

**PETITION TO LIST THE  
Porbeagle Shark (*Lamna nasus*)  
UNDER THE U.S. ENDANGERED SPECIES ACT**

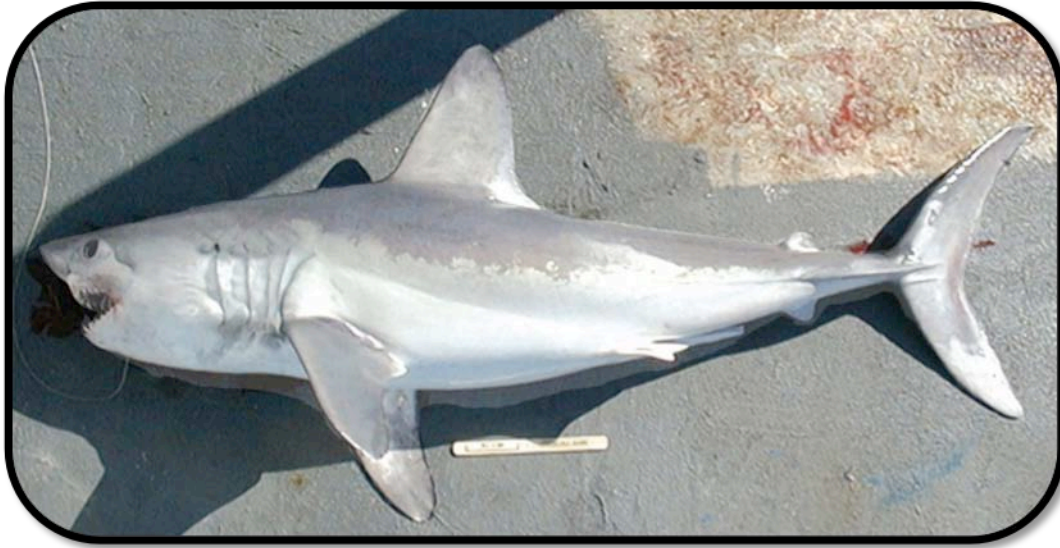


Photo: NOAA

**Petition Submitted to the U.S. Secretary of Commerce, Acting Through the National  
Oceanic and Atmospheric Administration Fisheries Service & the U.S. Secretary of  
Interior, Acting through the U.S. Fish and Wildlife Service**

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## Executive Summary

The Porbeagle Shark (*Lamna nasus*) is a remarkable fast, large shark that has adapted to cold waters in the northern and southern hemisphere through heat exchangers that keep its body warmer than surrounding waters. Its extensive range includes the North Atlantic, South Atlantic, South Pacific, South Indian, and Antarctic Oceans. Like other sharks, it is part of an ancient lineage stretching back more than 200 million years. Its evolutionary fine-tuning hasn't protected it, however, from a literal feeding frenzy – by humans on sharks.

The Porbeagle has suffered staggering declines as a result of fishing. In the Northeast Atlantic, European fishing fleets decimated this shark's populations within a few decades, starting in the 1930s. But what happened in the Northwest Atlantic was the eye-opener. Norwegian fishing vessels then turned their sights to the west in 1961. Within just six years the Porbeagle Shark stock in the Northwest Atlantic was destroyed. After the stock started to rebound a few decades later, the Canadians thought they would try their luck, focusing on Porbeagle starting in the 1990s. The same thing happened, but worse this time: the population plummeted to record lows. Scientists estimate it may take a century for this species to recover in the Northwest Atlantic. It remains imperiled in the Northeast Atlantic and is nearly gone from the Mediterranean.

Scientists are now resolved on the reason this misfortune keeps befalling the Porbeagle. This shark is cursed by a lethal combination: it is commercially valuable but has a low rate of reproduction, with Porbeagle not even reaching mating age until 8 for males and 13 for females. But this shark is not alone. Researchers are now finding that the majority of sharks globally are imperiled. It is because of this lethal combination.

The imperilment of the Porbeagle and other sharks is especially riveting because of what it says about humans, the Porbeagle's only predator. While sharks have endured for hundreds of millions of years, outlasting the dinosaurs and asteroid-strikes, they are having trouble surviving the first century of commercial fishing. The endangerment of sharks speaks to human gluttony and greed – many of these finely crafted creatures are “finned,” with their living bodies then tossed overboard to die lingering deaths, all for the economic value of those fins and to make space onboard for other victims.

The Porbeagle's history also speaks to the refusal of government agencies to take the necessary steps to avoid extinction. The Canadian government recognized in 2004 that this species was endangered, but refused to grant it federal protections under the Species At Risk Act, citing “economic” concerns that ignore the economic foolishness of boom-and-bust fisheries. The U.S. government recognizes that it is a “species of concern,” but hasn't protected it under one of the world's strongest biodiversity protection statutes, the Endangered Species Act (ESA). Repeated attempts to protect it under the Convention on International Trade in Endangered Species have been rejected.

Due to the imperilment of the Porbeagle Shark in the North Atlantic, WildEarth Guardians requests that the National Marine Fisheries Service and U.S. Fish and Wildlife

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Service list the full species or its Northwest Atlantic, Northeast Atlantic, and Mediterranean populations under the U.S. Endangered Species Act (ESA). WildEarth Guardians further requests designation of critical habitat for the Porbeagle.

## Introduction

WildEarth Guardians hereby petitions the Secretary of Commerce, acting through the National Marine Fisheries Service (NMFS) within the National Oceanic and Atmospheric Administration (NOAA), and the Secretary of the Interior, acting through the U.S. Fish and Wildlife Service, to list and thereby protect under the Endangered Species Act (ESA) the Porbeagle Shark, *Lamna nasus* (Bonnaterre, 1788).

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the Porbeagle Shark as endangered on May 1, 2004 but has since declined protecting the shark under the Species at Risk Act (SARA) due to economic concerns (COSEWIC 2004, 2010; NMFS 2010).<sup>1</sup> NMFS designated this shark as a species of concern in the Northwest Atlantic (NMFS 2010). The International Union for Conservation of Nature and Natural Resources (IUCN) lists the Porbeagle Shark as “vulnerable” on its respected Red List and considers several populations either “endangered” or “critically endangered.” By all accounts this species is imperiled.

This shark’s imperilment is part of a concerning pattern of shark endangerment globally (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” – wherein a shark’s fin is cut off but the shark is then discarded overboard to die a lingering death from drowning or starvation. Whether finned or otherwise killed, the Porbeagle Shark is currently quite vulnerable to the threat from fishing, given its low reproduction rate and the depletion of its populations in the North Atlantic and elsewhere.

In light of the Porbeagle Shark’s imperilment, WildEarth Guardians requests listing of this species or select populations under the U.S. Endangered Species Act (ESA). Federal protection will give this shark its best chance of survival. Over 99% of the species listed under the ESA still exist.<sup>2</sup> The ESA is the Porbeagle Shark’s best hedge against extinction.

## Endangered Species Act Implementing Regulations

Section 424 of the regulations implementing the Endangered Species Act (50 C.F.R. § 424) is applicable to this petition. Subsections that concern the formal listing of the Porbeagle Shark as an Endangered or Threatened species are:

424.02(e) “*Endangered species* means a species that is in danger of extinction throughout all or a significant portion of its range.”...(k)  
“species” includes any species or subspecies that interbreeds when mature.  
*See also* 16 U.S.C § 1532(6).

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<sup>1</sup>We attach Campana et al. (1999) and Gibson and Campana (2005). Please note the citation caveat on the first page of both documents. We therefore submit these documents solely for inclusion in the record.

<sup>2</sup>Compare the number of species currently listed under the ESA (1321) with the species that have been delisted due to extinction (9). *See* <http://www.fws.gov/endangered/wildlife.html> [Accessed November 2009].

(m) “*Threatened species* means any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” *See also* 16 U.S.C § 1532(20).

ESA Section 4 (16 U.S.C. § 1533(a)(1)) sets forth listing factors under which a species can qualify for ESA protection (see also 50 C.F.R. § 424.11(c)):

- 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; and
- E. Other natural or manmade factors affecting its continued existence.

At least three factors set forth in 50 C.F.R. § 424.11(c) and in ESA Section 4 (16 U.S.C. § 1533(a)(1)) have resulted in the continued decline of the Porbeagle Shark and are causing the species to face extinction or endangerment in the foreseeable future. This species has declined and continues to decline due to fishing (Factor B); has biological constraints preventing population recovery (Factor E); and is inadequately protected from the threats it faces (Factor D). A taxon needs to meet only one of the listing factors outlined in the ESA to qualify for federal listing.

### **Description of Petitioner**

WildEarth Guardians is a non-profit environmental organization whose mission is to restore wildlife, wild places, and wild rivers in the American West. WildEarth Guardians has over 4,500 members. The organization has an active endangered species protection campaign, with a geographic focus on the western United States (although the organization has a national scope). As part of this campaign, Guardians works to obtain or upgrade ESA protection for a wide variety of imperiled wildlife and plants and the ecosystems on which they depend.

### **Classification and Nomenclature**

**Common Name.** *Lamna nasus* is known by the common names “porbeagle shark” “porbeagle,” “requin-taupe commun,” “marrajo sardinero,” “tiburón sardinero,” or “tintorera” (Stevens et al. 2006). Throughout the petition, we refer to this species as the Porbeagle Shark, Porbeagle, or Shark.

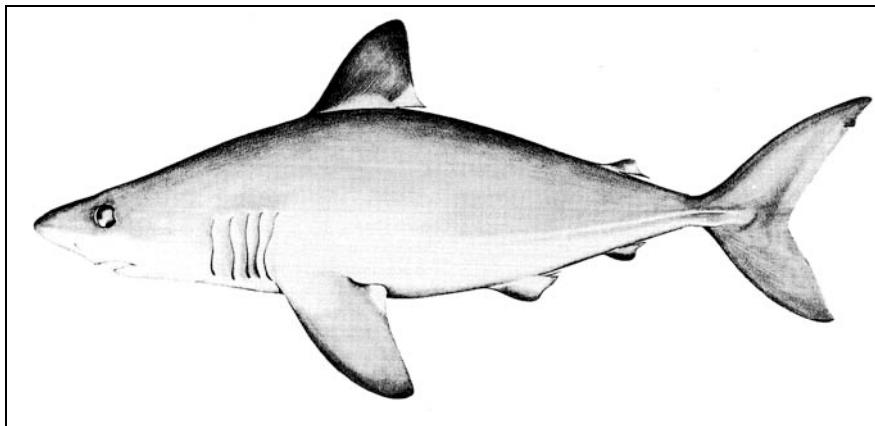
**Taxonomy.** The petitioned species is *Lamna nasus* Bonnaterre 1788. The taxonomic classification for *Lamna nasus* is shown in Table 1.

**Table 1. Taxonomy of *Lamna nasus*.**

Phylum	Chordata
Class	Chondrichthyes
Order	Lamniformes
Family	Lamnidae
Genus	<i>Lamna</i>
Species	<i>Lamna nasus</i>

### Description

The Porbeagle is large, with maximum size approximately 11.6 ft (355 cm). This species' size at maturity is approximately 8 feet (245 cm) for North Atlantic females; 6.4 ft (195 cm) for South Pacific females and North Atlantic males; and 5.4 ft (165 cm) for South Pacific males (Stevens et al. 2006; NMFS 2010). The size of the pups at birth is 2.1-2.6 ft (65-80 cm). *Id.* Its upper side is dark bluish grey and lower side is white (NMFS 2010). They have heavy bodies that are spindle-shaped (COSEWIC 2004) (Figure 1).



**Figure 1: Sketch of Porbeagle Shark.**

Source: M.H. Wagner, US Fish and Wildlife Service.

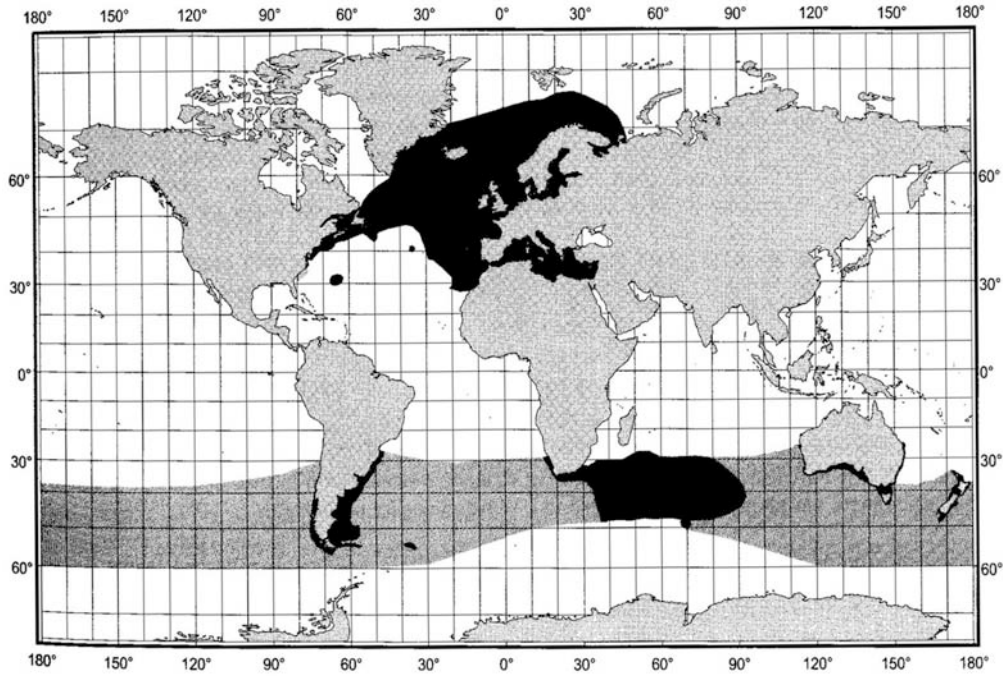
### Distinctive traits

The Porbeagle is distinguished from white sharks by their spiky smooth-edged teeth. The position of their second dorsal fin, found directly over the anal fin, further differentiates them (Collette and Klein-MacPhee 2002, cited in NMFS 2010). The Porbeagle's tooth cusplets and secondary caudal fin keels differentiate it from shortfin mako sharks. *Id.*

### **Geographic Distribution: Historic and Current**

The Porbeagle Shark has a wide range in temperate and cold-temperature waters, including the North Atlantic, and a circumglobal band in the South Pacific, South Indian, South Atlantic, and Antarctic Oceans (Figure 2). However, there is apparently little

interchange between adjacent populations. It occurs in coastal and oceanic areas (Stevens et al. 2006; NMFS 2010). While individual Sharks have been documented to travel from 4-1,005 nautical miles, over 90% of these individuals traveled less than 500 nm from their original location (Kohler et al. 2002; Stevens et al. 2006).

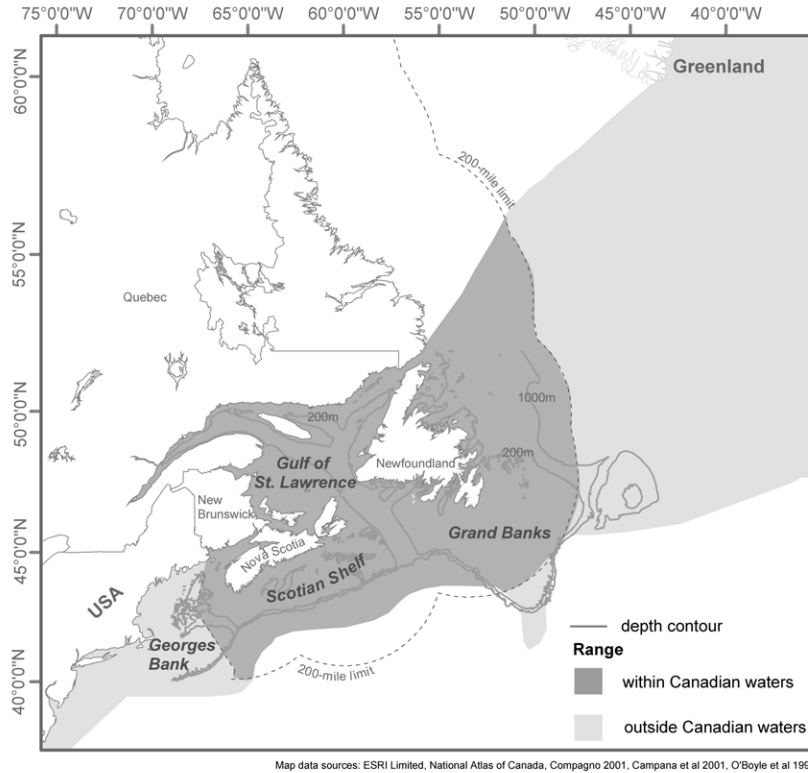


**Figure 2: The Porbeagle Shark's Range.**

Source: United Nations Food and Agriculture Organization.

Within the U.S., it occurs in Maine, Massachusetts, New Jersey, New York, Rhode Island, and South Carolina. Other nations in which it occurs are: Argentina, Australia, Bermuda, Brazil, Canada (Newfoundland, Nova Scotia), Chile, Denmark, France, Germany, Gibraltar, Greenland, Guinea, Ireland, Morocco, Namibia, Portugal, South Africa, Spain, Sweden, United Kingdom, and Uruguay (Stevens et al. 2006).

Porbeagle Sharks in the Northwest Atlantic migrate between Newfoundland and the Gulf of Maine (Campana et al. 1999, Campana and Joyce 2004; Stevens et al. 2006) (Figure 3). The Northwest and Northeast Atlantic populations are distinct (Kohler et al. 2002; Stevens et al. 2006; NMFS 2010). The Northern Hemisphere and Southern Hemisphere populations are likely separated by warm water and thus also distinct (Stevens et al. 2006; NMFS 2010).



**Figure 3: The Porbeagle Shark's Range in the Northwest Atlantic (with focus on Canada).** Source: COSEWIC (2004).

### Habitat Requirements

The Porbeagle Shark inhabits coastal and oceanic areas. Its preferred temperature in the Northwest Atlantic is 41-50°F (5-10°C) (Campana and Joyce 2004; Stevens et al. 2006). The Porbeagle has heat exchangers that allow it to maintain a body temperature 13-18°F (7-10°C) above that of surrounding water (NMFS 2010). While it prefers temperatures of below 64.4°F (18°C), it has also been caught in water temperatures of just 35.6-37.4°F (2-3°C) (Svetlov 1978, cited in Stevens et al. 2006). The species occurs from the surface to depths of 1,000 ft (300 m). They may move to deeper water in winter to avoid the coldest surface temperatures (Collette and Klein-MacPhee 2002, cited in NMFS 2010).

### Life History

This species is long-lived, reaching ages of up to 26 years in fished areas and perhaps as much as 46 years in unfished areas (Stevens et al. 2006).

### Diet

This species eats pelagic and demersal teleost fish, as well as cephalopods (Stevens et al. 2006). In the Gulf of Maine, diet is primarily mackerel, herring, other small fishes, other sharks, and squids (Collette and Klein-MacPhee 2002, cited in NMFS 2010). Joyce et al.



(2002) documented that it feeds opportunistically and recorded 21 species from 20 separate families in the Porbeagle's diet.

### Reproduction & Dispersal

The Porbeagle does not reach sexual maturity until approximately age 8 for males and age 13 for females (Stevens et al. 2006). The average reproductive age is 18 years. Gestation period is 8-9 months. Reproduction is annual, and average litter size is 4 pups (with a range of 1-5). The birthing season in Europe is in spring, in spring or summer in North America, and winter in Australasia. *Id.* They give birth to live young, which are immediately left on their own (NMFS 2010; COSEWIC 2010). After relatively rapid growth in their first year, their growth and maturation rate slow (COSEWIC 2004). The annual rate of population increase is just 0.05-0.07. The reproductive rate of this species is considered to be very low (Stevens et al. 2006; NMFS 2010). *See also* Camhi et al. (1998).

New research is showing strong site fidelity by this species, at least in the Northeast Atlantic (Pade et al. 2009).

### Mortality

The natural mortality rates of *Lamna nasus* are low. Natural mortality rates are 0.10 for immature individuals; 0.15 for mature males; and 0.20 for mature females (COSEWIC 2004; Stevens et al. 2006).

### **Ecology**

Sharks play an important role in oceanic ecosystems as apex predators in the marine food chain. Their removal “may well trigger undesirable consequences for other fishery resources, as well as ecosystem function” (Camhi et al. 1998: 18). *See also* Baum et al. (2003). Given the ecosystem protection purpose of the ESA,<sup>3</sup> it is especially imperative that this likely ecosystem regulator be safeguarded under the Act.

### **Historic and Current Population Status & Trends**

The IUCN describes the species' overall population trend as declining (Stevens et al. 2006). The large, multi-ocean extent of the Porbeagle's range makes range-wide population tracking. Baum et al. (2003) discuss how this is a typical problem for pelagic sharks, but that broad declines are now being documented. All sharks in their study (except makos) in the Northwest Atlantic declined by 50% in an 8-15 year period. *Id.* They state, “serious declining trends in Northwest Atlantic shark abundances may be reflective of a common global phenomenon.” *Id.* at p. 391. Dulvy et al. (2008) likewise

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<sup>3</sup>The ESA states: “The purposes of this Act are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species...” 16 U.S.C. § 1531(b).

found that most sharks are imperiled.

There is conclusive evidence the Northwest and Northeast Atlantic populations of *Lamna nasus* have been depleted due to longline fishing, and the species has nearly vanished from the Mediterranean (Stevens et al. 2006). In the 1960s, after the Northeast Atlantic stock crashed, fishers turned to the Northwest and depleted that fishery within approximately 6 years. Targeted Porbeagle Shark fishing in the Northwest Atlantic in the 1990s then removed approximately 11-17% of biomass. *Id.* The species continues to be depleted in the Northeast Atlantic. While NMFS estimates it will take a century for Porbeagle to rebound in the Northwest Atlantic (NMFS 2010), COSEWIC (2004; 2010) questions whether the decline is reversible.

#### *Northeast Atlantic*

In the 1930s, Norway began targeting Porbeagle with longlines. In 1933, Norwegian landings were at 3,884 t. Post-World War II landings were 6,000 t by Norwegians in 1947. There was a subsequent decline, to 1,200-1,900 t from 1953-1960. Both Norwegian and Danish fleets shifted to the Northwest Atlantic because of this decline. Subsequently, Norwegian landings in the Northeast Atlantic were 160-300 t per year in the early 1970s and 10-40 t annually in the late 1980s and early 1990s. Danish landings declined from more than 1,500 t in the early 1950s to fewer than 100t in the 1990s (DFO 2001a & Gauld 1989, cited in Stevens et al. 2006). French and Portuguese fishing fleets have also reported declines, as have historically important fisheries around the UK and the North Sea (Stevens et al. 2006). UK and North Sea landings of Porbeagle have declined to very low levels in the past 30-40 years. *Id.* See also Camhi et al. (1998).

#### *Mediterranean*

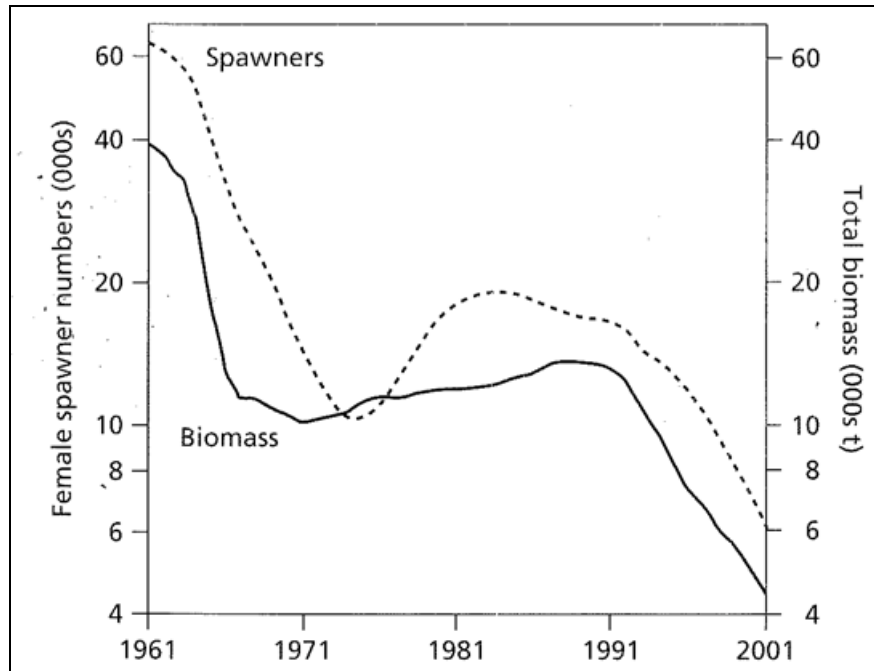
The species may be nearly extirpated from this area, although recent documentation of young individuals suggests that it may serve as a nursery. However, it is targeted by fishers, as *Lamna nasus* is a popular big game fishing species in some areas within the Mediterranean (Stevens et al. 2006).

#### *Northwest Atlantic*

After depleting the Northeast Atlantic population, Norwegians shifted to the Northwest. Targeted fishing began in this area in 1961, off the coasts of New England and Newfoundland. Landings were 1,900 t in 1961, swelling to over 9,000 t in 1964. But the frenzy was short-lived: by 1965, many fishers switched to other targets because of population declines. In 1970, fewer than 1,000 t were landed. With the establishment of Canada's Exclusive Economic Zone (EEZ) in 1995, Norwegians and other foreign fleets were excluded. The species is currently targeted by Canadian longliners, almost exclusively (DFO 2001a, cited in Stevens et al. 2006), but NMFS (2010) indicates that Japanese fishing vessels may also be focusing on the species in this area.

After the 1960s fishery collapse, it took decades before there was even partial recovery. Three Canadian longliners targeted the population in 1994. Landings of 1,000-2,000 t annually in the 1990s then reduced the population to a new low, with the average size and catch rates the smallest ever in 1999 and 2000. By 2000, the biomass was estimated to be 11-17% of virgin biomass (COSEWIC 2004, 2010; Stevens et al. 2006). Write Stevens et al. 2006: “The current porbeagle population is seriously depleted and will require a greatly reduced fishing mortality if recovery is to occur...” Over the past four decades, beginning with the target fishery in 1961, the Porbeagle has declined by 90% in this region (NMFS 2010; COSEWIC 2010).

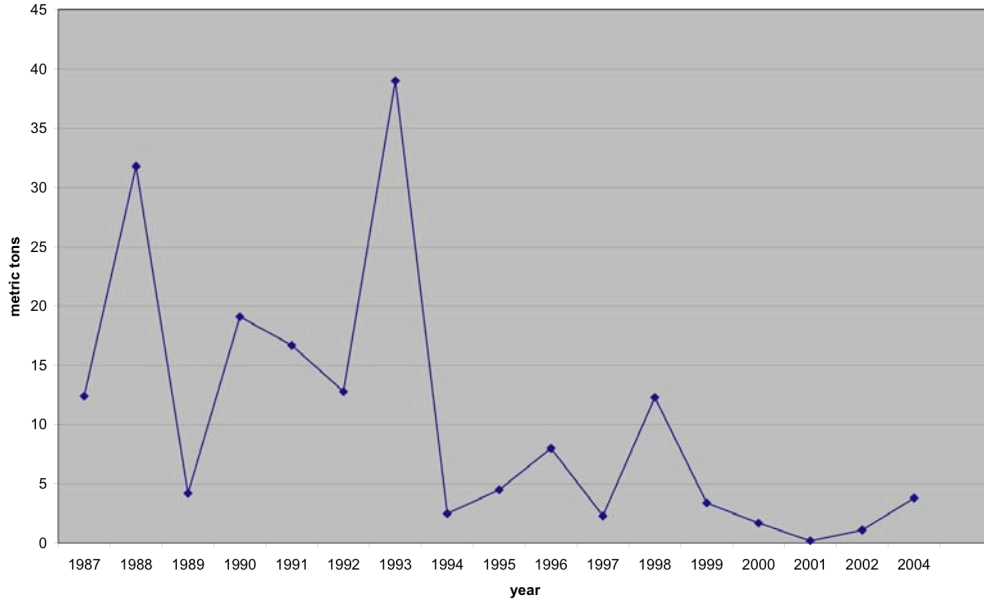
Campana et al. (2008) demonstrate the collapse of the Northwest Atlantic population in the 1960s and again in the 1990s (Figure 4); Campana et al. (2002) describe the loss of 90% of the sexually mature population as a result of fishing. COSEWIC (2004: 34) described the population as “at a record low.” COSEWIC (2010) further states, “There is nothing at this time to indicate that the decline of the Porbeagle Shark has ceased. In fact, it is not even certain that these declines are reversible.”



**Figure 4: Time trends in Porbeagle Biomass and Female Spawner Abundance.**

Source: Campana et al. (2008).

NMFS data on commercial landings indicate a decline in the species within the U.S. (Figure 5).



**Figure 5: Porbeagle Commercial Landings in the United States, 1987-2004.**  
Source: NMFS (2010).

### *Southern Hemisphere*

There is a general lack of information on the species in the southern hemisphere. However, in this region the Porbeagle may be a significant victim of bycatch from longline fishers. The Uruguayan longline fleet in the Southwest Atlantic reports over 90% declines in Porbeagle Shark landings (Stevens et al. 2006). Moreover, Dulvy et al. (1998) indicate that stocks in the southern hemisphere may be even more vulnerable to depletion than in the north due to even slower growth rates.

### **Qualification as Distinct Population Segment**

Substantial evidence suggests that the Northwest Atlantic, Northeast Atlantic, and Mediterranean populations of the Porbeagle Shark qualify as Distinct Population Segments (DPS's) under the ESA. The ESA specifies that a DPS can only be designated for vertebrates (16 U.S.C. § 1532(16)). In 1996, NMFS (and the U.S. Fish and Wildlife Service) established a set of guiding principles<sup>4</sup> for defining a DPS. 61 FR 4722. To qualify as a DPS, a population must be discrete from other populations of the species and significant to the species:

*Discreteness:* 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

<sup>4</sup>The Services describe the policy as “non-regulatory in nature” (61 FR 4722 at p. 4723) and “guiding principles” (*Id.* at p. 4725), and they therefore should be considered policy guidance, rather than regulation.

evidence of this separation.

2. It is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act.

*Significance:* 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...that the authority to list DPS's be used...“sparingly” while encouraging the conservation of genetic diversity. In carrying out this examination, the Services will consider 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.

*Id.* at p. 4725. Notably, the policy does not require absolute reproductive isolation nor does it require genetic evidence of differentiation.

**Discreteness:** NMFS considers the Northeast and Northwest Atlantic populations to be distinct from each other (NMFS 2010; *see also* Kohler et al. 2002; COSEWIC 2004, 2010). Furthermore, the northern and southern hemisphere populations are distinct and isolated (NMFS 2010).

**Significance:** the loss of the Northeast or Northwest Atlantic populations, and/or the Mediterranean population would result in a significant gap in the range of the taxon. Moreover, the Porbeagle is the only representative of its genus in the North Atlantic (COSEWIC 2004).

After meeting the discreteness and significance tests, the final question is whether these DPSs warrant ESA protection. We outlined evidence earlier in this petition that the Northwest Atlantic, Northeast Atlantic, and Mediterranean populations have declined drastically from historic levels. Further, as we demonstrate below, these populations meet at least three ESA listing factors (even though they need only meet one), and therefore warrant protection as a Threatened or Endangered DPS under the ESA.

Why protect these populations? In its 1996 DPS policy, FWS provided a compelling reason:

Listing, delisting, or reclassifying distinct vertebrate population segments may allow the Services to protect and conserve species and the ecosystems upon which they depend before largescale decline occurs that would necessitate listing a species or subspecies throughout its entire range. This may allow protection and recovery of declining organisms in a more timely and less costly manner, and on a smaller scale than the more costly and extensive efforts that might be needed to recover an entire species or subspecies. The Services' ability to address local issues (without the need to list, recover, and consult rangewide) will result in a more effective program.

61 FR 4722 at p. 4725. All of the threats discussed below apply at both the DPS and full species level. While range-wide declines cannot be shown at present, that is likely due to a lack of data, rather than a lack of threats.

Our petition presents NMFS with the opportunity to take swift action to protect the Porbeagle Shark. We believe this species warrants listing as a full species across its range, as it is considered “endangered” or “critically endangered” by the IUCN in a significant portion of its range, and is ranked “vulnerable” rangewide. In the alternative, we request listing for the Northwest Atlantic, Northeast Atlantic, and Mediterranean populations. Otherwise, we will all but ensure costly measures that may come too late for this remarkable shark.

#### **Identified Threats to the Petitioned Species: Criteria for Listing**

The Porbeagle Shark meets at least three of the criteria for listing under the ESA (bolded):

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

Historic and continued overfishing of this commercially valuable shark is a threat (Factor B). The failure of the U.S., Canadian, or other national governments to protect this species, along with the lack of international protection under the Convention on Trade in International Species (CITES), constitute inadequate regulatory mechanisms (Factor D). The biological constraints of the Porbeagle Shark include its low reproduction rate, which hinders its ability to recover from historic and continued overutilization (Factor E).

## **I. Present and Threatened Destruction, Modification, or Curtailment of Habitat or Range.**

Habitat loss and degradation is not known to be a threat to this species, but NMFS should analyze it fully during a status review. Camhi et al. (1998) discuss the alarming rate at which coastal habitat is being destroyed, including in the United States. An additional threat may be the bio-accumulation of pollutants, given that this species is a top predator and long-lived. *Id.*

## **II. Overutilization for commercial, recreational, scientific, or educational purposes**

The primary threat to the Porbeagle Shark is historic and continued overfishing (e.g., COSEWIC 2004, 2010; Stevens et al. 2006; NMFS 2010). Its low rate of reproduction (discussed under Listing Factor E) and high commercial value makes it particularly susceptible to depletion from fishers. It is threatened by target and bycatch fishing; longline and handline fishers; gill nets and driftnets; and pelagic and bottom trawls. If caught as bycatch, its meat – or at least its fins – will likely be exploited. The collapse of Northeast Atlantic Porbeagle stocks caused Norwegian and Danish longliners to shift to the Northwest Atlantic. *Id.*

A study by Dulvy et al. (2008) found that the majority of pelagic sharks and rays are imperiled. These researchers specifically discussed the overfishing on Porbeagle and their biological difficulties in recovering:

The higher threat status of the porbeagle is a result of intense fisheries in the North Atlantic and Mediterranean Sea since the early 1960s (Campana et al., 2002; Cavanagh and Gibson, 2007). Over-exploitation and collapse of porbeagle populations in the North-east Atlantic in the 1960s led to intensive directed and largely unregulated fishing in the North-west Atlantic, where most of the virgin biomass was removed in just six years. Porbeagles continued to be taken as bycatch in the Mediterranean and targeted in the North-east Atlantic even from depleted populations, whereas the North-west Atlantic population was able to begin rebuilding after fisheries collapsed. In the 1990s, renewed target fishing in the North-west Atlantic led to another population decline to 11–17% of virgin biomass (Campana et al., 2002). Age- and sex-structured life-history models project that this population will most likely require 70–100 years to recover to maximum sustainable yield [BMSY] (Gibson and Campana, 2005). Little is known of porbeagle shark population trends in the remainder of its range (i.e. the Southern Hemisphere), where they are also taken primarily as bycatch in the pelagic and demersal longline fisheries. However, the even slower growth rates and greater longevity of this stock (Francis et al., 2007) indicate that it is biologically more vulnerable to over-exploitation than the depleted North Atlantic stocks.<sup>5</sup>

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<sup>5</sup>See p. 470.

NMFS likewise estimates it may take 100 years for the Northwest Atlantic Porbeagle stock to rebuild (NMFS 2010). COSEWIC (2004, 2010) questions whether recovery is even possible.

There contains to be a high commercial demand for the Porbeagle Shark. Camhi et al. (1998: 7) state, “the porbeagle remains one of the highest-value food fishes landed in northern Europe and is still sought-after where it occurs.” COSEWIC (2004) likewise notes that Porbeagle are the target of the only directed commercial shark fishery in the Canadian Atlantic; its meat “is one of the most highly valued shark meats”; and Canadians export its meat to Europe (especially Italy) and also to the U.S. Fowler et al. (2004) further discuss trade in Porbeagle meat between members of the European Union.



**Figure 6: Both Target Fishing and Bycatch Threaten the Porbeagle Shark.**  
Photo by NOAA.

Porbeagle are used for their meat, fins, hides, and livers. *Id.* NMFS considers fishing a threat to the Northwest Atlantic population of the Porbeagle (NMFS 2010).

### **III. Disease or Predation**

Disease or predation is not known to be a threat to this species, but NMFS should analyze it fully during a status review. States COSEWIC (2010): “other than man, this species has no known predators.”

### **IV. The inadequacy of existing regulatory mechanisms**

The Porbeagle Shark is not adequately protected by federal, state, or international laws or policies to prevent its endangerment or extinction.



### *Scientific Rankings*

IUCN ranks the Porbeagle Shark as “Vulnerable,” defined as “considered to be facing a high risk of extinction in the wild.”<sup>6</sup> The Northwest Atlantic population is ranked as “Endangered,” (Stevens et al. 2006b) defined as “considered to be facing a very high risk of extinction in the wild.”<sup>7</sup> The Northeast Atlantic and Mediterranean populations are ranked as “Critically Endangered,” (Stevens et al. 2006c, 2006d), defined as “considered to be facing an extremely high risk of extinction in the wild.”<sup>8</sup> Although these designations are important for flagging the extinction risk to this shark, they confer no regulatory protections.

With the release of Dulvy et al.’s 2008 study that the majority of pelagic sharks and rays are imperiled (discussed above), IUCN representatives were outspoken about the continued lack of adequate protections for sharks, including the Porbeagle:

“The traditional view of oceanic sharks and rays as fast and powerful too often leads to a misperception that they are resilient to fishing pressure,” says Sonja Fordham, co-author of the paper and Deputy Chair of the IUCN SSC Shark Specialist Group (SSG). “Despite mounting evidence of decline and increasing threats to these species, there are no international catch limits for oceanic sharks. Our research shows that action is urgently needed on a global level if these fisheries are to be sustainable.”

“Fishery managers and regional, national and international officials have a real obligation to improve this situation,” says lead author Nicholas Dulvy, who is based at Simon Fraser University, Vancouver. “We are losing species at a rate 10 to 100 times greater than historic extinction rates. Humans are making increasing use of ocean resources so many more aquatic species, particularly sharks, are coming under threat. But it doesn’t have to be like this. With sufficient public support and resulting political will, we can turn the tide.” (IUCN 2008)

From these observations and documented declines, it is clear that regulatory mechanisms are currently inadequate to protect the Porbeagle Shark.

### *United States*

NMFS ranks the Porbeagle Shark as a Species of Concern in the Northwest Atlantic (NMFS 2010). According to NMFS,

Species of Concern are those species about which NOAA's National Marine Fisheries Service (NMFS) has some concerns regarding status and

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<sup>6</sup>See <http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria#categories> [Accessed November 2009].

<sup>7</sup>*Id.*

<sup>8</sup>*Id.*

threats, but for which insufficient information is available to indicate a need to list the species under the Endangered Species Act (ESA). We wish to draw proactive attention and conservation action to these species. “Species of concern” status does not carry any procedural or substantive protections under the ESA.<sup>9</sup>

The species therefore lacks federal protection in the U.S. Stevens et al. (2006) wrote that, “The current porbeagle population is seriously depleted and will require a greatly reduced fishing mortality if recovery is to occur,” yet the U.S. continues to allow a quota in its EEZ, of 92 t, which is higher than reported landings (NMFS 2010). This quota therefore confers no regulatory protections. While other restrictions exist, none are specific to the Porbeagle. *Id.*

Indeed, Camhi et al. (1998: 20) note the difficulties in regulating shark fisheries, particularly in the U.S.:

The fact that virtually no commercial shark fishery in the United States has been managed sustainably, despite considerable investments in shark fishery research and management, emphasises the extreme vulnerability of shark populations to overfishing.

#### *Canada*

COSEWIC recommended in 2004 that the Porbeagle be designated as endangered under the SARA. However, in 2006, the government declined, citing economic expense (NMFS 2010).

Canada allowed a quota of 250 t from 2002-2007 to allow recovery. However, both COSEWIC (2004) and Stevens et al. (2006) indicate that this level of exploitation may still be too high:

...even this amount now corresponds to a high exploitation rate because of the low population abundance. It is highly uncertain if this quota reduction will be sufficient to halt the porbeagle decline, and if so, to what extent the population will recover...

*See* COSEWIC 2004: vii; *see also* Stevens et al. 2006; Campana et al. 2002.

This high exploitation rate in Canada is particularly concerning given that COSEWIC (2004: v) stated that, within the Northwest Atlantic, “most of the area of occupancy is within Canadian waters.” In addition, NMFS (2010) indicated that Japanese vessels operating just outside the Canadian EEZ may be taking substantial Porbeagle catches.

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<sup>9</sup>See <http://www.nmfs.noaa.gov/pr/species/concern/#list> [Accessed January 2010].

*Northeast Atlantic*

The quotas in this region are set higher than the total landings and therefore provide no protection to the species. State Stevens et al. (2006):

The status of the largely unmanaged, unmonitored Northeast Atlantic stock is likely worse than the seriously depleted Northwest stock, with stringent conservation and management action (fisheries closure and stock assessment) needed urgently to enable stocks to rebuild to levels where sustainable commercial and recreational fisheries are possible.

*International*

Multiple attempts – in 2004 and again in 2007 – to list the Porbeagle under CITES have failed (NMFS 2010). This was despite recognition that,

The unsustainable porbeagle fisheries described above have been driven by the high value of the meat in national and international markets. Trade has therefore been the driving force behind depletion of populations in the North Atlantic and may potentially threaten southern hemisphere populations. (Fowler et al. 2004: 15)

State COSEWIC (2004: vii): “There are no management measures in place pertaining to porbeagle for fisheries in international waters.” Pade et al. (2009) note the need for international protections (e.g., the Bonn Convention; Convention for the Conservation of Migratory Species of Wild Animals) given that individual Porbeagle sometimes cross national boundaries in the Northeast Atlantic. Transnational migration is known to be the case for the species in the Northwest Atlantic (e.g., migrating between the U.S. and Canada). Pade et al. (2009) also found strong site fidelity by this shark and recommend particular protections where the species aggregates.

**V. Other natural or manmade factors affecting its continued existence**

*Biological Vulnerability.* As discussed above, the Porbeagle Shark has a very low rate of reproduction. It has a long gestation period; reproduces annually; and has delayed maturity. Given that it is targeted by fishers and killed even when taken as bycatch, this species is in particular peril due to its low recruitment rate (*see*, especially, COSEWIC 2004; NMFS 2010). Dulvy et al. (2003) discuss the correlation between body size and extinction risk, with larger animals at increased risk. This relationship may exist because larger animals are targeted and because of correlation of large size with additional factors, such as low population increase rates, late maturity, dependence on more vulnerable habitats, and behavior that may make them more catchable. *Id.* As a large fish (reaching as much as 11 ft), the Porbeagle is vulnerable to extinction. *See also* Camhi et al. (1998).

In addition, historic and continued fishing has resulted in population depression or possible extirpation in portions of its range (e.g., Mediterranean). The Northwest and Northeast Atlantic populations are isolated from each other, and the southern and northern hemisphere populations don't intermix. The resultant isolation and small population sizes may increase the likelihood of regional and global extinction.<sup>10</sup>

The U.S. Fish and Wildlife Service (FWS) has recognized this threat for other species. For the Langford's tree snail (*Partula langfordi*), the Service states:

Even if the threats responsible for the decline of this species were controlled, the persistence of existing populations is hampered by the limited number of known individuals of this species. This circumstance makes the species more vulnerable to extinction due to a variety of natural processes. Small populations are particularly vulnerable to reduced reproductive vigor caused by inbreeding depression, and they may suffer a loss of genetic variability over time due to random genetic drift, resulting in decreased evolutionary potential and ability to cope with environmental change (Lande 1988; Pimm et al. 1988; Center for Conservation Update 1994; Mangel and Tier 1994).<sup>11</sup>

FWS here relies on citations not specific to *Partula langfordi* that indicate the threat to survival presented by limited population numbers even without other known threats. This agency likewise notes for a snail called Sisi (*Ostodes strigatus*), "Even if the threats responsible for the decline of this species were controlled, the persistence of existing populations is hampered by the small number of extant populations and the small geographic range of the known populations."<sup>12</sup> NMFS should similarly analyze whether population size and isolation are a threat to the Porbeagle Shark or may become a threat in the foreseeable future.

NMFS considers the Porbeagle's low rate of reproduction and population isolation as threats to the Northwest Atlantic population. The agency calls the species "fundamentally unproductive" (NMFS 2010, citing Campana et al. 2002).

*Cumulative Impacts.* Most scientists recognize that the Porbeagle Shark is threatened by multiple threats. The overutilization pressure, combined with low reproduction rate and late maturity, and population isolation should be considered a cumulative threat to this species. NMFS should assess the synergistic effects of multiple factors in its status review for this species.

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<sup>10</sup>See, e.g., Service candidate assessment forms for *Doryopteris takeuchii*, *Huperzia stemmermanniae*, *Megalagrion nesiotis*, *Melicope degeneri*, *Melicope hiiakae*, *Myrsine mezii*, *Ostodes strigatus*, *Partula langfordi*, *Peperomia subpetiolata*, *Phyllostegia bracteata*, and *Tryonia circumstriata*. Accessible via FWS website at <http://www.fws.gov/endangered/wildlife.html> [Accessed November 2009].

<sup>11</sup>See 2009 Listing Form for *Partula langfordi* at: [http://ecos.fws.gov/docs/candforms\\_pdf/r1/G0AI\\_I01.pdf](http://ecos.fws.gov/docs/candforms_pdf/r1/G0AI_I01.pdf) [Accessed November 2009] at p. 5.

<sup>12</sup>See 2009 Listing Form for *Ostodes strigatus* at: [http://ecos.fws.gov/docs/candforms\\_pdf/r1/G0A5\\_I01.pdf](http://ecos.fws.gov/docs/candforms_pdf/r1/G0A5_I01.pdf) [Accessed November 2009] at p. 4.

### **Value of ESA Listing**

The Porbeagle Shark occurs in U.S. as well as foreign waters. Federal listing of this species under the ESA would help ensure (for example):

- Adequate habitat protections, restrictions on take, recovery planning, and funding for this species in U.S. waters;
- Prohibition on take of this species within U.S. waters;
- Prohibition on import, export, or possession of this species by U.S. individuals and corporations; and
- Consultation by U.S. agencies on federal permitting or funding of activities by U.S. and foreign entities that may jeopardize this species.

Moreover, NOAA has previously recognized that ESA protections for Elkhorn (*Acropora palmata*) and Staghorn Coral (*A. cervicornis*) would benefit these species even though the majority of their ranges existing in other countries: through the recovery planning process, the U.S. can encourage international conservation measures (Clarke et al. 2008). Similar logic applies to the Porbeagle Shark.

### **Summary**

The Porbeagle Shark merits listing as an Endangered or Threatened species under the Endangered Species Act, either as a full species or under multiple Distinct Population Segments. The species and DPS's face threats from historic and continued overfishing, as well as a low reproduction rate, which hinders its recovery. It does not enjoy regulatory protections sufficient to address the threats it faces.

The Porbeagle Shark's range is extensive, occurring in the Atlantic, South Indian, Antarctic, and South Pacific Oceans. However, in the Northwest Atlantic, Northeast Atlantic, and Mediterranean, this shark's population is especially imperiled: this constitutes a significant portion of its range, and the full species therefore deserves listing. This petition is submitted with the hope that federal protection will be granted and will prevent this species' extinction. We believe ESA listing is vital to preserving and recovering the Porbeagle Shark.

### **Requested Designation**

WildEarth Guardians hereby petitions the National Marine Fisheries Service within the U.S. Department of Commerce and the U.S. Fish and Wildlife Service within the Department of Interior to list the Porbeagle Shark (*Lamna nasus*) as a full species, or its Northwest Atlantic, Northeast Atlantic, and Mediterranean DPSs, as Endangered or Threatened species pursuant to the Endangered Species Act. This listing action is warranted, given the threats this species faces, as well as its extreme decline in numbers. The Porbeagle Shark is threatened by at least three listing factors: overutilization; the inadequacy of existing regulatory mechanisms; and other natural or manmade factors

affecting its continued existence. ESA listing will permit the development of protective regulations outside the scope of its present designation by NMFS as a species of concern.

**Critical habitat**

Petitioner requests that critical habitat be designated for this species concurrent with final ESA listing.

## References

- Baum, J.K., Myers, R.A., Kehler, D.G., Worm, B., Harley, S.J. and P.A. Doherty. 2003. Collapse and conservation of shark populations in the Northwest Atlantic. *Science* 299: 389-392. Online at: [http://myweb.dal.ca/bworm/Baum\\_etal\\_2003.pdf](http://myweb.dal.ca/bworm/Baum_etal_2003.pdf) [Accessed January 2010]. [Attachment 1]
- Camhi, M., Fowler, S.L., Musick, J.A., Bräutigam, A. and Fordham, S.V. 1998. Sharks and their Relatives – Ecology and Conservation. IUCN/SSC Shark Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK. iv + 39 pp. Online at: <http://data.iucn.org/dbtw-wpd/edocs/SSC-OP-020.pdf> [Accessed January 2010]. [Attachment 2]
- Campana, S., Marks, L., Joyce, W., Hurley, P., Showell, M. and Kulka, D. 1999. An analytical assessment of the porbeagle shark (*Lamna nasus*) population in the northwest Atlantic. CSAS. Res Doc.99/158. Online at: [http://www.marinebiodiversity.ca/shark/english/document/res%20doc%2099\\_158e.pdf](http://www.marinebiodiversity.ca/shark/english/document/res%20doc%2099_158e.pdf) [Accessed January 2010]. [Attachment 3]
- Campana, S.E. and Joyce, W.N. 2004. Temperature and depth associations of porbeagle shark (*Lamna nasus*) in the northwest Atlantic. *Fish. Oceanogr.* 13: 52–64. Online at: <http://www.marinebiodiversity.ca/shark/english/document/porbeagle%20temperature.pdf> [Accessed January 2010]. [Attachment 4]
- Campana, S.E., Joyce, W., Marks, L., Hurley, P., Natanson, L.J., Kohler, N.E., Jensen, C.F., Mello, J.J., Pratt Jr., H.L., Myklevoll, S. and Harley, S. 2008. The rise and fall (again) of the porbeagle shark population in the Northwest Atlantic. Pp. 445-461. In *Sharks of the Open Ocean: Biology, Fisheries and Conservation*. Eds. M.D. Camhi, E.K. Pikitch, and E.A. Babcock. Blackwell Publishing, Oxford, UK. Online at: <http://www.marinebiodiversity.ca/shark/english/document/Campana%20et%20al%202008%20Chapter%2035.pdf> [Accessed January 2010]. [Attachment 5]
- Campana, S.E., Joyce, W., Marks, L., Natanson, L.J., Kohler, N.E., Jensen, C.F., Mello, J.J., Pratt Jr., H.L. and Myklevoll, S. 2002. Population dynamics of the porbeagle in the Northwest Atlantic Ocean. *North. Am. J. Fish. Management* 22: 106–121. Online at: <http://na.nefsc.noaa.gov/sharks/refpdfs/Campana%20et%20al%202002b.pdf> [Accessed January 2010]. [Attachment 6]
- Clarke, A., Battista, T., Dieveney, B., Gledhill, D., Gombos, M., Jeffrey, C., Koss, J., Leberer, T., Loper, C., Liu, G., Miller, J., Moore, J., Morgan, J., Simpson, S., Waddell, J., and D. Wusinich-Mendez. 2008. National level activities to support US and FAS coral conservation. Pp. 11-28. In: J.E. Waddell and A.M. Clarke (eds.), *The State of Coral Reef Ecosystems of the United States and Pacific Freely Associated States: 2008*. NOAA Technical Memorandum NOS NCCOS 73. NOAA/NCCOS Center for Coastal Monitoring and Assessment's Biogeography Team. Silver Spring, MD. 569 pp. Online at: <http://ccma.nos.noaa.gov/stateofthereefs> [Accessed November 2009].

COSEWIC. 2004. COSEWIC assessment and status report on the porbeagle shark *Lamna nasus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. viii + 43 pp. Online at: [www.sararegistry.gc.ca/status/status\\_e.cfm](http://www.sararegistry.gc.ca/status/status_e.cfm) [Accessed January 2010]. [Attachment 7]

COSEWIC. 2010. Species Profile, *Lamna nasus*. Online at: [http://www.sararegistry.gc.ca/species/speciesDetails\\_e.cfm?sid=810#photo](http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=810#photo) [Accessed January 2010]. [Attachment 8]

Dulvy, N.K., Baum, J.K., Clarke, S., Compagno, L.J.V., Cortes, E., Domingo, A., Fordham, S., Fowler, S., Francis, M.P., Gibson, C., Martinez, J., Music, J.A., Soldo, A., Stevens, J.D. and S. Valenti. 2008. You can swim but you can't hide: the global status and conservation of oceanic pelagic sharks and rays. *Aquatic Conservation: Marine and Freshwater Ecosystems* 18: 459-482. Online at [http://www.dulvy.com/publications/2008/Dulvy\\_et\\_al\\_2008\\_AC\\_pub.pdf](http://www.dulvy.com/publications/2008/Dulvy_et_al_2008_AC_pub.pdf) [Accessed January 2010]. [Attachment 9]

Dulvy, N., Sadovy, Y., and J. Reynolds. 2003. Extinction vulnerability in marine populations. *Fish and Fisheries* 4: 25-64. Online at: [http://www.botany.hawaii.edu/faculty/cunningham/CunninghamCourse/Dulvy\\_et\\_al\\_FF\\_03.pdf](http://www.botany.hawaii.edu/faculty/cunningham/CunninghamCourse/Dulvy_et_al_FF_03.pdf) [Accessed November 2009] [Attachment 10]

Fowler, S., Raymakers, C., and U. Grimm. 2004. Trade in and conservation of two shark species, Porbeagle (*Lamna nasus*) and Spiny Dogfish (*Squalus acanthias*). Bundesamt für Naturschutz (BfN)/Federal Agency for Nature Conservation. Online at <http://www.vliz.be/imisdocs/publications/100231.pdf> [Accessed January 2010]. [Attachment 11]

Gibson, A.J.F. and S. Campana. 2005. Status and Recovery Potential of Porbeagle Shark in the Northwest Atlantic. Fisheries and Oceans Canada, Research Document 2005/053. Online at: [http://www.marinebiodiversity.ca/shark/english/document/Gibson%20and%20Campana%20RES2005\\_053\\_e.pdf](http://www.marinebiodiversity.ca/shark/english/document/Gibson%20and%20Campana%20RES2005_053_e.pdf) [Accessed January 2010]. [Attachment 12]

IUCN. 2008. You can swim but you can't hide - more oceanic sharks on the IUCN Red List. Press Release, dated May 22, 2008. Online at: [http://www.lenfestocean.org/newsroom/IUCN\\_PR\\_Pelagic\\_Sharks.pdf](http://www.lenfestocean.org/newsroom/IUCN_PR_Pelagic_Sharks.pdf) [Accessed January 2010]. [Attachment 13]

Joyce, W., Campana, S.E., Natanson, L.J., Kohler, N.E., Pratt, H.L. and Jensen, C.F. 2002. Analysis of stomach contents of the porbeagle shark (*Lamna nasus*) in the northwest Atlantic. *ICES J. Mar. Sci.* 59: 1263–1269. <http://icesjms.oxfordjournals.org/cgi/reprint/59/6/1263> [Accessed January 2010]. [Attachment 14]



Kohler, N.E., Turner, P.A., Hoey, J.J., Natanson, L.J. and Briggs, R. 2002. Tag and recapture data for three pelagic shark species, blue shark (*Prionace glauca*), shortfin mako (*Isurus oxyrinchus*), and porbeagle (*Lamna nasus*) in the North Atlantic Ocean. ICCAT Collective Volume of Scientific Papers SCRS/2001/064 1231–1260.

[http://www.iccat.int/Documents/CVSP/CV054\\_2002/no\\_4/CV054041231.pdf](http://www.iccat.int/Documents/CVSP/CV054_2002/no_4/CV054041231.pdf)

[Accessed January 2010]. [Attachment 15]

National Marine Fisheries Service. 2010. Species of Concern Account for Porbeagle (*Lamna nasus*). Online at:

[http://www.nmfs.noaa.gov/pr/pdfs/species/porbeagleshark\\_detailed.pdf](http://www.nmfs.noaa.gov/pr/pdfs/species/porbeagleshark_detailed.pdf)

[Accessed January 2010]. [Attachment 16]

Pade, N.G., Queiroz, N., Humphries, N.E., Witt, M.J., Jones, C.S., Noble, L.R. and D.W. Sims. 2009. First results from satellite-linked archival tagging of porbeagle shark, *Lamna nasus*: area fidelity, wider-scale movements and plasticity in diel depth changes. *Journal of Experimental Marine Biology and Ecology* 370: 64-74. Online at:

[http://www.mba.ac.uk/simslab/publica/pade\\_et\\_al2009.pdf](http://www.mba.ac.uk/simslab/publica/pade_et_al2009.pdf) [Accessed January 2010].

[Attachment 17]

Stevens, J., Fowler, S.L., Soldo, A., McCord, M., Baum, J., Acuña, E., Domingo, A. & Francis, M. 2006a. *Lamna nasus*. In: IUCN 2009. IUCN Red List of Threatened Species. Version 2009.2. <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 19 January 2010. Online at:

<http://www.iucnredlist.org/apps/redlist/details/11200/0>. [Attachment 18]

Stevens, J., Fowler, S.L., Soldo, A., McCord, M., Baum, J., Acuña, E. & Domingo, A. 2006b. *Lamna nasus* (*Northwest Atlantic subpopulation*). In: IUCN 2009. IUCN Red List of Threatened Species. Version 2009.2. <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 19 January 2010. Online at:

<http://www.iucnredlist.org/apps/redlist/details/39344/0>

[Attachment 19].

Stevens, J., Fowler, S.L., Soldo, A., McCord, M., Baum, J., Acuña, E. & Domingo, A. 2006c. *Lamna nasus* (*Northeast Atlantic subpopulation*). In: IUCN 2009. IUCN Red List of Threatened Species. Version 2009.2. <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 19 January 2010. Online at:

<http://www.iucnredlist.org/apps/redlist/details/39343/0>

[Attachment 20].

Stevens, J., Fowler, S.L., Soldo, A., McCord, M., Baum, J., Acuña, E. & Domingo, A. 2006d. *Lamna nasus* (*Mediterranean subpopulation*). In: IUCN 2009. IUCN Red List of Threatened Species. Version 2009.2. <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 19 January 2010. Online at:

<http://www.iucnredlist.org/apps/redlist/details/61420/0>.

[Attachment 21]