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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[Docket No. 130214141-4999-02]

RIN 0648-XC515

Endangered and Threatened Wildlife and Plants; Notice of 12-Month Finding on Petitions to List the Northwest Atlantic Population of the Dusky Shark as Threatened or Endangered Under the Endangered Species Act (ESA)

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

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

SUMMARY: We, NMFS, announce a 12-month finding on two petitions to list the Northwest Atlantic and Gulf of Mexico population of dusky shark (Carcharhinus obscurus) as a threatened or endangered distinct population segment (DPS) under the Endangered Species Act (ESA). We completed a comprehensive status review of the dusky shark in response to these petitions. Based on the best scientific and commercial information available, including the status review report (McCandless et al., 2014), we have determined that the Northwest Atlantic and Gulf of Mexico (henceforth abbreviated as NWA) population constitutes a DPS but does not warrant listing at this time. We conclude that the NWA DPS 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 [insert date of publication in the FEDERAL REGISTER].

ADDRESSES: The status review document for the dusky shark is available electronically at: http://www.nmfs.noaa.gov/pr/species/fish/duskyshark.htm. 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: Dusky Shark 12-month Finding.

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

SUPPLEMENTARY INFORMATION:

Background

On November 14, 2012, we received a petition from WildEarth Guardians (WEG) to list the dusky shark (Carcharhinus obscurus) as threatened or endangered under the ESA throughout its entire range, or, as an alternative, to list the Northwest Atlantic/Gulf of Mexico DPS as threatened or endangered. The petitioners also requested that critical habitat be designated for the dusky shark under the ESA. On February 1, 2013, we received a second petition from Natural Resources Defense Council (NRDC) to list the Northwest Atlantic DPS of dusky shark as threatened, or, as an alternative, to list the dusky shark range-wide as threatened, and a request that critical habitat be designated. On May 17, 2013, we published a positive 90-day finding (78 FR 29100) announcing that the petitions presented substantial scientific or commercial information indicating the petitioned action of listing may be warranted for the NWA population of dusky shark, but not for the species range-wide, and explained the basis for that finding. We also announced the initiation of a status review of the NWA population of dusky shark, 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 species are threatened or endangered under the ESA (16 U.S.C. 1531 et seq.). To make this determination, we consider first whether a group of organisms constitutes a "species" under section 3 of the ESA, and then whether the status of the species qualifies it for listing as either threatened or endangered. Section 3 of the ESA defines a "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 (the DPS Policy; 61 FR 4722). The 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." We interpret an "endangered species" to be one that is presently in danger of extinction. A "threatened species," on the other hand, is not presently in danger of extinction, but is likely to become so in the foreseeable future. In other words, the primary statutory difference between a threatened and endangered species is the timing of when a species may be in danger of extinction, either presently (endangered) or in the foreseeable future (threatened). In addition, we interpret "foreseeable future" as the horizon over which

predictions about the conservation status of the species can be reasonably relied upon.

Section 4(a)(1) of the ESA requires us to determine whether any species is endangered or threatened due to any one or a combination of the following five threat 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. We are also required to make listing determinations based solely on the best scientific and commercial data available, after conducting a review of the species' status and after taking into account efforts being made by any state or foreign nation to protect the species.

If we determine that a petitioned species meets the ESA definition of a "species" and warrants listing as threatened or endangered, we publish a proposed rule in the Federal Register and seek public comment on the proposed listing. To determine if a species warrants listing as threatened or endangered, first we determine if it is threatened or endangered throughout its entire range. If it is not, then we need to consider whether it may qualify as threatened or endangered in a significant portion of its range per the Significant Portion of its Range Policy (79 FR 37577; July 1, 2014). This policy clarifies the Services' interpretation of the phrase "significant portion of its range" (SPR) in the definitions of "threatened species" and "endangered species." Under the policy, if we find that a species is threatened or endangered only in an SPR, individuals of the entire ESA species are listed wherever found. Under the SPR policy, the word "range" is defined as the range occupied by the species at the time the Services make a listing determination under section 4 of the ESA. A portion of a species' range is defined as "significant" if: "the species is not currently endangered or threatened throughout all of 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." Finally, if the species is threatened or endangered in an SPR, and the population in that significant portion is a valid DPS, we will list the DPS rather than the entire taxonomic species or subspecies.

Status Review

We convened a team of agency scientists to conduct the status review for the NWA dusky shark and prepare a report. The status review team (SRT) was comprised of two research fishery biologists from NMFS' Northeast and Southeast Fisheries Science Centers, a research mathematical statistician from the Alaska Fisheries Science Center, a fishery management specialist from NMFS' Highly Migratory Species Management Division, and two fishery biologists from NMFS' Greater Atlantic Regional Fisheries Office and the Office of Protected Resources. The SRT had group expertise in dusky shark biology and ecology, population dynamics, highly migratory species management, and stock assessment science.

The status review report of the NWA dusky shark (McCandless et al., 2014) compiles the best available information on the status of the NWA dusky shark as required by the ESA, provides an evaluation of the discreteness and significance of the NWA population in terms of the DPS policy, and assesses the current and future extinction risk for the NWA dusky shark, focusing primarily on the impacts of threats to the status of the species related to the five statutory factors set forth above.

In assessing extinction risk, the SRT considered the demographic viability factors developed by McElhany et al. (2000) and the risk matrix approach developed by Wainwright and

Kope (1999) to organize and summarize extinction risk considerations. The status review report presents the SRT's professional judgment of the extinction risk facing the NWA dusky shark but makes no recommendation as to the listing status of the species. The status review report is available electronically at http://www.nmfs.noaa.gov/pr/species/fish/duskyshark.htm.

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). It was peer reviewed by three independent specialists selected from the academic and scientific community, with expertise in shark biology, conservation and management, stock assessment science, and knowledge of dusky sharks. The peer reviewers were asked to evaluate the adequacy, appropriateness, and application of data used in the status review report as well to evaluate the methods to assess extinction risk and the conclusions of the report. 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 listing determination is based, provides the best available scientific and commercial information on the NWA dusky shark. Much of the information discussed below on dusky shark biology, distribution, abundance, threats, and extinction risk is attributable to the status review report. However, in making the listing 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); our regulations regarding listing determinations; our DPS policy; and our SPR Policy.

Life History, Ecology, and Abundance of the Petitioned Species

Species Description

The dusky shark is classified as a requiem shark within the family Carcharhinidae. This family falls under the largest order of sharks, Carcharhiniformes, also known as ground sharks. Dusky sharks, like many requiem sharks, appear gray or bluish-gray in color dorsally and white ventrally. The sharks within the genus Carcharhinus also have an internal nictitating eyelid, lack a spiracle, have a second dorsal fin that is less than half the height of the first, have well-developed pre-caudal pits, and a heterocercal caudal fin (Castro, 2011).

Range and Distribution

Dusky sharks are coastal-pelagic sharks inhabiting temperate and tropical waters worldwide ranging from the surf zone, across continental and insular shelves, and adjacent oceanic waters from the surface down to 400 meters (m) depth (Compagno, 1984). In the NWA, dusky sharks range from off Cape Cod, Massachusetts and Georges Bank south to Florida, and also occur within the Gulf of Mexico and Caribbean Sea (Kohler et al., 1998; Kohler and Turner, 2010). This species does not use waters with reduced salinities and rarely enters estuarine environments (Compagno, 1984; Musick et al., 1993). During the summer months, small juveniles use nearshore coastal waters as nursery habitat in the NWA from off New Jersey to South Carolina (Castro, 1993; McCandless et al., 2007; NMFS, unpublished data).

Movement and Habitat Use

The dusky shark is a highly migratory species that begins moving north during the spring and returns south during the fall months, often traveling the full extent of its range during these seasonal migrations (Compagno, 1984; Musick and Colvocoresses, 1986; Kohler et al., 1998, Kohler and Turner, 2010). Mark/recapture data from the NMFS Cooperative Shark Tagging

Program between 1963 and 2013 show a maximum straight-line distance traveled of 2,052 nautical miles (nm; 3,800 kilometers (km)), with a mean distance traveled of 572 nm (1,059 km) for dusky sharks tagged in the NWA (number tagged = 8,776 sharks; recaptures = 181 sharks; Kohler and Turner, 2010; NMFS, unpublished data). Movements between the U.S. Atlantic and Gulf of Mexico (GOM), as well as between the U.S. GOM and Mexican Gulf waters were common, but there were no recaptures in the southwest Atlantic, and only one recapture off Central America (Barra de Colorado, Costa Rica) in the Caribbean Sea (Kohler and Turner, 2010; NMFS, unpublished data). Satellite tagging data from an aggregation site in the north central GOM during the summer months revealed dusky shark movements in excess of 200 km (108 nm, Hoffmayer et al., 2014). These sharks primarily used offshore GOM waters associated with the continental shelf edge, spending 87 percent of their time in waters between 20 and 125 m depth and 23° C and 30° C (Hoffmayer et al., 2014). Carlson and Gulak (2012) also tracked three dusky sharks off the U.S. Atlantic coast with pop up satellite tags and found that these sharks spent the majority of their time in water depths between 0 and 40 meters with dives down to depths of 400 m. These sharks spent nearly 60 percent of their time in water temperatures between 20°C to 24°C. The dusky sharks generally traveled about 10 km per day. Two of the sharks were tagged near Key Largo, FL with one shark tagged in January traveling north to the North Carolina/Virginia border by June and the other tagged in March heading south towards Cuba two weeks later (Carlson and Gulak, 2012).

Diet

The dusky shark is an apex predator with a high trophic level and diverse diet including bony fishes, cephalopods, elasmobranchs, decapod crustaceans, mollusks, and occasionally

marine mammals (Cortés, 1999). Juveniles primarily consume pelagic bony fishes and cephalopods with an increase in the consumption of elasmobranch prey as their body size increases (Gelsleichter et al., 1999; Simpfendorfer et al., 2001). Stable isotope analysis has also shown a shift to shelf edge foraging in large dusky sharks (Hussey et al., 2011).

Reproduction and Growth

The dusky shark is a placental, viviparous species, giving birth to between 2 and 16 pups per litter (Compagno, 1984; Romine, 2009; Castro, 2011) with an average litter size of 7.13 pups for NWA dusky sharks (Romine, 2009). Size-at-birth for dusky sharks ranges from 85 to100 centimeter (cm) fork length (FL, Castro, 1983; Compagno, 1984). Available data on reproduction suggests a 3-year reproductive cycle (Castro, 2009; Romine, 2009) with a gestation period of 18 months (Castro, 2009). Female and male size at maturity in the NWA is 235 and 231 cm FL (17.6 and 17.4 years of age), respectively (Natanson et al., 1995; Natanson et al., 2013). Maximum validated age estimates are between 38 and 42 years, confirming longevity to at least 42 years of age (Natanson et al., 2013). Logistic growth parameters derived from validated vertebral length-at-age data are L □ = 261.5 cm FL, L_o = 85.5 cm FL, t_o = 4.89 years and g = 0.15 year^{-1} for the sexes combined (Natanson et al., 2013).

Genetics

Genetic data can be used to provide information on a species' range as well as stock structure. Global phylogeographic studies of the dusky shark using maternally inherited mitochondrial DNA and nuclear microsatellite DNA analyses detected significant differentiation between dusky sharks from the NWA and Indo-Pacific regions, with waters off South America serving as a possible historical connection between these populations (Benavides et al., 2011;

Gray et al., 2012). Despite the history of severe population declines in the NWA, dusky sharks from all regions showed remarkably similar allelic richness and gene diversity (Gray et al., 2012).

The low nucleotide diversity for the dusky shark and the existence of a morphologically and genetically similar species (Galapagos shark, Carcharhinus galapagensis) indicates the dusky shark is recently derived on an evolutionary timescale (Naylor, 1992; Musick et al., 2004; Benevides et al., 2011). An ongoing genetic study using mitochondrial DNA sequencing found that specimens identified as Galapagos sharks from oceanic islands in the NWA are indistinguishable from specimens identified as dusky sharks collected off the U.S. east coast from New Jersey to Florida (Gavin Naylor, College of Charleston, personal communication, 2014). These findings could possibly be attributed to an ancient hybridization event where there was a directional transfer of mitochondrial DNA genes, which are maternally inherited, from one species to another. Alternatively, they could represent two forms of the same species, an offshore and an inshore form. However, at this time, the evolutionary genetic relationship between the NWA dusky shark and Galapagos shark remains unresolved. Work continues on this using a wider global sampling scheme and multiple nuclear markers, which reflects the genetics of both parents, to address the possibility that the observed pattern might be the consequence of an ancient hybridization event. Whether or not these two species have the ability to interbreed (e.g., if the timing and location of opposite sexes ever co-occur during mating season), or if they would produce viable offspring is unknown.

Abundance Trends

In 2011, the NWA dusky shark was assessed through the Southeast Data, Assessment,

and Review (SEDAR) process, which is a cooperative Fishery Management Council process initiated in 2002 to improve the quality and reliability of fishery stock assessments in the South Atlantic, GOM, and Caribbean. Results from this SEDAR stock assessment base model indicated that NWA dusky shark abundance had declined 74 percent from virgin (unexploited) levels by 2004, but was gradually increasing throughout the remainder of the time series modeled through 2009 (NMFS, 2011a). The only two fishery-independent surveys that were used in this model, the Northeast Fisheries Science Center Coastal Shark Bottom Longline Survey (NELL) and the Virginia Institute of Marine Science Shark Longline Survey (VIMS LL), were recently updated with data from 2010 to 2012 (for NELL) and to 2013 (for VIMS LL) using the same methodology (delta-lognormal generalized linear mixed modelling) as was conducted for the SEDAR stock assessment (NMFS, 2011a; McCandless et al., 2014). With these updates, the surveys show that the NWA relative abundance trends (based on numbers) have continued to increase.

In addition, analysis of the University of North Carolina Shark Longline Survey (UNC LL) data, another fishery-independent time series that is still being conducted, also shows an increasing trend in abundance in recent years (McCandless et al., 2014). Although NWA dusky sharks are only second to the blacknose shark (Carcharhinus acronotus) in terms of numbers caught in the UNC LL survey, dusky sharks are transient in the sampled area and could easily be missed by the two fixed sampling stations. Because of these limitations, the UNC LL time series was recommended for use only in the sensitivity model runs for the SEDAR stock assessment to examine uncertainty in data inputs and model configuration (NMFS, 2011a). Analysis of data from this time series through 2009, included in the sensitivity model runs, revealed a declining

trend in abundance for dusky sharks from the mid-1970s to the mid-1990s, with abundance appearing to stabilize at low levels into the 2000s (Schwartz et al. 2010; NMFS, 2011a). However, the addition of recent data from 2010 to 2012 in the analysis has since given the model more information to determine a trend in recent years, and has, in fact, revealed an increasing trend in dusky shark abundance that began around 2006 (McCandless et al., 2014). In other words, with the data updates to all three of the above fishery-independent surveys, it appears that the NWA dusky shark abundance has been on a positive trajectory for almost the past decade.

Species Finding

Based on the best available scientific and commercial information described above, we determined that Carcharinus obscurus is a taxonomically-distinct species and, therefore, meets the definition of "species" pursuant to section 3 of the ESA. As noted above, the ESA's definition of "species" also 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." Below, we evaluate whether the petitioned NWA population of Carcharinus obscurus qualifies as a DPS based on the elements of discreteness and significance as defined in our DPS policy, to determine whether it is eligible for listing under the ESA.

Distinct Population Segment Analysis

According to the SRT, the NWA population can be considered a discrete segment because it is markedly separate from other populations of dusky sharks as a consequence of genetic and physical/behavioral factors. Dusky shark populations have been reported in temperate and tropical waters worldwide, including the western Atlantic in the north from Nova Scotia to Cuba and the Gulf of Mexico, and in the south from Nicaragua to southern Brazil.

Dusky sharks are also found in the Mediterranean, Indian, and western Pacific waters including off Madagascar and Australia, and in the eastern Pacific from southern California to the Gulf of California. Genetic studies, using both mitochondrial and nuclear microsatellite DNA, showed significant genetic differentiation between the western North Atlantic, South African, and Australian dusky shark populations, with a low frequency of migration between these populations (Benavides et al., 2011; Gray et al., 2012). Specifically, Benavides et al. (2011) found 25 mitochondrial control region haplotypes and rejected a null hypothesis of panmixia (analysis of molecular variance, $\Phi_{ST} = 0.55$, $p < 0.000001$), detecting significant differentiation between dusky sharks from the U.S. Atlantic, South Africa, and Australia. Work by Gray et al. (2012) supports these findings by identifying a strong divergence among NWA, South African, and Australian samples using microsatellite markers ($\Phi_{ST} = 0.01\text{-}0.15$, $p < 0.05$).

Within the western Atlantic, there is qualitative evidence of population structure between the NWA dusky sharks and dusky sharks caught off Brazil. The most common haplotype from Brazil is intermediate to the NWA and Indo-Pacific haplotype clusters, indicating this region may have provided a historical connection between the NWA and Indo-Pacific regions (Benavides et al., 2011). However, there was no evidence of genetic differentiation between dusky sharks from waters off the U.S. east coast and the GOM based on analysis of mitochondrial control regions (Benavides et al., 2011), suggesting that these populations readily mix.

These genetic findings of a discrete population occurring within northwest Atlantic waters are further supported by tagging data collected from the NMFS Cooperative Shark Tagging Program between 1963 and 2013 (Kohler et al., 1998; Kohler and Turner, 2010).

Mark/recapture data from this program indicate that NWA dusky sharks commonly move between the U.S. Atlantic and GOM, as well as between the U.S. GOM and Mexican Gulf waters, but do not venture south of the Caribbean Sea (Kohler and Turner, 2010; NMFS, unpublished data). Although populations of dusky sharks occur off Brazil and South America, to date, no recaptures of the 8,776 tagged NWA dusky sharks have been identified from these areas, and only one has been recaptured within the Caribbean Sea (Kohler and Turner, 2010; NMFS, unpublished data). Given this behavioral information, it is likely that the dusky sharks found off Brazil and South America are independent from the NWA population of dusky sharks. Overall, based on the genetic and tagging study findings discussed above, we consider the NWA population of dusky sharks to be a discrete population.

In terms of significance, the SRT determined that loss of the NWA segment would translate to a significant gap in the current range of the species, specifically the entire northwest Atlantic. Although qualitative data in Benavides et al. (2011) show a potential historical connection between the NWA and Indo-Pacific populations through the southwest Atlantic waters, the study indicates that recovery of depleted NWA populations would likely rely on reproduction by surviving local females as opposed to replenishment from immigrant females from the southwest Atlantic or Indo-Pacific. In other words, loss of the NWA population would leave a significant gap in the range of the species, extending from the Gulf of Maine south to Florida, and including the GOM and Caribbean Sea. As such, we consider the discrete NWA population of dusky sharks to be significant to the taxon as a whole.

In conclusion, we agree with the SRT that the best available information indicates that the NWA population segment of dusky shark qualifies as a DPS under our DPS policy.

Summary of Factors Affecting the NWA DPS of Dusky Sharks

We thoroughly reviewed the available information regarding historical, current, and potential threats to the NWA DPS of dusky sharks (McCandless et al., 2014). In the following section, we summarize information regarding each of these threats according to the factors specified in section 4(a)(1) of the ESA and consider whether any one or a combination of the factors are contributing to the extinction risk of the NWA DPS of dusky sharks.

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

Based on our review of the best available information regarding historical and current range and habitat of the NWA DPS (McCandless et al., 2014), we found no evidence to suggest that the species has experienced a curtailment of its habitat or range, and there is little information that would suggest habitat destruction or modification is presently contributing or will contribute significantly to the NWA DPS' risk of extinction.

In the U.S. exclusive economic zone (EEZ), the Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires us to identify and describe essential fish habitat (EFH) in fishery management plans (FMPs), minimize the adverse effects of fishing on EFH, and identify actions to encourage the conservation and enhancement of EFH. The MSA defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." (16 U.S.C. 1802 (10)). Towards that end, we have funded two cooperative survey programs intended to help delineate shark nursery habitats in the Atlantic and GOM. The Cooperative Atlantic States Shark Pupping and Nursery Survey and the Cooperative Gulf of Mexico States Shark Pupping and Nursery Survey are designed to assess the geographical and seasonal extent of shark nursery habitat, determine which shark species use these areas, and

gauge the relative importance of these coastal habitats for use in EFH determinations. We also used fishery observer data, tagging data and fishery-independent sampling data to determine EFH for dusky sharks, as described in Amendment 1 to the 2006 Consolidated Atlantic Highly Migratory Species (HMS) FMP (the FMP which manages the conservation of the domestic fisheries for Atlantic swordfish, tunas, sharks, and billfish) (NMFS, 2006; NMFS, 2009). These data resulted in the designation of EFH areas for neonate, juvenile, and adult dusky sharks in coastal and offshore waters from Florida to Cape Cod, which could provide important nursery habitats and breeding areas for this species.

Next, we analyzed fishing and non-fishing impacts on EFH in the 2006 Consolidated HMS FMP and concluded that while bottom longline gear (BLL), in general, may have an effect on EFH, shark BLL gear as currently used in the Atlantic shark fishery was not having more than a minimal and temporary effect on EFH. This BLL gear (which normally consists of a mainline between 3 and 8 km long with 200-400 hooks attached and is set for 2 to 20 hours) is primarily used in sandy and/or muddy habitats where it is expected to have minimal to low impacts. Likewise, other HMS gears are not considered to have an impact on EFH. HMS gears do not normally affect the physical characteristics that define dusky shark habitat such as salinity, temperature, dissolved oxygen, and depth. Similarly, other state and federally managed gears were also determined not to have an impact on HMS EFH, with the possible exception of some bottom-tending gears in shark nursery areas in coastal bays and estuaries. However, we anticipate that any impacts resulting from these gears would be minimal and only temporary in nature (NMFS, 2009).

We also found no information to suggest that non-fishing related activities are affecting

dusky shark habitat in a significant way. Estuarine environments, which are most easily prone to degradation by human activity other than fishing, are rarely used by dusky sharks. Additionally, the NWA DPS is highly mobile throughout its range (as evidenced by results from tagging studies: Kohler and Turner, 2010; Carlson and Gulak, 2012; Hoffmayer et al., 2014; NMFS, unpublished data), and we found no evidence to suggest its access to suitable habitat is or will be restricted in the future.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The NWA DPS of dusky shark is currently a prohibited species in U.S. Atlantic HMS fisheries (NMFS, 1999), meaning that neither U.S. commercial nor recreational fishermen are allowed to legally land this species; however, this was not always the case. During the late 1930s, a shark fishery developed off the east coast of Florida, in the GOM, and in the Caribbean Sea (Wagner, 1966), areas where the NWA DPS is known to occur. The shark fishery grew in response to the demand for vitamin A obtained from shark livers, but by the 1950s, most of these shark fisheries were abandoned due to the development of synthetic vitamin A (Wagner, 1966). In the late 1970s, the U.S. Atlantic shark fishery developed rapidly once again, this time due to increased demand for shark meat, fins, and cartilage worldwide. At the time, sharks were perceived to be underutilized as a fishery resource. The high commercial value of shark fins led to the controversial practice of "finning," or removing the valuable fins from sharks and discarding the carcasses during this time. Growing demand for shark products encouraged expansion of the commercial fishery throughout the late 1970s and the 1980s. Tuna and swordfish vessels began to retain a greater proportion of their shark incidental catch and some directed fishery effort expanded as well. As catches accelerated through the 1980s, shark stocks

started to show signs of decline.

The NWA DPS of dusky shark was not immune to this exploitation and followed the same trend as many of the other shark stocks off the U.S. east coast. Historically, the fishing mortality of the NWA DPS was estimated to be low from 1960 through the early 1980s, with the size of the NWA DPS predicted as being close to virgin levels until the late 1980s (NMFS, 2011a). Fishing mortality was then thought to have increased to unsustainably high levels in the 1990s, before declining following the prohibition of dusky shark landings in 2000 (NMFS, 2011a).

In 2006, we assessed the status of the NWA dusky shark stock under the MSA and found it to be "overfished" with "overfishing" occurring (Cortés et al., 2006; NMFS, 2007). The 2006 stock assessment predicted that dusky sharks could rebuild within 100 to 400 years (Cortés et al., 2006). In 2011, the NWA dusky shark stock was re-assessed through the more comprehensive SEDAR process (NMFS, 2011a). Based on the results from this SEDAR assessment, we declared that the NWA dusky shark stock was still overfished and continues to experience overfishing (76 FR 62331; October 7, 2011); however, there was considerable uncertainty in the SEDAR stock assessment model about whether overfishing has occurred during the last several years of the time series (NMFS, 2011a; McCandless et al., 2014).

The fishery management terms of "overfishing" and "overfished" are defined under the MSA and are based on different criteria than threatened or endangered statuses under the ESA. As such, they do not automatically indicate that a species may warrant listing under the ESA because they do not necessarily have any relationship to a species' extinction risk. Overutilization under the ESA means that a species has been or is being harvested at levels that

pose a risk of extinction. Therefore, the analysis of the results from this most recent SEDAR stock assessment (NMFS, 2011a), catch and bycatch trends, and new data that have become available since the terminal year of the SEDAR stock assessment, are evaluated below in terms of insight into threats to the DPS and its likelihood of extinction.

Although the NWA DPS of dusky sharks is currently a prohibited species in U.S. waters, individuals are still incidentally caught in the U.S. commercial BLL and pelagic longline (PLL) fisheries and U.S. gillnet fisheries (although rarely), and they have also been reported as landed in NMFS recreational fishing survey data. The SRT identified this bycatch as potential overutilization of the NWA DPS because it is the primary source of anthropogenic mortality of the DPS in U.S. waters. In assessing the impact of this bycatch mortality on extinction risk, we examined the results from the SEDAR stock assessment because the model implicitly included bycatch mortality in the calculations of total fishing mortality of the species. Due to the uncertainty about the magnitude of total catches and discards, an alternative modeling methodology was used in the SEDAR stock assessment, the Age-structured Catch Free Model (ASCFM), which re-scales the model population dynamics as proportional to unexploited conditions. Fishing mortality rates were estimated by the ASCFM using a correlated random walk prior. Although estimates of commercial at-vessel and commercial and recreational post-release mortality for dusky sharks were included in the "Data Workshop Report" section of the SEDAR stock assessment report, these estimates were not directly inputted in the actual model (NMFS, 2011a). Pup survival was also estimated and given an informative lognormal prior (median=0.81, CV=0.3, and was bounded between 0.50 and 0.99). Relative effort series for the three primary U.S. fishing fleets that incidentally catch the NWA DPS (BLL, PLL, and

recreational fleets) were used to determine a single, annual weighted selectivity vector for modeling fishing mortality. In other words, although the SEDAR stock assessment used an ASCFM modeling approach, it still factored in total mortality attributable to fishing for its projections, which implicitly includes both discard mortality as well as mortality of those sharks retained in the catch. For these reasons, the at-vessel and post-release mortality associated with current trends of catch and bycatch should not negatively impact future stock projections. As such, the ASCFM base model stock assessment allows us to examine whether overutilization is still considered a threat to the species by modeling the effect of historical and current fishing mortality rates, including bycatch mortality, on the abundance trends and spawning stock biomass of the population.

As mentioned before, overutilization under the ESA means that a species has been or is being harvested at levels that pose a risk of extinction and is most often indicated by a declining abundance and a low likelihood of a reversal of this trend due to this threat, or a combination of threats, and demographic risks. However, based on the SEDAR stock assessment model outputs, this does not appear to be the case. Although recruitment and spawning stock biomass have declined rather substantially since the late 1980s, spawning stock biomass levels are projected to maintain near 15 percent of unexploited levels into the future, indicating that the level of bycatch and landings and associated mortality at the time of the model (i.e., 2008 levels) is sustainable. In other words, recent exploitation levels do not appear to pose a risk of extinction to the NWA DPS as its biomass is projected to remain stable through the future.

In addition, based on the estimates and trends of dusky shark bycatch from the available U.S. commercial BLL, PLL, gillnet, commercial handgear, and recreational fisheries data, we do

not foresee a significant reversal in this biomass trend in the future, at least not in the negative direction. In terms of bycatch on BLL gear, the primary commercial gear employed for targeting large coastal sharks in all regions, the U.S. National Bycatch Report (NMFS, 2011b; NMFS 2013a) provides a comparison of estimates of dusky shark bycatch over the years from the GOM Reef Fish BLL commercial fishery. This comparison allows for insight into the bycatch trend for this fishery. For the time period of 2005 to 2006, the report estimated that annual dusky shark bycatch was approximately 798 individuals in the GOM Reef Fish BLL fishery (NMFS, 2011b). In an update to the report, for the years covering 2006 to 2010, the dusky shark bycatch in this fishery remained rather stable, with an annual estimate of 804 individuals (NMFS, 2013a).

Dusky shark bycatch in the U.S. Atlantic and GOM shark BLL fishery was included in the U.S. National Bycatch Report in pounds only and for the years of 2005 and 2006, but with the caveat that the estimates given were being refined due to discrepancies in the calculation of total effort (NMFS, 2011b). There was no reported dusky shark bycatch in the report update for the Atlantic and GOM shark BLL fishery so we are unable to evaluate the trend using this information (NMFS, 2013a). However, examination of observer data from the U.S. Atlantic and GOM shark BLL fishery indicates that NWA dusky sharks made up a small percentage of the total large coastal shark catch from 2005 to 2009 and showed a relatively stable trend across years (Hale et al., 2010). Out of 879 observed sets over the 5 years, only 8.2 percent of these sets caught dusky sharks (n =192 individuals). In the NMFS Shark Research Fishery, which has had 100 percent observer coverage since its creation in 2008 (NMFS, 2007), very low numbers of dusky sharks have been caught as bycatch (average = 161 individuals from 2009 to 2012; Hale et al., 2010; NMFS, 2011c; NMFS, 2012a; NMFS, 2013b) compared to overall bycatch estimates

(NMFS 2011b; NMFS 2013a). Although there appears to be a minor increasing trend in the annual dusky shark bycatch in this fishery ($y=38.9x-78047.2$, $R^2=0.45$, McCandless et al., 2014), analysis of fishing effort indicates there has been little change in effort from 2009 through 2012. In other words, the increase in the bycatch amounts may be more likely attributed to increases in the relative abundance of dusky sharks within the NMFS Shark Research Fishery area, suggesting potential recovery of the NWA DPS within this area.

In terms of bycatch on U.S. PLL gear, analysis of reported dusky shark catches from U.S. PLL logbook and observer data from 1992-2009 showed similar trends, marked by an initial decrease in catch per unit effort (CPUE) in the 1990s followed by a more stable trend through the 2000s (Cortés, 2010), indicating that bycatch in the U.S. PLL fishery has potentially stabilized in recent years. The annual number of hooks deployed in the U.S. Atlantic PLL fishery, which is a representation of the level of fishing effort, has ranged from 5,662,000 to 7,679,000 from 2003 to 2012, with no distinct pattern of increasing or decreasing effort (NMFS 2013a).

In the U.S. gillnet fishery, NWA dusky shark bycatch is negligible. Since the implementation of Amendment 2 to the Consolidated Atlantic HMS FMP (NMFS, 2007), the directed large coastal shark (LCS) gillnet fishery has been greatly reduced. The 33-head LCS trip limit has essentially ended the strike net fishery and limited the number of fishermen targeting LCS with drift gillnet gear. As a result, many gillnet fishermen who historically targeted sharks are now targeting teleost species such as Spanish mackerel, king mackerel, and bluefish. In 2012, 316 sets comprising various gillnet fisheries were observed. During the strike gillnet trips, no dusky sharks were observed on trips that targeted king mackerel and only one dusky shark was

caught during an observed sink net trip targeting smoothhound (Mathers et al., 2013).

U.S. commercial handgears, including handline, harpoon, rod and reel, buoy gear and bandit gear, are also used to fish for Atlantic HMS by fishermen on private vessels, charter vessels, and headboat vessels. However, the shark commercial handgear fishery presently contributes very little to the overall dusky shark landings. The estimated annual NWA dusky shark bycatch in the GOM Reef Handline (vertical line) fisheries was approximately 256 individuals from 2006 to 2010, based on updated data to the U.S. National Bycatch Report (NMFS, 2013a). This reflects an 87 percent decrease from the previous annual estimate of approximately 1,941individuals in 2006 (NMFS, 2011b) and was mainly attributed to the establishment and implementation of an individual fishing quota system for the GOM commercial red snapper fishery before the start of the 2007 fishing season.

In terms of U.S. recreational catch, most Atlantic HMS are targeted by domestic recreational fishermen using a variety of handgear including rod and reel gear. Given that the NWA DPS is currently a prohibited species, only catch and release is allowed in the U.S. recreational fishery; however, landings of dusky sharks are still reported in NMFS recreational fishing survey data and, thus, are considered to be due to misidentification of the species (as dusky sharks are commonly confused with other Carcharhinid sharks (e.g., sandbar and silky sharks, Carcharhinus falciformis)) or fishermen not understanding the regulations. Given these issues, estimates of U.S. recreational catches of the NWA DPS are considered highly uncertain.

Analysis of three data sources that estimated U.S. recreational dusky shark catches (the Marine Recreational Fishery Statistics Survey (MRFSS), the NMFS Headboat Survey (HBOAT) operated by the SEFSC Beaufort Laboratory, and the Texas Parks and Wildlife Department

Recreational Fishing Survey (TXPWD)) shows that, by weight, the recreational landings and recreationally caught sharks that were killed but not landed appear to be of similar magnitude to the commercial discards in recent years, but shows no clear trend (Cortés and Baremore, 2010). When data from these three surveys are combined by number, the total estimated recreationally landed and killed sharks from 2000 to 2009 depicts an overall decreasing trend (y=-346.7+696865, R^2=0.30; data from Cortés and Baremore, 2010). Although these data are highly uncertain, the available information indicates that mortality from recreational bycatch is not likely increasing.

Analysis of the NMFS Large Pelagics Survey data from 1986 to 2009, where dusky sharks are primarily caught and released, shows that recreational NWA dusky shark catches exhibited a pattern of declines from the 1980s into the 1990s and a recent pattern of slight increases since 2000. Analysis of effort (shark directed trips) from 2003 to 2009 also suggests very little change in total effort in recent years (y=7.8214x-15139, R^2 = 0.0525, data from Walter and Brown, 2010), indicating that the increasing trend in catch rates may be attributed to increases in the relative abundance of dusky sharks within the areas fished (McCandless et al., 2014).

Available data on Mexican shark landings and fishing effort indicate that even though Mexican fisheries likely contribute to dusky shark mortality, these impacts appear to have stabilized or be decreasing in recent years and are unlikely to lead to a significant reversal in the projected biomass trend of the NWA DPS. The Mexican shark fishery is part of a diverse multi-species artisanal fishery (Oviedo, 2010; Soriano-Velásquez, 2011). The fleet uses both gillnet and longline gear to harvest sharks (Oviedo, 2010). The PLL gear is a selective gear, with

yellowfin tuna making up over 70 percent of the catches (Brown and Ramírez-López, 2012). In 2006, shark species made up only 1.4 percent of the catch by numbers, and no dusky sharks were caught that year (Oviedo, 2010). During spring and summer, fleet activity is concentrated in the central, southern, and western portions of the Mexican EEZ and expands into the northern and eastern portions of the Mexican EEZ in the fall and winter (Brown and Ramírez-López, 2012). However, an analysis of PLL effort from 2001 to 2006 indicates that there has been very little change in fishing effort ($y=30x-58212$, $R^2=0.003$, data from Brown and Ramírez-López, 2012).

Based on an intensive monitoring study of Mexican artisanal shark landings from November 1993 to December 1994, Castillo-Géniz et al. (1998) reported that the Campeche region in the southeastern Gulf had the highest landings and effort, where Bonfil (1997) reported that dusky shark catches are rare. In 2010, Oviedo reported that there were 1,813 fishing vessels documented fishing in Mexican waters in the GOM. Areas with the highest shark landings are reported to occur in Veracruz and Tamaulipas (Oviedo, 2010), where Bonfil (1997) reported that dusky shark catches were common with the addition of the Yucatan region. There is no known nursery habitat for dusky sharks in GOM waters within Mexico's EEZ, with primarily large juveniles and adults >1.5 m total length caught in the artisanal fisheries (Bonfil 1994, Bonfil 1997).

In general, however, there has been an overall decline in Mexican shark landings from GOM fisheries in recent years (Soriano-Velásquez, 2011). A qualitative frequency analysis of landings from the southeastern GOM fisheries showed moderate dusky shark catches in the 1980s followed by low catches in the 1990s and no recorded dusky catches in the 2000s (Perez, 2011). The decline in shark landings is thought to be a result of past fishing pressure as well as

rising fuel costs and shifts to other targets, such as rays and octopi (Soriano-Velásquez, 2011; Excartín, 2011). Socio-economic research on Mexican artisanal fisheries reports that the artisanal fisheries in general are "stagnant" as many of the fishermen are older and younger people are less attracted to fishing as a career (Excartín, 2011). This study also indicates that the decline in shark catches within this region may be partially attributed to fishermen changing their target species to more profitable species such as the octopus, which is currently one of the most important commercial species and has increased landings in recent years (Excartín, 2011). Therefore, based on the above information, it appears that the level of harvest of the NWA dusky shark by Mexican fishermen is likely minimal and also on the decline, as indicated by the decreasing trends in fishing effort.

Overall, the combination of (1) the stable levels of the NWA DPS biomass into the future projected by the SEDAR stock assessment, indicating that the level of exploitation in 2008 was sustainable; (2) the evidence of stable and even decreasing NWA dusky shark bycatch, harvest trends, and fishing effort in U.S. commercial fisheries and Mexican fisheries; and (3) the catch rates from the NMFS Large Pelagics Survey, the NMFS Shark Research Fishery, and updated analyses of U.S. fishery-independent surveys (see Abundance Trends section), which all suggest increasing abundance trends in recent years, indicate that overutilization of the species in the form of U.S. bycatch and Mexican landings appears to no longer be a threat contributing significantly to the risk of the DPS' extinction.

In terms of illegal harvest of the DPS, we did not find evidence that this is significantly contributing to the overutilization of the DPS. Since the mid-1990s, the United States Coast Guard (USCG) has been aware of Mexican fishing vessels fishing for sharks and other species in

the U.S. Exclusive Economic Zone (EEZ) off the coast of Texas. The vessels originate from Matamoros, Mexico, and fish in the area surrounding South Padre Island, Texas, anywhere from zero to 20 miles (32 km) offshore. These vessels, or lanchas, fish during the day with gillnet and longline gear in U.S. waters for shark and red snapper, which are believed to be more prevalent in the U.S. EEZ off Texas than in the Mexican EEZ near Matamoros (Brewster-Geisz et al., 2010). However, analysis of detected fishery-related lancha incursions from 2000 to 2009 show a recent decreasing trend since 2004 ($y=-22.6x+45470$, $R^2=0.81$, Brewster-Geisz et al., 2010). In fact, since 2005, there has been a 46 percent decrease in the number of detected incursions (Brewster-Geisz et al., 2010). In addition, the majority of the sharks found on these lanchas are not dusky but rather blacktip and hammerhead sharks (Brewster-Geisz and Eytcheson, 2005).

These illegally caught sharks are usually finned and the fins sold; however, the best available information on the international shark fin trade does not indicate that this level of utilization is likely of the magnitude to affect the status of the NWA DPS. In fact, a study by Clarke et al. (2006) estimated that dusky shark fins made up only 1.4 percent (1.2–1.7 percent) of the auctioned fins in Hong Kong, the world's largest fin trading center. It was the second least encountered species in the fin auction (the first being tiger shark fins, Galeocerdo cuvier, comprising 0.13 percent of the fins at market, Clarke et al., 2006). It is also unclear what proportion of the total dusky shark fins belonged to the prohibited NWA DPS. In addition, the primer that was used in the study to genetically identify fins of dusky sharks was unable to distinguish between dusky shark fins and Galapagos shark (C. galapagensis) fins; therefore, it is likely the reported percentage of dusky sharks in the fin market is overestimated (Clarke et al., 2006).

Therefore, although some illegal harvest for dusky shark fins in the NWA may occur, the available information indicates that the present level of such illegal activity, especially for the fin trade, is minimal and we find it is unlikely to contribute significantly to the risk of the DPS' extinction.

Disease or Predation

Various parasitic copepods have been documented on dusky sharks, including Alebion carchariae, Paralebion elongates, Perrisoppus communis, Pandarus satyrus, Pandarus sinuatus, Pandarus smithii, Pandarus cranchii, Nessipus alatus, Nessipus gracilis, Nessipus orientalis, Nemesis pallida, Nemesis spinulosis, Eudactylina spinifera, Kroyeria gracilis, and Opimia exilis (Bere, 1936; Cressey, 1970). Though there are many different types of parasitic copepods associated with dusky sharks, there are also species of diskfishes (Echenidae) that rely on the dusky shark for the host-fish relationship they provide for feeding on those copepods. Cressey and Lachner (1970) found the Remora remora and the "white suckerfish" (R. albescens) feed on copepods attached to dusky sharks. The connection between the host fish and R. remora was noted to be a stable, long-term relationship and that the white suckerfish is rarely caught apart from the host fish, which may indicate that these fish maintain a relationship with and/or close proximity to the host-fish (Cressey and Lachner, 1970).

Acanthocephala, cestodes and trematodes have also been documented on dusky sharks (Linton, 1901; Linton, 1908; Linton, 1921; Bullard et al., 2004). Bullard et al. (2004) found a dusky shark in the Indian Ocean with Dermophthirius carcharhini, documenting the first record of the D. carcharhini distribution extending outside of the Atlantic Ocean. A dusky shark captured in the New York Bight and held in the New York Aquarium for 5 months suffered a

mortal infection with D. carcharhini that was thought to show host specificity as it did not infect the other sharks present in the same tank (Cheung and Ruggieri, 1983). Sea lampreys have also been documented on dusky sharks, though the extent of this occurrence is not known as sea lampreys tend to be opportunistic, feeding on a wide variety of bony and cartilaginous fish (Jensen and Schwartz, 1994; Wilkie et al., 2004; Gallant et al., 2006).

Although dusky sharks experience some degree of parasitic disease, this does not appear to be a significant factor affecting the abundance or persistence of dusky shark populations in the wild, with the only mortality event due to parasitic disease recorded from a fish in captivity (Bullard et al., 2004). Additionally, as noted above, there are diskfishes that serve in a mutually beneficial relationship with dusky sharks feeding on the parasites.

Like many other large coastal shark species, dusky sharks tend to be opportunistic feeders and occupy high trophic levels in the marine communities where they occur. Primarily a coastal species, but also found in the outer continental shelf and sometimes in pelagic waters (Castro, 2011), dusky sharks have a wide trophic spectrum that includes mostly fishes, cephalopods (squid, octopuses), other elasmobranchs (rays, other sharks), and crustaceans (Cortés, 1999). Although some of their prey species may have experienced population declines, no information exists to indicate that depressed populations of these prey species are negatively affecting dusky shark population abundance. In addition, not much is known of resource partitioning and competition for resources in elasmobranch fishes in general, although both are likely to occur in marine communities of which sharks are a part (Wetherbee et al., 2012; Heithaus and Vaudo, 2012). It is possible that juvenile dusky sharks, in particular, may have to compete for food resources with other co-occurring sharks and teleosts, but it is unlikely that this competition for

food would be important enough to affect their abundance, especially considering the high trophic plasticity and opportunistic behavior of large predatory species like the dusky shark (Cortés et al., 2008).

It is also very unlikely that predation on dusky sharks is a factor influencing their abundance. Adult dusky sharks reach a size of almost 4 m and are considered the largest of the carcharhinid sharks (Castro, 2011), with no major predators known. Owing to their large size at birth of about 1 m, it is also unlikely that newborn and juvenile dusky sharks have major predators that would regulate population size.

The Inadequacy of Existing Regulatory Mechanisms

The NWA dusky shark receives a significant degree of regulatory protection in U.S. waters. In 2000, the dusky shark was added to list of prohibited shark species in the U.S. Atlantic. Since that time, U.S. commercial fishermen have not been allowed to retain, possess, land, sell, or purchase NWA dusky sharks, and recreational retention has also been prohibited, essentially affording the NWA DPS the highest level of fisheries protection under the MSA. (A review of Federal regulations pertaining to the NWA DPS prior to 2000 can be found in McCandless et al. (2014)). Projected apical fishing mortality relative to maximum sustainable yield levels for the NWA DPS has declined dramatically since 2000, indicating that this prohibition on the U.S. commercial and recreational retention of dusky sharks has directly and significantly decreased fisheries-related mortality of the species.

In terms of state regulations, state fishery management agencies have authority for managing fishing activity only in state waters (0-3 miles (0-5 km) in most cases; 0-9 miles (0-14 km) off Texas and the Gulf coast of Florida). In the case of federally permitted shark fisherman,

fishermen are required to follow Federal regulations in all waters, including state waters, unless the state has more restrictive regulations. The Atlantic States Marine Fisheries Commission approved the Interstate FMP for Atlantic Coastal sharks in August 2008 to create consistent regulations across the Atlantic states from Maine to Texas. All Atlantic states, along with Puerto Rico and the U.S. Virgin Islands, have adopted the same prohibited status for the NWA DPS as the Federal regulations and those in the Interstate FMP for Coastal Sharks; therefore, commercial and recreational retention of NWA dusky sharks is prohibited in all U.S. Atlantic state and Federal waters.

In addition to the prohibition, the NWA DPS also directly and indirectly receives a significant degree of protection from overutilization and fisheries-related mortality through the implementation of a number of other Federal regulations. For example, in 2005, we created the Mid-Atlantic Shark Closure Area, which encompasses North Carolina habitat for many dusky sharks. The area was closed to protect both dusky sharks and juvenile sandbar sharks from January through July. Data collected in the Shark Research Fishery and by NMFS scientists conducting BLL surveys in the Mid-Atlantic Shark Closure Area indicate elevated interactions with dusky sharks during the time/area closure compared to outside the closed areas (NMFS, 2012b) , suggesting that this Mid-Atlantic Shark Closure area is providing protection to NWA dusky sharks from incidental fishing mortality.

In the U.S. directed shark BLL fishery, where dusky sharks are known to suffer quite high at-vessel mortality (with an 81 percent at-vessel mortality rate estimate, Morgan and Burgess, 2007; Romine et al. 2009), commercial fishing impacts on dusky sharks have been greatly reduced since 2008 due to existing regulatory mechanisms. This is mainly a result of the

U.S. management measure prohibiting the commercial harvest of sandbar sharks outside of the NMFS Shark Research Fishery (NMFS, 2012b), as implemented by Amendment 2 to the 2006 Consolidated HMS FMP (NMFS, 2007). This prohibition ultimately resulted in shark fishermen targeting other species of sharks (e.g., blacktip, lemon, and bull sharks) that tend to occur in areas closer to shore than sandbar and dusky sharks (NMFS, 2014). Anecdotal evidence suggests that in the Atlantic Ocean, vessels that targeted sandbar sharks were more likely to catch dusky sharks because of similar habitat preferences, including depth and water temperature (NMFS, 2012b). Therefore, with the implementation of this regulation and the resultant shift in species targeted by commercial BLL fishermen, fishery-related mortality from the U.S. directed commercial BLL shark fishery has been significantly reduced and is considered to have only negligible impacts on the extinction risk of the species. This reduction has also likely led to the observed increase in the abundance of the species as indicated by the increasing trend in annual dusky shark bycatch in the NMFS Shark Research Fishery from 2009 through 2012 with little change in fishing effort (McCandless et al., 2014).

Based on the findings above, the SRT concluded that the majority of current anthropogenic mortality of the NWA dusky shark can be attributed to U.S. PLL bycatch mortality, Mexican landings, and possibly mortality in the U.S. recreational fisheries from landings misidentifications and/or misunderstanding of the existing regulations. However, the U.S. PLL is a heavily managed gear type and the fishery is strictly monitored. Based on analyses using Pelagic Longline Observer Program data, the at-vessel mortality rate for dusky sharks in the U.S. PLL fishery has been estimated to be approximately 34 percent using data from 1992 – 2012 (NMFS, unpublished data) and 27.9 percent using data from 1995 to 2012 (Gallagher et al.,

2014), significantly lower than rates on BLL gear. In other words, there is a higher likelihood that incidentally caught individuals on PLL gear can be released alive and continue to contribute to the viability of the NWA DPS. Regardless, additional measures to reduce interactions (e.g., time/area closures) with dusky sharks in the U.S. PLL fishery were proposed in Draft Amendment 5 to the 2006 Consolidated HMS FMP, but were not implemented, with further analyses being conducted on these measures in another FMP Amendment (Amendment 5b; NMFS, 2014). Management measures to correct the problems of misidentification or misunderstanding of U.S. recreational regulations have also not been implemented at this time; however, we have increased outreach efforts and education on proper identification and safe release practices for recreational shark fishing, including the publication of shark identification guides for U.S. recreational fishermen. Thus, although existing management measures may not suffice to further decrease the level of dusky shark mortality in the U.S. PLL and recreational fisheries, the current level of anthropogenic mortality experienced by the NWA DPS under these measures has been identified as sustainable (see Overutilization section) with the potential to decrease even further with current outreach efforts . Therefore, we do not find existing regulatory measures to be inadequate to the degree that they pose a threat to the species or contribute significantly to its risk of extinction.

Additionally, states such as Delaware, Hawaii, Washington, California, Oregon, Illinois, New York, Maryland, and Massachusetts have implemented or are working towards the implementation of shark fin bans. These bans have been developed by states individually, but generally prohibit the purchase or sale of shark fin in the state. These bans may not have much of a direct impact on NWA DPS because of its prohibited status, but may have a broader impact on

the shark fishing industry in general, especially if they lead to decreases in shark fishing effort which could indirectly lower the likelihood of dusky shark bycatch.

In terms of Mexican regulations, the General Law of Sustainable Fishery and Aquaculture (Ley General de Pesca y Acuacultura Sustentables) regulates the use of living marine resources. Fishery management plans and regulations are implemented through the National Fishing Charter (CNP: Carta Nacional de Pesca). With authority under the CNP, and the National Plan of Action for the Conservation and Management of Sharks, Rays and Similar Species in Mexico (NPOA-Sharks), the National Fisheries Institute (INAPESCA: Instituto Nacional de Pesca) and the management agency, Comisión Nacional de Acuacultura y Pesca (CONAPESCA), implemented NOM 029-PESC-2006 (NOM: Norma Oficial Mexicana) called "Responsible Fishery of Sharks and Rays; specifications for use." NOM 029-PESC-2006 regulates harvesting, designates prohibited species, specifies fishing zones and seasons, authorizes gears, and requires permit holders to report data. It promotes full use of shark catch by prohibiting finning. The goals are to maintain sharks at sustainable levels and reduce incidental catch of sea turtles and marine mammals. Additionally, CONAPESCA recently implemented an annual shark fishing prohibition in Mexican jurisdictional waters which began on the date of publication of the Agreement (June 11, 2012) through June 30, 2012, and in subsequent years is in effect during the period of May 1 to June 30 of each year. The prohibition extends to August 31 of each year in the Campeche Bank region. This regulation should help protect the NWA DPS from harvest mortality and may also deter future illegal fishing by Mexican fishermen, at least during the prohibition period.

Challenges with existing Mexican regulations include poor enforcement, lack of

compliance, and inaccurate logbook reporting due to its complex format. In response, CONAPESCA and INAPESCA prepared a shark ID guide, and are working to create a friendlier format. Overall, vast improvements in monitoring and regulating Mexican fisheries have been made in recent years, but many challenges still exist that may jeopardize the ability of NWA dusky shark populations to increase beyond current sustained levels. However, based on the evidence of stable and even decreasing NWA dusky shark fishing effort in Mexican fisheries coupled with low to no levels of catch in recent years, at this time, we do not find these existing regulatory measures to be inadequate to the point where they are contributing or will contribute significantly to the NWA DPS' risk of extinction.

Other Natural or Manmade Factors

Many sharks are considered to be biologically vulnerable to overexploitation due to their life history traits, with demographic analyses often the tool used to assess this vulnerability. Productivity expressed as the intrinsic rate of population increase (r) is the key parameter estimated from these analyses, with low estimates of r indicating a species that will be slow to recover from depletion. Musick (1999) suggested the following ranges for evaluating the productivity of marine species based on r (yr^{-1}) values: high = >0.50, medium = 0.16-0.50, low = 0.05-0.15, and very low = < 0.05. Given the late age at maturity, slow growth rate, long life span, and low fecundity of many elasmobranchs, sharks are often at the low to very low end of this scale. In 2010, Cortés et al. conducted an ecological risk assessment (ERA) of sharks caught in Atlantic PLL fisheries. The International Commission for the Conservation of Atlantic Tunas (ICCAT) recently updated this ERA in 2012 by adding five previously unassessed sharks, including the dusky shark. In this ERA (ICCAT, 2012), productivity for the dusky shark was

modeled using updated life history information on age and growth from Natanson et al. (2013) and a 3-year reproductive cycle (Castro, 2009; Romine, 2009). Out of the 20 Atlantic shark stocks assessed by ICCAT (2012), the dusky shark stock had the fifth lowest intrinsic rate of population increase (r = 0.043 per year). Generation time was estimated at 29.6 years (ICCAT, 2012), which is 10 years shorter than the estimate that was used in the recent SEDAR dusky shark stock assessment (NMFS, 2011a). Although the productivity estimated by ICCAT (2012) nearly doubles the r (yr^{-1}) values estimated during previous studies (r = 0.020, Smith et al., 1998; r = 0.028, Cortés, 1998; r = 0.018, Romine et al., 2009), bringing the relative rating of productivity from very low to borderline between very low and low (Musick, 1999), it still depicts a species vulnerable to overexploitation and susceptible to demographic and density-independent risks in the face of significant depletion. However, based on the evidence of increasing abundance and sustainable levels of exploitation of the NWA DPS, and the assessment of its current demographic and density-independent risks (discussed below in the "Assessment of Demographic Viability Factors"), we do not find this biological vulnerability as currently inhibiting recovery or a threat that will contribute significantly to the NWA DPS' risk of extinction.

Another factor that was evaluated as a potential threat to the NWA DPS was climate change. The effects of climate change are a growing concern for fisheries management as the distributions of many marine organisms are shifting in response to their changing environment. Factors having the most potential to affect marine species are changes in water temperature, salinity, ocean acidification, ocean circulation, and sea level rise. Two recent studies have addressed the vulnerability of dusky sharks to climate change. Chin et al. (2010) conducted a

vulnerability assessment of sharks and rays on Australia's Great Barrier Reef (GBR) and we are in the process of finalizing a vulnerability assessment of U.S. northeast fish stocks (Jon Hare, NEFSC, personal communication, 2014). These studies identified similar factors for use in their vulnerability assessments, ranked the level of exposure and sensitivity to these factors using current knowledge and expert opinion, and based the resulting relative vulnerability for each species on simple logic rules. Dusky shark exposure rankings were highly influenced by water temperature, but sensitivity to this factor was ranked low for both the NWA and Australia's GBR sharks. NWA dusky sharks were assessed a high vulnerability ranking with respect to climate change, but this was primarily influenced by its MSA-defined stock status and population growth rate. Although the population growth rate was taken into account in the GBR study, little is known about the population status of sharks in this area (Chin et al., 2010; McAuley et al., 2012). GBR dusky sharks were assessed a low vulnerability ranking with respect to climate change. If the factor of stock status is removed from the NWA climate vulnerability analysis (or status is significantly improved) the overall vulnerability of dusky sharks to climate change would be assessed as low (Jon Hare, NEFSC, personal communication, 2014).

Dusky sharks are not reliant on estuarine habitats, which are the habitats thought to be the most vulnerable to climate change. In addition, dusky sharks appear to prefer warmer temperatures and are frequently found in temperate to tropical water temperatures between 23 °C and 30 °C. Although at-vessel mortality rates of dusky sharks were found to positively correlate with bottom water temperatures on BLL gear (Morgan and Burgess, 2007; Gallagher et al., 2014), the effects of climate change on increased fishery-related mortality of the NWA DPS are likely to be minimal as previously discussed regulatory mechanisms have significantly reduced

the likelihood of dusky shark capture in the U.S. commercial shark BLL fishery. Dusky sharks are also highly migratory and opportunistic predators, which gives them the ability to shift their range or distribution to remain in an environment conducive to their physiological and ecological needs. Based on the above information and analysis, we do not find that the impacts of warming water temperature from climate change will significantly contribute to the species' risk of extinction.

Assessment of Demographic Viability Factors

In addition to the identification of threats, we also considered the collective condition of individual populations at the species level according to demographic viability factors but did not find evidence to indicate that these factors are appreciably reducing the fitness of the species. The NWA DPS is highly migratory and is not spatially restricted during any life stage, which contributes to its dispersal and re-colonization ability. The NWA DPS also exhibits high genetic diversity, with no indication that it is experiencing reduced reproductive fitness, fecundity, or survival due to loss of phenotypic diversity. Although the life history characteristics of the NWA DPS (long lived, late sexual maturity, low fecundity) limit the productivity of the species, rendering it less resilient to high levels of exploitation, its maximum rate of population increase is not decreasing nor are there indications that this productivity level could lead to extinction. In terms of abundance, it is difficult to make absolute statements about the number of dusky sharks in the NWA DPS because of the lack of reliable retention and discard data; however, fishery-independent surveys suggest that there are still a large number of dusky sharks in the U.S. Atlantic and GOM. In addition, although its current abundance has been significantly reduced from unexploited levels, there are multiple lines of evidence that indicate this number could be

increasing (see Abundance section and analyses of data from the NMFS Shark Research Fishery and NMFS Large Pelagics Survey in Overutilization section). Overall, the NWA DPS does not appear to be at a point where normal environmental changes, anthropogenic perturbations, current fisheries-related mortality, habitat destruction, or demographic stochasticity could lead to its extinction.

Extinction Risk

After considering the extent to which demographic viability factors may be indicating a risk of extinction and our evaluation of the ESA section 4(a) factors impacts on the status of the species as discussed above, we find that the NWA DPS is presently at a low risk of extinction. This finding is in agreement with the SRT conclusions (McCandless et al., 2014). The 2011 SEDAR stock assessment for this DPS indicated the population was depleted to around 85 percent of pre-exploitation levels; however, this assessment also suggested that the prohibition on dusky shark retention has come close to ending overfishing, with the projected biomass under existing management measures stabilizing near current values. Fishing mortality has significantly decreased since the U.S. commercial and recreational retention prohibition in 2000, with the present mortality of dusky sharks mainly attributed to bycatch mortality in the U.S. PLL fisheries and harvest by Mexican fishermen. However, U.S. PLL bycatch and Mexican landings appear to have stabilized at low levels in recent years, with trends that do not indicate any increases in fishing effort that would lead to extinction of this population. Additionally, fishery-independent survey indices (i.e., NELL, VIMS LL, UNC LL) and bycatch from the NMFS Shark Research Fishery and the NMFS Large Pelagic survey indicate that abundance trends for the NWA DPS have continued on a positive trajectory since the terminal year of the SEDAR stock

assessment. There will always be some level of extinction risk associated with this DPS, given its inherent vulnerability to overexploitation and potential to suffer mortality when bycaught. However, based on the best available data that show stable to decreasing fishing effort, U.S. bycatch levels, and Mexican harvest, stabilizing spawning stock biomass, and increasing abundance trends, we consider the species to be at a low risk of extinction.

In assessing the extinction risk of the species through the foreseeable future, the SRT defined the foreseeable future as the timeframe over which the threats to the species could be reliably predicted to impact the biological status of the species. Anthropogenic mortality from U.S. bycatch and Mexican landings and the species' natural biological vulnerability to overexploitation were the main operative threats that were likely to contribute significantly to the extinction risk of the NWA DPS. Since the main sources of NWA dusky shark bycatch (U.S. BLL and PLL fisheries) and Mexican landings appear to have stable, if not decreasing, trends since the last assessment, and the only change to management measures in place since that time has been the Mexican seasonal closure implemented in 2012, the SRT relied on the 2011 SEDAR stock assessment projection using the fishing mortality estimated for the final year of the assessment (F = 0.055; NMFS, 2011a) as a precautionary approach to determine the foreseeable future. As discussed previously, this SEDAR stock assessment model takes into account the species' life history information and projects the effects of anthropogenic mortality on the biomass of the species. However, due to the exponential increase in uncertainty seen in the projections of spawning stock biomass beyond 2045 (i.e., $F_{current}$ projection; NMFS, 2011a), the SRT decided that 30 years was the extent of time over which they could confidently predict the impact of the operative threats on the species status. Thus, foreseeable future was defined as

30 years.

In terms of extinction risk, we find that the NWA DPS will be at a low risk of extinction through the foreseeable future. This is also in agreement with the SRT, who was fairly certain that the NWA dusky shark DPS will have a low to no risk of extinction in the foreseeable future and will likely show improvement from its current status. For all SEDAR projection scenarios using data from the most recent SEDAR stock assessment, spawning stock biomass is predicted to either stabilize through the foreseeable future (based on the 2008 estimated fishing mortality) or increase (based on alternate projections taking into account potential changes in fishing mortality that likely would require changes to current management measures) (NMFS, 2011a). The SRT did note that the greatest source of uncertainty in the SEDAR stock assessment data was the amount of human induced removals, with the projections of NWA dusky shark status most sensitive to the inclusion of different abundance indices and the weighting of these indices. For example, if total fishing mortality was underestimated or productivity was overestimated, there could be some cause for concern regarding the future status of the species (as exhibited by the lower 5-10 percent quantiles of biomass projections; NMFS, 2011a). However, recent and sustained positive trends in dusky shark abundance indices with updated data that was not considered in the projection suggests that the point estimates for exploitation levels (fishing mortality) may have been biased high and estimates of stock biomass may have been biased low given that an increase in biomass was not predicted for 2010-2012 by the SEDAR stock assessment model (NMFS, 2011a). Additionally, estimates of the species' productivity have increased, based on updated life history information since the last assessment was conducted, suggesting the potential biases mentioned above are not operative.

Final Determination

Section 4(b)(1) of the ESA requires that we 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 (78 FR 29100; May 17, 2013), the status review report (McCandless et al., 2014), and other published and unpublished information, and have consulted with species experts and individuals familiar with the dusky shark.

We conclude that the dusky sharks occurring in the NWA are discrete and significant from other members of their species and, therefore, we consider this population to be a DPS. Next, we considered each of the ESA section (4)(a)(1) factors to determine whether it presented an extinction risk to the NWA DPS on its own. We also considered the combination of those factors to determine whether they collectively contributed to the extinction of the species. 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 NWA DPS throughout its entire range.

We conclude that the NWA DPS of dusky shark is not presently in danger of extinction, nor is it likely to become so in the foreseeable future throughout all of its range. We summarize the factors supporting this conclusion as follows: (1) the DPS is highly migratory, occurring throughout its range, with no barrier to dispersal; (2) its current range is indistinguishable from its historical range, and there is no evidence of habitat loss, destruction, or modification that is

significantly contributing to the species' extinction risk; (3) there is no evidence that disease, predation, or competition is contributing to increasing the risk of extinction of the species; (4) while the species possesses life history characteristics that increase its susceptibility to depletion, current abundance levels are sufficient to maintain population viability now and into the foreseeable future; (5) stock assessment projections and trends in catch data and updated fishery-independent time series indicate increasing abundance of the NWA DPS, with spawning stock biomass stabilizing through the foreseeable future; (6) while the main threat to the species is fishery-related mortality from bycatch in U.S. commercial and recreational fisheries and Mexican landings, U.S. bycatch and Mexican harvest under existing management measures has decreased and/or stabilized at low levels in recent years, with current levels deemed sustainable through the foreseeable future; (7) existing regulatory mechanisms throughout the DPS' range, including the U.S. retention prohibition as well as time and area closures in both U.S. and Mexican waters and strict management of the U.S. line fisheries, appear effective in addressing the most important threat to the species (i.e., exploitation through bycatch mortality and harvest); and (8) while the NWA DPS has declined from historical numbers, there is no evidence that the species is currently suffering from depensatory processes (such as reduced likelihood of finding a mate or mate choice or diminished fertilization and recruitment success) or is at risk of extinction due to environmental variation or anthropogenic perturbations. Accordingly, the NWA DPS of dusky shark does not meet the definition of a threatened or endangered species, and our listing determination is that the NWA DPS of dusky shark does not warrant listing as threatened or endangered at this time.

Significant Portion of Its Range

Because we find that the species does not warrant listing as threatened or endangered throughout its range, we must evaluate whether there is substantial information indicating that a portion of the species' range is both significant and either threatened or endangered per the Significant Portion of its Range Policy (79 FR 37577; July 1, 2014). However, after a review of the best available information, we could not identify a portion of the NWA DPS range where its contribution to the viability of the species is so important that, without the members in that portion, the NWA DPS would be at risk of extinction, or likely to become so in the foreseeable future, throughout all of its range. The NWA DPS is highly mobile throughout its range. Loss of any portion of its range would not likely isolate the species to the point where the remaining portions would be at risk of extinction from demographic processes. Similarly, we did not find that loss of any portion would severely fragment and isolate the NWA DPS to the point where individuals would be precluded from moving to suitable habitats or have an increased vulnerability to threats. In fact, we found no information that would suggest that the remaining populations could not repopulate the lost portion. There are very few restrictions governing their movements, with individuals of the DPS commonly moving between the U.S. Atlantic, U.S. GOM and Mexican Gulf waters based on mark/recapture studies (Kohler and Tuner 2010; Carlson and Gulak, 2012; NMFS, unpublished data). Individuals of the species also tend to travel the extent of their range during their seasonal migrations (Compango, 1984; Musick and Colvocoresses, 1986; Kohler et al., 1998; Kohler and Turner, 2010). Areas exhibiting source-sink dynamics, which could affect the survival of the species, were not evident in any part of the NWA DPS range.

There is no information that the loss of genetic diversity from one portion (such as the

Atlantic Ocean) would result in the remaining population lacking enough genetic diversity to allow for adaptations to changing environmental conditions. Dusky sharks from all regions show remarkable similar allelic richness and gene diversity, and within the NWA there was no evidence of genetic differentiation between dusky sharks from waters off the U.S. east coast and the GOM (Benavides et al., 2011; Gray et al., 2012).

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. EFH areas, which could provide important nursery, breeding, and feeding grounds, have been identified along the length of the U.S. east coast, with smaller localized areas in the central GOM, southern Texas, the Florida Panhandle, mid-west coast of Florida, and Florida Keys (NMFS, 2009). Given that the environmental characteristics that constitute this EFH, such as warm waters with reduced salinities, nearshore coastal waters, and waters associated with the continental shelf edge, can be found throughout the species' range, we do not consider them to be limiting factors for the species' survival. 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.

Additionally, in our evaluation of the potential threats to the species, including the likelihood of fishery-related mortality, we did not find information to show that these threats are significantly concentrated or substantially greater in any specific portion of the species' range. The dusky shark is susceptible to being caught as bycatch in U.S. commercial and recreational fisheries throughout the entire extent of its range and is landed in Gulf waters by Mexican fishermen; however, we found no information to suggest that increased effort in a certain area is

leading to a higher risk of extinction for that portion. Again, there are no barriers to the shark's movement and existing management measures appear adequate in protecting the NWA DPS from extinction throughout all portions of its range.

In conclusion, we find that there is no portion of the NWA DPS range that can be considered significant under the SPR Policy. Therefore, we find that the NWA DPS is not presently in danger of extinction throughout all or a significant portion of its range, nor is it likely to become so in the foreseeable future, and, as such, does not warrant listing at this time.

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: December 9, 2014.

Samuel D. Rauch III,

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National Marine Fisheries Service.

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