PETITION TO LIST THE NORTHEASTERN PACIFIC OCEAN DISTINCT POPULATION SEGMENT OF Great White Shark (*Carcharodon carcharias*) UNDER THE U.S. ENDANGERED SPECIES ACT

Photo: Terry Goss

Petition Submitted to the U.S. Secretary of Commerce, Acting through the National Oceanic and Atmospheric Administration and the National Marine Fisheries Service

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INTRODUCTION

WildEarth Guardians ("Guardians") requests that the Secretary of Commerce, acting through the National Marine Fisheries Service (NMFS),[1] an agency within the National Oceanic and Atmospheric Administration (NOAA), list the northeastern Pacific Distinct Population Segment (DPS) of Great White Shark, *Carcharodon carcharias,* under the Endangered Species Act (ESA) (16 U.S.C. §§ 1531-1544). WildEarth Guardians also requests that NMFS designate critical habitat for the species in U. S. waters.

Despite its reputation, the Great White Shark needs our protection more than our fear. Over 100 million sharks, of all species, are killed annually by humans. In contrast, sharks of any type only claim approximately 10 human lives per year (NOAA 2012 at 2). A human is 15 times more likely to be killed by a falling coconut than by a shark (Id.).

The Great White Shark's imperilment is part of a concerning pattern of shark endangerment globally (for example see Baum et al. 2003; Dulvy et al. 2008). Sharks are both intentionally targeted by fisheries and are killed when caught as bycatch. Sometimes they are simply "finned" – a cruel technique wherein a shark's fin is cut off but the living shark is discarded to die a lingering death from drowning or starvation at the bottom of the ocean. Whether finned or otherwise killed, the Great White Shark is very vulnerable to fishing and bycatch, given its low reproductive rate and the depletion of its populations in the northeastern Pacific and elsewhere.

In light of the Great White Shark's imperilment, Guardians requests listing of the northeastern Pacific DPS under the Endangered Species Act (ESA). NOAA has acknowledged the importance of preserving dwindling populations of Great White Sharks (NOAA 2012 at 2) and recognizes that shark biology "makes them highly susceptible to the threats of fishing and other human activities" (Id.), citing statistics on shark and skate imperilment from the International Union for Conservation of Nature (IUCN), which lists the global population of Great White Shark as "vulnerable" (IUCN 2009 at 1). WildEarth Guardians requests that NOAA do its part to protect the global population by listing the petitioned DPS as "endangered."

PETITIONER

WildEarth Guardians is a nonprofit environmental advocacy organization that works to protect endangered species and biodiversity, in part, by attempting to obtain Endangered Species Act listing for all deserving species. The organization has more than 4,500 members and 10,000 supporters located throughout the United States and in several foreign countries. WildEarth Guardians has an active endangered species program that works to protect imperiled marine and terrestrial species and their habitat throughout the United States and beyond.

ENDANGERED SPECIES ACT AND IMPLEMENTING REGULATIONS

The Endangered Species Act of 1973 protects plants and animals that are listed by the federal government as "endangered" or "threatened" (16 U.S.C. § 1531 *et seq*.). Any interested person may submit a written petition to the Secretary of Commerce requesting him or her to list a

[1] NOAA Fisheries.

species as “endangered” or “threatened” under the ESA (50 C.F.R. § 424.14(a)). An “endangered species” is “any species that is in danger of extinction throughout all or a significant portion of its range” (16 U.S.C. § 1532(6)). A “threatened species” is defined as “any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range” (16 U.S.C § 1532(20)). “Species” includes subspecies and distinct population segments of vertebrate taxa (16 U.S.C § 1532(16)).

The ESA sets forth listing factors under which a species can qualify for protection (16 U.S.C. § 1533(a)(1)):

A. The present or threatened destruction, modification, or curtailment of habitat or range;
B. Overutilization for commercial, recreational, scientific, or educational purposes;
C. Disease or predation;
D. The inadequacy of existing regulatory mechanisms; or
E. Other natural or manmade factors affecting its continued existence.

A taxon need only meet one of the listing criteria outlined in the ESA to qualify for federal listing.

If the Secretary determines that a species warrants a listing as “endangered” or “threatened” under the ESA, and the species lives within the United States or its waters, he or she is obligated to designate critical habitat for that species based on the best scientific data available (16 U.S.C. § 1533(b)(2)).

The National Marine Fisheries Service and Fish and Wildlife Service[2] have jointly published a policy document defining the statutory term “distinct population segment” (61 Fed. Reg. 4722). This joint policy employs a three-part analysis to determine the status of a possible distinct population segment as endangered or threatened under the ESA: (1) the “*discreteness*” of the population segment; (2) the “*significance*” of the population segment; and (3) its conservation status (61 Fed. Reg. at 4725). The joint policy provides that in a decision to list a distinct population segment under the ESA the responsible agency will evaluate: (1) the discreteness of the population segment in relation to the remainder of the species to which it belongs; (2) the significance of the population segment to the species to which it belongs; and (3) the population segment’s conservation status in relation to the ESA’s standards for listing (i.e. does the population segment, when treated as if it were a species, meet the ESA’s definition of endangered or threatened?) (Id.).

[2] The ESA delegates listing decisions to two cabinet-level Secretaries, Interior and Commerce (16 U.S.C. § 1532(15)). The Secretary of Interior has sub-delegated authority to the Fish and Wildlife Service (FWS). The Secretary of Commerce has sub-delegated authority to the National Oceanic and Atmospheric Administration (NOAA) and the National Marine Fisheries Service (NMFS). In general, the Secretary of Interior has responsibility for terrestrial and freshwater species and the Secretary of Commerce has responsibility for marine and anadromous species.

As to *discreteness*, the joint policy provides a population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions:

1. It is markedly separated from other populations of the same taxon 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)[3] of the Act.

As to *significance*, the joint policy provides that if a population segment is considered discrete under one or more of the above conditions, its biological and ecological significance will then be considered in light of Congressional guidance (see Senate Report 151, 96th Congress, 1st Session) that the authority to list distinct population segments be used "sparingly" while encouraging the conservation of genetic diversity. In carrying out this examination, the agencies will consider the available scientific evidence of the discrete population segment's importance to the taxon to which it belongs. This consideration may include, but is not limited to, the following:

1. Persistence of the discrete population segment in an ecological setting unusual or unique for the taxon;
2. Evidence that loss of the discrete population segment would result in a significant gap in the range of a taxon;
3. Evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historic range; or
4. Evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics. (61 Fed. Reg. at 4725)

Although these guidelines are not regulations and serve only as policy guidance for the agencies (Id. at 4723), they have been upheld as a reasonable interpretation of ambiguous statutory language (Maine v. Norton, 257 F. Supp. 2d 357 (D. Maine 2003)).

Accordingly, if the responsible agency determines a potential distinct population segment of vertebrate fish or wildlife is both discrete and significant, it will then evaluate the population segments' conservation status under the ESA as though the distinct population segment were in fact a species and it is eligible for listing.

CLASSIFICATION AND NOMENCLATURE

Common Name. *Carcharodon carcharias* is commonly known as the "great white shark," "white pointer," or "white shark" (CCSA undated at 1). This petition refers to the species as Great White Shark or White Shark.

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[3] Section 4(a)(1)(D) of the Act, 16 U.S.C. § 1533(a)(1)(D) refers to the fourth of the ESA's five listing factors, "the inadequacy of existing regulatory mechanisms."

Taxonomy. The petitioned species is the northeastern Pacific DPS of *Carcharadon carcharias*. The full taxonomic classification is shown in Table 1.

Table 1. Taxonomy of *Carcharadon carcharias* (Source: IUCN 2009 at 1)

Kingdom	Animalia
Phylum	Chordata
Class	Chondricthyes
Order	Lamniformes
Family	Lamnidae
Genus	*Carcharodon*
Species	*Carcharias*
Distinct Population Segment	Northeastern Pacific

SPECIES DESCRIPTION

Diagnostic features of the Great White Shark include:

> Heavy spindle-shaped body, moderately long conical snout, huge, flat, triangular, serrated bladelike teeth, long gill slits, large first dorsal fin with light free rear tip, minute, pivoting second dorsal and anal fins, strong keels on caudal peduncle, no secondary keels on caudal base, crescentic caudal fin, ventral surface of body white. Body usually stout. Snout bluntly conical, rather short; nostrils lateral on snout, situated adjacent to head rim in ventral view; mouth broadly parabolic; teeth flat, triangular, with broad, serrated, nearly straight cusps, and lateral cusplets only in juveniles below 2 [meters] long (which may have at least some smooth-edged or partially smooth); intermediate teeth in upper jaw very large, over half height of upper anteriors. First dorsal origin usually over the pectoral inner margins; anal origin under or slightly posterior to second dorsal insertion; no secondary keels on base of caudal. (FAO 2012 at 1, see Figure 1)
>
> Jaws with large, serrated, upright teeth; lower jaw teeth much more slender than upper jaw teeth. Upper jaw teeth near front of mouth are large, erect, triangular and serrated; smaller sharks have more slender teeth that sometimes lack serrations. Teeth in both jaws become progressively smaller toward the back of the mouth. Maximum width of jaw: 70 [centimeters]. (CITES undated at 2)

"The maximum size attained by Great White Sharks remains a matter of debate, and is estimated to be around 6 m, and possibly to 640 cm or more; the largest free-swimming individuals commonly captured are between 500-580 [centimeters]" (IUCN 2009 at 2). They may weigh up to 3000 kilograms (~6600 pounds) (CCSA undated at 1).

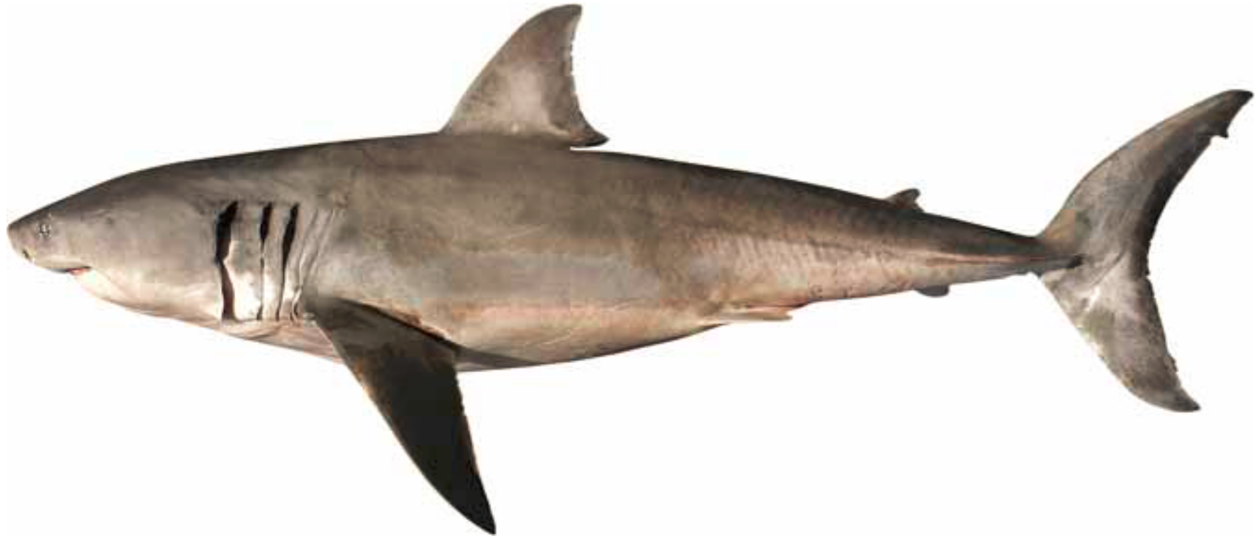
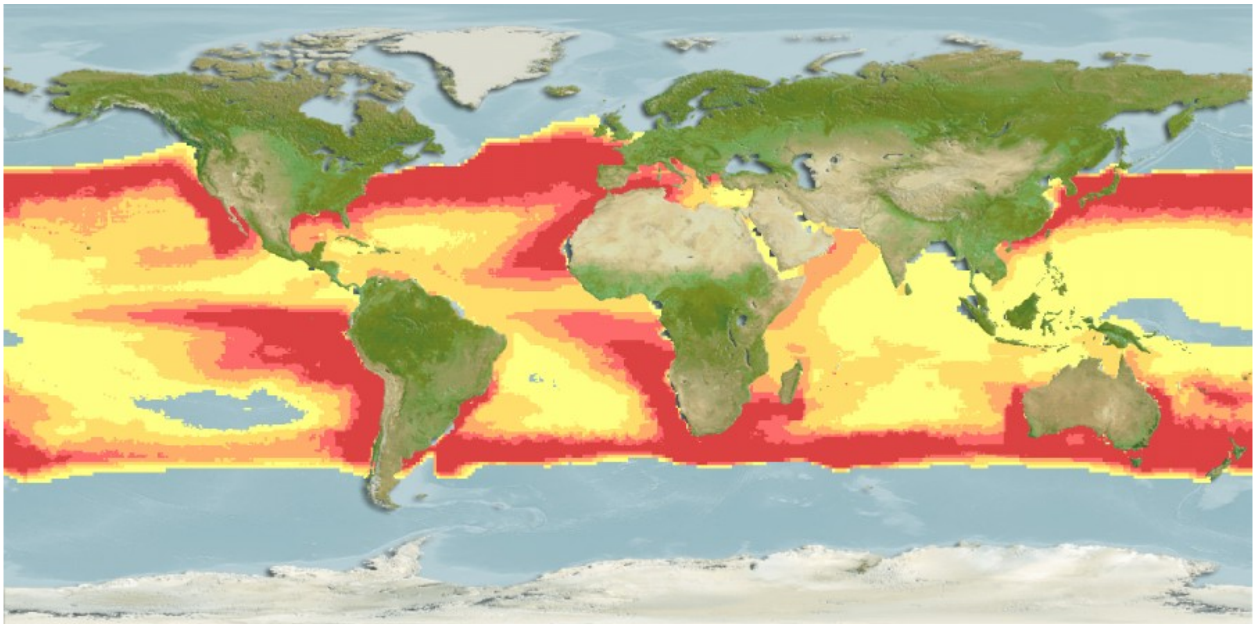


Figure 1. Great White Shark. Source: CITES undated at 1.

Habitat. Great White Sharks are distributed around the globe with primary concentrations in South Africa (SA), the Australia and New Zealand area (ANZ), and the northeastern Pacific (NEP) (Jorgensen et al. 2010 at 679, see Figure 2). Great White Sharks seem to prefer temperatures from 15-22ºC (59-72ºF) (CCSA undated at 2). Great White Sharks commonly inhabit coastal and shelf water near seal or sea lion colonies, but also range through deep waters (CCSA undated at 2). "What was once thought to be a species restricted to coastal, temperate regions is now known to spend considerable time in deep-ocean habitats, thousands of kilometers from shore" (Domeier 2012 at 200):

> Within its range states, the Great White Shark is often found close in shore to the surfline and even penetrates shallow bays in continental coastal waters. In waters along the continental shelf, Great White Sharks generally locate near the surface, or at the bottom from 16 to 32 metres depth. Average depth is 20 metres. While Great White Sharks are widely distributed, they seem more common in some locations, with particular areas seen as important pupping grounds. Coastal areas are a preferred habitat, and the Sharks' population level could be affected by coastal habitat degradation. The risk is heightened by the fact that much of the species' habitat is in areas with dense human populations. Beach meshing, often employed the Great White Shark's preferred habitats, threatens to reduce population numbers. Great White Sharks caught by beach meshing programs are usually small (less than 3 metres), and in many cases, particularly off eastern Australia, are smaller than 2 metres. This suggests that these programs operate close to pupping grounds or in juvenile nursery habitats. However, while beach meshing undoubtedly is detrimental to smaller specimens, the widespread occurrence of similar small sized Great White Sharks in areas where beach meshing is not undertaken suggests that nursery habitats are also probably widespread. (CITES 2000 at 4-5, internal citations omitted)



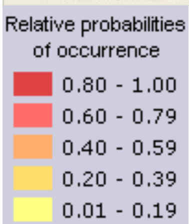


Figure 2. Computer generated native distribution map of *Carcharodon carcharias*. Source: AquaMaps 2010.

Diet and Hunting. Great White Sharks consume a wide variety of prey animals, but seem to prefer those with a higher fat content (Klimley et al. 1996 at 190). A Great White shark can remove 20 kilograms of flesh in a single bite (Long and Jones 1996 at 307). Thirty kilograms of blubber may supply enough energy for the average Great White Shark to live for 1.5 months (Id.). Great White Sharks have been found to prey upon seals, sea lions (see Klimley et al. 1996), sea turtles (albeit rarely, see Long at 1996), ceteceans (Long and Jones 1996 at 293), and fishes including other sharks (Fergusson 1996 at 334-335). "Great White Sharks take a variety of bony fish as prey, from sedentary demersal rockfish, lingcod and benthic flatfish to fast pelagic species, and ranging in size from small demersal and schooling fishes to giants such as broadbill swordfish and bluefin tuna. Great White Sharks are known to congregate at concentrations of schooling bony fishes such as pilchards and bluefish" (IUCN 2009 at 2, internal citations omitted).

Unlike many fish, Great White Sharks are warm-bodied with body temperatures significantly higher than the water around them (Goldman et al. 1996 at 119). This likely allows them to move quickly after prey even in cold waters (Id.). The warming of the body may extend to the brain and eye and enhance the processing speed and efficiency of these organs (Demski and Northcutt 1996 at 129). The relative contribution of the olfactory bulb to total brain mass is the highest of all chondrichthyans studied, indicating a great potential for Great White Sharks to locate prey and mates by smell (Id. at 128). The Great White Shark's sense of smell is so sensitive that one can detect one part of blood in ten billion parts of water (CCSA undated at 2). In order to protect its highly sensitive eyes, the Great White Shark will roll its eyes tail-ward in their sockets at the moment of attack. The tough, fibrous sclerotic coat will be exposed and protect the Great White Shark's eyes, blinding it at the moment it strikes its prey (Id. at 3).

Reproduction.

> White sharks are large, rare, warm-blooded apex marine predators. It is estimated that they mature at ~12–18 years and 4–5 m total length in females, 8–10 years and 3.5–4.1 m in males. Maximum length is 6.4 m (for females). Longevity estimates range from 23–60 years. Females give birth at two or three year intervals to litters of 2–10 pups (average ~7) 1.09-1.65 m long after an estimated 12-18 month gestation. There is no maternal care. Despite their large size, pup survival is estimated to be low. The (theoretical) intrinsic rate of population increase for this species is about 4–5.6%. (CITES 2004a at 2-3, internal citations omitted).

Parturition begins in May and ends in October (Domeier 2012 at 209). The embryos are oophagous, meaning they consume and store yolk in their stomachs (Uchida et al. 1996 at 144). Little is known about the reproductive rate and behavior of this species, as pregnant females are rarely reported.

> Compagno *et al.* (1997) reported that the species may have an unusually low fecundity rate for elasmobranchs, and a long gestation period, with relatively few adult females being pregnant at any one time. Great white shark females do not reproduce before reaching 4.5 – 5.0 metres in length, and have a relatively small litter of around two to ten pups (sometimes as high as 14). It is thought that they do not reproduce every year, and that their gestation time is longer than 12 months. This is typical of many K-strategists, making them vulnerable to exploitation. ("K-strategist" species are defined has having slow development, relatively large size, and producing only a small number of offspring at a time). (CITES 2000 at 5, internal citations omitted)

Ecology. Great White Sharks are apex predators; effects of changes in their population likely cascade throughout trophic levels:

> Removal of large predators from the ocean does not necessarily result in increased populations of their prey and other commercially important species lower down the food chain; indeed, just as on land, the reverse may be true. Findings from ecosystem modeling show that in certain ecosystems the depletion of apex predator sharks can have negative effects on other species directly or indirectly through the food web. It is difficult to predict accurately what impact a continued decline of the white shark may have on the ecosystem, but, 'in the absence of more precise information… the roles of these fishes should not be underestimated. Indiscriminate removal of apex predators from marine habitats could disastrously upset the balance within the sea's ecosystems.' (CITES 2004a at 7, internal citations omitted)

For example, on the eastern seaboard of the United States, a decrease in Great White Sharks resulted in higher populations of mesopredators like the cownose ray and decreased populations of bivalves like scallops (Myers et al. 2007 at 1849). Great White Sharks also suppress pinniped populations (Wilson and Patyten 2008 at 2).

QUALIFICATION AS A DISTINCT POPULATION SEGMENT

DISCRETENESS. Great White Shark populations are separated by migration routes and genetics. "The globally distributed Great White Shark displays population structuring despite its ability to undertake transoceanic migrations, proving to be another exception to the low genetic differentiation of highly vagile elasmobranches" (Gubili et al. 2012 at 364, internal citations omitted). "Overall, at least three White Shark matrilineal populations (South Africa/northwest Atlantic, northeast Pacific, and southwest Pacific) are indicated by analysis of DNA from the mitochondrial control region" (Id. at 367, internal citations omitted). "Despite the identification of gene flow among the Indo-South Pacific oceans by microsatellite analyses, the marked population differentiation revealed by the mtDNA analyses indicate the existence of more fin-scale matrilineal structure, including populations from South Africa, New Zealand/Australian, northeast Pacific, northwest Atlantic, and the Mediterranean" (Id. at 373, internal citations omitted).

As one of these identified matrilineal populations, the northeastern Pacific (NEP) population is "markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors" (61 Fed. Reg. 4725).

Physical Factors

Genetic Differences. Although the southwestern Pacific and NEP populations could potentially interbreed, genetic sampling shows that the two populations are largely reproductively isolated (Gubili et al. 2012 at 367). The NEP population "was likely founded by a small number of sharks sometime in the last 200,000 years and hasn't mixed with other shark populations near Australia and South Africa since" (Hance 2009 at 2).

> Strong [genetic] clustering of... NEP sharks with those from ANZ was evident, yet NEP sharks formed a unique monophyletic clade (bootstrap = 58%, Bayesian posterior probability = 60%) of relatively recently derived lineages… [W]e believe the small number of substitutions (1.3 mean pairwise differences) among NEP haplotypes along with the short, star-like branching is indicative of a population established from a limited number of founders sometime during the Late Pleistocene. The NEP population is more similar to, and a clear descendent, of the ANZ group. However, highly significant population divergences (pairwise FST = 0.68, $p < 0.0001$) indicate that since their introduction into the NEP, female white sharks aggregating off California have maintained little gene flow with the southwestern Pacific ANZ population. (Jorgensen et al. 2010 at 685-686, internal citations omitted)

Behavioral Factors

Migratory Patterns and Site Fidelity. Using pop-up satellite tags, researchers followed the movements of Great White Sharks caught off the coast of central California. The six tagged sharks remained in the area between Hawaii and California. Only one ventured all the way to Hawaii; most stayed fairly close to North America (Boustany et al. 2002 at 35). A more recent study with a larger number of sharks confirms and expands upon this finding. Tagging of 179 white sharks in the NEP showed a pattern of "site fidelity and repeated homing in a highly structured seasonal migratory cycle with fixed destinations, schedule and routes" (Jorgensen et al. 2010 at 680). "The distribution of geoposition estimates and acoustic detection locations (*n* = 74,354) across the northeastern and central Pacific demonstrate that white sharks were consistently focused on three core areas: (i) the North America shelf waters, (ii) the slope and offshore waters of the Hawaiian archipelago, and (iii) the offshore white shark 'Café'" (Id., see Figure 3).

> Each winter, white wharks left coastal aggregation sites off central California and migrated 2000 – 5000 km offshore to sub-tropical and tropical pelagic habitats. Their return in late summer to the original tagging location was evident from long-term tag deployments (n = 23 acoustic and n = 11 PAT deployments) describing a recurring "to and fro" migratory pattern. Acoustic tags revealed a regular presence/absence pattern in North American coastal habitats with presence peaking during the months of August through February followed by near-complete absence during spring between mid-April and mid-July. This precise and repeatable site fidelity over the scale of years, coupled with long-term photo-identification studies, suggests that North American coastal foraging hotspots are composed of a limited number of seasonally returning individuals. (Jorgensen et al. 2010 at 680-681, internal citations omitted)

In the NEP, "the coastal areas of Southern California and Baja Mexico are important [Young of the Year] nursery areas and therefore are likely the sites of parturition" (Domeier 2012 at 218). Young of the Year and juvenile Great White Sharks appear to concentrate in the Southern California Bight and in Vizcaino Bay, Mexico (Domeier 2012 at 209). "These observations parallel new findings from eastern Australia that have identified a relatively small number of preferred habitat areas for juvenile White Sharks over multiple years" (Id.). Adults spend most of their time at one of two aggregation sites, one off the coast of central California and the other near Guadelupe Island, 255 kilometers from the coast of Baja California, Mexico (Id. at 211-212). Strong evidence suggests that Great White Sharks use the aggregation sites for breeding (Id. at 216-217). Adult males annually migrate from their preferred aggregation site to an area of ocean approximately halfway between Hawaii and California, known as the Shared Offshore Foraging Area (SOFA), Offshore Focal Area, or White Shark Café (Id. at 214). Females will migrate biennially between their adult aggregation site and an expansive offshore region surrounding the SOFA (Id. at Figure 16.13). Females are typically only found in the SOFA once the males have returned to their preferred aggregation sites (Id. at 216).

These data, overlapping with data from a second group of NEP White Sharks tagged off Mexico near Guadalupe Island (see Domeier and Nasby-Lucas 2007), "reveal the adherence of… tagged White Sharks to a fixed geographical range with no evidence of straying or spatial overlap with ANZ. This result has implications for a White Shark population unique to North American shores" (Jorgensen et al. 2010 at 684, internal citations omitted).

> *Carcharodon carcharias* individuals exhibited site fidelity at multiple scales. At the ocean basin scale, white sharks made predictable long-distance migrations to and from defined oceanic core areas. At the regional scale individuals tagged off central California

returned to this same coastal region. Likewise, white sharks tagged off Guadalupe Island (1000km from central California) also returned to their respective region despite extensive overlapping at the Café. At the local scale, within the central California region, individuals exhibited clear preferences for particular coastal sites separated by only kilometres to which they consistently homed following offshore periods or occasional visits to similar adjacent sites. (Jorgensen et al. 2010 at 686, internal citations omitted)

…NEP white sharks form a demographically isolated population with clearly defined spatial demarcation. The geographical isolation revealed from electronic tagging coupled with significant genetic (mtDNA) divergence evident from monophyletic clade structure indicates that NEP sharks, particularly females, are isolated from previously studied populations in the South Indo-Pacific, specifically ANZ and SA. The highly predictable seasonal distribution of NEP white sharks including repeated homing to and focus at a network of key coastal hotspots highlights where future population assessment and monitoring can be effectively conducted within US territorial waters. These results further emphasize the need for coordinated ocean management between the USA and Mexico. (Jorgensen et al. 2010 at 687)

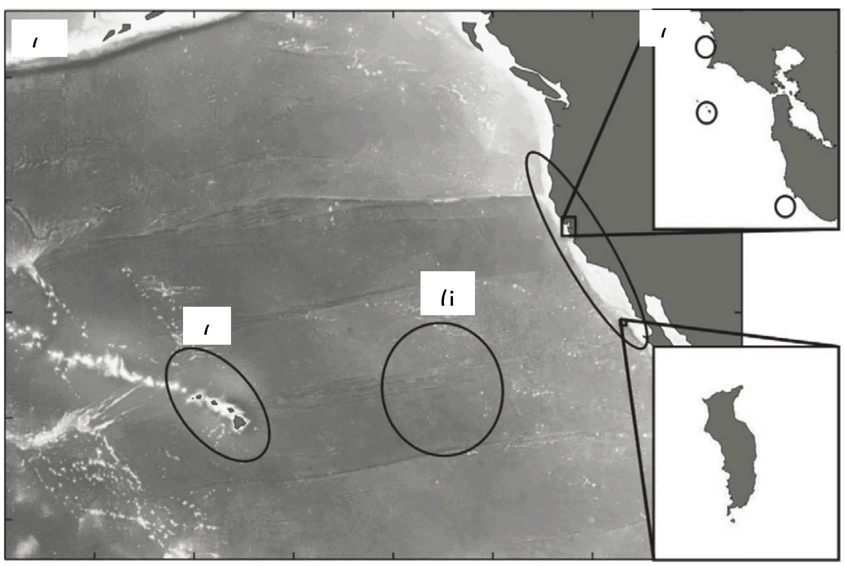


Figure 3. (a) The known focal use areas in the northeastern Pacific (NEP). Coastlines and landmasses are designated by dark grey (i) slope and offshore waters around Hawaii, (ii) the White Shark "Café," and (iii) North American shelf waters, comprised of (b) aggregation sites in CCA (open circles from north to south: Tomales Point, Farallon Islands, Año Nuevo Island) and (c) Guadalupe Island, Mexico. Source: Chapple et al. 2011 at 582.

International Boundaries and Management

These sharks spend time in the Exclusive Economic Zone (EEZ) of the United States (off of Hawaii and California), in the EEZ of Mexico (see Figure 4), potentially in the small EEZ of Canada between California and Alaska (see Figure 5), and in the High Seas (while at and traveling to and from the SOFA). The NEP population has a significant amount of habitat subject to U.S. control (see Figure 6), including the majority of known focal areas (see Figure 3). However as these sharks cross in and out of U.S. controlled areas into the High Seas and into the territorial seas of Mexico and to a lesser extent Canada, they are subject to exploitation outside the U.S. EEZ by non-U.S. actors. Therefore the NEP DPS is delimited from other Great White Shark populations 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 Act.

If a species such as the NEP DPS were listed under the ESA, the requirements of the Act would apply differently within U.S. territorial waters than outside. Within the EEZ, federal actions that might impact Great White Sharks would be subject to Section 7 consultation requirements. This standard is set forth in section 16 U.S.C.§1536(a)(2) of the ESA:

> Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency (hereinafter in this section referred to as an "agency action") is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this section. In fulfilling the requirements of this paragraph each agency shall use the best scientific and commercial data available.

Section 7 consultation is required for U.S. actions taken on the high seas (50 C.F.R. § 402.01), but is not currently required by NMFS for federal actions carried out in foreign countries (50 C.F.R. § 402.01(a)). Section 9 prohibitions on "take" would also apply differently within and outside of the EEZ. Section 9 prohibits those subject to U.S. jurisdiction from taking endangered species in the U.S., U.S. territorial seas, or upon the high seas (16 U.S.C. §§ 1538(a)(1)(B)-(C)).

Lastly, the United States does not have the authority to designate critical habitat outside the U.S. (42 Fed. Reg. 4869; 43 Fed. Reg. 870).

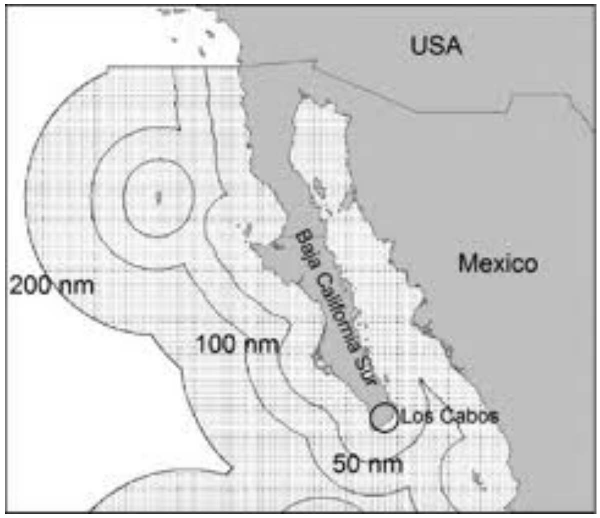


Figure 4. Baja California Sur, including Mexico's Exclusive Economic Zone (EEZ). Lines depict 50, 100 and 200 nautical mile (nm) EEZ limits. Source: Cisneros-Montemayor et al. 2012.

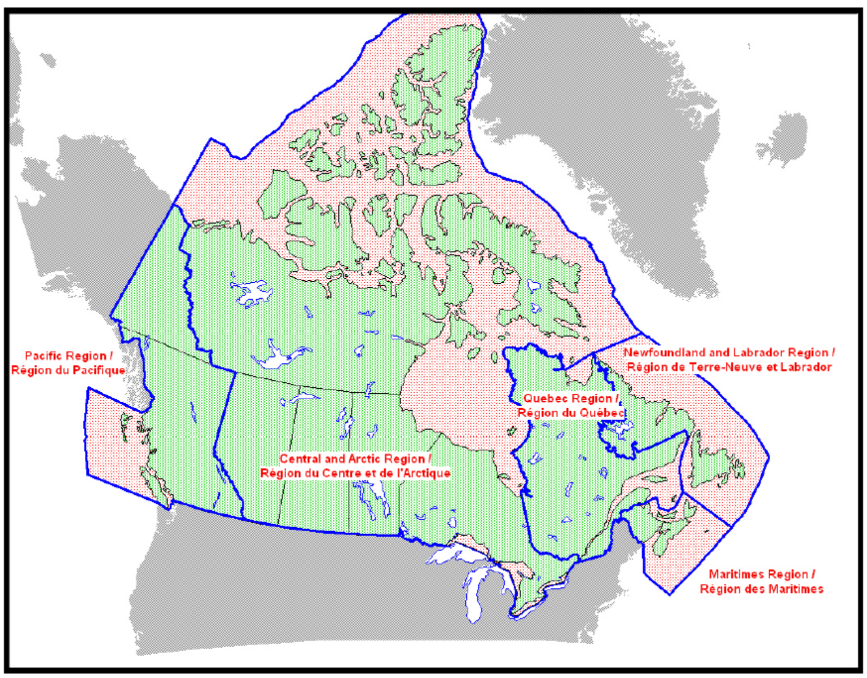


Figure 5. The Canadian Exclusive Economic Zone. Source: Canadian Coast Guard, http://www.ccg-gcc.gc.ca.

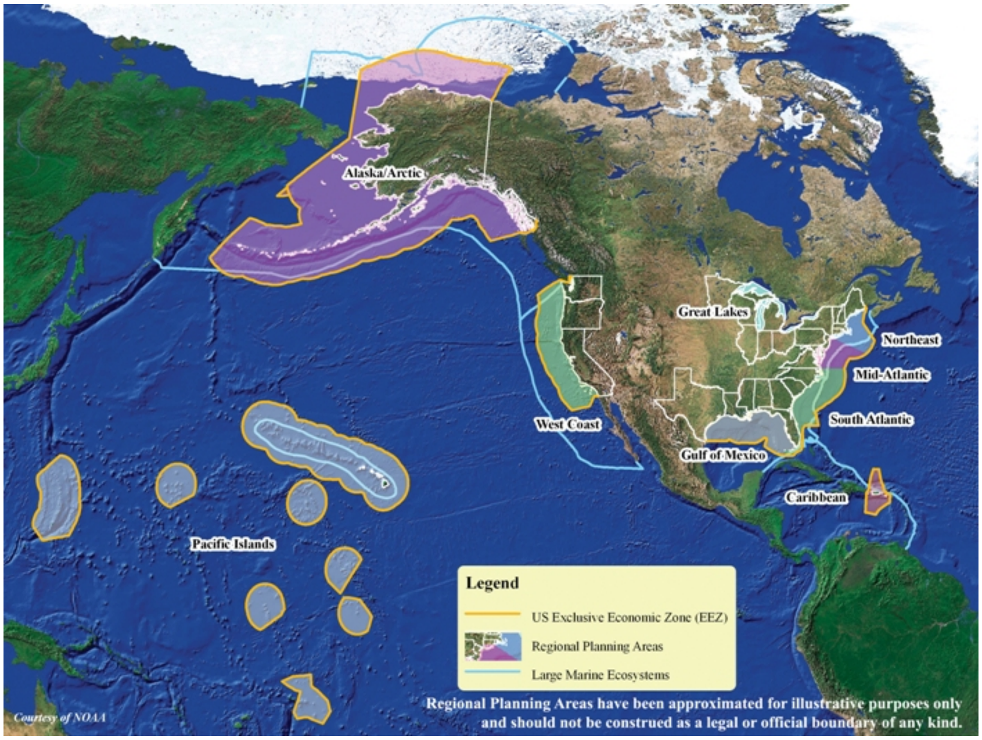


Figure 6. Map showing the United States Exclusive Economic Zone. Source: National Ocean Council, www.whitehouse.gov/administration/eop/oceans/cmsp/regional-planning.

SIGNIFICANCE. The NEP population of Great White Shark is significant to the species because protecting it would assure "persistence of the discrete population segment in an ecological setting unusual or unique for the taxon" (61 Fed. Reg. 4725). Each identified matrilineal population appears to be behaviorally and genetically unique, and retains predictable migration patterns and fidelity to certain sites despite the ability to travel long distances (see Gubili et al. 2012). Loss of the NEP population would result in a significant gap in the range of the taxon – it is unknown whether sharks from other populations of Great White Shark would be able to fill the gap if this population vanished. Lastly, the discrete population of NEP Great White Sharks differs from other populations in its genetic characteristics. See "Genetic Differences," above.

The NEP Great White Shark population qualifies as a DPS under both the "discreteness" and "significance" requirements. Hereinafter, "species" or "Great White Shark" should be understood to refer to the DPS described above.

RANGE AND HABITAT REQUIREMENTS

See "Migratory Patterns and Site Fidelity," above, for a full description of this population's habitat. In addition, "Hawaii is likely to be an important foraging area for white sharks. Extensive use of waters surrounding the Hawaiian island archipelago in winter and spring was evident from [satellite and acoustic tag records]" (Jorgensen et al. 2010 at 683).

POPULATION STATUS AND TRENDS

Global.

> World catches of white sharks from all causes are difficult to estimate, though it is known to have a relatively low intrinsic rebound potential. Threats to the species include targeted commercial and sports fisheries for jaws, fins, game records and for aquarium display; protective beach meshing; media-fanned campaigns to kill white sharks after a biting incident occurs; and degradation of inshore habitats used as pupping and nursery grounds. (Fowler et al. 2005 at 256, internal citations omitted)

"The rarity of White Sharks means that catch records are rare and population trend data scarce. All data series available (catch per unit effort and catches), however, demonstrate either significant population declines over time or stability (no recovery), even in areas where the species has long been protected" (CITES 2004a at 1). "Globally, there has been a reported decline of between 60-95% in White Shark numbers within the last 50 years" (CCSA undated at 4, citing Reid & Krogh 1992).

> …[T]he size of the global population is unknown, but the species does appear to be uncommon to rare compared to most other large sharks, comprising from 0.03% to 0.5% of shark records in commercial fisheries, or low to mid hundreds of individual sharks captured annually in a region. Most importantly: large, mature females represent only a very small proportion of the total population, although they are the most important breeding segment of the population… it is this section of the population that is most seriously threatened by international trade. (CITES 2004a at 4, internal citations omitted)

A study of White Shark populations in the northwest Atlantic showed a reduction of more than 50% between approximately 1988-1995 and 2003 (Baum et al. 2003 at 389). Information on the Mediterranean population provides "sufficient evidence for declines of 50–60% to be inferred and an increasing scarcity of White Sharks through the latter half of the 20th century" (Cavanagh and Gibson 2007 at 14).

> Comparative data of catch-rates and [catch per unit effort (CPUE)] are sketchy or lacking for most of the great white shark's range, although some figures are available from select regions. Observations of game fishery captures in south-east Australia between 1961–1990 indicate a catch-ratio from 1:22 in the 1960s, declining to 1:38 in the 1970s and 1:651 in the 1980s, suggesting a possible decline in abundance. South Australian game-fishing catches from 1980–1990 averaged 1.4 sharks per year and has declined since the 1950s, possibly through a reduction in effort. Sydney game fishing catches have ranged from 0–17 between 1950–1980, with no significant trend. Commercial bycatches off Australia are suspected to be the largest cause of mortality to Australian great white sharks, although without any data to currently substantiate this claim… Off the eastern USA, NMFS statistics from 1965–1983 show a decline from 1:67–1:210, suggesting a possible decline in abundance. Data from beach meshing programmes in NSW and Queensland show a gradual and irregular decline in CPUE since the 1960s whilst trends in KwaZulu-Natal meshing programmes are variable and less clear, but essentially downwards. Other indices of catch-rates are available from: California, between 1960–1985 as 0–14 sharks per year

> (mean 3.2), KwaZulu-Natal, between 1974–1988 as 22–61 sharks per year and the Central Mediterranean Sea (Sicilian Channel), between 1950– 1994 as 0–8 sharks per year (mean 2.2). We presently have no complete data for Japan, New Zealand or Chile. In other areas, catches are much more nominal and very sporadic (e.g. Brazil, Hawaii). (Fowler et al. 2005 at 258, internal citations omitted)

The United States first recognized the threat to Great White Sharks in the 2000 proposal (with Australia) to include them on Appendix I of CITES:

> Available data on absolute or total population numbers for the Great White Shark is extremely limited. As large commercial fishing fleets do not target Great White Sharks, information on the volume of catches and landings is poor. As such, its population status is uncertain. What is apparent from work done on sharks, however, is that it is uncommon to rare compared to most sharks. It appears to be relatively scarce compared to most other widely distributed species, and its population is considered to be declining. This is reflected in the fact that the Great White Shark is listed as "vulnerable" on the 1996 IUCN World Conservation Union Red List of Threatened Species. (CITES 2000 at 5)

Great White Sharks were listed in CITES Appendix II in 2004 (CITES 2004b at 4). The joint proposal from Madagascar and Australia was accepted with 72% of votes in favor (87 in favor, 34 opposed, and 9 abstentions) (WST undated at 1). The United States supported this listing (with modifications):

> The current proposal provides substantial information about the species' decline in various parts of its range, and presents some compelling reasons to list the species in Appendix II. We are concerned that the zero quota contained in the proposal is more restrictive than an Appendix I listing and would bar any international movement in scientific research samples or other non-commercial, non-detrimental trade. We note that the Fisheries Department of the [Food and Agriculture Organization of the United Nations (FAO)] convened a panel of fisheries experts in July 2004, in part to review this proposal. The panel could not ascertain the global status for the species, but indicated that some regional and national populations appeared threatened by unsustainable catches in recent years. Catches in other regions appeared sustainable, while the status of some populations remained uncertain. Given these results, the expected continued demand for white shark products, the species' vulnerability to overexploitation, and the international scope of trade in its parts, we support the adoption of the proposal with some modification to its zero quota. (USFWS 2004 at 58197)

FAO productivity measures were considered in the CITES proposal:

> FAO considers that productivity, as a surrogate for resilience to exploitation, is the single most important consideration when assessing population status and vulnerability to fisheries. The most vulnerable species are those with an intrinsic rate of population increase of <0.14 and a generation time of >10 years. Life history data… indicate that the white shark falls into FAO's lowest productivity category, with an intrinsic rate of population increase of 0.04-0.056, a generation time of 23 years, and natural mortality of

> 0.125. It therefore qualifies for consideration for Appendix I listing if the population has declined to 20% or less of the historic baseline. FAO (2001) further recommend that even if a species is no longer declining, if populations have been reduced to near (defined as from 5- 10% above the Appendix I extent of decline) to the guideline above on extent of decline, they could be considered for Appendix II listing. [This proposal has] presented documented evidence of white shark population declines well in excess of these levels. (CITES 2004a at 15, internal citations omitted)

The IUCN has classified Great White Sharks as "vulnerable" since 1996. A listing of "vulnerable" is given when any of the following criteria are met, indicating that the species is facing a high risk of extinction in the wild:

1. A reduction in population size has been observed, estimated, or projected within specific parameters;
2. The geographic range of the species is severely fragmented, continues to decline, or experiences extreme fluctuations in the extent of occurrence or the area of occupancy;
3. Population size is estimated at less than 10,000 mature individuals with either a continuing decline of more than 10% within 10 years or 3 generations or a continuing decline and unstable subpopulation structure;
4. Population is restricted because it is estimated to be fewer than 1000 individuals or the population has a very small area of occupancy or number of locations such that it is prone to human effects or a stochastic events within a very short time period and thus capable of suddenly becoming Critically Endangered or Extinct; or
5. Quantitative analysis shows that the probability of extinction in the wild is at least 10% within 100 years. (See IUCN 2001 at 21-23)

These criteria are similar to the definition of "endangered" and "threatened" under the ESA. Both definitions require that a species be at risk of extinction within the foreseeable future (IUCN 2001 at 21 and 16 U.S.C. §1532(6)). The "endangered" definition requires that the species be in danger of extinction "throughout all or a significant portion of its range," and the "threatened" definition requires that a species be at risk of endangerment "throughout all or a significant portion of its range," while the IUCN definition of "vulnerable" lists certain criteria which define "significant portion of its range" or "in danger of extinction" (Id.). The IUCN assessment was last updated in 2009 – despite this fairly recent update the profile is missing some key information including the 2004 inclusion of the White Shark in CITES Appendix II (see IUCN 2009). The assessment states that the population trend worldwide is "unknown" – however "all available research indicates that population of White Sharks is decreasing; in some areas the decline is in large, possibly unsustainable numbers" (Martin 2007 at 199, internal citations omitted).

Table 2. Populations of Great White Sharks in coastal aggregations. Source: NOAA 2012 at 2.

Australia/New Zealand (Feb. to Oct.)	133 individuals (juveniles, sub-adults)[a]
South Africa (Apr. to Oct.)	1,279 (juveniles, sub-adults)
Northwest Atlantic (migrates between New England and Florida)	Unknown
Northeast Pacific (2 aggregation sites)	
Tomales Pt., Pt. Reyes, Año Nuevo, Farallon Islands (Aug. to Nov.)	219 (adults, sub-adults)[4]
Guadalupe Island, MX (Jul. to Jan.)	135 (adults, sub-adults)[5]
Mediterranean	Unknown

[a]Population estimates based on mark-recapture studies and models.

Northern Pacific DPS. A 2011 study estimated a population of 219 sub-adult and adult Great White Sharks in the coastal California area (CCA) through mark-recapture methods of sampling (Chapple et al. 2011 at 581). The authors estimate that the CCA "comprises approximately half the total abundance of mature and sub-adult White Sharks in the NEP. This population is relatively small, even for apex marine predators" (Id. at 582). Populations of killer whales (*Orcinus orca*) and polar bears (*Usus martimus*) in the NEP have smaller ranges, but significantly larger populations (1,145 and 1,526 respectively) (Id. at 582). The Southern Resident Population of killer whales, a DPS with a population ranging between 60-100 animals (NMFS 2008 at Figure 8 (page II-56)), was listed as "endangered" under the ESA in 2005 (see NOAA 2005), and polar bears were listed as "threatened" in 2008.[6]

> Though historical abundances remain unknown for White Sharks [in the NEP], recent findings illustrate the low genetic diversity in this population, which supports our results of a low population abundance. This small estimate of abundance may therefore reflect a naturally low carrying capacity after an initial founding event from the western Pacific, or may reflect anthropogenic pressures (e.g. human-induced prey reduction of pinnipeds or fishing mortality). Although it is not known how this abundance compares with historical levels, establishing a baseline at this time will allow quantitative assessment of the future effects of anthropogenic disturbances or natural population fluctuations. (Chapple et al. 2011 at 582)

The population of Great White Sharks (adults and sub-adults) in the Guadalupe Island aggregation site was estimated at 135 in a 2009 study (NOAA 2012 at 2).

IDENTIFIED THREATS TO THE PETITIONED SPECIES: CRITERIA FOR LISTING

The northeastern Pacific DPS of Great White Sharks meets all of the criteria for listing under the ESA:

[4] Chapple et al. 2011.
[5] Sosa-Nishizaki, O. 2009. Estimating the white shark population in Guadalupe Islands, Mexico, based on mark-recapture data. International White Shark Symposium. Honolulu, Hawaii. February 8, 2009.
[6] ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A0IJ

A. The present or threatened destruction, modification, or curtailment of habitat or range;
B. Overutilization for commercial, recreational, scientific, or educational purposes;
C. Disease or predation;
D. The inadequacy of existing regulatory mechanisms; or
E. Other natural or manmade factors affecting its continued existence.

<u>(Factor A) The Present or Threatened Destruction, Modification, or Curtailment of the Species' Habitat or Range</u>

Coastal Habitat Degradation. In the NEP, "the coastal areas of Southern California and Baja Mexico are important [Young of the Year] nursery areas" (Domeier 2012 at 218). Young of the Year and juvenile Great White Sharks appear to concentrate in the Southern California Bight and in Vizcaino Bay, Mexico (Domeier 2012 at 209). Adults spend most of their time at one of two aggregation sites, one off the coast of central California (<u>Id.</u> at 211-212). "Because coastal areas are a preferred habitat, the population level of the [Great White Shark] or of its preferred prey could be affected by coastal habitat degradation, particularly in areas with dense human populations. Prey populations are also likely to be affected by overfishing in many parts of the world" (CITES 2004a at 4).

> Increasing human population and fisheries activities in coastal areas may lead to degradation of important inshore feeding and reproduction habitat for white sharks, as well as depletion of important prey species. The proximity of white shark habitat to human populations further increases the chances of sharks being killed in targeted fisheries or as a by-catch. The species is known to actively investigate human activity. This innate behavior increases the likelihood of being killed by humans, intentionally or not. The negative image of the white shark and the fear it inspires in humans often precipitates unwarranted killing of the species. The impact of these actions is made worse by the proximity of white shark feeding and breeding areas to coastal human populations. Examples include campaigns to kill white shark after shark attacks or in anticipation of such attacks, and disregard of conservation and management measures. (CITES 2004a at 9)

The California Bight comprises the curved coastline of California from Point Conception to San Diego.

> The rapidly expanding southern California megalopolis, which includes the coastal counties of San Diego, Orange, Los Angeles, Ventura and Santa Barbara, is home to approximately 20 million people who represent nearly 25% of the total US coastal population. Activities of this large human population result in the discharge of a broad range of pollutants into coastal waters of the Southern California Bight [SCB] including pesticides, fertilizers, trace metals, synthetic organic compounds, petroleum, and pathogens. These pollutants enter coastal waters through two main pathways: stormwater runoff from heavily urbanized watersheds and wastewater discharge from publicly owned treatment works (POTWs) and shoreline industries. Additionally, an important pathway for

> hydrocarbon pollutants to enter waters of the SCB is natural hydrocarbon seepage from coastal sources on the sea floor from Los Angeles to Point Conception, CA. Southern California has a complex physical circulation due to varying bathymetry, offshore islands, and numerous prominent headlands, which likely affect the transport of these pollution hazards. Urban stormwater runoff is currently the most significant pollution hazard for coastal waters in the SCB. Stormwater runoff rates and volumes are growing in urban regions such as Los Angeles due to the increasing population and proliferation of impervious surfaces. Increases in the number of sources, types of constituents, and concentrations of pollutants in stormwater runoff accompany the rising population of this region. Episodic storm events, typically occurring late fall through early spring, contribute more than 95% of the annual runoff volume and pollutant load in the SCB. These inputs modify the physical and biogeochemical state of coastal waters. Stormwater runoff changes density stratification and coastal circulation processes, nutrient distributions, suspended sediment concentrations, phytoplankton biomass, and primary productivity. (DiGiacomo et al 2004 at 1013-1014, internal citations omitted)
>
> Many highly industrialized areas have repositories of organochlorines (OCs), such as dichlorodiphenyltrichloroethane (DDT) and polychlorinated biphenyls (PCBs), which through bioturbation and resuspension of sediments act as chronic sources of these compounds long after their use has ceased. The coast adjacent to the Southern California Bight is one such example where large amounts of organic pollutants were discharged into the Pacific Ocean off the Palos Verdes Shelf (PVS) from 1949 to 1970s. By 1993 it was determined that over 11 tons of PCBs and 110 tons of DDT remained in the SCB and these high levels of contaminants have been shown to have deleterious effects on local marine life. (Blasius and Goodmanlowe 2008 at 1973, internal citations omitted)

These contaminants continue to affect predators in the Bight. In a recent assessment, “more than 50% of the CA sea lions sampled had levels of contaminants above the threshold known to cause a depressed immune system… In addition, high levels of contaminants were also found in harbor seals, and to a lesser extent, northern elephant seals…” (Blasius and Goodmanlowe 2008 at 1981, internal citations omitted, <u>see also</u> “Factor E; Pollution” below).

Great White Sharks breeding or spending their first years in Mexico may suffer some of the same threats. Though protected to a degree as part of El Vizcaino Biosphere Reserve in Mexico, Vizcaino Bay still suffers from anthropogenic threats including overfishing, mining, and contamination (ParksWatch 2004, entire).

The Great Pacific Garbage Patch. “The [White Shark] Café lies within the eastern boundary of the North Pacific Gyre” (Jorgensen et al. 2010 at 682). The North Pacific Gyre is also home to the “Great Pacific Garbage Patch,” “an area of high concentration of debris in the northeastern corner of the vortex, or center, of the North Pacific Subtropical Gyre,” where plastic of various sizes is distributed throughout the water column (Algalita 2009 at 1, <u>see</u> Figure 7). This “soup” of debris has deleterious effects on many forms of marine life:

> Large pieces of plastic can kill by entrapment, suffocation and drowning. Smaller pieces can be ingested, causing choking or intestinal blockage. In some cases, starvation occurs

> because the plastic makes the animal feel full without having had any nourishment. Plastic consumed by marine life appears to either pass through the digestive tract intact, if it is small enough, or remains in the animal, blocking the intestinal tract, causing death. When the animal dies, the plastic is either released to be eaten again, or it is swallowed by a predator eating the plastic-ridden prey. In the case of seabirds, many of them simply perish on shore with their stomach contents eventually being the only thing to remain. Accumulation of Persistent Organic Pollutants (POPs) on plastic, and the resulting effects on marine life when this plastic is ingested is a topic of much discussion in the scientific community. The term POP (persistent organic pollutant) is a description of organic materials which do not completely dissolve in water and do not degrade into harmless materials in a relatively short amount of time. Examples include PCB's (polychlorinated biphenyls) and other materials that resist degradation. Many POPs are proven carcinogens. Other POPs contribute to other problems with marine life, such as reproductive issues due to hormone disruption. (Algalita 2009 at 2)

It is possible that Great White Sharks feeding in the Café could be affected by POPs or by ingesting plastic, either directly or in prey.

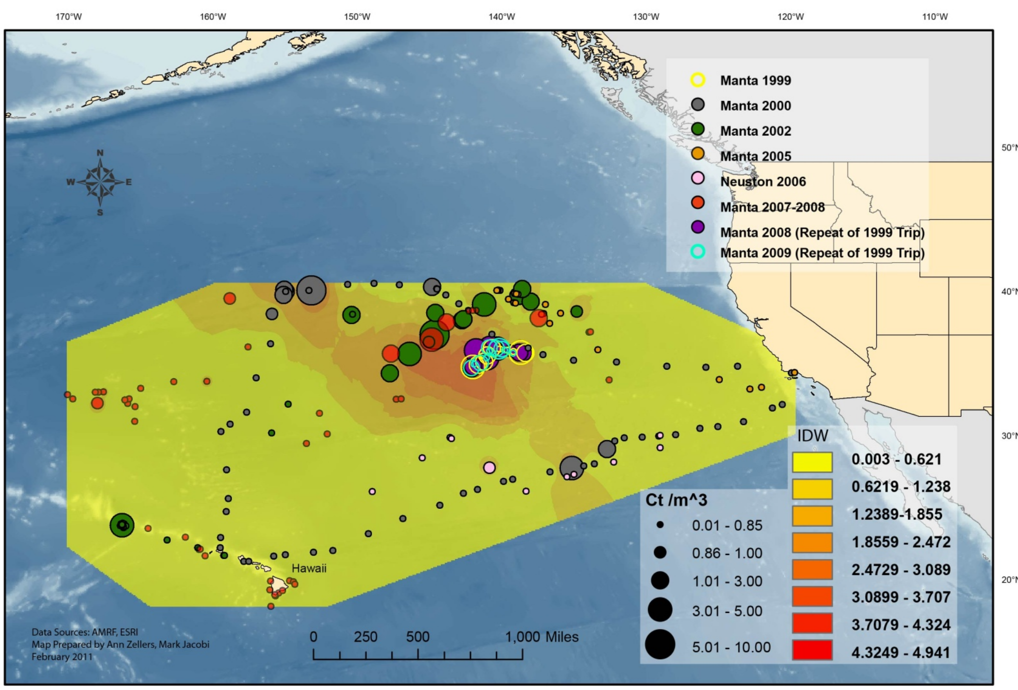


Figure 7. Abundance of plastic debris from ocean surface (neuston) samples 1999-2009. Source: Algalita 2011 at 7.

<u>(Factor B) Overutilization for Commercial, Recreational, Scientific, or Educational Purposes</u>

Target Commercial Fishing. "The most significant threat to the White Shark is human predation" (Martin 2007 at 202). "…[M]arket demand remains a powerful motivation for continued depletion" (<u>Id.</u> at 199). Great White Shark populations have been impacted by finning, direct or indirect catch in commercial fishing, and harvesting for jaws or teeth.

> Nowhere is the [great white shark] abundant and productive enough to sustain long-term directed fisheries; the majority of annual captures worldwide being made incidentally through commercial fisheries operating longlines, setlines, gillnets, trawls, fish-traps and other gear. The great white shark is ensnared throughout the water column in nearshore fisheries but, notably, is rarely represented in the elasmobranch bycatch of offshore oceanic pelagic fisheries (unlike shortfin mako *Isurus oxyrinchus* and porbeagle *Lamna nasus*). The great white shark is vulnerable to capture trauma and may be killed or has limited survivorship after capture. Great white sharks are curious and readily approach boats, scavenge from fishermens' nets or longlines and devour hooked fish taken by rod-and-line or swordfish harpoon. This vulnerable propensity often results in either their own accidental entrapment or deliberate killing by commercial fishermen. In certain regions the great white shark has traditionally been viewed negatively as manifesting a costly interference to fisheries, although some fishers appreciate it for its role in eating pinnipeds that devour their catches. This species is unquestionably vulnerable to directed exploitation such as sports fisheries, the curio trade, the oriental shark-fin trade and even the public aquarium trade. The overall, long-term impact of these causes of mortality upon regional populations, coupled to those caused through indirect fishery captures or protective beach meshing, is probably detrimental. The removal of even a few individuals apparently has very tangible effect at discrete localities (such as the Farallon Islands, California, based upon observations following the cull of four local sharks in 1984)... Great white sharks have been sought as the ultimate species to display in large public oceanaria, but with poor survivorship so far. Directed fishery exploitation of great white sharks is primarily undertaken with the aim of trading its teeth and jaws as trophies or curios and its fins for the oriental fin trade. In South Africa offers of US$20,000–$50,000 have been made for great white shark jaws and US$600– $800 for individual teeth. Apart from their size, great white shark products in the form of curios and fins are boosted in value because of notoriety. A fin-set from a large great white shark may be valued at over US$1,000. Unfortunately, as with rhino horns and elephant tusks, the high value of great white shark products encourages poaching, clandestine trade and flouting of protective laws. (Fowler et al. 2005 at 258, internal citations omitted)

Fishermen are likely to keep Great White Shark bycatch because of the high value of Great White Shark teeth and jaws (WCS 2004 at 2), as stated above. Another estimate of their market value indicates that one tooth may be sold on the internet for $425 and an entire jaw set is worth up to $12,500 (Id. at 4). The value of these products has not decreased with time: a recent search of EBay (May 7, 2012) revealed Great White Shark teeth for sale from $5 to $1,500 per tooth, Great White Shark vertebrae for $10 to $30, and Great White Shark jaw sets for up to $8,393.75. The search produced approximately 5,500 hits with half of those being actual Great White Shark body parts.

> It is often difficult to distinguish between target and bycatch fisheries for white shark products and the distinction is not always useful. This is because the high value of shark products promotes the utilization of incidentally captured white sharks and discourages avoidance or release of bycatch, sometimes despite legislation prohibiting this practice.

> The white shark is an incidental catch of fisheries that use longlines, hook-and-line, fixed bottom gillnets, fish traps, herring weirs, trammel nets, harpoons, bottom and pelagic trawls, and purse seines. (CITES 2004a at 8, internal citations omitted)

During a survey of Great White Shark populations in Australia, 10 percent of the sharks wore remnants of longlines or gill nets (Strong et al. 1996 at 413), showing that the population commonly encounters commercial fishing gear.

> The overall low abundance of white sharks means that target commercial fisheries are uncommon and usually opportunistic, targeting aggregations when these are located. Because white sharks, though generally rare, appear to show site fidelity, the species is highly vulnerable to over-exploitation if there is strong fishing pressure within that area. Evidence suggests they can easily be exploited to the point of extinction, even where relatively few are regularly removed from an environment. (CITES 2004a at 8, internal citations omitted)

> [Young of the Year] and juvenile White Sharks are susceptible to incidental capture by gillnet and longline fisheries. Adults are less vulnerable to commercial fisheries because their large size allows them to escape most fishing gears; occasionally they can get entangled in gillnet or longline gear. Very little commercial fishing activity currently takes place in the SOFA, so the offshore region acts as a refuge, but there are no international laws in place to protect White Sharks in international waters. Females migrating through parturition regions are likely more vulnerable to incidental fishery related mortality during that time… Adults are extremely vulnerable to exploitation while they occupy adult aggregation sites, but these sites have protective laws forbidding the take of White Sharks. (Domeier 2012 at 219-220)

The Great White Sharks is only one of the multitude of shark species affected by the demand for shark fins. An estimated 38 million sharks are harvested for their fins each year, as much as 3-4 times more than reported in the FAO fisheries landings database (Dulvy et al 2008 at 461). In the Hong Kong shark fin market, 70% of shark fins were found to be from pelagic sharks such as the Great White Shark (Id.).

Target Sport Fishing. Great White Sharks are a popular target of sport fishermen in search of trophies.

> The publicity gained by some of the earliest big game sports fishers in the 1950s and the film "Jaws" in the 1970s led to a dramatic increase in interest in game fishing for this shark, particularly the largest individuals. This direct targeting of white sharks, together with developments in fishing equipment and growth in human population and affluence, is likely to have increased its mortality rate in recent decades. While some sports fishers release alive the white sharks that they target, sometimes after tagging them, post-release mortality has not been studied. Other sports anglers will undertake expensive international travel in order to target and kill the largest available specimens of this species, often retaining and exporting trophies in the form of jaws and teeth. Sports fisheries are thought to kill tens to low hundreds of white sharks annually worldwide,

> with peaks when local aggregations are targeted (records are incomplete in most regions). (CITES 2004a at 8, internal citations omitted)

Catch numbers show a disturbing decrease in Great White Shark population (CCSA undated at 4). A study conducted by Pepperell in 1992 charted a change in ratio of Great White Sharks to all shark species caught in New South Wales from 1:22 in the 1960's, 1:38 in the 70's, and 1:651 in the 80's (Id.). The eastern United States has seen similar results with a ratio of 1:67 in 1965 declining to 1:210 in 1983 (Id.).

In recognition of the danger from trade, the Great White Shark was listed in CITES Appendix II in 2004. Seventy-two percent of member nations (likely including the U.S., which indicated its support for the proposal with changes to the proposed zero quota and previously supported an Appendix I listing – this is unknown because the vote was conducted through secret ballot: see WST undated and "Population Status and Trends" above) agreed that the Great White Shark might become in danger of extinction if trade was not closely controlled.

(Factor C) Disease or predation

The addition of mercury, organochlorine contaminants, and other pollutants to the ocean and the resultant effects on the bodies of Great White Sharks may be categorized as disease. "All life-history stages may be vulnerable to high body burdens of anthropogenic toxins; how these may impact the population is not known" (Domeier 2012 at 219-220). As discussed under Factor E, mercury and organochlorine contaminants specifically may cause behavioral alterations, emaciation, cerebral lesions, and impaired sexual development (Mull et al. 2012 at 73). Organochlorines and other pollutants are a particular problem for Young of the Year in the California Bight, which is subject to high levels of pollution from the southern California megalopolis (the coastal counties of San Diego, Orange, Los Angeles, Ventura and Santa Barbara) (see "Factor A" above and "Factor E" below).

(Factor D) Inadequacy of Existing Regulatory Mechanisms

"The Great White Shark is currently protected in the Australian EEZ and state waters, South Africa, Namibia, Israel, Malta and the USA (California and Florida states, with directed fisheries prohibited off all coasts). Protective laws are strict, but loopholes and inadequate enforcement causes problems including promoting the black-market for high-value Great White Shark products including jaws, teeth and fins" (Fowler et al. 2005 at 258). The 2004 CITES listing was partly due to concern over inadequate management programs:

> Sustainable harvesting of such a rare and low-productivity species would be extremely difficult (if not impossible) and would require highly precautionary management, but there is still no national or regional management of fisheries for the species, despite its legal status. The lack of trans-boundary management programmes (essential for a highly migratory species) hampers national conservation and management actions for white sharks. (CITES 2004a at 1)

Lack of management control remained an issue for the northeast Pacific even after the CITES listing:

> There is virtually no regional or international management for sharks or rays in the Northeast Pacific region. Domestic management for these fisheries is limited to the USA and Canada, although there is only a draft federal management plan for sharks in US Pacific waters and this only covers five species of pelagic sharks. According to Susan E. Smith (NMFS, La Jolla pers. comm.), this plan will prohibit the retention of *C. carcharias*, *C. maximus* and megamouth shark *Megachasma pelagios* while fishing for highly migratory tunas, billfish and sharks within the US west coast Exclusive Economic Zone (EEZ). For the eastern Pacific, only California and Alaska currently have regulations for sharks. (Fowler et al. 2005 at 176, internal citations omitted).

International regulations.

> The white shark is legally protected in Australia, South Africa, U.S. Federal and some state waters, Namibia and Malta. These control measures have, in some cases, only a limited impact, as evidenced by the fact that shark teeth and jaws are still freely available from California, South Africa, and Australia despite the current protective legislation. Illegal fishing of white sharks during 2003 and the sale of their teeth, jaws and fins has been detected and prosecuted in a couple of cases in the US. Furthermore, poaching in South Africa is a problem that needs to be addressed by the local authorities. (CITES 2004a at 13, internal citations omitted).

In part because of these concerns, the Great White Shark was listed on CITES Appendix II in 2004. An export permit is required for this species; no import permit is required. After the CITES listing, researchers still expressed concern about management programs:

> A CITES listing might help slow trade in great white shark products, but will not eliminate low-volume criminal trade. The great white shark was added to both Appendices of the Convention on the Conservation of Migratory Species (CMS) in 2002 with the objective of providing a framework for the coordination of measures adopted by range states to improve the conservation of the species. The great white shark should be removed from international game fish record lists, and needs consistently rational and realistic treatment by entertainment and news media to counter its notoriety and inflated market value. (Fowler et al. 2005 at 259, internal citations omitted)

Other international agreements protecting Great White Sharks in some way include the Convention on Migratory Species (Appendix I and II), UN Convention on the Law of the Sea (UNCLOS), the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Annex II), and the Bern Convention on the Conservation of European Wildlife and Natural Habitats (Appendix II in the Mediterranean) (WST undated at 2). "Despite these precautionary listings, trade in White Shark products, primarily fins, persists" (Jorgensen et al. 2010 at 679). Poachers continue to catch Great White Sharks and enforcement can be lean in some parts of the world (see, for example, Viegas 2011).

Mexico. "Mexico introduced an Official Norm for responsible Shark and Ray Fisheries in 2006 under which landing of shark fins without carcasses on board is prohibited; catch and retention of whale shark, basking shark, great white shark and big skate is banned; closed and exclusion zones are in place; detailed logbooks to record retained species and an observer program are required; driftnets are banned" (Lack and Sant 2011 at 32, internal citations omitted).

Canada. Finning was banned in Canada in 1994, and "the trade and sale of fins must be in appropriate proportion to the quantity of carcasses landed (five per cent of dressed carcass weight)" (DFO 2007 at 7). The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) "uses the best available scientific, Aboriginal and community knowledge to assess species that might be at risk in Canada and reports its assessment… to the Canadian Endangered Species Conservation Council and to the Canadian public… The Minister of Environment, in close consultation with the Minister of Fisheries and Oceans, then considers the assessment and may or may not recommend that the species be added to the List of Wildlife Species at Risk." Only the Atlantic population of Great White Sharks was the subject of a COSEWIC assessment (Id. at 7-8)

"All shark landings (directed and bycatch) in the groundfish fisheries are monitored dockside by an approved dockside observer at industry's cost. However, in the case of many skate species and some shark species, the [dockside monitoring program] does not include discarded catches at sea or rarer species that are difficult to identify once landed" (Id. at 8). In the Pacific, "100 per cent at-sea observer coverage of trawl, hook-and-line, and trap fisheries means that almost all bycatch and discard totals are recorded and classified for all 14 shark species" (Id. at 13). White Sharks are considered "uncommon bycatch" in Canadian waters (Id. at 26).

United States. The Great White Shark was listed as a prohibited species in U.S. Federal waters in 2005 (Lowe et al. 2012 at 171). There are some contradictory statements about this, however – in one document the FAO claims that the Great White Shark is both "important as a big-game sports fish in a few areas, especially Australia and the northeastern United States…" and that "it is protected from all directed fishing (commercial and recreational) in all federal waters of the US East Coast and in California State waters" (FAO 2012 at 4 and 5).

> In the United States, the species first received temporary legal protection in California in 1993; this was confirmed under state legislation in 1997. It is also protected in Florida State waters. Commercial catches of white sharks were prohibited throughout the US Atlantic and Gulf coast federal waters from 1997 (although recreational catch and release is still permitted) when the species was identified as highly susceptible to overexploitation… Recent scientific findings demonstrating regular long-distance, trans-boundary movements of white sharks indicate that protective measures through national legislation may be an ineffective guarantee of the survival of the species throughout its range. Comprehensive and collaborative regional and international management is essential. (CITES 2004a at 11, internal citations omitted)

California. Ocean sport fishing regulations prohibit the take of White Shark except under permit from the California Fish and Game Department (CFGD) for scientific or educational purposes (CDFG 2012 at 36). "Title 14, California Code of Regulations, Fish and Game states that white sharks may not be taken. However, the unintentional catch of sharks in the commercial fishing industry (long-line, purse seine, gillnets and mid-water trawl fisheries) threaten sharks, particularly juvenile white sharks in southern California" (NOAA 2012 at 1). The law allows commercial fishers to land White Sharks that have been incidentally caught (Domeier 2012 at 201). "Juvenile White Sharks are occasionally captured by commercial gillnets targeting nearshore species such as California Halibut (*Paralichthys californicus*), Pacific Angelshark (*Squatina californica*), and White Seabass (*Atractoscion nobilis*)" (Id., internal citations omitted). In 2011, California passed AB 376, which makes it unlawful to possess, sell, offer for sale, trade, or distribute shark fins (Fact Sheet undated at 1).

Oregon and Washington. "Legislation [similar to AB 376] is now under review by the Guam, Oregon, and Washington state legislatures" (Fact Sheet undated at 1). Washington does not appear to have any regulations governing sportfishing for sharks aside from the sixgill and dogfish sharks (WDFW 2012, entire). Oregon includes the Great White Shark on their Watch List (ODFW 2005 at 32), which identifies "important nearshore species that do not require immediate management action, but may in the future. Managers should be aware of conservation needs and potential factors affecting these species" (Id. at 40). In Oregon, "any number of rods or lines are allowed outside of three miles from shore when angling for offshore pelagic species and only if no species other than offshore pelagic species have been retained… Taking or attempting to take any fish by means of chumming, or knowingly angle with the aid of chum, except chumming is allowed when fishing for offshore pelagic species outside of three miles from shore and only if no species other than offshore pelagic species have been retained" (ODFW 2012 at 10). White Sharks and basking sharks, though included in the definition of offshore pelagic species, are "prohibited and must be immediately released unharmed" (Id. at 101).

Hawaii. "A similar ban [to AB 376] was enacted in Hawaii in 2010" (Fact Sheet undated at 1). HRS 188-40.7 makes it unlawful to possess, sell, offer for sale, trade, or distribute shark fins.[7] HRS 188-40.6 makes it "unlawful to conduct any activity related to the feeding of sharks in state waters. Persons engaged in taking marine life that results in captured, injured, or dead fish being incidentally eaten by sharks are not in violation, provided the purpose of taking marine life is not the feeding of sharks. Persons may feed sharks for traditional Hawaiian cultural or religious practices, provided the feeding is not part of a commercial activity."[8] Great White Sharks do not appear among the species for which fishing is regulated in Hawaii.[9]

State Marine Protected Areas. "Some marine protected areas cover important White Shark aggregation sites (e.g. in California), but there are otherwise no specific measures in place for the conservation of their habitats, which are now known to include large high seas areas" (CITES 2004a at 12).

National Marine Sanctuaries. Federal law (15 CFR Part 922) prohibits "[a]ttracting a White Shark anywhere in Gulf of the Farallones or Monterey Bay National Marine Sanctuaries [or

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[7] hawaii.gov/dlnr/dar/regulations_special_provis.html [Accessed 6/15/12].
[8] Id.
[9] hawaii.gov/dlnr/dar/regulated_fish_mfv.html [Accessed 6/15/12].

a]pproaching within 50 meters (164 ft.) of any White Shark within 2 nautical miles (2.3 miles; 3.7 km) of any of the Farallon Islands" (NOAA 2012 at 1, see Figure 8).

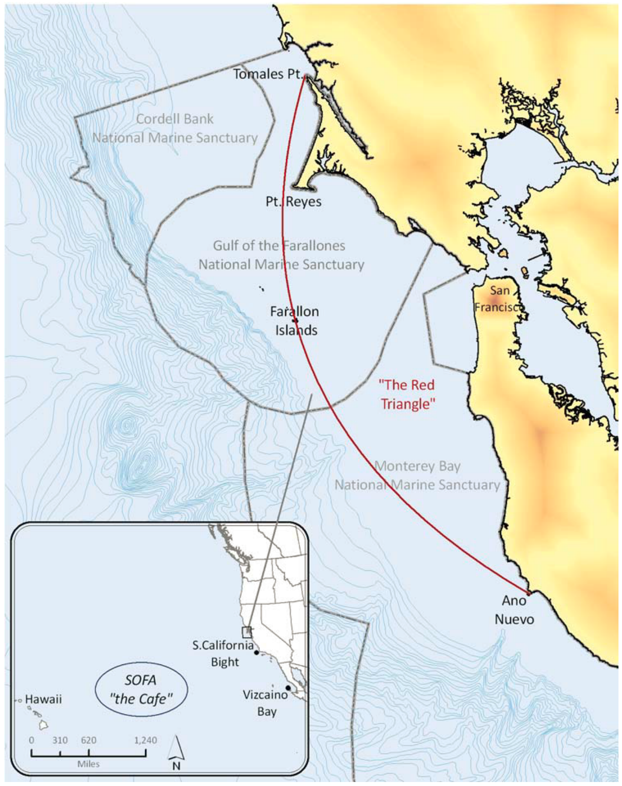

Figure 8. Important Great White Shark habitat for the northeastern Pacific Ocean DPS, showing Monterey Bay, Gulf of the Farallones, and Cordell Bank National Marine Sanctuaries. Source: NOAA 2012 at 1.

The above regulations, though important, are insufficient for the following reasons:

Great White Sharks do not stay within marine protected areas, nor does the NEP DPS remain within the EEZs of the U.S., Canada, and Mexico. They are vulnerable to exploitation when they travel outside protected areas and EEZs, especially in the recently discovered SOFA (see Jorgensen et al. 2010), which may become more heavily exploited now that it is known to be a center of Great White Shark activity. "Very little commercial fishing activity currently takes place in the SOFA, so the offshore region acts as a refuge, but there are no international laws in place to protect White Sharks in international waters" (Domeier 2012 at 219).

These regulations do not provide sufficient protection from bycatch. "[Young of the Year] and juvenile White Sharks are susceptible to incidental capture by gillnet and longline fisheries. Adults are less vulnerable to commercial fisheries because their large size allows them to escape most fishing gears; occasionally they can get entangled in gillnet or longline gear" (Domeier 2012 at 219). Small number of sharks removed can have huge impacts on entire local populations. "Research off the Farallon Islands, California (United States) suggested that the removal of just four White Sharks greatly reduced and possibly eliminated for a while the entire local population of White Sharks (CITES 2004a at 8, citing Ainley et al. 1985). It would likely not take many deaths from bycatch to impact the NEP DPS, especially considering its already small population size. Great White Sharks are naturally rare and have a slow rate of recovery. The patchwork of existing fishing regulations makes rules unclear and enforcement difficult, leaving them vulnerable to harm and mortality from fishing and other human activities.

Additionally, the regulations in place to protect Great White Sharks from exploitation and bycatch only address threats under Factor B. They do not address threats to habitat (Factor A) or health (Factor C, Factor E) from pollution, specifically 1) mercury from industrial emissions including those from coal-fired powerplants and other sources; 2) organochlorine contaminants; 3) plastic debris and/or POPs, particularly as they are found concentrated in the North Pacific Gyre; 4) other pollutants with deleterious health effects on Great White Sharks.

The regulations also do not address coastal habitat degradation of important sites for juvenile White Sharks. "Habitat degradation (development, pollution and overfishing)… threatens this species and may largely exclude it from areas, perhaps traditionally utilised for feeding or as nurseries, where it was historically much more abundant" (Fowler et al 2005 at 258, see "Factor A" above, and "Factor E; Pollution" below).

(Factor E) Other Natural of Manmade Factors Affecting the Species' Continued Existence

Pollution. Heavy metals and organochlorine contaminants such as DDT may be affecting the survival of Great White Sharks (Mull et al. 2012 at 73). A study conducted in the Southern California Bight (from approximately Santa Barbara, California to Mexico) revealed high levels of mercury and organochlorines in tissues sampled from young Great White Sharks (Id.). The balance of mercury and selenium in the tissues of the sharks indicated a physiological response to the high levels of mercury found in the shark's muscle that could lead to behavioral alterations, emaciation, cerebral lesions, and impaired sexual development (Id.). The authors surmised that the high levels of heavy metals and organic contaminants may cause the sharks to suffer lower survival or future reproductive impairment (Id.). Mercury bioaccumulates in the bodies of predatory animals. On average, mercury accumulates to levels a million times higher in the bodies of predatory fish than in the atmosphere (Geiger 2011 at 7). In addition, White Sharks are known to prey upon seals and sea lions (see Klimley et al. 1996). In the California Bight, harbor seals, sea lions, and northern elephant seals were found to contain high levels of contaminants (Blasius and Goodmanlowe 2008 at 1981, internal citations omitted, see also "Factor A; Coastal Habitat Degradation" above). Eating so high on the food chain exposes the Great White Shark to a high risk of bioaccumulating toxins.

One of the largest contributors to oceanic mercury is industrial emissions, including coal-fired powerplants (Cone 2009 at 1). With the need for energy growing, mercury levels in the ocean have risen about 30% over the last 20 years (Id.). A study conducted by scientists from Harvard University and the U.S. Geological Survey predict that the amount of mercury found in the Pacific Ocean will reach double 1995 levels by 2050 under current emission rates (Id.). Increasing amounts of airborne mercury rise from Chinese power plants, cross the Pacific Ocean, and deposit on or near American shores (Geiger 2011 at 6-7). This suggests that the biological effects of mercury on Great White Sharks will only increase.

Negative Press.

> Under various synonyms (maneater, white death), the Great White Shark has long been a focus for negative media attention, generated by its sometimes lethal interactions with humans. As a consequence of this typically exaggerated threat to human safety and an almost legendary "Big Fish" status, the species is targeted as a source for sports-fishing, commercial drumline trophy-hunting (for jaws, teeth and even entire specimens preserved), sporadic human consumption or merely as the piscine whipping-boy of individuals pandering to shark attack paranoia. All of these activities have greatly increased since the "Jaws" media phenomenon of the mid 1970s, not only to the detriment of *C. carcharias* but also in encouraging targeting of other, less high-profile species. (IUCN 2009 at 3)

Life History Factors.

> White sharks are particularly slow growing, late maturing and long-lived with a long generation period, small litter size and low reproductive capacity. The productivity (r_{msy}) of the white shark, 0.04 to 0.056 (4 to 5.6% annual population increase), is lower than that of many more abundant large sharks. These characteristics make white sharks particularly susceptible to exploitation. Their habit of aggregating at coastal locations and inquisitive nature make them behaviourally as well as biologically vulnerable to target commercial and recreational fisheries. (CITES 2004a at 1)
>
> …[T]he biological characteristics of white sharks mean that this species is naturally rare and has a very low intrinsic rate of population increase. This minimises the sustainable yield that may be obtained from any population and makes the species highly susceptible to population depletion as a result of unsustainable rates of harvest and other anthropogenic factors. These animals are also bold and inquisitive in their approach to vessels and fishing gear, which may make them an easy opportunistic target. They may also be targeted when, because of this behaviour, they become a nuisance to fishing operations. (CITES 2004a at 8, internal citations omitted)

The Great White Shark is a K-selected species. It has a small number of offspring in which it invests significant energy (Withgott and Brennan 2007 at 139, see "Reproduction" above). Due to Great White Sharks' breeding habits, their population would tend to stabilize near carrying capacity over time under natural conditions. This makes it difficult for the species to recover when the population declines at dramatic rates, making it vulnerable to extinction. The Great White Shark has a low biotic potential (ability to produce offspring). "The interaction between an organism's biotic potential and the environmental resistance to its population growth helps determine the fate of its population" (Id. at 139). Since the Great White Shark is a K-selected species with low biotic potential, it is extremely susceptible to extinction in the face of declining numbers and continuing threats.

Small Population Size. With an estimated ~440 sub-adult and adult Great White Sharks remaining in the NEP DPS (see Chapple et al. 2011), it is highly possible that one stochastic event could cause extinction. "Population size matters; small populations are more likely to go extinct as a result of chance effects (known as the small population paradigm)" (Brook et al. 2008 at 455, internal citation omitted). FWS has frequently recognized small population size as a threat to species' persistence.[10]

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of the NEP DPS of Great White Sharks. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction" (Brook et al. 2008 at 457, internal citations omitted).

The combination of threats to the Great White Shark and its habitat could cause a greater and faster reduction in the remaining population than might be expected from simply the additive impacts of the threats. "[H]abitat loss can cause some extinctions directly by removing all individuals over a short period of time, but it can also be indirectly responsible for lagged extinctions by facilitating invasions, improving hunter access, eliminating prey, altering biophysical conditions and increasing inbreeding depression. Together, these interacting and self-reinforcing systematic and stochastic processes play a dominant role in driving the dynamics of population trajectories as extinction is approached" (Brook et al. 2008 at 453, internal citations omitted).

The Great White Shark is already at risk as a low-fecundity or K-selected species, rendering it more vulnerable to synergistic impacts of multiple threats. "Traits such as ecological specialization and low population density act synergistically to elevate extinction risk above that expected from their additive contributions, because rarity itself imparts higher risk and specialization reduces the capacity of a species to adapt to habitat loss by shifting range or changing diet. Similarly, interactions between environmental factors and intrinsic characteristics make large-bodied, long-generation and low-fecundity species particularly predisposed to anthropogenic threats given their lower replacement rates" (Brook et al. 2008 at 455, internal citations omitted).

REQUESTED DESIGNATION

WildEarth Guardians hereby petitions the Secretary of Commerce, acting through NMFS, to list the northeastern Pacific DPS of Great White Shark (*Carcharadon carcharias*) as an "endangered" or "threatened" species under the Endangered Species Act. The Great White Shark is threatened all five listing factors. The petitioner also requests the designation of critical habitat in U.S. waters for the Great White Shark concurrent with listing. These imperiled sharks face major threats from historic and continued exploitation, bycatch, habitat destruction, and fitness-reducing pollution, which are compounded by a low reproductive rate. Nor do they enjoy regulatory protections sufficient to address the threats they face. ESA listing will streamline

[10] See, for examples, candidate assessment forms for *Porzana tabuensis* (spotless crake, April 2010), *Eumops floridanus* (Florida bonneted bat, March 2010), *Vagrans egistina* (Mariana wandering butterfly, April 2010), *Gallicolumba stairi* (friendly ground-dove, March 2010), *Eremophila alpestris strigata* (streaked horned lark, April 2010), and *Hyla wrightorum* (Arizona treefrog, April 2010) (Available at ecos.fws.gov/tess_public/pub/SpeciesReport.do?listingType=C&mapstatus=1).

regulations affecting the Great White Shark and provide them with the strong protections they need to persist as one of the top predators in the northeastern Pacific Ocean.

Protecting apex predators such as Great White Sharks protects entire ecosystems:

> Findings from ecosystem modeling show that in certain ecosystems the depletion of apex predator sharks can have negative effects on other species directly or indirectly through the food web. It is difficult to predict accurately what impact a continued decline of the white shark may have on the ecosystem, but, 'in the absence of more precise information… the roles of these fishes should not be underestimated. Indiscriminate removal of apex predators from marine habitats could disastrously upset the balance within the sea's ecosystems.' (CITES 2004a at 7, internal citations omitted)

In the sea as on land, predators are key species in maintaining the natural balance. They often face unjust and disproportionate persecution or intensive human exploitation; the Great White Shark is no exception. Yet protection for these powerful creatures would result in benefits for a host of other organisms that share their habitat.

If you have any questions about this petition or any difficulty locating cited sources, please contact Taylor Jones, Endangered Species Advocate for WildEarth Guardians, at 303-353-1490 or tjones@wildearthguardians.org. Thank you for your consideration.

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