining whether overutilization is a significant threat to the species.

Smooth hammerhead sharks are both targeted and taken as bycatch in many global fisheries by a variety of gear types, including: Pelagic and bottom longlines, handlines, gillnets, purse seines, and pelagic and bottom trawls. They are valued for their large, high-quality fins for use in shark fin soup (Abercrombie *et al.* 2005; Clarke *et al.* 2006a). Additionally, smooth hammerhead sharks exhibit high mortality rates after being caught in fishing gear such as longlines and nets. In fact, estimates of mortality rates range from 47 to 71 percent in longline fishing gear and 94 to 98 percent in net gear (Cliff and Dudley 1992; Kotas *et al.* 2000; Braccini *et al.* 2012; Coelho *et al.* 2012; Fernandez-Carvalho *et al.* 2015). As such, we considered the impact of historical and current catch and bycatch levels (taking into account the species' high mortality rate on fishing gear and the effects of the shark fin trade) on the species' status to evaluate the threat of overutilization to the species. Due to the lack of global estimates and the above data limitations, the available information, including species-specific fishery data, is presented below by regions to better inform a global analysis.

In the northwestern Atlantic, smooth hammerhead sharks are mainly caught, albeit rarely, as bycatch in the U.S. Highly Migratory Species (HMS) commercial longline and net fisheries, and by U.S. recreational fishermen using rod and reel. Their rare occurrence in the fisheries data is likely a reflection of the low abundance of the species in this region (Hayes 2007; NMFS 2015a). As mentioned previously, two preliminary species-specific stock assessments examined the effect of U.S. commercial and recreational fishing on the species' abundance in the northwest Atlantic (Hayes 2007; Jiao *et al.* 2011). These stock assessments drew conclusions about the status of the stock (*e.g.,* ''overfished'' or ''experiencing overfishing'') in relation to the fishery management terms defined under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), such as ''maximum sustainable yield'' (MSY). These statuses, which provide information for determining the sustainability of a fishery, are based on different criteria than those under the ESA, which relate directly to the likelihood of extinction of the species. In other words, the status under MSA does not necessarily have any relationship to a species' extinction risk.

For example, a species could be harvested at levels above MSY but which do not pose a risk of extinction. As such, the analysis of the results from these stock assessments were considered in conjunction with available catch and bycatch trends, abundance, biological information, and other fisheries data in evaluating whether overutilization is a threat to the species.

For the stock assessment models, the limited amount and low quality of available data on smooth hammerhead sharks allowed for the input of only one index of relative abundance (the U.S. Atlantic PLL dataset) into the models. Catch time series data for the models included recreational catches, commercial landings, and pelagic longline discards. Based on these data, both assessments found significant catches of smooth hammerhead sharks in the early 1980s. Although these catches were over two orders of magnitude larger than the smallest catches, Hayes (2007) suggested that these large catches, which correspond mostly to the NMFS Marine Recreational Fishery Statistics Survey (MRFSS), are likely overestimated. Hayes (2007) also identified other data deficiencies that add to the uncertainty surrounding these catch estimates, including: Misreporting of the species, particularly in recreational fisheries, leading to overestimates of catches; underreporting of commercial catches in early years; and unavailable discard estimates for the pelagic longline fishery for the period of 1982–1986.

Results from the stock assessments indicated that the northwest Atlantic smooth hammerhead shark population declined significantly from virgin levels (by up to 91 percent; Hayes 2007), which was likely a consequence of fishery-related mortality exacerbated by the species' vulnerable life history. Although modeled fishing mortality rates were variable over the years, both assessments found a high degree of overfishing during the mid-1990s for smooth hammerhead sharks that likely led to the decline in the population. Towards the end of the modeled time series, however, Hayes (2007) noted that the stock assessment was highly sensitive to the inclusion of pelagic discards for the determination of whether the stock was experiencing overfishing in 2005. The Jiao *et al.* (2011) stock assessment model indicated that after 2001, the risk of overfishing was very low and that the smooth hammerhead population was still overfished but no longer experiencing overfishing. Additionally, the modeled trajectory of abundance appears to depict a depleted but stable population since the early 2000s (Hayes 2007). It is important to note, however, that both studies point out the high degree of uncertainty associated with these stock assessment models, with Jiao *et al.* (2011) warning that the stock assessment model should be ''viewed as illustrative rather than as conclusive evidence of their [*S. zygaena*] present status,'' and Hayes (2007) noting that the ''Questionable data give us little confidence in the magnitude of the results.''

Since 2005 (the last year of data included in the stock assessment models), smooth hammerhead shark catches have remained low, and additional regulatory and management measures have been implemented that significantly decrease any remaining risk of overutilization of the species. For example, in the U.S. bottom longline fishery, which is the primary commercial gear employed for targeting large coastal sharks, *S. zygaena* continues to be a rare occurrence in both the shark catch and bycatch. Based on data from the NMFS shark bottom longline observer program, between 2005 and 2014, only 6 smooth hammerhead sharks were observed caught by bottom longline vessels fishing in the Gulf of Mexico and South Atlantic (data from 214 observed vessels, 833 trips, and 3,032 hauls; see NMFS Reports available at *http://www.sefsc.noaa.gov/labs/panama/ob/bottomlineobserver.htm*). In the pelagic longline fisheries, starting in 2011, the United States prohibited retaining, transshipping, landing, storing, or selling hammerhead sharks in the family Sphyrnidae (except for *Sphyrna tiburo*) caught in association with International Commission for the Conservation of Atlantic Tunas (ICCAT) fisheries (consistent with ICCAT Recommendations 09–07, 10–07, 10–08, and 11–08). During 2012 and 2014, no smooth hammerhead sharks were reported caught by pelagic longline vessels, and in 2013, only one was reported caught and subsequently released alive (NMFS 2013a; NMFS 2014b).

Presently, harvest of the species is managed under the 2006 Consolidated HMS Fishery Management Plan (FMP). With the passage of Amendment 5a to this FMP, which was finalized on July 3, 2013 (78 FR 40318), management measures have been implemented in the U.S. Federal Atlantic HMS fisheries that will help decrease fishery-related mortality of the species. These measures include separating the commercial hammerhead quotas (which includes great, scalloped, and smooth hammerhead sharks) from the large coastal shark (LCS) complex quotas, and linking the Atlantic hammerhead shark quota to the Atlantic aggregated LCS quotas, and the Gulf of Mexico hammerhead shark quota to the Gulf of Mexico aggregated LCS quotas. In other words, if either the aggregated LCS or hammerhead quota is reached, then both the aggregated LCS and hammerhead management groups will close. These quota linkages were implemented as an additional conservation benefit for the hammerhead shark complex due to the concern of hammerhead bycatch and additional mortality from fishermen targeting other sharks within the LCS complex. Furthermore, the separation of the hammerhead species from other sharks within the LCS management unit for quota monitoring purposes will allow NMFS to better manage the specific utilization of the hammerhead complex.

Since these management measures have been in place, landings of hammerhead sharks have decreased significantly. In fact, in 2013, only 49 percent of the Atlantic hammerhead shark quota was reached due to the closure of the Atlantic aggregated LCS group. In 2014, the Atlantic LCS quota was reached when only 46 percent of the Atlantic hammerhead quota had been caught. Most recently, in 2015, only 66 percent of the Atlantic hammerhead quota was caught. In other words, due to existing regulatory measures, the mortality of hammerhead sharks from both targeted fishing and bycatch mortality on fishing gear for other LCS species appears to have been significantly reduced, with current levels unlikely to lead to overutilization of the species.

In the southwest Atlantic, hammerhead sharks are susceptible to being caught by the artisanal, industrial, and recreational fisheries operating off the coast of Brazil and Uruguay. However, the impact of these fisheries specifically on smooth hammerhead sharks remains unclear as the available landings data from this region, which tend to be lumped for all hammerhead species (*Sphyrna* spp.), have fluctuated over the years (Vooren and Klippel 2005). Additionally, when species-specific fisheries information is available, the data indicate that *S. lewini* tend to comprise the majority of the hammerhead shark catch.

According to Vooren and Klippel (2005), the majority of the hammerhead catch off Brazil is caught by the oceanic drift gillnet fleet, which operates on the outer shelf and slope between 27 °S. and 35 °S. latitudes. For example, in 2002, total hammerhead landings from all Brazilian fisheries totaled 356 t, with 92 percent of the landings attributed to the gillnet fleet. However, similar to the findings from the northwest Atlantic, the available species-specific fisheries data indicate that smooth hammerhead sharks comprise a very small proportion of the hammerhead catch from these fisheries, with estimates of around <1 − 5 percent (Sadowsky 1965; Vooren and Klippel 2005).

Although not as frequent as in the oceanic gillnet fisheries, catches of smooth hammerhead sharks are also observed in the longline fisheries operating in the shelf and oceanic waters off southern Brazil and Uruguay. Based on results from a study that examined shark catches from five São Paulo State surface longliners, smooth hammerhead sharks may actually comprise a larger proportion of the longline hammerhead catch in this region (Amorim *et al.* 2011). Over the course of 27 fishing trips from 2007–2008, a total of 376 smooth and scalloped hammerheads were caught, with smooth hammerhead sharks comprising 65 percent of this catch (n=245 *S. zygaena*). Life stages of 30 male smooth hammerhead sharks were ascertained, with the large majority (n=20) constituting juveniles; however, the longliners also caught 10 adults, primarily during fishing operations in depths of 200 m–3,000 m (Amorim *et al.* 2011). In total, hammerhead sharks comprised 6.3 percent of the shark total by weight, at 37.7 t, which is similar to the range of yields reported by Silveira (2007) in Amorim *et al.* (2011), with estimates from 9 t (in 2002) to 55 t (in 2005).

In the Brazilian artisanal net fisheries, smooth hammerhead sharks are caught in beach seines, cable nets, and gillnets, which are deployed off beaches in depths of up to 30 m. Given the area of operation (*e.g.,* closer to shore, in shallower waters), hammerhead catches from these artisanal fishing operations consist mainly of juveniles of both *S. lewini* and *S. zygaena,* but generally with higher proportions of *S. lewini.* For example, from November 2002 to March 2003, Vooren and Klippel (2005) monitored artisanal fish catches off a stretch of beach between Chui and Tramandai and recorded a total of 218 hammerhead sharks, with only 4 (or 1.8 percent) identified as smooth hammerhead sharks. Artisanal fishermen operating near Solitude Lighthouse (30°42′ S) also reported a fish haul of 120 kg of newborn hammerhead sharks, with around 180 scalloped hammerheads and only 2 smooth hammerhead sharks (or 1 percent of the hammerhead catch) (Vooren and Klippel 2005). Off Parana, Bornatowski *et al.* (2014) documented 77 juveniles of *S. zygaena* (with sizes ranging from 67.1–185 cm TL) and 123 scalloped hammerhead sharks in the artisanal gillnet fish catch over a 2-year period.

Based on the available information, it is clear that all life stages of the smooth hammerhead shark are susceptible to the fisheries operating in the southwest Atlantic. However, the degree to which these fisheries are contributing to overutilization of the species is highly uncertain. Furthermore, analysis of the available CPUE data from this region as a reflection of abundance does not indicate any trends that would suggest the smooth hammerhead shark is at an increased risk of extinction. The available hammerhead CPUE data (for *S. lewini* and *S. zygaena* combined) from the oceanic gillnet fishery (the fishery that catches the majority of hammerhead sharks), show a variable trend over the period of 1992 to 2004. From 1992 to 1997, CPUE decreased from 0.28 (t/trip) to 0.05 (t/trip), and then increased to 0.25 (t/trip) by 2002. Similarly, there was no discernible trend in the recreational fisheries CPUE data for hammerhead sharks for the period covering 1999 to 2004 (Vooren and Klippel 2005). The CPUE of the longline fisheries was also variable, increasing from 0.02 (t/trip) in 1993 to 0.87 (t/trip) in 2000 and then decreasing to 0.02 (t/trip) in 2002 (Vooren and Klippel 2005). However, according to personal communication from the authors (Vooren and Klippel), cited in Food and Agriculture Organization of the United Nations (FAO) (2010), the effort data used to estimate CPUE did not account for changes in the size of gillnets or number of hooks in the longline fisheries. Given these results, and noting that smooth hammerhead sharks, while being primarily juveniles, generally tend to be harvested at low levels, with no evidence of impacts to recruitment, the available species-specific information does not indicate that overutilization is a significant threat presently contributing to the species' risk of extinction in this region.

In the northeast and central Atlantic, smooth hammerhead sharks are caught primarily by the artisanal and industrial fisheries operating throughout the region. Additionally, many of these hammerheads are also juveniles, which could have serious implications on the future recruitment of hammerhead sharks to the population (Zeeberg *et al.* 2006; Dia *et al.* 2012). For example, in a sample of the Spanish longline fleet landings at the Algeciras fish market (the largest fish market in southwestern Spain), Buencuerpo *et al.* (1998) observed that the average sizes of *S. zygaena* were 170 cm TL for females and 150 cm TL for males, indicating a tendency for these fisheries to catch immature individuals. Similarly, Portuguese longliners targeting swordfish in the eastern equatorial Atlantic were also observed catching smooth hammerhead sharks that were smaller than the estimated sizes at maturity. Between August 2008 and December 2011, Coelho *et al.* (2012) reported that the average length for captured smooth hammerheads (n=372) was 197.5 cm fork length (FL) (220 cm TL) (Coelho *et al.* 2012), which falls within the range of maturity size estimates for the species, but indicates that both adults and immature smooth hammerhead sharks are being caught. However, the impact of this level of juvenile catch on the smooth hammerhead shark population is largely unknown due to a lack of information on *S. zygaena* population size, CPUE trend data, or other time-series information that could provide insight into smooth hammerhead shark recruitment and population dynamics.

Off the west coast of Africa, fisheries data are severely lacking, particularly species-specific data. While the available information suggests there has been a significant decline in the overall abundance of shark species due to heavy exploitation of sharks in the 1990s and 2000s for the international fin trade market, the impact of this past utilization, and current levels, on the smooth hammerhead shark population are unclear. There is evidence that hammerhead sharks faced targeted exploitation by the Senegalese and Gambian fisheries (Diop and Dossa 2011), but in terms of available hammerhead-specific information from this region, the data show variable trends in catch or abundance over the past decade. For example, data from Senegal's annual Marine Fisheries Reports depict fairly stable landings in recent years, but with peak highs of around 1,800 mt in 2006 and most recently in 2014 (Republique du Senegal 2000–2014). Seemingly in contrast, in Mauritanian waters, scientific research survey data collected from 1982–2010 indicate that the abundance of *Sphyrna* spp. (identified as *S. lewini* and *S. zygaena*) has sharply declined, particularly since 2005, with virtually no *Sphyrna* spp. caught in 2010 (Dia *et al.* 2012). However, similar to the findings from the other areas in the Atlantic, scalloped hammerhead sharks appear to be the more common hammerhead shark in this region, comprising the majority of the hammerhead catches and likely influencing the trends observed in the hammerhead data. For example, in 2009, Dia *et al.* (2012) reported that the total catches of sharks in Mauritanian waters amounted to 2,010 mt, with total hammerhead landings of 221 mt. Smooth hammerheads constituted only 1.76 percent of the total shark catch (or 35 mt) and 16 percent of the hammerhead total (Dia *et al.* 2012). Similarly, based on data from 246 fishery surveys spanning the years from 1962 to 2002 and conducted along the west coast of Africa (from Mauritania to Guinea, including Cape Verde), scalloped hammerheads occurred more frequently and in higher numbers in the observed catch. In fact, the greatest number of smooth hammerhead sharks observed during any single survey year was 12 individuals, recorded in 1991, whereas the scalloped hammerhead shark saw a peak of 80 individuals, recorded in 1993 (see Miller 2016 for more details). Overall, without additional information on present abundance levels, distribution information, or catch and overall utilization rates of the smooth hammerhead shark in this region, conclusions regarding the impact of current fishing pressure specifically on the extinction risk of the species would be highly uncertain and speculative.

In the temperate waters of the Mediterranean Sea, smooth hammerhead sharks have been fished for over a century, and have consequently suffered significant declines in abundance in this region. In the early 20th century, coastal fisheries would target large sharks and also land them as incidental bycatch in gill nets, fish traps, and tuna traps (Feretti *et al.* 2008). Feretti *et al.* (2008) hypothesized that certain species, including *S. zygaena,* found refuge in offshore pelagic waters from this intense coastal fishing. However, with the expansion of the tuna and swordfish longline and drift net fisheries into pelagic waters in the 1970s, these offshore areas no longer served as protection from fisheries, and sharks again became regular bycatch. Consequently, Feretti *et al.* (2008) estimate that the hammerhead shark abundance in the Mediterranean Sea (primarily *S. zygaena*) declined by more than 99 percent over the past 107 years, with the authors considering hammerhead sharks to be functionally extinct in the region. Although these specific estimates are highly uncertain, hindered by a lack of reliable species-specific data and small sample sizes, they indicate a potentially serious decline in the population of hammerhead sharks within the Mediterranean that is further confirmed by findings from Celona and de Maddalena (2005) and fishery surveys conducted throughout the Mediterranean (Megalofonou *et al.* 2005; Baino *et al.* 2012).

Specifically, Celona and de Maddalena (2005) reviewed historical and more recent data (through 2004) on hammerhead shark (likely *S. zygaena*) occurrence from select areas off Sicily and found that smooth hammerhead sharks have been fished to the point where they are now extremely rare. Historically, there were no regulations or management of the hammerhead shark fishery in Italy. When captured, these sharks were usually retained and sold, fresh and frozen, for human consumption. In the 1970s, when a specific hammerhead fishery existed off Sicily, and these sharks were caught in large numbers, their price even climbed to around 30 percent of swordfish prices (Celona and de Maddalena 2005). The high value and demand for the species, in combination with the lack of any regulations to control the fishery, led to significant overutilization of the species in Sicilian waters. In the Messina Strait, for example, hammerhead sharks were historically caught throughout the year and observed in schools, especially when bullet tuna schools (*Auxis rochei rochei*) were present in these waters. Hammerhead sharks were also historically common in waters off Palermo. Based on data from the most important landing site for the area, Portciello di Santa Flavia, around 300–400 sharks were caught per year as bycatch in driftnets targeting swordfish, and around 50 hammerhead sharks were caught annually in pelagic longlines. However, by the late 1970s, these sharks became noticeably less abundant, with only 1–2 sharks caught per year. Since 1998, no hammerhead sharks have been observed in the Messina Strait, and the last observed hammerhead shark in waters off Palermo was caught in 2004 (Celona and de Maddalena 2005). Similar findings were made on the west coast of Sicily, off Catania, and in waters around Lampedusa Island in the Sicilian Channel, where hammerhead sharks were once regularly caught by swordfish and tuna fishermen (in both nets and longlines), but presently are a rare occurrence. According to Celona and de Maddalena (2005), fishermen acknowledge the negative effect that the historical heavy fishing pressure and the extensive use of the drift net gear has had on the abundance of hammerhead sharks. The authors ''roughly'' estimate that captures of hammerhead shark have declined by at least 96–98 percent in the last 30 years as a result of overexploitation.

The disappearance of smooth hammerhead sharks is not just relegated to waters off Italy. In a sampling of fleets targeting swordfish and tuna throughout the Mediterranean from 1998 to 2000, only 4 smooth hammerhead sharks were observed based on data from 5,124 landing sites and 702 fishing days (onboard commercial fishing vessels) (Megalofonou *et al.* 2005). Similarly, the MEDLAM program, which was designed to monitor the captures and sightings of large cartilaginous fishes occurring in the Mediterranean Sea, also has very few records of *S. zygaena* in its database. Since its inception in 1985, the program has collected around 1,866 records (including historical records) of more than 2,000 specimens from 20 participating countries. Out of the 2,048 elasmobranchs documented in the database through 2012, there are records identifying only 17 individuals of *S. zygaena* [note: Without access to the database, the dates of these observations are unknown] (Baino *et al.* 2012).

Recently, Sperone *et al.* (2012) provided evidence of the contemporary occurrence of the smooth hammerhead shark in Mediterranean waters, recording 7 individuals over the course of 9 years (from 2000–2009) near the Calabria region of Italy. Previous findings by Ferretti *et al.* (2008) indicated the species was likely extirpated from this area based on Ionian longline data from 1995 to 1999. Although Sperone *et al.* (2012) suggest these new findings may indicate the potential recovery of smooth hammerhead shark populations in Ionian waters off Calabria, Italy, the populations in the Mediterranean are still significantly depleted. Any additional fishing mortality on these existing populations is likely to significantly contribute to its risk of extirpation in the Mediterranean. Given the large fishing fleet in the Mediterranean, this likelihood remains high. In fact, in 2012, the European Commission (2014) reported a Mediterranean fleet size of 76,023 vessels, with a total fishing capacity of 1,578,015 gross tonnage and 5,807,827 kilowatt power. As of January 2016, the General Fisheries Commission for the Mediterranean (GFCM) identified 9,343 large fishing vessels (*i.e.,* larger than 15 meters) as authorized to fish in the GFCM convention area (which includes Mediterranean waters and the Black Sea). Of these vessels, 12 percent (or 1,086 vessels) reported using longlines or nets (drift nets, gillnets, trammel nets) as their main fishing gear (see *http://www.gfcmonline.org/data/avl/*). While the GFCM passed Recommendation GFCM/35/2011/7 (C), based on the ICCAT recommendation 10–08, prohibiting the onboard retention, transshipment, landing, storing, selling, or offering for sale any part or whole carcass of hammerhead sharks of the family Sphyrnidae (except for the *S. tiburo*) taken in the Convention area, as noted previously, the smooth hammerhead exhibits high rates of at-vessel mortality. Given the extremely depleted status of the species, it is therefore unlikely that this regulation will significantly decrease the fishery-related mortality of the smooth hammerhead shark to the point where it is no longer at significant risk of further declines and potential extirpation from overutilization in the Mediterranean.

In the southeastern Atlantic, hammerhead sharks (likely primarily *S. zygaena* given the more temperate waters of this region) have also been reported caught by commercial and artisanal fisheries operating off Angola, Namibia and the west coast of South Africa. However, within the Benguela Current Large Marine Ecosystem (defined as west of 20° E. longitude, north of 35° S. latitude and south of 5° S. latitude.) Petersen *et al.* (2007) found that hammerhead sharks were only a minor component of the shark bycatch. Based on reported observer data from the Namibian longline fisheries, hammerhead sharks comprised only 0.2 percent of the total shark bycatch from 2002–2004, with a very low catch rate of 0.2 sharks/1000 hooks (Petersen *et al.* 2007). Hammerhead sharks were also rarely caught by the South African pelagic longline fishery, with only one identified hammerhead shark out of 10,435 sharks caught from 2000 to 2005 (Petersen *et al.* 2007). In the shark directed longline fishery off South Africa, hammerhead sharks also appear to comprise a small component of the catch (by number). Based on logsheet landings data from 1992–2005, as a group, hammerheads, copper sharks, cowsharks, threshers, and skates made up only 3 percent of the total number of sharks (Petersen *et al.* 2007). Additionally, local demand for smooth hammerhead sharks (particularly meat) does not appear to be a threat in these waters, with smooth hammerhead sharks generally relegated to the colloquial ''bad'' trade category due to the lower value of its flesh in South African markets (Da Silva and Burgener 2007).

The fisheries information and catch data for the entire Atlantic region from ICCAT also depict a species that is not regularly caught by industrial fishing vessels operating throughout the Atlantic Ocean. ICCAT is the RFMO responsible for the conservation of tunas and tuna-like species in the Atlantic Ocean and adjacent seas. Smooth hammerhead sharks are taken in the ICCAT convention area by longlines, purse seine nets, gillnets, and handlines, with around 44 percent of the total catch from 1987–2014 caught by drift gillnet gear and 23 percent caught by longlines. In total, approximately 1,746 mt of smooth hammerhead catches were reported to ICCAT from 1987–2014.

In 2010, ICCAT adopted recommendation 10–08 prohibiting the retention onboard, transshipment, landing, storing, selling, or offering for sale any part or whole carcass of hammerhead sharks of the family Sphyrnidae (except for *S. tiburo*) taken in the Convention area in association with ICCAT fisheries. However, there is an exception for developing coastal nations for local consumption as long as hammerheads do not enter into international trade. Despite this exception, analysis of available observer data from ICCAT fishing vessels shows that, in general, smooth hammerhead catches are fairly minimal in the industrial fisheries operating throughout the Atlantic. For example, data from French and Spanish observer programs, collected over the period of 2003–2007, show that smooth hammerhead sharks represented 3.5 percent of the shark bycatch (in numbers) in the European purse seine fishery (Amandè *et al.* 2010). This fishery primarily operates in latitudes between 20° N. and 20° S. and longitudes from 35° W. to the African coast. In total, only 12 smooth hammerhead sharks were caught on the 27 observed trips which corresponded to 598 sets (Amandè *et al.* 2010). Similarly, in the tropical Atlantic Ocean, fishery observers onboard two Chinese tuna longline vessels from December 2007 to April 2008 (covering 90 fishing days and 226,848 hooks) recorded only 7 smooth hammerhead sharks, making it the second least commonly encountered shark, with an average CPUE of 0.031 (number of sharks/1000 hooks) and comprising only 3 percent of the shark bycatch by weight and 1.1 percent by number (Dai *et al.* 2009).

Observer data from tuna longliners operating throughout the Atlantic Ocean also support the observed low likelihood of catching *S. zygaena* during normal fishing operations. From 1995–2000, Japanese observers collected data from 20 trips, covering 886 fishing operations and 2,026,049 deployed hooks throughout the Atlantic (Matsushita and Matsunaga 2002). A total of 9,921 sharks were observed; however, only 22 of these were smooth hammerhead sharks, comprising 0.2 percent of the total shark bycatch (Matsushita and Matsunaga 2002). Observers aboard Portuguese longline fishing vessels collected more recent data from 834 longline sets (1,078,200 deployed hooks) and conducted between August 2008 and December 2011 (Coelho *et al.* 2012). A total of 36,067 elasmobranchs were recorded over the course of the 3-year study, of which 372 (or roughly 1 percent) were smooth hammerhead sharks (Coelho *et al.* 2012).

Perhaps not surprising, given the above data on ICCAT longline catches, Cortés *et al.* (2012) conducted an Ecological Risk Assessment and concluded that smooth hammerheads were one of the least vulnerable stocks to overfishing by the ICCAT pelagic longline fisheries. Ecological Risk Assessments are popular modeling tools that take into account a stock's biological productivity (evaluated based on life history characteristics) and susceptibility to a fishery (evaluated based on availability of the species within the fishery's area of operation, encounterability, post capture mortality and selectivity of the gear) in order to determine its overall vulnerability to overexploitation (Cortés *et al.* 2012; Kiszka 2012). Results from the Cortés *et al.* (2012) Ecological Risk Assessment, which used observer information collected from a number of ICCAT fleets, indicate that smooth hammerhead sharks face a relatively low risk in ICCAT fisheries. In fact, based on the best available data from the Atlantic region, the evidence suggests that while smooth hammerhead sharks are caught as both targeted catch and bycatch, and then marketed for both their fins and meat, overall, the present level of utilization does not appear to be a threat significantly contributing to the species' risk of extinction.

In the Indian Ocean, smooth hammerhead sharks have historically been and continue to be caught as bycatch in pelagic longline tuna and swordfish fisheries and gillnet fisheries, and may also be targeted by semi-industrial, artisanal and recreational fisheries; however, fisheries data, particularly species-specific information, are severely lacking. Presently, there are very few studies that have examined the status of or collected data specifically on smooth hammerhead sharks in the Indian Ocean, making it difficult to determine the level of exploitation of this species within the ocean basin.

In the western Indian Ocean, where artisanal fisheries are highly active, studies conducted in waters off Madagascar and Kenya provide limited data on the catch and use of smooth hammerhead sharks from this region. For the most part, many of the fisheries operating throughout this region are poorly monitored, with catches largely undocumented and underestimated. For example, in southwest Madagascar, McVean *et al.* (2006) investigated the directed shark fisheries of two villages over the course of 10 and 13 months, respectively, and found that the scale of these fisheries was ''largely unexpected.'' These fisheries, described as ''traditional fisheries'' (*i.e.,* fishing conducted on foot or in non-motorized vessels), used both surface-set longlines and also gillnets to catch sharks. Sharks are processed immediately after landing, with valuable fins exported to the Far East at high prices and shark meat sold locally. Out of the examined 1,164 catch records, hammerhead sharks (*Sphyrna* spp.; fishermen did not differentiate between species) were the most commonly caught shark (n = 340), comprising 29 percent of the total sharks caught and 24 percent of the total wet weight. Overall, the fisheries landed 123 mt of sharks, which was significantly higher than the previous annual estimate of 500 kg per km of Madagascar coastline. The data also provided evidence of declines in both the numbers of sharks landed and size (McVean *et al.* 2006). Due to the high economic returns associated with shark fishing in Madagascar, the authors predicted that these fisheries will likely continue despite the potential risks of resource depletion. However, without more accurate species-specific data, the effect of this level of exploitation, particularly on smooth hammerhead sharks, remains uncertain. In fact, in other areas of Madagascar, studies examining the artisanal and shark fisheries, including the genetic testing of fins from these fisheries, report hammerhead catches that consist mainly of scalloped hammerhead sharks and, to a lesser degree, great hammerhead sharks, but no smooth hammerhead sharks (Doukakis *et al.* 2011; Robinson and Sauer 2011).

In Kenya, however, there is evidence of smooth hammerhead sharks in the fish catch. Similar to the McVean *et al.* (2006) study, Kyalo and Stephen (2013) analyzed data from various landing sites along the coast of Kenya as well as observer data from commercial and scientific trawl surveys to examine the extent of shark catch in Kenya's artisanal tuna fisheries and semi-industrial prawn trawls. In Kenya, sharks are primarily caught as bycatch, with the meat consumed locally and fins exported to Far East countries (including Hong Kong and China). Based on data collected over a 1-year period (July 2012-July 2013), hammerhead sharks (*S. lewini* and *S. zygaena*) comprised 58.3 percent of the shark catch in the semi-industrial prawn trawl fisheries. Smooth hammerhead sharks, alone, made up 27 percent of the sharks (n=69), with a catch rate estimated at 2 kg/hour. Additionally, all of the smooth hammerheads were neonates, with the vast majority within the estimated size at birth range, indicating that the fishing grounds likely also serve as parturition and nursery grounds for the species. While it is particularly concerning that the Kenyan semi-industrial trawl fisheries are harvesting neonate and juvenile smooth hammerhead sharks, the degree to which this harvest is impacting recruitment of *S. zygaena* to the population is unknown. However, the authors do note that the general catch trend of elasmobranchs in Kenya has exhibited a declining trend since 1984, and suggest additional research is needed to determine current harvest rates and sustainable catch and effort levels.

While range maps place smooth hammerhead sharks within the Persian Gulf, there is no available information on the abundance or magnitude of catches of *S. zygaena* within this body of water. In the waters of the United Arab Emirates (UAE), hammerhead sharks are noted as generally ''common'' and are currently protected from being retained or landed. However, while the UAE prohibits the export of hammerheads caught in UAE waters, it still allows for the re-export of these sharks caught elsewhere (such as in Oman, Yemen, and Somalia) (Todorova 2014). In fact, in the past decade, the UAE has emerged as an important regional export hub for these countries in terms of the international shark fin trade, exporting up to 500 mt of dried raw fins annually to Hong Kong. Yet, information on the species traded and quantities involved is limited. Based on data collected from 2010–2012 at the Deira fish market (the only auction site in UAE for sharks destined for international trade), hammerheads were the second most represented family in the trade (at 9.3 percent) behind Carcharinidae sharks (which represented 74.9 percent of the species) (Jabado *et al.* 2015). A total of 12,069 sharks were recorded at the fish market, with the majority originating from Oman (Jabado *et al.* 2015). Around half (6,751 individuals) were identified to species, with 186 identified as *S. zygaena* caught in Oman waters (Jabado *et al.* 2015). Thus, while the UAE affords protections to hammerhead sharks within its own waters, its re-export business continues to drive the demand for the species throughout the region. However, while UAE traders confirmed that fins from hammerhead sharks are highly valued, they also note that the general trend in recent years has been a decline in prices and profits due to a reduction in demand for fins in Hong Kong (see Shark Fin Trade section for more details) (Jabado *et al.* 2015). As such, this decrease in demand may translate to a decrease in fishing pressure on the species. Yet, without any data on catch trends, fishing effort, or the size of the *S. zygaena* population in this region, the impact of current or even future fishing mortality rates on the smooth hammerhead population remains unknown.

In the central Indian Ocean, data on smooth hammerhead shark utilization is available from the countries of Sri Lanka, India, and Indonesia. In Sri Lanka, shark meat, both fresh and dried, is used for human consumption as well as for a cheap animal feed source, while shark fins are exported to other countries (SL–NPOA–Sharks 2013). Shark catches in Sri Lanka reached high levels in the 1980s, coinciding with demand for shark products in the international market, and peaked in 1999 at 34,842 mt (SL–NPOA–Sharks 2013). However, since 1999, annual shark catches have exhibited a significant decline, down to a low of 1,611 t in 2014 (Jayathilaka and Maldeniya 2015). According to Jayathilaka and Maldeniya (2015), the decline in annual shark production, particularly over the past few years, can be mainly attributed to the implementation and enforcement of new regulations on sharks and, specifically, conservation provisions for thresher sharks (which were one of the more dominant species in the shark catches). The authors further go on to state that the declining price of shark fins has also influenced fishermen to shift to export-oriented tuna fisheries. In terms of the impacts on smooth hammerhead sharks, when the data are broken out by shark species, hammerhead sharks have and continue to comprise a very small proportion of the catch. Based on landings data over the past decade (and similarly reported in historical catches), silky sharks tend to dominate the shark catch, followed by blue sharks, thresher sharks (until their prohibition in 2012), and oceanic whitetip sharks. In 2014, smooth hammerhead sharks comprised around only 1 percent of the retained shark bycatch in Sri Lanka, with a total of 18 mt caught (Hewapathirana *et al.* 2015; Jayathilaka and Maldeniya 2015). While sharks have generally declined in Sri Lankan waters due to historical overutilization, there is no information to indicate that present catch levels of *S. zygaena* are a significant threat to the species in this portion of its range.

Similarly, in Indian waters, available longline survey data collected from within the exclusive economic zone (EEZ) show that smooth hammerheads tend to comprise a small portion of the shark bycatch (0.5–5 percent) (Varghese *et al.* 2007; John and Varghese 2009). Although India is considered to be one of the top shark-fishing nations, smooth hammerhead sharks, in particular, are not considered to be a species of interest (based on 2008–2013 Indian Ocean Tuna Commission (IOTC) data holdings) (Clarke and IOTC Secretariat 2014). The same appears true for Indonesia, which is considered to be the largest shark-catching country in the world. In fact, the available landings and observer data suggest that *S. zygaena* distribution is not likely concentrated within Indonesian fishing areas. For example, in an analysis of data collected from Indonesian tuna longline fishing vessels from 2005–2013, scientific observers recorded only 6 smooth hammerheads (covering 94 trips, 2,268 operations, and 3,264,588 hooks) (Novianto *et al.* 2014). In another study, data were collected and analyzed from numerous fish markets and landing sites throughout Indonesia from 2001–2005, including Central Java, Bali, Jakarta, West Java, and Lombok. This study revealed that *Sphryna* spp. are among the most commonly taken shark species as bycatch; however, when identified to species, only *S. lewini* was detected within the landings data (Blaber *et al.* 2009). Similarly, a study that used DNA barcoding to identify shark fins from numerous traditional fish markets and shark-fin exporters across Indonesia (from mid-2012 to mid-2014) found a relatively high frequency of scalloped hammerhead sharks in the data (10.48 percent of fins; 2nd most common shark), whereas *S. zygaena,* while present in the fish markets, comprised only 1.03 percent of the fins (n=6 fins) (Sembiring *et al.* 2015). These results are not that surprising given the more temperate distribution of the smooth hammerhead shark compared to the tropical scalloped hammerhead. However, it also speaks to the threat of overutilization in that the largest shark-catching country in the world appears to primarily target sharks in tropical waters, so smooth hammerhead sharks may be provided some protection from these intensive fisheries due to their more temperate distribution.

Given the above information on distribution, it is not surprising that the majority of *S. zygaena* catches in Australian waters is attributed to the Western Australian temperate gillnet and longline fisheries, which operate in continental shelf waters along the southern and lower west coasts. The main commercial shark species targeted in these fisheries are gummy sharks (*Mustelus antarcticus*), dusky sharks (*Carcharhinus obscurus*), whiskery sharks (*Furgaleus macki*) and sandbar sharks (*Carcharhinus plumbeus*). Smooth hammerhead sharks are considered to be a bycatch species and tend to comprise over 98 percent of the hammerhead catch from this fishery (Australian Government 2014; Commonwealth of Australia 2015). A recent multi-fisheries bycatch assessment, which examined the sustainability of bycatch species in multiple Gascoyne and West Coast Australian fisheries, found smooth hammerhead sharks to be at a low to moderate risk in this region, with the risk largely influenced by the species' biological profiles (vulnerable life history traits) as opposed to fishery impacts (Evans and Molony 2010). Between 1994 and 1999, McAuley and Simpfendorfer (2003) estimated that the average annual take of smooth hammerheads in the Western Australian temperate gillnet and longline fisheries was around 53 t. Based on recent catches of hammerhead sharks (range: 59.9 t–71 t), harvest levels have increased slightly since the 1990s, but have remained fairly stable over the past 4 years. Furthermore, these harvest levels are considered to be within the recommended sustainable take for the species, which has been estimated at around 70 t per year (Australian Government 2014). An increasing CPUE trend specifically for hammerhead sharks in this fishery (Simpfendorfer 2014), as well as a declining trend in total gillnet effort (with effort on the west coast now at low historical levels) (Government of Western Australia 2015), suggests that the ongoing harvest of the species by the Western Australian temperate gillnet fisheries is unlikely to be a significant threat to the species.

Fisheries information and catch data from the RFMO that operates throughout the Indian Ocean (the IOTC) also depict a species that is not regularly caught by industrial fishing vessels (see Miller (2016) for more details), nor does this RFMO consider the species to be a key ''priority species'' (*i.e.,* those shark species whose status the IOTC is concerned about and have scheduled future stock assessments). While current catches reported in the IOTC public domain database are thought to be incomplete and largely underestimated (Murua *et al.* 2013; IOTC 2015), the available observer data from the IOTC convention area suggest that smooth hammerhead sharks tend to be rare in the various industrial and artisanal fisheries operating within the convention area (Huang and Liu 2010).

In the western Pacific, smooth hammerhead sharks are regularly recorded in fisheries catch data, particularly from the temperate waters off southeastern Australia and New Zealand. They have also been reported in landings data from Japan, as far north as Hokkaido (Taniuchi 1974). According to Taniuchi (1974), smooth hammerhead sharks were historically widely distributed throughout Japan, with their flesh sold at fish markets from Shikoku to the Kanto District and Hokkaido; however, species-specific data are lacking. Over the past decade, reported catches of hammerhead sharks at main fishing ports in Japan have been low and variable (range: <10 mt to <40 mt), with no clear trend (Fisheries Agency of Japan 2015). Furthermore, overall fishing effort by Japanese longliners (which are responsible for the majority of shark catches) has been on a declining trend since the late 1980s, with significant declines noted particularly in the Pacific Ocean (Fisheries Agency of Japan 2011; Uosaki *et al.* 2015), with expansion of the scale of these fisheries unlikely in the foreseeable future (Fisheries Agency of Japan 2011).

Although Japan is a significant producer and exporter of sharks fins, ranking 10th worldwide in terms of chondrichthyan catches and 11th in (dried) shark fin exports from 2000–2011, both capture production and fin exports have steadily declined over the past decade (Dent and Clarke 2015). Compared to statistics from 2000, Japan's catches of chondrichthyans decreased by 68 percent in 2011 and fin exports dropped by 52 percent in 2012. Additionally, Japan has stated that due to the uncertainty of the stock structure of hammerhead sharks, as well as the lumping of all hammerhead sharks in the available Japanese data, it is unable to make a CITES non-detriment finding for the export of hammerhead shark species (Fisheries Agency of Japan 2015). Effective September 14, 2014, scalloped, smooth, and great hammerhead sharks are listed on Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which means that international trade in specimens of these species may be authorized by the granting of a CITES export permit or re-export certificate. However, under CITES, these permits or certificates should only be granted if that trade will not be detrimental to the survival of the species. This is done through the development of a ''non-detriment'' finding, or NDF. Because Japan is unable to make an NDF for the export of scalloped, smooth, or great hammerhead sharks, it will not issue any permits for the export of products from these species. This decision has likely significantly decreased the incentive for Japanese fishermen to target smooth hammerhead sharks for the international fin trade market, and has decreased the threat of overutilization of the species within Japanese waters.

Smooth hammerhead sharks are also documented in the fisheries catch data from Taiwan, whose fleet also ranks in the top ten for global shark catches. However, based on the available data, the species does not appear to be a significant component of the shark catch. For example, from 2002–2010, Liu and Tsai (2011) examined offloaded landings at two major fish markets in Taiwan (Nanfangao and Chengkung) to get a better sense of the catch composition and whole weight of the sharks commonly caught by Taiwanese offshore tuna longliners. What they found was that there are 11 species of pelagic sharks that are commonly caught by the longliners, with blue sharks dominating the shark landings (by weight), comprising an average of 44.5 percent of the landings, followed by scalloped hammerheads (at 9.87 percent) and shortfin makos (at 9.42 percent) (Liu and Tsai 2011). Smooth hammerhead sharks, on the other hand, were one of the least represented species, comprising an average of 1.38 percent of the landings over the study period, which translated to around 78 mt per year (Liu and Tsai 2011). Since 2010, reported annual catches of smooth hammerhead sharks by Taiwan's tuna longline fleets have ranged from 81 mt to 149 mt (Fisheries Agency of Chinese Taipei 2015).

According to the annual reports of Chinese Taipei, provided to the Western and Central Pacific Fishery Commission (WCPFC), over 93 percent of the smooth hammerhead bycatch can be attributed to the small scale tuna longline vessels, which operate mostly in the EEZ of Taiwan but also beyond the EEZ (particularly those vessels with freezing equipment which allows for expansion to more distant waters). Since 2011, reported smooth hammerhead shark catches by both the large and small-scale longline fleets have decreased, but so has fishing effort, with a decline in the number of active vessels engaged in the fisheries (Fisheries Agency of Chinese Taipei 2015). Presently, there is no information to indicate overutilization of *S. zygaena* in Chinese Taipei by these fisheries.

Off the east coast of Australia, smooth hammerhead sharks are normally found in continental shelf waters. While the majority of smooth hammerhead shark catches are taken in the previously discussed Western Australian fisheries, minimal numbers are also caught in the Commonwealth-managed southern shark fishery and the NSW Offshore Trap and Line Fishery, which operates off the eastern and southern coasts of Australia (Macbeth *et al.* 2009; Simpfendorfer 2014). Hammerhead sharks are also occasionally caught in Australia's NSW Shark Meshing Program (SMP). The NSW SMP annually deploys a series of bottom-set mesh nets between September 1st and April 30th along 51 ocean beaches from Wollongong to Newcastle. Based on the data from the NSW SMP, the CPUE of hammerhead sharks (likely *S. zygaena,* given the placement of nets in more temperate waters; Reid *et al.* 2011; Williamson 2011) over the past decade has exhibited a declining trend, although no significant trend was found when data from the start of the program were included (from 1950–2010; Reid *et al.* 2011). Yet, since the 1970s, the number of hammerhead sharks caught per year in the NSW beach nets has decreased by more than 90 percent, from over 300 individuals in 1973 to fewer than 30 in 2008 (Williamson 2011).

While changes in the SMP methods and level of effort since its inception have complicated long-term analyses, in 2005, the SMP was listed as a ''key threatening process'' by the NSW Fisheries Scientific Committee (convened under Australia's Fisheries Management Act 1994) and the NSW Scientific Committee (convened under Australia's Threatened Species Conservation Act 1995). It was listed as such due to its adverse effect on threatened species, populations, or ecological communities, and its potential for causing species, populations, or ecological communities that are not yet threatened to become threatened. Since 2009, the program has operated in accordance with Joint Management Agreements and an associated management plan, with an objective of minimizing the impact of its nets on non-target species (such as smooth hammerhead sharks) and threatened species to ensure that the SMP does not jeopardize the survival or conservation status of the species. To meet this objective, the SMP developed a ''trigger point'' that, when tripped, indicates additional measures are needed to comply with the objective. The trigger point is defined as: ''*entanglements of non-target species and threatened species over two consecutive meshing seasons exceed twice the annual average catch of the preceding 10 years for those species.''* For smooth hammerhead sharks, the trigger point was estimated at 55 individuals. Based on recent species-specific data from the SMP program, the annual catch of smooth hammerhead sharks has remained below the trigger point for the past 5 years, ranging from 18 sharks captured in 2010 to 42 sharks in 2014, indicating that under the current evaluation parameters, the SMP is not considered to be impacting *S. zygaena* to the extent that it would jeopardize its survival or conservation status (NSW Department of Primary Industries 2015).

To the east, in New Zealand, smooth hammerhead sharks are occasionally caught as bycatch in commercial fisheries, but are prohibited from being targeted. The available data from New Zealand waters, covering the time period from 1986–1997, show no clear trend in smooth hammerhead landings (Francis and Shallard 1998), and corresponding effort information is unavailable. When compared to all shark landings for the same time period, smooth hammerhead sharks comprised <1 percent of the total, indicating that the commercial fisheries in this region likely do not pose a significant threat to the species. However, in an analysis of 195 shark fillets from marketed cartons labelled as lemon fish (*Mustelus lenticulatus),* 14 percent were identified as *S. zygaena* (n=28). Similarly, analysis of 392 shark fins obtained from commercial shark fisheries operating in the Bay of Plenty indicated that 12 percent (n=47) came from smooth hammerhead sharks. These data suggest that while smooth hammerhead sharks may be prohibited from being targeted in New Zealand waters, they are still occasionally landed. However, at present, there is no indication that the impact of this take on the population is significantly contributing to the species' risk of extinction in this region.

In the central Pacific, smooth hammerhead sharks are caught as bycatch in the Hawaii and American Samoa pelagic longline fisheries. NMFS authorizes these pelagic longline fisheries under the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific (Pelagics FEP) developed by the Western Pacific Fishery Management Council (WPFMC) and approved by NMFS under the authority of the MSA. The WPFMC has implemented strict management controls for these fisheries. Although smooth hammerhead sharks are not a target species in these pelagic longline fisheries, the measures that regulate the longline fishery operations have helped to monitor the bycatch of smooth hammerhead sharks and may minimize impacts to the species. Some of these regulations include mandatory observers, vessel monitoring systems, designated longline buffer zones, areas of prohibited fishing, and periodic closures and effort limits (see Miller *et al.* (2014a) for more details). A mandatory observer program for the Hawaii-based pelagic longline fishery was also initiated in 1994, with coverage rate that increased to a minimum of 20 percent in 2001. The Hawaii-based deep-set pelagic longline fishery is currently observed at a minimum of 20 percent and the Hawaii-based shallow-set pelagic fishery has 100 percent observer coverage. The American Samoa longline fishery has also had an observer program since 2006, with coverage ranging between 20 percent and 33 percent since 2010.

Based on the available observer data, smooth hammerhead sharks appear to be caught in low numbers and comprise a very small proportion of the bycatch. For example, from 1995–2006, only 49 *S. zygaena* individuals on 26,507 sets total were observed caught for both Hawaii-based pelagic longline fishery sectors combined, translating to an estimated nominal CPUE of 0.001 fish per 1,000 hooks (Walsh *et al.* 2009). Additionally, according to the U.S. National Bycatch Report (NMFS 2011; NMFS 2013b), the Hawaii-based deep-set pelagic longline fishery reported only 2,453.74 pounds (1.1 mt) of smooth hammerheads as bycatch in 2005 and 3,173.91 pounds (1.44 mt) in 2010. The Hawaii based shallow-set pelagic longline fishery reported even lower levels of bycatch, with 930.35 pounds (0.422 mt) in 2005 and no bycatch of smooth hammerhead sharks in 2010. From 2010 to 2013, only three smooth hammerheads were observed caught in the American Samoa longline fishery, all in 2011, with total take extrapolated to 12 individuals (NMFS Pacific Islands Fisheries Science Center (PIFSC), unpublished data). The number of unidentified hammerhead sharks observed caught for the same period was 2, extrapolated to 11 total (PIFSC, unpublished data). Given the strict management of these pelagic longline fisheries and the low levels of bycatch, with no evidence of population declines of smooth hammerhead sharks in this area, there is no information to suggest that overutilization is presently a threat in this portion of the species' range.

The WCPFC, the RFMO that seeks the conservation and sustainable use of highly migratory fish stocks throughout the western and central Pacific Ocean, has also collected data on the longline and purse seine fisheries operating throughout the region; however, data specific to smooth hammerhead sharks (and hammerhead sharks in general) is severely limited. Only since 2011 have WCPFC vessels been required to report specific catch information for hammerhead sharks (in their annual reports to the WCPFC), and it tends to be for the entire hammerhead group (including *S. mokarran, S. lewini,S. zygaena,* and *Eusphyra blochii*). Given the lumping of all hammerhead species together and the limited information on catches and discards, the available data provide little insight into the impact of present utilization levels on the status of smooth hammerhead shark in this region (see Miller (2016) for more details).

Similarly, available WCPFC observer data are also lacking, hindered by low observer rates and spatio-temporal coverage of fishing effort throughout the region. This is particularly true in the longline fisheries where coverage rates have been below 2 percent since 2009, despite the requirement under the Conservation and Management Measure for the Regional Observer Programme (CMM 2007-01) requiring 5 percent observer coverage by June 2012 in each longline fishery (Clarke 2013). With these limitations in mind, the available observer data from 1994–2009 indicate that, in general, catches of hammerhead sharks (*S. mokarran, S. lewini, S. zygaena,* and *E. blochii)* are negligible in all WCPFC fisheries. Rice *et al.* (2015) analyzed the WCPFC observer data through 2014 and found that hammerhead sharks generally have low encounter rates (*i.e.,* low frequency of occurrence in the western and central Pacific Ocean). In the purse-seine fisheries data, Rice *et al.* (2015) noted that observations of hammerhead sharks are ''virtually non-existent,'' and in the longline observer data, hammerheads had a patchy distribution (concentrated around the Hawaiian Islands, Papua New Guinea, and Australian east coast), but relatively stable CPUE (from 2002–2013). However, due to the overall low frequency of occurrence of the species in the data, no conclusions could be made regarding hammerhead shark temporal trends, with Rice *et al.* (2015) noting that a stock assessment to determine the status of the hammerhead shark species throughout the western and central Pacific Ocean would not be feasible at this time.

In the eastern Pacific Ocean, smooth hammerhead sharks are both targeted and taken as bycatch in industrial and artisanal fisheries. While the range of the smooth hammerhead shark is noted as extending as far north as northern California waters, based on the available data, the distribution of the species appears to be concentrated in waters off Mexico and areas south (Miller 2016). Observer data of the west coast based U.S. fisheries further confirms this finding, with smooth hammerhead sharks rarely observed in the catches (Miller 2016). In Mexico, however, sharks, including hammerheads, are considered an important component of the artisanal fishery (Instituto Nacional de la Pesca 2006), and artisanal fisheries account for around 80 percent of the elasmobranch fishing activity (Cartamil *et al.* 2011). Sharks are targeted both for their fins, which are harvested by fishermen for export, and for their meat, which is becoming increasingly important for domestic consumption. Yet, details regarding fishing effort and species composition of artisanal landings are generally unavailable (Cartamil *et al.* 2011).

Information on Mexican artisanal catches specifically of smooth hammerhead sharks was found in studies examining artisanal fishing camps operating off Sinaloa, the ''Tres Marias'' Islands of Mexico, and Laguna Manuel (Pérez-Jiménez *et al.* 2005; Bizzarro *et al.* 2009; Cartamil *et al.* 2011). While findings from these studies indicate a predominance of immature smooth hammerhead sharks in artisanal landings, the CPUE is low, with *S. zygaena* representing a fairly small component of the shark and hammerhead catch. For example, a 1999 survey of the Sinaloa artisanal elasmobranch-targeted fishery revealed that CPUE (# individuals/vessel/trip) of smooth hammerhead sharks ranged from 0 to 0.7, depending on the season (Bizzarro *et al.* 2009). From 2006–2008, a study of the Laguna Manuela artisanal fishing camp, identified as one of the most important elasmobranch fishing camps in Baja California, found that out of 10,595 captured elasmobranchs over the course of 387 panta trips (small-scale operations, using 5–8 m long boats), only 306 (~3 percent) were smooth hammerhead sharks. The estimated CPUE was 1.32 (mean catch per trip) on gillnet and 0.08 on longline (Cartamil *et al.* 2011). Carcass discard sites were also surveyed outside of the Laguna Manuela fishing camp, with species composition within the sites very similar to the beach survey catch. Within the 17 carcass discard sites, 31,860 elasmobranch carcasses were identified, with 374 attributed to smooth hammerhead sharks (1.17 percent) (Cartamil *et al.* 2011).

In July 2015, the CITES Scientific Authority of Mexico held a workshop in an effort to collect information and assess the vulnerability of CITES-listed shark species to harvesting pressures in fishing grounds throughout all Mexican waters. Participants from government agencies, academic institutions, civil associations and independent consultants with experience on the management and knowledge of shark fisheries in all fishing areas and coasts of Mexico gathered to discuss the available data and conduct Productivity and Susceptibility Assessments for each shark species (following methods proposed by Patrick *et al.* 2010; Benítez *et al.* (2015)). For *S. zygaena,* the semi-quantitative assessment looked at the species' vulnerability in specific fishing zones along the Pacific coast and also by fishing vessel type (small or coastal vessels versus large fishing vessels). Results from the assessment showed that *S. zygaena* had a medium to low vulnerability to fishing pressure by large Mexican fishing vessels for all evaluated fishing zones, and a higher vulnerability to fishing by smaller/coastal vessels, particularly off the Pacific coast of Baja California south to Jalisco (Benítez *et al.* 2015). While these assessments provide managers and scientists with an index of the vulnerability of target and non-target species to overfishing within a fishery (*e.g., S. zygaena* is more likely to experience overfishing by smaller/coastal vessels as opposed to the larger fishing vessels), it does not provide information on the current status of the species or whether the species, is, in fact, being overfished in waters off Mexico.

While the best available information, including from the above assessment and the fisheries surveys, shows that smooth hammerhead sharks (and particularly juveniles) are being utilized and face higher fishing pressure in the Mexican artisanal fisheries, without any information on current population size or CPUE trends in this region, the impact of this level of utilization on the extinction risk of the species is presently unknown. Due to the limited data available, the status of the Mexican *S. zygaena* population remains highly uncertain, with no data to indicate that overutilization is a threat significantly contributing to the species' risk of extinction.

In waters farther south in the Eastern Pacific, three countries (Costa Rica, Ecuador and Peru) contribute significantly to shark landings and are important suppliers of shark fins for the Asian market. In Costa Rica, where shark fishing is still allowed, the limited available fisheries data suggest that smooth hammerhead sharks are only rarely caught as catch and bycatch (Whoriskey *et al.* 2011; Dapp *et al.* 2013). However, recent data on fin exports indicate that the species, at least when caught, is kept and utilized for the international fin trade market. For example, in December 2014, around 259.2 kg of *S. zygaena* fins and 152 kg of *S. lewini* fins were exported out of Costa Rica to Hong Kong (Boddiger 2015). In February 2015, Costa Rican officials allowed the export of another batch of scalloped and smooth hammerhead fins, with estimates of total weight between 249–490 kg (depending on the source of information) (Boddiger 2015). The conservation group Sea Turtle Recovery Programme estimated that these fins came from between 1,500 and 2,000 hammerhead sharks (Boddiger 2015). While the impact of this take on the smooth hammerhead population is highly uncertain, given the lack of species-specific abundance estimates or trends for this region, in March 2015, the National System of Conservation Areas, in its role as the CITES Administrative Authority of Costa Rica, stated that no more export permits for hammerhead fins would be issued until the CITES NDF process is completed (Murias 2015). Whether this moratorium on exports will curb fishing of hammerhead sharks and decrease fishery mortality rates for the species has yet to be seen. In addition, depending on the findings from the NDF process, some level of export of hammerhead products may still be allowed in the future. Nevertheless, without information on the size or distribution of the smooth hammerhead population in this region, or evidence of declines in abundance, the best available information does not presently suggest that current levels of fishery-related mortality are significantly contributing to the overutilization of *S. zygaena.*

In Ecuador, directed fishing for sharks is prohibited, but sharks can be landed if caught as bycatch. Hammerhead sharks, in particular, tend to be landed as incidental catch and, similar to Costa Rica, are used primarily for the fin trade. Unlike many of the other areas discussed in this report, smooth hammerhead sharks appear to be the dominant hammerhead species caught in Ecuadorian waters. Based on artisanal records from 2007–2011, catches of *S. zygaena* are on the order of three to four times greater than catches of *S. lewini* (see Miller 2016). Additionally, the majority of the smooth hammerhead sharks taken in Ecuadorian fisheries appear to be immature (Aguilar *et al.* 2007; Cabanilla and Fierro 2010), which, as mentioned previously, could potentially negatively affect recruitment and contribute to declines in the abundance of smooth hammerhead sharks. However, without information on corresponding fishing effort or population sizes, inferences regarding the status of the species or the impacts of current levels of take on the extinction risk of the species in Ecuador cannot be made with any certainty at this time.

In waters off Peru, smooth hammerhead sharks are also prevalent. In fact, from 2006–2010, *S. zygaena* was the third most commonly landed shark species (comprising 15 percent of the shark landings) by the Peruvian small-scale fishery (Gonzalez-Pestana *et al.* 2014). In a 61-year analysis of Peruvian shark fisheries, Gonzalez-Pestana *et al.* (2014) noted a significant increase in the amount of reported landings for smooth hammerhead sharks between 2000 and 2010, with peaks in 1998 and 2003. The authors estimated that landings increased by 7.14 percent per year (confidence interval: 1.2–13.4 percent); however, if the 2003 estimates (which appear to strongly influence the analysis) are removed from the dataset, smooth hammerhead landings show a fairly stable trend since 1999 (<500 t). Based on the latest available landings figure from 2014 of 364 t, this trend does not appear to have changed (Instituto del Mar del Peru 2014). However, as Gonzalez-Pestana *et al.* (2014) note, without accompanying information on fishing effort, it is difficult to fully understand the dynamics of the shark fishery, and particularly, in this case, its impact on the smooth hammerhead population.

In terms of the data from the RFMO that operates within the Eastern Pacific, the Inter-American Tropical Tuna Commission (IATTC), bycatch of hammerhead sharks has been variable between 1993 and 2013. Specifically, catches of hammerhead sharks by large purse seine vessels peaked in 2003–

2004, at around 3,000 sharks, before significantly decreasing. This decline is thought to be, in part, a result of purse seiners moving fishing effort farther offshore in recent years to waters with fewer hammerhead sharks, but could also reflect a decline in the actual abundance of hammerhead sharks (Hall and Roman 2013). Since 2006, annual bycatch of hammerhead sharks has fluctuated between 750 and 1,400 individuals (Román-Verdesoto and Hall 2014). The Scientific Advisory Committee to the IATTC noted that this purse-seine catch may represent only a relatively small portion of the overall harvest of hammerhead sharks in this region, with insufficient data (due to the rarity of *Sphyrna* spp. in the catch) to provide for a meaningful analysis. Rather, the Committee indicated that the majority of harvest in this region is likely taken by the artisanal fisheries (Hall and Roman 2013; IATTC 2015). However, as already discussed, and further acknowledged by others in reviewing the IATTC information (Hall and Roman 2013; Román-Verdesoto 2015), the data from these artisanal fishing operations are, for the most part, largely unavailable or not of the detail needed (*e.g.,* species-specific with corresponding fishing effort over time) to examine impacts on the populations (Hall and Roman 2013; Román-Verdesoto 2015). Thus, at this time, the best available information does not provide evidence that overutilization is a threat significantly contributing to the species' risk of extinction in the Eastern Pacific portion of its range.

Shark Fin Trade

As noted in the above regional reviews examining utilization of the species, hammerhead sharks are primarily targeted and valued particularly for their fins. As hammerhead fins tend to be large in size, with high fin needle content (a gelatinous product used to make shark fin soup), they are one of the most valuable fins in the international market. Based on 2003 figures, smooth hammerhead shark fins fetch prices as high as $88/kg (Abercrombie *et al.* 2005). In the Hong Kong fin market, which is the largest fin market in the world, *S. lewini* and *S. zygaena* are mainly traded under a combined market category called *Chun chi,* and found in a 2:1 ratio, respectively (Abercrombie *et al.* 2005; NMFS 2014a). Based on an analysis of the Hong Kong fin data from 2000–2002, *Chun chi* was the second most traded category, comprising around 4–5 percent of the annual total fins (Clarke *et al.* 2006a), and translating to around 1.3–2.7 million individuals of scalloped and smooth hammerhead sharks (equivalent to a biomass of 49,000–90,000 tons) traded each year (Clarke *et al.* 2006b). By 2003–2004, both global catches of chondrichthyans and trade in shark fins peaked (Dent and Clarke 2015; Eriksson and Clarke 2015). However, as the impacts of this exploitation, particularly of chondrichthyan species to match the demand for their fins, became increasingly more apparent, many countries and states began passing management measures and regulations to discourage and dis-incentivize fishermen from targeting vulnerable sharks, and particularly their fins, for the international shark fin trade (PEW Environment Group 2012; Whitcraft *et al.* 2014; Miller 2016). Between 2008 and 2011, quantities of chondrichthyan catches and trade in shark fins leveled out at around 82–83 percent of the peak figure (Dent and Clarke 2015; Eriksson and Clarke 2015). In 2012, the trade in shark fins through China, Hong Kong Special Administrative Region (SAR), which has served as an indicator of the global trade for many years, saw a decrease of 22 percent from 2011 figures, indicating that recent government-led backlash against conspicuous consumption in China, combined with the global conservation momentum, appears to have had an impact on traded volumes (Dent and Clarke 2015; Eriksson and Clarke 2015). Dent and Clarke (2015) also note that a number of other factors may have contributed to this downturn in the trade of fins through Hong Kong SAR, including: Increased domestic chondrichthyan production by the Chinese fleet, increased monitoring and regulation of finning, a change in trade dynamics, other trade bans and curbs, and an overall growing conservation awareness. Potentially, if the demand for fins continues to decrease in the future, so will the direct targeting of hammerhead sharks (and illegal fishing of the species—see *Inadequacy of Existing Regulatory Measures*). Additionally, with the listing of the species on CITES Appendix II, for those countries unable to make NDFs, such as Japan, the incentives for fishermen to target or retain hammerhead sharks for trade will also likely decline and contribute to a decrease in fishing pressure. The extent (magnitude) to which this decrease in fishing pressure will translate to a decrease in mortality of the species is currently unclear, but will likely only benefit the species. As such, at this time, the best available information does not indicate that overutilization, including the demand for smooth hammerhead sharks in the shark fin trade, is a threat significantly contributing to the species' risk of extinction throughout its global range, now or in the foreseeable future.

Disease or Predation

No information has been found to indicate that disease or predation is a factor that is negatively affecting the status of smooth hammerhead sharks. These sharks have been documented as hosts for the nematodes *Parascarophis sphyrnae* and *Contracaecum* spp. (Knoff *et al.* 2001); however, no data exist to suggest these parasites are affecting *S. zygaena* abundance. Additionally, predation is also not thought to be a factor negatively influencing smooth hammerhead shark abundance. The most significant predator on smooth hammerhead sharks is likely humans; however, a study from New Zealand observed two killer whales (*Orcinus orca*) feeding on a small, juvenile (~100 cm TL) smooth hammerhead shark (Visser 2005). In a 12-year period that documented 108 encounters with New Zealand killer whales, only 1 smooth hammerhead shark was preyed upon (Visser 2005); thus, predation on *S. zygaena* by killer whales is likely opportunistic and not a contributing factor to abundance levels of smooth hammerhead sharks. Juvenile smooth hammerhead sharks also likely experience predation by adult sharks (including their own species); however, the rate of juvenile predation and the subsequent impact to the status of smooth hammerhead sharks is unknown. As such, at this time, the best available information does not indicate that disease or predation are threats significantly contributing to the species' risk of extinction throughout its global range, now or in the foreseeable future.

The Inadequacy of Existing Regulatory Mechanisms

Although none of the previously discussed ESA section 4(a)(1) factors were identified as significant threats to *S. zygaena,* existing regulatory mechanisms in some portions of the species' range could be strengthened (or better enforced) to promote the long-term viability of the species. For example, in a recent study that examined current regulatory and management measures for smooth hammerhead sharks, including data collection requirements and level of compliance, Lack *et al.* (2014) concluded that additional management measures (particularly species-specific management measures) could benefit the species. For a comprehensive list of current management measures pertaining to hammerhead sharks, as well as sharks in general, see the Appendix in Miller (2016).

Despite the number of existing regulatory measures in place to protect sharks and promote sustainable fishing, enforcement tends to be difficult, and illegal fishing has emerged as a problem in many fisheries worldwide. Specifically, illegal fishing occurs when vessels or harvesters operate in violation of the laws of a fishery. In order to justify the risks of detection and prosecution involved with illegal fishing, efforts tend to focus on high value products (*e.g.,* shark fins) to maximize returns to the illegal fishing effort. Thus, as the lucrative market for shark products, particularly shark fins, developed, so did increased targeting, both legal and illegal, of sharks around the world. Given that illegal fishing tends to go unreported, it is difficult to determine, with any certainty, the proportion of current fishery-related mortality rates that can be attributed to this activity. This is particularly true for smooth hammerhead sharks, where even legal catches go unreported. 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 have relatively high levels of illegal fishing (compared to the rest of the regions), with illegal and unreported catch constituting 34 percent and 32 percent of the region's catch, respectively (Agnew *et al.* 2009). The annual value of high seas illegal, unreported and unregulated (IUU) catches of sharks worldwide has been estimated at $192 million (High Seas Task Force 2006) and annual worldwide economic losses from all IUU fishing is estimated to be between $10 billion and $23 billion (NMFS 2015d).

However, as mentioned in the *Overutilization for Commercial, Recreational, Scientific or Educational Purposes* section of this finding, given the recent downward trend in the trade of shark fins (Dent and Clarke 2015; Eriksson and Clarke 2015), illegal fishing for the sole purpose of shark fins may not be as prevalent in the future. It is also a positive sign that most (70 percent) of the top 26 shark-fishing countries, areas and territories have taken steps to combat IUU fishing, either by signing the Port State Measures Agreement (46 percent) or by adopting a National Plan of Action to prevent, deter, and eliminate IUU or similar plan (23 percent) (Fischer *et al.* 2012). However, whether these agreements or plans translate to less IUU fishing activity is unclear. For example, in quite a few countries, the effective implementation of monitoring, control, and surveillance schemes is problematic, often due to a lack of personnel and financial resources (Fischer *et al.* 2012), and a number of instances of IUU fishing, specifically involving sharks, have been documented over the past decade. For instance, as recently as May 2015, it was reported that Ecuadorian police confiscated around 200,000 shark fins from at least 50,000 sharks after raids on 9 locations in the port of Manta (BBC 2015). In September 2015, Greenpeace activists boarded a Taiwan-flagged boat fishing near Papua New Guinea and found 110 shark fins but only 5 shark carcasses (which was in violation of both the Taiwanese and the WCPFC rules requiring onboard fins to be at most 5 percent of the weight of the shark carcasses) (News24 2015). Recreational fishermen have also been caught with illegal shark fins. A report from June 2015 identified 3 unlicensed recreational fishers operating in waters off Queensland, Australia, and in possession of 3,200 illegal shark fins most likely destined for the black market (Buchanan and Sparkes 2015). While these reports provide just a few examples of recent illegal fishing activities, more evidence and additional reports of specific IUU fishing activities throughout the world can be found in Miller *et al.* (2014a) and Miller *et al.* (2014b).

In terms of tracking IUU fishing, most of the RFMOs maintain lists of vessels they believe to be involved in illegal fishing activities, with the latest reports on this initiative seeming to indicate improvement in combatting IUU. In the most recent 2015 Biennial Report to Congress, which highlights U.S. findings and analyses of foreign IUU fishing activities, NMFS reports that all 10 nations that were previously identified in the 2013 Biennial Report for IUU activities took appropriate actions to address the violations (*e.g.,* through adoption of new laws and regulations or by amending existing ones, sanctioning vessels, and improving monitoring and enforcement) (NMFS 2015c). In the current report, 6 countries were identified for having vessels engaged in IUU fishing activities; however, no countries were identified for engaging in protected living marine resources bycatch or for catching sharks on the high seas (although NMFS caveats this by noting the inability to identify nations due primarily to the restrictive time frames and other limitations in the statute) (NMFS 2015b).

While it is likely that *S. zygaena* is subject to IUU fishing, particularly for its valuable fins, based on the best available information on the species' population trends throughout its range, as well as present utilization levels, the mortality rates associated with illegal fishing and impacts on smooth hammerhead shark populations do not appear to be contributing significantly to the species' extinction risk. Furthermore, illegal fishing activities will likely decrease in the future as nations step up to combat IUU fishing and as the demand for shark fins declines. As such, at this time, the best available information does not indicate that the inadequacy of existing regulatory measures is a threat significantly contributing to the species' risk of extinction throughout its global range, now or in the foreseeable future.

Other Natural or Man-Made Factors Affecting Its Continued Existence

In terms of other natural or manmade factors, environmental pollutants were identified as a potential threat to the species. Many pollutants in the environment, such as brevotoxins, heavy metals, and polychlorinated biphenyls, have the ability to bioaccumulate in fish species. Because of the higher trophic level position and longevity of hammerhead sharks, these pollutants tend to biomagnify in liver, gill, and muscle tissues (Storelli *et al.* 2003; García-Hernández *et al.* 2007; Marsico *et al.* 2007; Escobar-Sanchez *et al.* 2010; Maz-Courrau *et al.* 2012; Lee *et al.* 2015). A number of studies have attempted to study and quantify the concentration levels of these pollutants in fish species, but with a focus on human consumption and safety (Storelli *et al.* 2003; García-Hernández *et al.* 2007; Marsico *et al.* 2007; Escobar-Sanchez *et al.* 2010; Maz-Courrau *et al.* 2012; Lee *et al.* 2015). As such, many of the results from these studies may indicate either ''high'' or ''low'' concentrations in fish species, but this is primarily in comparison to recommended safe concentrations for human consumption and does not necessarily have any impact on the biological status of the species.

In terms of smooth hammerhead sharks, mercury appears to be the most studied environmental pollutant in the species. International agencies, such as the Food and Drug Administration and the World Health Organization, have set a recommended maximum mercury concentration of 1 μg/g wet weight in seafood tissues for human consumption. However, observed mercury concentrations in the tissues of smooth hammerhead sharks are highly variable.

For example, Storelli *et al.* (2003) tested tissue samples from four smooth hammerhead sharks from the Mediterranean Sea (size range: 277–303 cm TL) and found that, on average, tissue samples from the liver and muscle had concentrations of mercury that greatly exceeded the 1 μg/g recommended limit. Mean mercury concentration in muscle samples were 12.15 ± 4.60 μg/g and mercury concentration in liver samples averaged 35.89 ± 3.58 μg/g. Similarly, García-Hernández *et al.* (2007) found high concentrations of mercury in tissues of four smooth hammerhead sharks (size range: 163–280 cm TL) from the Gulf of California, Mexico, with mean mercury concentration in muscle tissue of 8.25 ± 9.05 μg/g. In contrast, Escobar-Sanchez *et al.* (2010) tested muscle tissue of 37 smooth hammerhead sharks from the Mexican Pacific (Baja California Sur, Mexico; size range: >55–184 cm TL) and found mercury concentrations were below the maximum safety limit of 1 μg/g (average = 0.73 μg/g; median = 0.10 μg/g). Out of the 37 studied sharks, only one shark had a mercury concentration that exceeded the recommended limit (1.93 μg/g). Likewise, Maz-Courrau *et al.* (2012) also found ''safe'' concentrations of mercury in smooth hammerhead sharks from the Baja California peninsula. Analysis of muscle tissue samples from 31 smooth hammerhead sharks (mean size = 114 cm TL ± 19.2) showed an average mercury concentration of 0.98 ± 0.92 μg/g dry weight (range: 0.24–2.8 μg/g). The authors also tested mercury concentrations in four prey species of Pacific sharks (mackerel *Scomber japonicus,* lantern fish *Symbolophorus evermanni,* pelagic red crab *Pleuroncodes planipes,* and giant squid *Dosidicus gigas*) and found that *D. gigas,* a common prey item for smooth hammerhead sharks (see *Diet and Feeding*), had the lowest mercury concentration (0.12 ± 0.05 μg/g). The authors suggest that the transfer of mercury to smooth hammerhead sharks is unlikely to come from feeding on cephalopods; however, these results may very well explain the observed low levels of mercury in smooth hammerhead shark tissues (*i.e.,* because these sharks prefer to feed on cephalopods, bioaccumulation of mercury in tissues would likely be low).

In Atlantic waters, Marsico *et al.* (2007) also found that smooth hammerhead sharks had relatively low levels of mercury concentrations (in comparison to the recommended 1 μg/g human consumption limit). Based on muscle tissue samples from 5 smooth hammerhead sharks caught off the coast of Santa Catarina, Brazil, average mercury concentration was 0.443 ± 0.299 μg/g with a range of 0.015–0.704 μg/g. In Indo-Pacific waters, the only information on *S. zygaena* mercury bioaccumulation is an analysis of muscle tissue from a single smooth hammerhead that was caught off Port Stephens, NSW, Australia (Paul *et al.* 2003). The smooth hammerhead shark was 232 cm in length and had a muscle tissue mercury concentration of 1.9 μg/g.

Based on the above information, it appears that mercury concentrations may correlate with size of the smooth hammerhead shark, with larger sharks, such as those examined in the Paul *et al.* (2003), Storelli *et al.* (2003), and García-Hernández *et al.* (2007) studies, containing higher mercury concentrations. However, analyses examining this very relationship show conflicting results (Escobar-Sanchez *et al.* (2010)—no correlation; Maz-Courrau *et al.* (2012)—significant correlation). Furthermore, the effect of these and other mercury concentrations in smooth hammerhead shark populations, and potential risk to the viability of the species, remains unknown. It is hypothesized that these apex predators can actually handle higher body burdens of anthropogenic toxins due to the large size of their livers which ''provides a greater ability to eliminate organic toxicants than in other fishes'' (Storelli *et al.* 2003) or may even be able to limit their exposure by sensing and avoiding areas of high toxins (like during *K. brevis* red tide blooms) (Flewelling *et al.* 2010). Currently, the impact of toxin and metal bioaccumulation in smooth hammerhead shark populations is unknown. In fact, there is no information on the lethal concentration limits of toxins or metals in smooth hammerhead sharks, or evidence to suggest that current concentrations of environmental pollutants are causing detrimental physiological effects to the point where the species may be at an increased risk of extinction. As such, at this time, the best available information does not indicate that the present bioaccumulation rates and concentrations of environmental pollutants in the tissues of smooth hammerhead sharks are threats significantly contributing to the species' risk of extinction throughout its global range, now or in the foreseeable future.

Threats Assessment Summary

Based on the best available information summarized above and discussed in more detail in the status review (Miller 2016), none of the ESA Section 4(a)(1) factors, either alone or in combination with each other, are identified as threats significantly contributing to the extinction risk of the species. While overutilization poses the largest potential threat to the species, based on the best available data throughout the species' range, present fishery-related mortality rates of the shark do not appear to be affecting the species' demographics to such a degree that cause it to be strongly influenced by stochastic or depensatory processes or on a trajectory toward this point.

In the Atlantic Ocean, where species-specific data is available, the regional and local information indicates that smooth hammerhead sharks tend to be a rare occurrence, observed only sporadically in the fisheries data and in low numbers. In the northwest Atlantic, harvest and bycatch of the species is very low and strong management measures are in place to prevent overfishing of the species. In the southwest Atlantic, while the majority of the catch appears to be juveniles, smooth hammerhead sharks are generally harvested at low levels and comprise a small proportion of the fisheries catch. In the temperate waters of the Mediterranean Sea, smooth hammerhead sharks were historically a common occurrence. However, with the intense coastal fishing and the expansion of the tuna and swordfish longline and drift net fisheries in the 1970s, smooth hammerhead sharks have been fished almost to extinction in the Mediterranean Sea. Fishing pressure remains high in this portion of the species' range, which will likely result in additional fishing mortality and continued declines in the population. However, the Mediterranean comprises only a small portion of the species' range, and given the lack of trends or evidence of significant declines elsewhere in the Atlantic, the available data do not indicate that the overutilization and depletion of the Mediterranean population has significantly affected other *S. zygaena* populations in the Atlantic.

Similarly, in the Indian and Pacific Oceans, the available data, albeit severely lacking, depict a species that is not regularly caught, or caught in large numbers, by fisheries operating in these regions. The majority of fishing effort, particularly in the Indian Ocean, tends to be concentrated in more tropical waters, thereby decreasing the threat of overutilization by these fisheries on the more temperately-distributed smooth hammerhead shark. However, in the Western Pacific, there are a number of fisheries operating within the temperate portions of this region (*e.g.,* off Japan, Australia, New Zealand) that report regular catches of smooth hammerhead sharks. Based on the available data from these fisheries, including catch time series and CPUE data, no clear trends were found that would suggest overutilization is a significant threat to the species. In the Eastern Pacific, artisanal fisheries are responsible for the majority of the smooth hammerhead catch, and land primarily juveniles of the species. However, based on preliminary information on catch trends (primarily from Peru and Ecuador), there is no evidence to suggest that this level of utilization has or is significantly impacting recruitment to the population.

Furthermore, the number of regulatory and management measures, including hammerhead retention bans and finning regulations, as well as the creation of shark sanctuaries, has been on the rise in recent years. These regulations are aimed at decreasing the amount of sharks being landed or finned just for the shark fin trade and work to dis-incentivize fishermen from targeting vulnerable shark species. Additionally, with the CITES Appendix II listing, mechanisms are also now in place to monitor and control international trade in the species and ensure that this trade is not detrimental to the survival of the species in the wild. Already it appears that the demand for shark fins is on the decline. While it is unclear how effective these regulations will be in ultimately reducing fishing mortality rates for the smooth hammerhead shark (given their high at-vessel mortality rates), it is likely to decrease fishing pressure on the species, particularly in those fisheries that target the species and by those fishermen that illegally fish for the species solely for the shark fin trade.

Overall, while there is a clear need for further research and data collection on smooth hammerhead sharks, the best available information at this time does not indicate that any of the ESA Section 4(a)(1) factors, or a combination of these factors, are significantly contributing to the extinction risk of the species throughout its global range, now or in the foreseeable future.

Overall Risk Summary

While the species' life history characteristics increase its inherent vulnerability to depletion, and likely contributed to past population declines of varying magnitudes, the best available information suggests that present demographic risks are low. Smooth hammerhead sharks continue to be exploited throughout their range, particularly juveniles of the species. While it is universally acknowledged that information is severely lacking for the species, including basic catch and effort data from throughout the species' range, global, regional, and local population size estimates, abundance trends, life history parameters (particularly from the Pacific and Indian Oceans), and distribution information, the best available data do not indicate that present fishing levels and associated mortality, habitat modification, disease, predation, environmental pollutant levels, or a combination of these factors, are causing declines in the species to such a point that the species is at risk of extinction or likely to become so in the foreseeable future. Thus, guided by the results from the demographic risk analysis and threats assessment, we conclude that the smooth hammerhead shark is currently at a low risk of extinction throughout all of its range.

Significant Portion of Its Range

The definitions of both ''threatened'' and ''endangered'' under the ESA contain the term ''significant portion of its range'' as an area smaller than the entire range of the species which must be considered when evaluating a species risk of extinction. On July 1, 2014, the Services published the SPR Policy, which provides our interpretation and application for how to evaluate whether a species is in danger of extinction, or likely to become so in the foreseeable future, in a ''significant portion of its range'' (79 FR 37578; July 1, 2014).

Because we found that the smooth hammerhead shark is at a low risk of extinction throughout its range, under the SPR Policy, we must go on to evaluate whether the species is in danger of extinction, or likely to become so in the foreseeable future, in a ''significant portion of its range.'' The SPR Policy explains that it is necessary to fully evaluate a particular portion for potential listing under the ''significant portion of its range'' authority only if substantial information indicates that the members of the species in a particular area are likely *both* to meet the test for biological significance *and* to be currently endangered or threatened in that area. Making this preliminary determination triggers a need for further review, but does not prejudge whether the portion actually meets these standards such that the species should be listed. To identify only those portions that warrant further consideration, we will determine whether there is substantial information indicating that (1) the portions may be significant and (2) the species may be in danger of extinction in those portions or likely to become so within the foreseeable future. We emphasize that answering these questions in the affirmative is not a determination that the species is endangered or threatened throughout a significant portion of its range—rather, it is a step in determining whether a more detailed analysis of the issue is required (79 FR 37578, at 37586; July 1, 2014).

Thus, the preliminary determination that a portion may be both significant and endangered or threatened merely requires us to engage in a more detailed analysis to determine whether the standards are actually met (79 FR 37578, at 37587). Unless both standards are met, listing is not warranted. The SPR policy further explains that, depending on the particular facts of each situation, we may find it is more efficient to address the significance issue first, but in other cases it will make more sense to examine the status of the species in the potentially significant portions first. Whichever question is asked first, an affirmative answer is required to proceed to the second question. *Id.* ''[I]f we determine that a portion of the range is not 'significant,' we will not need to determine whether the species is endangered or threatened there; if we determine that the species is not endangered or threatened in a portion of its range, we will not need to determine if that portion is 'significant' '' *Id.* Thus, if the answer to the first question is negative—whether that regards the significance question or the status question—then the analysis concludes and listing is not warranted.

As defined in the SPR Policy, a portion of a species' range is ''significant'' ''if the species is not currently endangered or threatened throughout its range, but the portion's contribution to the viability of the species is so important that, without the members in that portion, the species would be in danger of extinction, or likely to become so in the foreseeable future, throughout all of its range'' (79 FR 37578, at 37609). For purposes of the SPR Policy, ''[t]he 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. This range includes those areas used throughout all or part of the species' life cycle, even if they are not used regularly (*e.g.,* seasonal habitats). Lost historical range is relevant to the analysis of the status of the species, but it cannot constitute a significant portion of a species' range'' *Id.*

Applying the SPR policy to the smooth hammerhead shark, we first evaluated whether there is substantial information indicating that any portions of the species' range may be significant. After a review of the best available information, we find that the data do not indicate any portion of the smooth hammerhead shark's range as being more significant than another. Smooth hammerhead sharks are highly mobile, with a global distribution, and very few restrictions governing their movements. While the Mediterranean region was recognized as a portion of the species' range in which it is likely at risk of extinction due to threats of overutilization, the Mediterranean represents only a small portion of the global range of the smooth hammerhead sharks. Furthermore, there is no indication that loss of that part of the species' range would constitute a moderate or high extinction risk to the global species, now or in the foreseeable future. As was mentioned previously, the available population and trend data do not indicate that the depletion of the Mediterranean population has significantly affected other *S. zygaena* populations. Thus, the Mediterranean would not qualify as ''significant'' under the SPR Policy.

Likewise, there is no substantial evidence to indicate that the loss of genetic diversity from one portion of the species' range (such as loss of an ocean basin population) would result in the remaining populations lacking enough genetic diversity to allow for adaptations to changing environmental conditions. Similarly, there is no information to suggest that loss of any portion would severely fragment and isolate the species to the point where individuals would be precluded from moving to suitable habitats or have an increased vulnerability to threats. In other words, loss of any portion of its range would not likely isolate the species to the point where the species would be at risk of extinction from demographic processes, or likely to be so in the foreseeable future, throughout all of its range.

Areas exhibiting source-sink dynamics, which could affect the survival of the species, were not evident in any part of the smooth hammerhead sharks' range. There is also no evidence of a portion that encompasses aspects that are important to specific life history events, but another portion that does not, where loss of the former portion would severely impact the growth, reproduction, or survival of the entire species, now or in the foreseeable future. In fact, potential pupping grounds and nursery areas for the species were identified in all three major ocean basins. In other words, the viability of the species does not appear to depend on the productivity of the population or the environmental characteristics in any one portion.

It is important to note that the overall distribution of the smooth hammerhead shark is still uncertain, considered to be generally patchy but also unknown in large areas, such as the Indian Ocean. As better data become available, the species distribution (and potentially significant portions of its range) will become better resolved; however, at this time, there is no evidence to suggest that any specific portion of the species' range has increased importance over another with respect to the species' survival. As such, we did not identify any portions of the species' range that meet both criteria under the SPR Policy (*i.e.,* the portion is biologically significant *and* the species may be in danger of extinction in that portion, or likely to become so within the foreseeable future). Therefore, listing is not warranted under the SPR policy.

Distinct Population Segment Analysis

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.'' Our DPS Policy clarifies our interpretation of the phrase ''distinct population segment'' for the purposes of listing, delisting, and reclassifying a species under the ESA (61 FR 4722; February 7, 1996). In the 90-day finding addressing the smooth hammerhead shark petition, we stated that we would consider whether the populations requested by the petitioner qualify as DPSs pursuant to our DPS Policy and warrant listing (80 FR 48052; August 11, 2015).

When identifying a DPS, our DPS policy stipulates two elements that must be considered: (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. In terms of discreteness, the 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. If a population segment is considered discrete under one or more of the above conditions, then its biological and ecological significance is considered. Significance under the DPS policy 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; (3) evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historic range; or (4) evidence that the population segment differs markedly from other populations of the species in its genetic characteristics.

The petition states that the smooth hammerhead shark is comprised of five DPSs: Northeast Atlantic and Mediterranean Sea, Northwest Atlantic, Southwest Atlantic, Eastern Pacific, and Indo-West Pacific. However, the petition provides no boundary lines for these identified population segments. As such, it is difficult to determine the discreteness and significance of these populations without knowing how to separate these populations, such as the Northwest and Southwest Atlantic populations. Therefore, we had to make assumptions regarding the boundary lines. Below we explain where we made assumptions and provide our evaluation of the qualification of these populations as DPSs under our DPS policy.

In terms of discreteness, the petition asserts that the identified populations are ''markedly separate from each other as a result of multiple types of barriers that separate the different populations.'' Specifically, the petition identifies deep ocean areas as areas that contain the ''wrong habitat'' for the species and which act as barriers to movement between the petition's identified populations. The petition cites Bester (undated) and Hayes (2007) as support that the species avoids open-ocean and trans-oceanic movements. Additionally, the petitioner cites Diemer *et al.* (2011) to support its statement that the smooth hammerhead shark has less vagility, or freedom to move about, compared to other shark species, therefore making it unlikely that ''populations will connect or reconnect even if they are only separated by relatively short distances.''

In evaluating the information within Bester (undated), we found no data to suggest that the species cannot make open-ocean or trans-oceanic movements. In the Hayes (2007) paper, the author notes ''As semi-oceanic species, they [hammerhead sharks] can be found from continental and insular shelves to deeper water just beyond the shelves, but avoid open-ocean and transoceanic movements (Compagno, 1984).'' This statement refers generally to hammerhead sharks and does not specify species. Additionally, in reviewing the Compagno (1984) reference in Hayes (2007), there is no information to indicate that the species is not capable of these movements. In fact, in describing the habitat and biology of smooth hammerhead sharks, Compagno (1984) states that the species is an ''active, common, coastal-pelagic and semi-oceanic hammerhead, found . . . at depths from the surface down to at least 20 m and probably much more.'' While the petitioner notes that this species may be less vagile than other species of sharks (that share similar depth ranges), thus suggesting a low potential for mixing of *S. zygaena* populations, we have no evidence to indicate that any populations of the smooth hammerhead shark are, in fact, markedly separated from other populations of the species.

In our review of the best scientific and commercial information available, we found evidence to indicate that smooth hammerhead sharks are capable of long-distance movements, and, hence, the ability to potentially mix with other populations, with no data to suggest that they could not make trans-oceanic migrations. While the petition only references Diemer *et al.* (2011) as support for limited maximum and average annual movements, and, thus, low vagility for smooth hammerhead sharks (*i.e.,* 384 km and 141.8 km, respectively), we found three additional studies that provided information on movements of *S. zygaena,* and whose results indicate that *S. zygaena* travels significantly farther distances than those reported in the petition. For example, Kohler and Turner (2001) provided available tagging data from recaptured adult smooth hammerhead sharks (n = 6) and found observed maximum distance travelled for *S. zygaena* to be 919 km, with a maximum speed of 4.8 km/day. In June 2015, NOAA scientists tagged a female smooth hammerhead shark (~213 cm FL) off San Clemente Island, CA. Data from the tag showed that the animal traveled more than 400 miles south to the central Baja Peninsula and then returned north to waters off Ventura, CA, making the total distance traveled equal to more than 1,000 miles (>1,609 km) (SWFSC 2015). Clarke *et al.* (2015) also noted the ability of the species to travel significant distances, citing a study off New Zealand that found tagged individuals traveled to Tonga, a distance of around 1,200 nm (2,222 km). In fact, Clarke *et al.* (2015) characterized *S. zygaena* as the most oceanic of the hammerhead species. This characterization is further supported by Kohler *et al.* (1998), who showed tagging locations of *S. zygaena* in the central Atlantic Ocean, between 20° W. and 30° W. longitudes, indicating the presence of the species in open-ocean water areas. The presence of smooth hammerhead sharks in oceanic waters is also confirmed by fisheries data from the southwest Atlantic (Amorim *et al.* 2011), tropical Atlantic Ocean (Matsushita and Matsunaga 2002; Dai *et al.* 2009), and eastern Pacific Ocean (Román-Verdesoto 2015). Given the above information on long-distance movements and presence in oceanic waters, we do not find that the populations identified by the petitioner are markedly separate from each other as a consequence of physical or habitat barriers.

The petition also asserts that populations of smooth hammerhead sharks are genetically distinct from each other, but notes that ''there is not extensive species-specific genetic differentiation information available.'' The petition cites Duncan *et al.* (2006), who examined the global phylogeography of the scalloped hammerhead shark and compared haplotypes of *S. lewini* to those of nine individuals of *S. zygaena.* The origin of these 9 *S. zygaena* samples were only identified as Atlantic (n = 6), Pacific (n = 2) and Indian (n = 1). The authors found high haplotype diversity for smooth hammerhead sharks (similar to the variation in scalloped hammerhead haplotype diversity); however, this analysis was based on very few samples of *S. zygaena* from non-specific locations and, therefore, provides no information regarding the genetic discreteness of the petitioner's identified populations, particularly between the Northeast Atlantic and Mediterranean Sea, Northwest Atlantic, and Southwest Atlantic populations, and between the Eastern Pacific and Indo-West Pacific populations. Additionally, the Duncan *et al.* (2006) study examined mitochondrial DNA (mtDNA). Mitochondrial DNA is maternally-inherited, and, as such, differences in mtDNA haplotypes between populations do not necessarily mean that the populations are substantially reproductively isolated from each other because they do not provide any information on males. As demonstrated in previous findings, in species where female and male movement patterns differ (such as philopatric females but wide-ranging males), analysis of mtDNA may indicate discrete populations, but analysis of nuclear (or bi-parentally inherited) DNA could show homogenous populations as a result of male-mediated gene flow (see *e.g.,*loggerhead sea turtle, 68 FR 53947, September 15, 2003, and sperm whale, 78 FR 68032, November 13, 2013).

The petitioners also cite to the genetic information provided in Abercrombie *et al.* (2005) as support of the genetic differentiation between Pacific and Atlantic Ocean smooth hammerhead individuals. However, similar to the discussion above, this analysis was based on very few *S. zygaena* samples from non-specific locations (n = 7 samples from Atlantic; n = 34 from Pacific) and, therefore, provides no information regarding the genetic discreteness of the petitioner's identified populations, particularly between the Atlantic populations and between the Indo-West and Eastern Pacific populations. Additionally, neither the petitioner, nor the information in the Abercrombie *et al.* (2005), discuss the relative importance of the differences in the observed amplicons (segments of chromosomal DNA that undergo amplification and contain replicated genetic material) between the Atlantic and Pacific *S. zygaena* primers (strands of short nucleic acid sequences that serve as starting points for DNA synthesis) in terms of genetic diversity between these populations. Finally, the petition cites fossil records (Lim *et al.* 2010) as evidence that would support genetic differentiation amongst populations. The Lim *et al.* (2010) study used samples of *S. zygaena* from only one location (South Africa) to examine the phylogeny of all hammerhead species. The study provides no information on the genetic differentiation amongst the populations identified by the petitioner.

As discussed previously in this finding, as well as in the smooth hammerhead shark status review (Miller 2016), very few studies have examined the population structure of *S. zygaena.* In addition to the studies referenced by the petitioner, we evaluated two other available genetic studies (Naylor *et al.* (2012) and Testerman (2014)) to determine if they provided evidence to support the discreteness of the petitioner's identified populations. Similar to the Duncan *et al.* (2006) study, Naylor *et al.* (2012) analyzed mtDNA from *S. zygaena* individuals. This study also suffered from a small sample size (n = 16), but provided specific locations of the analyzed specimens (4 from Gulf of California, 6 from Northwest Atlantic, 3 from Taiwan, and 1 each from Senegal, Vietnam, and Japan). While these samples do not cover all of the identified petitioner's populations (*i.e.,* no samples from the Southwestern Atlantic, Northeastern and Mediterranean, or Eastern Pacific), they provide some limited information for evaluating the discreteness of the Northwestern Atlantic and Indo-Pacific populations. The results from the Naylor *et al.* (2012) study show a single cluster of smooth hammerhead sharks, with no evidence to suggest matrilineal genetic partitioning of the species. In other words, the available data do not indicate that the identified Northwestern Atlantic population is markedly separate from the Indo-Pacific population due to genetic differentiation.

In contrast, the Testerman (2014) study found statistically significant matrilineal genetic structuring within oceanic basins and significant genetic partitioning between oceanic basins. Specifically, Testerman (2014) analyzed both mitochondrial control region sequences (mtCR; n = 303, 1,090 bp) and 15 nuclear microsatellite loci (n = 332) from smooth hammerhead sharks collected from eight regional areas: Western North Atlantic (n = 21); western South Atlantic (n = 55); western Indian Ocean (n = 63); western South Pacific (n = 44); western North Pacific (n = 11); eastern North Pacific (n = 55); eastern Tropical Pacific (n = 15); and eastern South Pacific (n = 26). Results from the analysis of mtDNA indicated between-basin genetic structuring between the Atlantic and Indo-Pacific basins (mtCR φ_{ST} = 0.8159), and shallow genetic variation among individuals from the Atlantic, eastern Tropical/South Pacific, western North Pacific, and western Indian Ocean. Analysis of the nuclear DNA (which is bi-parentally inherited) also showed significant genetic structure between ocean basins (nuclear F_{ST} = 0.0495), with the Atlantic and Indo-Pacific considered to comprise two genetically distinct populations (Testerman 2014). However, unlike the mtDNA results, no significant structure was detected within oceanic basins using the nuclear markers, suggesting evidence of potential female philopatry and male mediated gene flow (Testerman 2014). In other words, the available data support genetic differentiation on a broad scale, between the Atlantic and Indo-Pacific basins, but do not provide genetic evidence of the discreteness of the populations identified by the petitioner. Furthermore, the Testerman (2014) study did not include samples from all of the petitioner's identified populations, including the Northeast Atlantic and Mediterranean population or the eastern Indian Ocean (with the assumption that these individuals are part of the identified Indo-West Pacific population). Additionally, as Testerman (2014) indicates, more studies are needed, and in particular studies using samples from individual smooth hammerhead sharks of known size class and gender, to further refine the population structure of the smooth hammerhead shark and confirm the above results. Given the best available information, we do not find that the populations identified by the petitioners are markedly separate from each other as a consequence of genetic differences.

Finally, the petition asserts that the populations are ''delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, and regulatory mechanisms exist.'' The petition notes that the range of the smooth hammerhead shark is global, and, as such, extends across international government boundaries and waters regulated by different RFMOs. The petition references its discussion of the ''Inadequacy of Existing Regulatory Mechanisms'' as evidence of the overutilization of the species due to differences in control of exploitation of the species, management of habitat, conservation status, and regulatory mechanisms. The petition argues that because ''various international, national, regional, and RFMO regulations relevant to the species exist throughout all of the aforementioned populations, and since exploitation in these populations varies, they all meet the discreteness requirement.''

We find that the populations identified by the petitioner are not delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, and regulatory mechanisms exist that are significant in light of Section 4(a)(1)(D) of the ESA. Firstly, we note that three of the petitioner's identified populations (the Northeast Atlantic and Mediterranean Sea population, the Northwest Atlantic population, and the Southwest Atlantic population) are governed by the same RFMO, ICCAT. The ICCAT convention area covers all waters of the Atlantic as well as adjacent Seas, including the Mediterranean. In 2010, ICCAT adopted recommendation 10–08 prohibiting the retention onboard, transshipment, landing, storing, selling, or offering for sale any part or whole carcass of hammerhead sharks of the family Sphyrnidae (except for *S. tiburo*) taken in the Convention area in association with ICCAT fisheries. In other words, these populations are not delimited by international governmental boundaries within which differences in the control of exploitation of the species exist as these populations are all governed under the same RFMO, which presently prohibits the retention and sale of the smooth hammerhead shark in its fisheries. Additionally, the RFMO GFCM, whose convention area covers Mediterranean waters and the Black Sea, passed a similar recommendation based on ICCAT 10–08, further supporting the finding that the regulations governing the exploitation of the Northeast Atlantic and Mediterranean Sea population (*e.g.,* the prohibition of retention and selling of *S. zygaena* individuals) are no different than those governing the exploitation of the Northwest Atlantic population or Southwest Atlantic population.

Secondly, we did not find evidence of the overutilization of any of the populations identified by the petitioner due to differences in control of the exploitation of the species, management of habitat, conservation status, or regulatory mechanisms across international governmental boundaries. The status review report (Miller 2016) provides a detailed discussion of the threat of overutilization, and presents this analysis by region. These regional discussions encapsulate the petitioner's identified populations, and, therefore, can be used to evaluate whether differences in the control of exploitation exist that are significant in light of Section 4(a)(1)(D) of the ESA. However, since this finding has already discussed, in detail, the threat of overutilization by region (see *Overutilization for Commercial, Recreational, Scientific or Educational Purposes* section), below we provide the conclusions as they relate to the petitioner's identified populations.

In the Northwest Atlantic, we find that existing regulatory measures have significantly decreased the mortality of hammerhead sharks from both targeted fishing and bycatch mortality on fishing gear for other large coastal shark species, with current levels unlikely to lead to overutilization of the species. In the Southwest Atlantic, we find that smooth hammerhead sharks tend to generally be harvested at low levels and that the available species-specific information does not indicate that overutilization is a significant threat presently contributing to the species' risk of extinction in this region. In the Indo-West Pacific, we find that the best available information, including catch time series and CPUE data, does not indicate that present utilization of the species is contributing significantly to its risk of extinction within this region. In the Eastern Pacific, we find that the best available information does not indicate that the species has suffered declines to the point where it is at risk from depensatory processes or that present utilization levels are impacting populations of *S. zygaena* to such a degree that would significantly increase the species' risk of extinction in this region.

For the Northeastern and Mediterranean population, while we found that the best available information suggests that smooth hammerhead sharks in the Mediterranean Sea have significantly declined, and acknowledge that existing regulatory mechanisms may not be adequate to prevent overutilization of the smooth hammerhead sharks specifically when they occur in the Mediterranean, the same cannot be concluded for those sharks when they occur in the Northeastern Atlantic. Available hammerhead-specific information from the Northeastern Atlantic shows a variable trend in the catch and abundance of hammerhead sharks over the past decade, and without additional information on present abundance levels, distribution information, or catch and overall utilization rates of the smooth hammerhead shark, we found that the best available information does not indicate that overutilization is a threat significantly contributing to the species' risk of extinction in this region. Additionally, as noted previously, the current regulations managing the exploitation of the Northeastern and Mediterranean population are not significantly different across international governmental boundaries.

Given the above findings on the exploitation of the populations identified by the petitioner, as well as the information on the other ESA Section 4(a)(1) factors discussed previously in this finding, we do not find that the petitioner's identified populations are delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, and regulatory mechanisms exist that are significant in light of Section 4(a)(1)(D) of the ESA.

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. Based on our evaluation of the best available scientific information, we do not find biological evidence to suggest that any of the populations identified by the petitioner meet the discreteness criterion of the DPS Policy. Because the identified populations are not discrete from each other, we do not need to determine whether the identified populations are significant to the global taxon of smooth hammerhead sharks, per the DPS policy. As such, we find that none of the population segments identified by the petitioner qualify as a DPS under the DPS policy and, therefore, none warrant listing under the ESA.

Similarity of Appearance Listing

The Defenders of Wildlife petition requested that we also consider listing the smooth hammerhead shark as threatened or endangered based on its similarity of appearance to the listed scalloped hammerhead shark DPSs. Section 4 of the ESA (16 U.S.C. 1533(e)) provides that the Secretary may treat any species as an endangered or threatened species even though it is not listed pursuant to Section 4 of the ESA when the following three conditions are satisfied: (1) Such species so closely resembles in appearance, at the point in question, a species which has been listed pursuant to such section that enforcement personnel would have substantial difficulty in attempting to differentiate between the listed and unlisted species; (2) the effect of this substantial difficulty is an additional threat to an endangered or threatened species; and (3) such treatment of an unlisted species will substantially facilitate the enforcement and further the policy of this chapter (16 U.S.C. 1533(e)(A)–(C)).

While we find that the smooth and scalloped hammerhead sharks do closely resemble each other in appearance, we do not find that this resemblance poses an additional threat to the listed scalloped hammerhead shark, nor do we find that treating the smooth hammerhead shark as an endangered or threatened species will substantially facilitate the enforcement of current ESA prohibitions or further the policy of the ESA. As described in the scalloped hammerhead shark final rule (79 FR 38213; July 3, 2014) and critical habitat determination (80 FR 71774; November 17, 2015), the significant operative threats to the listed scalloped hammerhead DPSs are overutilization by foreign industrial, commercial, and artisanal fisheries and inadequate regulatory mechanisms in foreign nations to protect these sharks from the heavy fishing pressure and related mortality in waters outside of U.S. jurisdiction. While three of the listed DPSs have portions of their range within U.S. waters (*i.e.,* the Central and Southwest Atlantic DPS, Eastern Pacific DPS, and Indo-West Pacific DPS), the take and trade of scalloped hammerhead sharks by persons under U.S. jurisdiction were not identified as significant threats to the listed DPSs. In fact, for the threatened scalloped hammerhead shark DPSs (*i.e.,* the Central and Southwest Atlantic DPS and Indo-West Pacific DPS), we determined that prohibiting these activities would not have a significant effect on the extinction risk of those DPSs (79 FR 38213; July 3, 2014). [For the Eastern Pacific DPS, while take and trade of this DPS by persons under U.S. jurisdiction were not identified as significant threats, the take prohibitions of section 9(a)(1) of the ESA (16 U.S.C. 1538(a)(1)) automatically apply because it is listed as endangered under the ESA.] Overall, interaction with the listed scalloped hammerhead shark DPSs by fishermen under U.S. jurisdiction is negligible.

Additionally, the United States does not have a significant presence in the international fin trade, with U.S. exports and imports of *all* species of shark fins comprising less than 0.50 percent of the total number of fins globally exported and imported (based on 2009–2013 data from U.S. Census Bureau, available at: *http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index,* and from the FAO, available at: *http://www.fao.org/fishery/statistics/global-commodities-production/en*). As such, it was determined that any conservation actions for the listed scalloped hammerhead shark DPSs that would bring these DPSs to the point that the measures of the ESA are no longer necessary will need to be implemented by foreign nations.

In terms of the impact of fishing pressure on the listed scalloped hammerhead shark DPSs by U.S. fishermen, as the final rule details, this additional mortality is not viewed as contributing significantly to the identified threats of overutilization and inadequate regulatory measures to the listed DPSs (79 FR 38213; July 3, 2014). This is primarily a result of the negligible interaction between U.S.

fishermen and the listed scalloped hammerhead shark DPSs, with the listed DPSs rarely caught by persons under U.S. jurisdiction (Miller *et al.* 2014a). Furthermore, current U.S. fishery regulations prohibiting the landing of scalloped hammerhead sharks also prohibit the landing of smooth hammerhead sharks. For example, in the Atlantic Ocean, including the Caribbean Sea, Atlantic HMS commercially-permitted vessels that have pelagic longline gear on board, and dealers buying from these vessels, have been prohibited from retaining onboard, transshipping, landing, storing, selling, or offering for sale any part or whole carcass of hammerhead sharks of the family Sphyrnidae (except for the *S. tiburo*) (76 FR 53652; August 29, 2011). As such, there is unlikely to be any enforcement issue requiring officials to distinguish between, for example, endangered Eastern Atlantic DPS of scalloped hammerhead sharks and smooth hammerhead sharks as both species are prohibited from being landed.

In the Pacific, the core range of the endangered Eastern Pacific DPS is outside of U.S. jurisdiction (80 FR 71774; November 17, 2015). Based on the information from the scalloped hammerhead shark status review (Miller *et al.* 2014a), catch of this DPS by U.S. fishermen is extremely rare. In fact, observer data collected from 1993 to 2015 indicate that no scalloped hammerhead sharks have been observed caught by large U.S. purse seine vessels (>363 mt capacity) operating in the Eastern Pacific Ocean since 2006 (C. Barroso, Fishery Policy Analyst, personal communication 2016). Furthermore, the U.S. States and territories located in the Pacific have passed laws addressing the possession, sale, trade, or distribution of shark fins, which will further discourage landing of scalloped hammerhead sharks. These U.S. states and territories (and year that law was passed) include Hawaii (2010), California (2011), Oregon (2011), Washington (2011), the Commonwealth of the Northern Mariana Islands (2011), Guam (2011), and American Samoa (2012). As such, it is unlikely that U.S. fishermen will be landing hammerhead species in the United States if their fins cannot be traded. Hence, we do not foresee enforcement difficulties related to distinguishing between hammerhead species. As an additional note, the states of Illinois (2012), Maryland (2013), Delaware (2013), New York (2013), and Massachusetts (2014) have also passed similar laws prohibiting the possession, sale, trade, or distribution of shark fins.

With the passage of the U.S. Shark Conservation Act (Pub. L. 111–348, Jan. 4, 2011), except for smooth dogfish sharks (*Mustelus canis*), it is also now illegal to ''remove any of the fins of a shark (including the tail) at sea; to have custody, control, or possession of any such fin aboard a fishing vessel unless it is naturally attached to the corresponding carcass; to transfer any such fin from one vessel to another vessel at sea, or to receive any such fin in such transfer, without the fin naturally attached to the corresponding carcass; or to land any such fin that is not naturally attached to the corresponding carcass, or to land any shark carcass without such fins naturally attached.'' As mentioned in the U.S. Shark finning report to Congress (NMFS 2014a), these provisions have improved the ability of U.S. enforcement personnel to enforce shark finning prohibitions in domestic shark fisheries. These shark finning prohibitions also facilitate enforcement of ESA prohibitions as any landed hammerhead shark will have its fins attached to its corresponding carcass. As noted in the NMFS Shark Fin ID Guide, while the first dorsal fins of the smooth and scalloped hammerhead shark are ''almost indistinguishable,'' the pectoral fins differ in coloration and can be ''easily identified'' (Abercrombie *et al.* 2013). Specifically, in scalloped hammerhead sharks, the ventral surfaces of the pectoral fins have dark patches concentrated at the apex whereas smooth hammerheads lack this dark patch. Since these sharks must be landed with all their fins naturally attached to the carcass, enforcement officials at U.S. ports can use the differences in pectoral fin coloration to differentiate between the species. If the cephalophoil (or head) of the hammerhead shark is also left on the carcass, it provides an additional morphological distinction that can be used to differentiate the species as the smooth hammerhead shark lacks the central indentation that is found on the scalloped hammerhead shark cephalophoil. Regardless, as previously mentioned, there are no ESA take prohibitions for the threatened scalloped hammerhead sharks found in U.S. waters in the Caribbean (Central and Southwest Atlantic DPS) or western Pacific (Indo-West Pacific DPS) and coupled with the other state and Federal fishery regulations that have been implemented in U.S. Atlantic and Pacific waters, it will largely be unnecessary for enforcement personnel to differentiate between landed smooth and scalloped hammerhead sharks for the furtherance of the ESA.

For the reasons above, we do not find it advisable to further regulate the commerce or taking of the smooth hammerhead shark by treating it as an endangered or threatened species based on similarity of appearance to the listed scalloped hammerhead shark DPSs.

Final Determination

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 independently reviewed the best available scientific and commercial information including the petition, public comments submitted on the 90-day finding (80 FR 48053; August 11, 2015), the status review report (Miller 2016), and other published and unpublished information, and have consulted with species experts and individuals familiar with smooth hammerhead sharks. We considered each of the statutory factors to determine whether it presented an extinction risk to the species on its own, now or in the foreseeable future, and also considered the combination of those factors to determine whether they collectively contributed to the extinction risk of the species, now or in the foreseeable future. As previously explained, we could not identify any portion of the species' range that met both criteria of the SPR policy. Additionally, we did not find biological evidence that would indicate that the population segments identified by the petitioner qualify as DPSs under the DPS policy. Therefore, our determination set forth below is based on a synthesis and integration of the foregoing information, factors and considerations, and their effects on the status of the species throughout its entire range.

Based on our consideration of the best available scientific and commercial information, as summarized here and in Miller (2016), we find that the smooth hammerhead shark faces an overall low risk of extinction and conclude that the species is not currently in danger of extinction throughout its range nor is it likely to become so within the foreseeable future. Accordingly, the smooth hammerhead shark does not meet the definition of a threatened or endangered species, and thus, the smooth hammerhead shark does not warrant listing as threatened or endangered at this time. This is a final action, and, therefore, we do not solicit comments on it.

References

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

Authority

The authority for this action is the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Dated: June 20, 2016.

Samuel D. Rauch III,

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

[FR Doc. 2016–15200 Filed 6–27–16; 8:45 am]

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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[Docket No. 160517429–6429–01]

RIN 0648–XE635

Endangered and Threatened Wildlife; 90-Day Finding on a Petition To List the Maui and Kona Reef Manta Ray Populations as Threatened Distinct Population Segments Under the Endangered Species Act

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

ACTION: Notice of 90-day petition finding.

SUMMARY: We, NMFS, announce a 90-day finding on a petition to list the Maui and Kona reef manta ray (*Manta alfredi*) populations as threatened distinct population segments (DPSs) under the Endangered Species Act (ESA). We find that the petition and information in our files do not present substantial scientific or commercial information indicating that either the Maui or Kona reef manta ray population may qualify as a DPS under the ESA. As such, we find that the petition does not present substantial scientific or commercial information indicating that the Maui and Kona reef manta ray populations are ''species'' eligible for listing under the ESA. However, in response to a previous petition to list the entire reef manta ray species under the ESA, we are currently conducting a status review of *M. alfredi* to determine if the species warrants listing throughout all or a significant portion of its range.

ADDRESSES: Copies of the petition and related materials are available on our Web site at *http://www.fisheries.noaa.gov/pr/species/fish/manta-ray.html.*

FOR FURTHER INFORMATION CONTACT: Maggie Miller, Office of Protected Resources, 301–427–8403.

SUPPLEMENTARY INFORMATION:

Background

On April 26, 2016, we received a petition from Dr. Mark Deakos to list the Maui and Kona reef manta ray (*M. alfredi*) populations as threatened DPSs under the ESA. The Maui reef manta ray is described as occurring in the State of Hawaii around the islands of Maui, Molokai, Lanai, and Kahoolawe. The Kona reef manta ray is described as occurring off the western side of the Big Island of Hawaii, referred to as the Kona coast. The petition also requested that critical habitat be designated concurrent with the listing. The petition was submitted as a public comment on our previous 90-day finding response on a petition to list the giant manta ray (*M. birostris*) and reef manta ray under the ESA (81 FR 8874; February 23, 2016). Copies of the petitions are available upon request (see **ADDRESSES**).

ESA Statutory, Regulatory, and Policy Provisions and Evaluation Framework

Section 4(b)(3)(A) of the ESA of 1973, as amended (16 U.S.C. 1531 *et seq.*), requires, to the maximum extent practicable, that within 90 days of receipt of a petition to list a species as threatened or endangered, the Secretary of Commerce make a finding on whether that petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted, and to promptly publish such finding in the **Federal Register** (16 U.S.C. 1533(b)(3)(A)). When it is found that substantial scientific or commercial information in a petition indicates that the petitioned action may be warranted (a ''positive 90-day finding''), we are required to promptly commence a review of the status of the species concerned during which we will conduct a comprehensive review of the best available scientific and commercial information. In such cases, we conclude the review with a finding as to whether, in fact, the petitioned action is warranted within 12 months of receipt of the petition. Because the finding at the 12-month stage is based on a more thorough review of the available information, as compared to the narrow scope of review at the 90-day stage, a ''may be warranted'' finding does not prejudge the outcome of the status review.

Under the ESA, a listing determination may address a species, which is defined to also include subspecies and, for any vertebrate species, any DPS that interbreeds when mature (16 U.S.C. 1532(16)). A joint NMFS-U.S. Fish and Wildlife Service (USFWS) (jointly, ''the Services'') policy clarifies the agencies' interpretation of the phrase ''distinct population segment'' for the purposes of listing, delisting, and reclassifying a species under the ESA (61 FR 4722; February 7, 1996). A species, subspecies, or DPS is ''endangered'' if it is in danger of extinction throughout all or a significant portion of its range, and ''threatened'' if it is likely to become endangered within the foreseeable future throughout all or a significant portion of its range (ESA sections 3(6) and 3(20), respectively, 16 U.S.C. 1532(6) and (20)). Pursuant to the ESA and our implementing regulations, we determine whether species are threatened or endangered based on any one or a combination of the following five section 4(a)(1) factors: The present or threatened destruction, modification, or curtailment of habitat or range; overutilization for commercial, recreational, scientific, or educational purposes; disease or predation; inadequacy of existing regulatory mechanisms; and any other natural or manmade factors affecting the species' existence (16 U.S.C. 1533(a)(1), 50 CFR 424.11(c)).

ESA-implementing regulations issued jointly by the Services (50 CFR 424.14(b)) define ''substantial information'' in the context of reviewing a petition to list, delist, or reclassify a species as the amount of information that would lead a reasonable person to believe that the measure proposed in the petition may be warranted. In evaluating whether substantial information is contained in a petition, we must consider whether the petition: (1) Clearly indicates the administrative measure recommended and gives the scientific and any common name of the species involved; (2) contains detailed narrative justification for the recommended measure, describing, based on available information, past and present numbers and distribution of the species involved and any threats faced by the species; (3) provides information regarding the status of the species over all or a significant portion of its range; and (4) is accompanied by the appropriate supporting documentation in the form of bibliographic references, reprints of pertinent publications, copies of reports or letters from