PETITION TO LIST
EIGHTY-ONE MARINE SPECIES
UNDER THE ENDANGERED SPECIES ACT

Photo: Stuart Wilcox 2012

Submitted to the U.S. Secretary of Commerce, Acting Through the National Marine Fisheries Service, an Agency Within the National Oceanic and Atmospheric Administration

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July 8, 2013

WILDEARTH GUARDIANS
A FORCE FOR NATURE

PETITION INTRODUCTION

WildEarth Guardians requests that the Secretary of Commerce ("Secretary"), acting through the National Marine Fisheries Service ("NMFS"), an agency within the National Oceanic and Atmospheric Administration ("NOAA"), list the seventy-five petitioned species and subspecies rangewide and/or in any distinct population segments ("DPSs") that NMFS concludes exists as "threatened" or "endangered," and to list the six petitioned subpopulations of vertebrate species as "threatened" or "endangered" DPSs, under the U.S. Endangered Species Act ("ESA") (16 U.S.C. §§ 1531-1544). The ESA defines species, subspecies, and DPSs as species for ESA listing purposes and therefore the term species will be used interchangeably with these terms throughout this petition. See 16 U.S.C. § 1532(16). Guardians details each subpopulation's qualifications as a DPS below: therefore "DPS" and "subpopulation" are used interchangeably throughout this petition as well. Petitioners also request critical habitat designation for these species and subpopulations in waters under U.S. jurisdiction where appropriate. Guardians incorporates this introductory section in its entirety into each species and subpopulation account that follows.

The seventy-five marine species and subspecies and six marine subpopulations petitioned for listing under the ESA are as follows:

Acropora roseni
Acropora suharsonoi
Aipysurus apraefrontalis
Aipysurus foliosquama
Aipysurus fuscus
Alveopora excelsa
Alveopora minuta
Arctocephalus galapagoensis
Argyrosomus hololepidotus
Azurina eupalama
Bathyraja griseocauda
Cantharellus noumeae
Carcharhinus borneensis
Carcharhinus hemiodon
Carcharias taurus (Southwest Atlantic Subpopulation)
Centrophorus harrissoni
Cephalorhynchus hectori
Cetorhinus maximus (North Pacific Subpopulation)
Cetorhinus maximus (Northeast Atlantic Subpopulation)
Chaetodontoplus vanderloosi
Colpichthys hubbsi
Ctenella chagius
Dasyatis margarita
Electrolux addisoni
Enneapterygius namarrgon
Eptatretus octatrema
Halichoeres socialis
Haploblepharus kistnasamyi
Hemitriakis leucoperiptera
Holohalaelurus favus
Holohalaelurus punctatus
Hydnophora bonsai
Isogomphodon oxyrhynchus
Isopora togianensis
Lamiopsis temmincki
Latimeria chalumnae
Lithophyllon ranjithi
Lobophyllia serratus
Millepora boschmai
Millepora striata
Montipora setosa
Mustelus fasciatus
Mustelus schmitti
Mycteroperca fusca
Mycteroperca jordani
Myxine paucidens
Okamejei pita

Paraclinus magdalenae
Paraclinus walkeri
Paralabrax albomaculatus
Paramyxine taiwanae
Parasimplastrea sheppardi
Pastinachus solocirostris
Pectinia maxima
Phocoena phocoena (Baltic Sea Subpopulation)
Pocillopora fungiformis
Porites desilveri
Porites eridani
Porites ornata
Pterapogon kauderni
Raja undulata
Rhinobatos cemiculus
Rhinobatos rhinobatos
Rhinobatos horkelii
Rhizopsammia wellingtoni
Scarus trispinosus
Siderastrea glynni
Sousa chinensis (eastern Taiwan Strait Subpopulation)
Squatina aculeate
Squatina argentina
Squatina formosa
Squatina guggenheim
Squatina oculata
Squatina punctata
Squatina squatina
Stylophora madagascarensis
Tomicodon abuelorum
Triakis acutipinna
Trygonorrhina melaleuca
Tubastraea floreana
Tursiops truncatus (Fiordland Subpopulation)

The International Union for Conservation of Nature ("IUCN")[1] lists all of the species and subpopulations included in this Petition as "endangered" or "critically endangered."[2] The IUCN's "endangered" assessment means that the species or subpopulation is facing threats to its existence that create a "very high risk of extinction in the wild."[3] The IUCN's "critically endangered" assessment indicates that the IUCN

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[1] The IUCN is the world's oldest and largest global environmental network and has become a leading authority on the environment. See IUCN Undated 2, Exhibit 182 at 1. It is a neutral, democratic membership union with more than 1,200 government and non-governmental organization ("NGO") members, and almost 11,000 volunteer scientists and experts in more than 160 countries. Id. Its work is supported by over 1,000 professional staff in 45 offices and hundreds of partners in public, NGO, and private sectors around the world. Id. Through these exhaustive efforts, the IUCN's Red List of Threatened Species has become the "definitive international standard for species extinction risk." Id.

[2] WildEarth Guardians hereby incorporates all citations and references contained in the IUCN's Species Reports for the seventy-five petitioned marine species and six petitioned subpopulations (Exhibits 1-23, 48-61, 67, 90-97, 100-134, 185) into this Petition by reference. If the Secretary does not have access to any of the incorporated citations or references contained in the IUCN Species Reports (Exhibits 1-23, 48-61, 67, 90-97, 100-134, 185) please contact Guardians and copies will be provided upon request. Guardians presently believes the Secretary has ready access to this incorporated material.

[3] IUCN Undated, Exhibit 38 at 17-20; see also IUCN (Acropora roseni) 2012, Exhibit 1 at 3; IUCN (Acropora suharsonoi) 2012, Exhibit 2 at 3; IUCN (Alveopora excelsa) 2012, Exhibit 3 at 3; IUCN (Alveopora minuta) 2012, Exhibit 4 at 3; IUCN (Cantharellus noumeae) 2012, Exhibit 5 at 3; IUCN (Ctenella chagius) 2012, Exhibit 6 at 3; IUCN (Hydnophora bonsai) 2012, Exhibit 7 at 3; IUCN (Isopora togianensis) 2012, Exhibit 8 at 3; IUCN (Lithophyllon ranjithi) 2012, Exhibit 9 at 3; IUCN (Lobophyllia serratus) 2012, Exhibit 10 at 3; IUCN (Millepora striata) 2012, Exhibit 12 at 3; IUCN (Montipora setosa) 2012, Exhibit 13 at 3; IUCN (Parasimplastrea sheppardi) 2012, Exhibit 14 at 3; IUCN (Pectinia maxima) 2012, Exhibit 15 at 3; IUCN (Pocillopora fungiformis) 2012, Exhibit 16 at 3; IUCN (Porites desilveri) 2012, Exhibit 17 at 3; IUCN (Porites eridani) 2012, Exhibit 18 at 3; IUCN (Porites ornata) 2012, Exhibit 19 at 3; IUCN (Stylophora madagascarensis) 2012, Exhibit 22 at 3; IUCN (Argyrosomus hololepidotus) 2012, Exhibit 48 at 3; IUCN (Chaetodontoplus vanderloosi) 2012, Exhibit 50 at 3; IUCN (Colpichthys hubbsi) 2012, Exhibit 51 at 3; IUCN (Enneapterygius namarrgon) 2012, Exhibit 52 at 3; IUCN (Mycteroperca

believes the "critically endangered" species or subpopulation faces even greater risks than "endangered" species and that these risks present "an extremely high risk of extinction in the wild."[4] This is the highest level of extinction risk, short of extinct in the wild. See generally IUCN Undated, Exhibit 38 § 4. The threats driving these species and subpopulations to the edge of extinction are similar among categories of species. Accordingly, it appears efficient for the Secretary to examine these individual species and subpopulation accounts together as this Petition requests. Immediate protection of all seventy-five petitioned species and six petitioned subpopulations under the ESA is both warranted and necessary to ensure the survival of these "endangered" and "critically endangered" species and subpopulations.

"To the maximum extent practicable," the Secretary must issue an initial finding as to whether this Petition "presents substantial scientific or commercial information indicating that the petitioned action may be warranted" within 90 days of receipt. 16 U.S.C. § 1533(b)(3)(A). Through this Petition, WildEarth Guardians need not demonstrate conclusively that the listing of the seventy-five petitioned species and six subpopulations is warranted; rather, this Petition need only present information demonstrating that such listing *may be* warranted. Id. There can be no reasonable dispute that the available information, in particular the IUCN's scientific assessment that each of

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fusca) 2012, Exhibit 54 at 3; IUCN (Mycteroperca jordani) 2012, Exhibit 55 at 3; IUCN (Paraclinus magdalenae) 2012, Exhibit 56 at 3; IUCN (Paralabrax albomaculatus) 2012, Exhibit 58 at 3; IUCN (Pterapogon kauderni) 2012, Exhibit 59 at 4; IUCN (Scarus trispinosus) 2012, Exhibit 60 at 3; IUCN (Tomicodon abuelorum) 2012, Exhibit 61 at 3; IUCN (Arctocephalus galapagoensis) 2012, Exhibit 90 at 3; IUCN (Cephalorhynchus hectori) 2012, Exhibit 91 at 3; IUCN (Myxine paucidens) 2012, Exhibit 96 at 3; IUCN (Paramyxine taiwanae) 2012, Exhibit 97 at 3; IUCN (Bathyraja griseocauda) 2012, Exhibit 100 at 3; IUCN (Dasyatis margarita) 2012, Exhibit 101 at 3; IUCN (Pastinachus solocirostris) 2012, Exhibit 104 at 3; IUCN (Raja undulata) 2012, Exhibit 105 at 3; IUCN (Rhinobatos cemiculus) 2012, Exhibit 106 at 3; IUCN (Rhinobatos rhinobatos) 2012, Exhibit 108 at 3; IUCN (Trygonorrhina melaleuca) 2012, Exhibit 109 at 3; IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 3; IUCN (Carcharhinus borneensis) 2012, Exhibit 113 at 3; IUCN (Cetorhinus maximus (North Pacific Subpopulation)) 2012, Exhibit 117 at 3; IUCN (Cetorhinus maximus (Northeast Atlantic Subpopulation)) 2012, Exhibit 118 at 3; IUCN (Hemitriakis leucoperiptera) 2012, Exhibit 120 at 3; IUCN (Holohalaelurus favus) 2012, Exhibit 121 at 3; IUCN (Holohalaelurus punctatus) 2012, Exhibit 122 at 3; IUCN (Lamiopsis temmincki) 2012, Exhibit 124 at 3; IUCN (Mustelus schmitti) 2012, Exhibit 126 at 3; IUCN (Squatina argentina) 2012, Exhibit 128 at 3; IUCN (Squatina formosa) 2012, Exhibit 129 at 3; IUCN (Squatina guggenheim) 2012, Exhibit 130 at 3; IUCN (Squatina punctata) 2012, Exhibit 132 at 3; IUCN (Triakis acutipinna) 2012, Exhibit 134 at 3.

[4] IUCN Undated, Exhibit 38 at 14-17; see also IUCN (Millepora boschmai) 2012, Exhibit 11 at 3; IUCN (Rhizopsammia wellingtoni) 2012, Exhibit 20 at 3; IUCN (Siderastrea glynni) 2012, Exhibit 21 at 3; IUCN (Tubastraea floreana) 2012, Exhibit 23 at 3; IUCN (Azurina eupalama) 2012, Exhibit 49 at 3; IUCN (Halichoeres socialis) 2012, Exhibit 53 at 3; IUCN (Latimeria chalumnae) 2012, Exhibit 67 at 3; IUCN (Paraclinus walkeri) 2012, Exhibit 57 at 3; IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 3; IUCN (Sousa chinensis (eastern Taiwan Strait Subpopulation)) 2012, Exhibit 94 at 3; IUCN (Tursiops truncatus (Fiordland Subpopulation)) 2012, Exhibit 95 at 4; IUCN (Electrolux addisoni) 2012, Exhibit 102 at 3; IUCN (Okamejei pita) 2012, Exhibit 103 at 3; IUCN (Rhinobatos horkelii) 2012, Exhibit 107 at 3; IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 3; IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 3; IUCN (Carcharhinus hemiodon) 2012, Exhibit 114 at 3; IUCN (Carcharias taurus (Southwest Atlantic Subpopulation)) 2012, Exhibit 115 at 3; IUCN (Centrophorus harrissoni) 2012, Exhibit 116 at 3; IUCN (Haploblepharus kistnasamyi) 2012, Exhibit 119 at 3; IUCN (Isogomphodon oxyrhynchus) 2012, Exhibit 123 at 3; IUCN (Mustelus fasciatus) 2012, Exhibit 125 at 3; IUCN (Squatina aculeata) 2012, Exhibit 127 at 3; IUCN (Squatina oculata) 2012, Exhibit 131 at 3; IUCN (Squatina squatina) 2012, Exhibit 133 at 3; IUCN (Eptatretus octatrema) 2012, Exhibit 185 at 3.

the petitioned species and subpopulations is either "endangered" or "critically endangered" (Exhibits 1-23, 48-61, 67, 90-97, 100-134, 185), indicates that listing of the species and subpopulations as either "threatened" or "endangered" *may be* warranted. Accordingly, it is entirely "practicable" for the Secretary to make a positive 90-day finding on this Petition within 90-days and to promptly commence status reviews of the seventy-five species and six subpopulations as required by 16 U.S.C. § 1533(b)(3)(B).

PETITIONERS

WildEarth Guardians is a nonprofit environmental advocacy organization that works to protect endangered and threatened species throughout the world. The organization has more than 14,000 members throughout the United States and in several foreign countries. It is currently focusing on protecting marine species as part of its Wild Oceans campaign.

ENDANGERED SPECIES ACT

Congress enacted the ESA to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, [and] to provide a program for the conservation of such endangered species and threatened species . . . " 16 U.S.C. § 1531(b). Section 3 of the ESA (16 U.S.C. § 1532) defines key terms in the Act. Those relevant to this petition include:

1. "The term 'species' includes any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." Id. § 1532(16).

2. "The term 'endangered species' means any species which is in danger of extinction throughout all or a significant portion of its range . . . " Id. § 1532(6).

3. "The term 'threatened species' means any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." Id. § 1532(20).

CRITERIA FOR LISTING

Section 4 of the ESA sets forth five listing criteria under which a species can qualify for listing as "threatened" or "endangered":

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.

Id. § 1533(a)(1).

In considering these criteria, the Secretary must use only "the best available scientific and commercial information regarding a species' status, without reference to possible economic or other impacts of such determination." 50 C.F.R. § 424.11(b) (2012). A taxon need only meet one of the listing criteria outlined in the ESA to qualify for federal listing. 16 U.S.C. 1533(a)(1). If the Secretary determines that a species warrants listing as "endangered" or "threatened" under the ESA, and the species occurs or could be recovered within the United States or its waters, he or she is obligated to consider designating critical habitat for that species based on the best scientific data available. 16 U.S.C. § 1533(b)(2).

CRITERIA FOR LISTING A DPS

NMFS and Fish and Wildlife Service ("FWS")[5] have jointly published a policy document defining the statutory term "distinct population segment." 61 Fed. Reg. 4,722 (Feb. 7, 1996). 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. 4,722, 4,725. 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.

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

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

4(a)(1)(D)[6] of the Act.

Id.

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.

Id.

Although these guidelines are not regulations and serve only as policy guidance for the agencies, they have been upheld as a reasonable interpretation of ambiguous statutory language. See id. at 4,723; Maine v. Norton, 257 F. Supp. 2d 357 (D. Me. 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 that is eligible for listing.

Species and subpopulation accounts for the seventy-five petitioned species and six petitioned subpopulations are split into general categories under the titles "A. Corals," "B. Fish," "C. Hagfish," "D. Mammals," "E. Rays and Skates," "F. Sea Snakes," and "G. Sharks" to aid in discussion of common threats and to increase the efficiency of the Secretary's review.

[6] 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 criteria, "the inadequacy of existing regulatory mechanisms."

THE OBAMA ADMINISTRATION'S POLICY OF INCREASING PROTECTION OF MARINE ENVIRONMENTS

Recent advances in knowledge and understanding have helped to create a situation wherein decisionmakers can proceed to help stop the threats faced by ocean species. For example, the Census of Marine Life was completed in 2010. COML 2010, Exhibit 183 at 2. This was a ten-year international research program, which brought together 2,700 scientists to "establish a baseline of the diversity, distribution, and abundance of life in the ocean, against which future change can be measured." Id. "While the Census discovered that ocean life is richer than imagined, it also found the ocean is more connected and more impacted than previously thought." Id. at 4. "The Census . . . confirmed that, excluding microbes, approximately 250,000 valid marine species have been formally described in the scientific literature. Scientists estimated at least 750,000 more species remain to be described." Id. It found that, "[i]n the ocean, a small number of types dominate and thousands of low-abundance populations account for most of the observed diversity. Changes in this highly diverse 'rare biosphere' may have profound impacts on the Earth's ecosystems." Id. It also found that, "[b]iodiversity is under greatest threat in the enclosed seas and areas with high population density such as the Mediterranean, Gulf of Mexico, Baltic, Caribbean, and China's continental shelf. Marine industries and land based pollutants are creating ever greater impacts on the health of ocean ecosystems, direct exploitation is reaching deeper depths, sectoral uses are overlapping [], and passive dispersion and accumulation are contaminating all ocean realms []." Id. "The good news is that recovery is possible if action is taken. Where conservation efforts were implemented, populations of some species . . . recovered. In contrast to rapid depletion, however, recovery tends to be slow." Id. "In the coastal environment, researchers documented that the fastest path to recovery was achieved by mitigating the cumulative impacts of human activities. Seventy-eight percent of documented recoveries occurred, for example, when at least two human activities, such as resource exploitation, habitat destruction, and pollution, were reduced. Likewise, for top predators, recovery was noted for seals, whales, birds, and some bottom dwelling fish, such as flounder and sole, when actions were taken to protect their numbers." Id. at 6. The species and subpopulations petitioned here for inclusion on the list of threatened and endangered species are part of this "rare biosphere" and often occur in enclosed seas and areas with high human population density. As such, they are at an extremely high risk of extinction. However, their recovery is possible if conservation measures are implemented quickly and aggressively. This quick and aggressive conservation is the policy of the United States and should be accomplished by the Secretary through protection of the species under the ESA.

On July 22, 2010 President Barack Obama released Executive Order 13,547 entitled "Stewardship of the Ocean, Our Coasts, and the Great Lakes." Exec. Order No. 13,547, 75 Fed. Reg. 43,023 (July 22, 2010). This executive order stated that it is the policy of the United States to "protect, maintain, and restore the health and biological diversity of ocean, coastal, and Great Lakes ecosystems and resources" and to "use the best available science and knowledge to inform decisions affecting the ocean, our coasts, and the Great Lakes, and enhance humanity's capacity to understand, respond, and adapt to a changing global environment." Id. § 2(a)(i), (iv). As to this section, the President said that:

> All executive departments, agencies, and offices that are members of the Council and any other executive department, agency, or office whose actions affect the ocean, our coasts, and the Great Lakes shall, to the fullest extent consistent with applicable law[] take such action as necessary to implement the policy set forth in section 2 of this order and the stewardship principles and national priority objectives as set forth in the Final Recommendations and subsequent guidance from the Council.

Id. § 6(a).

Both the Secretary of Commerce and the Undersecretary of Commerce for Oceans and Atmosphere (the NOAA Administrator) are members of the Council, and, even if they were not, NOAA, NMFS, and the Department of Commerce are undoubtedly "executive department[s], agenc[ies], or office[s] whose actions affect the ocean, our coasts, and the Great Lakes." See id.; see also id. § 4(b)(ii) (discussing members of the Council). As a result, the Secretary is required to abide by the policy set forth in this executive order, namely he or she must "protect, maintain, and restore the health and biological diversity of ocean . . ." See id. § 2(a)(i). The Secretary is to "use the best available science and knowledge to inform decisions affecting the ocean, our coasts, and the Great Lakes, and enhance humanity's capacity to understand, respond, and adapt to a changing global environment." See id. § 2(a)(iv). One clear way for the Secretary to comply with this obligation is to use his or her authority under the ESA to protect marine biodiversity.

The IUCN is the world's oldest and largest global environmental network and has become a leading authority on the environment. See IUCN Undated 2, Exhibit 182 at 1. It is a neutral, democratic membership union with more than 1,200 government and NGO members, and almost 11,000 volunteer scientists and experts in more than 160 countries. Id. Its work is supported by over 1,000 professional staff in 45 offices and hundreds of partners in public, NGO, and private sectors around the world. Id. Through its exhaustive efforts, the IUCN's Red List of Threatened Species has become the "definitive international standard for species extinction risk." Id. However, inclusion on this list carries with it no legal protections. For the species on this list to be offered the protection they so desperately need in order to avoid extinction, the actions of governmental or international entities are required. This is what Guardians seeks to accomplish with this petition: to take the determinations of the IUCN, explain its reasoning in coming to its determinations, apply this information to the relevant concerns represented in the ESA, and to request that the Secretary list these species and subpopulations as endangered or threatened species and distinct population segments respectively. The IUCN has used the best available science in its evaluations that all of the petitioned species and subpopulations are "endangered" or "critically endangered." By using the IUCN's determinations and research in this way, the Secretary's ESA review will experience vast improvements in efficiency without which there is seemingly no way to avoid the extinction crisis currently plaguing the oceans.

The dire threats to the health of the oceans and marine species are clearly understood by the President and those threats were included in the policy decisions that led to Executive Order 13,547. President Obama created the Interagency Ocean Policy Task Force on June 12, 2009 and charged it with "developing recommendations to enhance our ability to maintain healthy, resilient, and sustainable ocean, coasts, and Great Lakes resources for the benefit of present and future generations." Task Force 2010, Exhibit 184 at 1. The President stated that Executive Order 13,547 "adopts the recommendations of the Interagency Ocean Policy Task Force, except where otherwise provided in this order, and directs executive agencies to implement those recommendations under the guidance of a National Ocean Council." Exec. Order No. 13,547 § 1. On July 19, 2010 the Task Force released its final recommendations. It said that:

> Despite the critical importance of these areas to our health and well-being, the ocean, coasts and Great Lakes face a wide range of threats from human activities. Overfishing, pollution, coastal development and the impacts of climate change are altering ecosystems, reducing biological diversity, and placing more stress on wildlife and natural resources, as well as on people and coastal communities. Compounding these threats, human uses of the ocean, coasts, and Great Lakes are expanding at a rate that challenges our ability to plan and manage significant and often competing demands. Demands for energy development, shipping, aquaculture, emerging security requirements and other new and existing uses are expected to grow.

Id. at 1-2. The Task Force went on to say that "[w]hile we commonly refer to different oceans (Atlantic, Pacific, Arctic, etc.), it is important to recognize that all of these bodies of water are connected and influenced by each other. These linkages require our Nation to recognize that we benefit from and affect one global ocean." Id. at 11. It recognized that "[m]arine ecosystems house biological diversity exceeding that found in the world's rain forests." Id. at 12. It stated that "[d]ecision-making will [] be guided by a precautionary approach as reflected in the Rio Declaration of 1992, which states in pertinent part, '[w]here there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.'" Id. at 16. It stated that use of the precautionary approach "is consistent with and essential for improved stewardship. Moreover, the United States has already affirmed this exact wording in the 1992 Rio Declaration on Environment and Development." Id. at C-III – IV. It recognized that "ocean acidification is expected to have significant and largely negative impacts on the marine food web, ocean ecosystems as a whole, and biological diversity in general." Id. at 36. Furthermore, "[t]he Task Force is unanimous in its call for the Nation to set a new course for improved stewardship of the ocean, our coasts, and the Great Lakes." Id. at 77.

Therefore, the Task Force, and President Obama through Executive Order 13,547, have recognized the extreme threats to the ocean biodiversity and the need to combat those threats wherever they occur. They have recognized the need to follow the "precautionary approach" when dealing with threats to the oceans and the need to set a new course for improved stewardship of the ocean . . ." In considering this Petition, the Secretary should follow this direction from the President by recognizing the weight of the science, listing the petitioned species and subpopulations under the ESA, and thus provide them with the protection that they need in order to stop their slide towards extinction.

References for "The Obama Administration's Policy of Increasing Protection of Marine Environments":

Exec. Order No. 13,547, 75 Fed. Reg. 43,023 (July 22, 2010).

International Union for Conservation of Nature ("IUCN") ("IUCN Undated 2"). Undated. About IUCN. IUCN. Online at: www.iucn.org/about/ [Accessed April 9, 2013] [Exhibit 182].

Williams, M., H. Mannix, K. Yarincik, P. Miloslavish, D.T. Crist ("COML 2011"). 2011. Scientific Results to Support the Sustainable Use and Conservation of Marine Life: A Summary of the Census of Marine Life for Decision Makers. CENSUS OF MARINE LIFE. Online at: http://www.coml.org/comlfiles/policy/ENGLISH_Policy_Report_reduced.pdf [Accessed April 1, 2013] [Exhibit 183].

Interagency Ocean Policy Task Force ("Task Force 2010"). 2010. Final Recommendations of the Interagency Ocean Policy Task Force July 19, 2010. WHITE HOUSE COUNCIL ON ENVIRONMENTAL QUALITY. Online at: http://www.whitehouse.gov/files/documents/OPTF_FinalRecs.pdf [Accessed January 14, 2013] [Exhibit 184].

A. CORALS

CORALS INTRODUCTION

Corals and coral reefs are severely threatened by a variety of impacts, many stemming from, or intensified by, anthropogenic climate change. "The individual coral animals, known as polyps, have a tubular body and central mouth ringed by stinging tentacles, which can capture food. Living within their body tissues are microscopic algae (zooxanthellae) that need sunlight to survive. These algae convert sunlight into sugars, which produces energy to help sustain their coral hosts. These same algae also provide the corals with their vibrant colors." WRI 2012, Exhibit 24 at 7. The reefs formed by these tiny animals are among the most biologically rich and productive ecosystems on earth. Id. at 5. Though they cover less than one tenth of one percent of the marine environment, they are home to an amazing 25 percent of all known marine species. Id. at 6. These incredible areas of intensely focused biodiversity are built by the actions of many tiny individual corals living in colonies and depositing their communal limestone skeletons. Id. at 7. Over thousands of years these combined skeletons form vast reef systems that are home to corals and innumerable other species of flora and fauna. See id. at 7. The deaths of these corals will bring about the deaths of the reefs that depend on them. See Hoegh-Guldberg 2006, Exhibit 25 at 3.

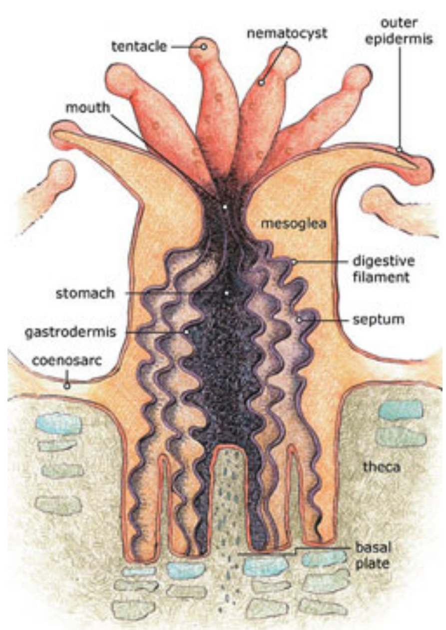

Figure 1: Anatomy of a Coral Polyp
Source: NOAA

To survive, corals need bright, warm, clear waters within their tolerances. See WRI 2012, Exhibit 24 at 7. Unfortunately, corals are fragile creatures that face a variety of threats to their survival. As a result of these threats, corals have experienced shocking declines all over the world. According to WRI, "more than 60 percent of the world's reefs are under immediate threat from one or more local sources," "almost 40 percent of coral reefs have experienced water temperatures warm enough to induce severe coral bleaching" since 1998, and in Southeast Asia (where many important reefs are located) 95 percent of reefs are threatened. Id. at 12. WildEarth Guardians is petitioning the Secretary to list 23 corals from IUCN's lists of "endangered" and "critically endangered" species (Species Accounts 1-23) under the ESA. This section will begin with a consideration of various common threats to corals and then will examine each petitioned species and the threats they face individually. The "Corals Introduction" section is to be considered as incorporated by reference in all of the individual coral species accounts that follow.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

To begin with a stark statement, "UN scientists are predicting that coral reefs around the world, can disappear by the end of the century" due to climate change. Freeport News 2012, Exhibit 26 at 1. This would make coral reefs the first entire ecosystem destroyed by humans. Id. This threat is palpable as an estimated 20 percent of the world's reefs have already been lost in the last several decades. Id. at 2. The point that "[c]orals are, quite obviously, central to coral reef ecosystems" cannot be overstated. See Hoegh-Guldberg 2006, Exhibit 25 at 3. Therefore, many of the threats to coral reef habitat are also threats to corals themselves, and vice versa. Without their coral architects and builders, reefs will not be replaced when they are damaged by storms, harvested by humans, or otherwise damaged or removed. Without sufficient corals able to complete their reef building activities effectively, the loss of this habitat will be complete over time. Corals are being lost in great numbers to a variety of threats. The negative effect on reef building due to scarcity of individuals and continuing population decline is compounded as ocean acidification makes reef building difficult and potentially even impossible in the future.

Given that corals and the reefs they build and maintain are inextricably linked, threats to one generally equal a threat to both. These threats include removal of both living and dead coral for economic reasons such as mining for construction and calcium and harvesting for jewelry, curios, marine aquaria, and medical uses.[7] Corals are also incidentally harmed by human activities including dynamite fishing, chemical fishing, and human recreation and tourism activities. Id. Corals are subject to coral disease, which can eliminate healthy corals making rebuilding of damaged reefs impossible.[8] Likewise, unnaturally heavy predation by the crown-of-thorns starfish can render large areas of coral barren, leading to reef building stagnation.[9] Human population growth and anthropogenic climate change will continue to cause and exacerbate many threats to reefs.[10] Bleaching and sedimentation will also increase stress on corals, killing many and

[7] See "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," infra.
[8] See "Disease or Predation (Criterion C): Coral Diseases," infra.
[9] See "Disease or Predation (Criterion C): Predation by Crown-of-Thorns Starfish," infra.
[10] See "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Human Population Growth," infra; "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Anthropogenic Climate Change," infra.

hampering reef building activities.[11] Ocean acidification threatens to halt reef building entirely if the pH of the ocean becomes too low for corals to form the calcite skeletons that form reefs, making repair and replacement of damaged or removed reef material impossible.[12] Finally, the synergistic effects of these multiple threats to coral habitat may have a larger combined effect than would be expected from their additive impact alone.[13]

While it is possible that at least some corals could survive the loss of reefs as obscure invertebrates, many others will likely become "extinct, and the others are going to be very, very rare." Freeport News 2012, Exhibit 26 at 1, 2. This rarity and vulnerability increases the likelihood of extinction for even those rare survivor corals in the absence of reefs. Therefore, the impending loss of corals' coral reef habitat increases these species' risk of extinction.

Human Population Growth and Resultant Pollution. As the human population continues to grow, most, if not all, of the threats to corals will become more severe. In its recent Status Review Report, NMFS said that:

> The common root or driver of most, possibly all, [] threats [to corals] is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. The combination of increasing numbers of humans and their persistently rising per capita resource demands are directly responsible for escalating atmospheric CO_2 buildup and associated impacts, both direct (e.g., ocean warming, ocean acidification, and sea-level rise) and indirect (influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of coastal sediments by changing precipitation patterns or sea-level rise). Increased human population and consumption of natural resources are also root causes for increases in fishing (particularly of herbivores) at many locations around the globe, for massive inputs of nutrients (eutrophication), toxic pollutants, and sediments into many coastal waters, and for the spread of invasive species.

Status Review Report, Exhibit 40 at 19. NMFS also said that "[t]rends in human population size and resource demands, []are the ultimate drivers of both global and local threats [to corals]." Id. Therefore, NMFS recognizes that human population growth is the main deciding factor in the likelihood of coral reef extinction. NMFS also recognizes that human population is continuing to grow. NMFS' own recent Status Review Report put the total number of people by 2045-2050 at around 9 billion, and cited one source putting

[11] See "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Bleaching," infra; "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Sedimentation," infra.
[12] See "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Ocean Acidification," infra.
[13] See "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Synergistic Effects," infra.

that total at an even larger 10.6 billion. Id. at 20 (citations omitted). Therefore, NMFS recognizes that the human population will grow and that this growth will increase the pressures pushing corals towards extinction.

While the general human population has a substantial negative effect on coral populations, human populations located near the coasts have an even stronger negative impact. See id. at 19. This is very problematic because, worldwide, approximately 2.5 billion people already live within just **100 km** of the coastline. See WRI 2011, Exhibit 41 at 21. By 2020, an astonishing 75% of the expanded human population is expected to live within just **60 km** of the coastline. Knip et al. 2010, Exhibit 42 at 2 (citation omitted). This increasing concentration of people near the coasts means that the negative effect of the general population increase recognized by NMFS will be compounded.

Impacts from population growth do not occur evenly. Increased economic growth in coastal cities is a major cause of ocean habitat destruction. With growth comes an increase in consumption and development. This is reflected in an increase in construction projects, some of which occur on reef communities; dredging of harbors and shipping channels; dumping of waste, run-off pollution and increased sedimentation; deforestation; and increased tourism. As a result of these factors, the coasts around virtually all urban areas are "beset by a pattern of pollution and over-development." Hinrichsen Undated, Exhibit 43 at 2. "Coastal urban areas dump increasing loads of toxic wastes into the sea. In fact, waters around many coastal cities have turned into virtual cesspools, so thick with pollution that virtually no marine life can survive." Id. at 4.

This urban pollution is contributing to increasing "dead zones," amongst other things. These dead zones are areas where dissolved oxygen content is so low that no marine life, apart from microorganisms, can survive. A 2007 study identified 200 of these dead zones, which represents an increase of 51 such zones found just four years earlier. Id. at 5. Worse yet, these dead zones are not only becoming more numerous, they are also greatly expanding "due mainly to high nutrient pollution levels brought in by rivers and streams and washed off coastal land." Id. One striking example is that the Gulf of Mexico dead zone, the world's second largest, has now reached the size of the state of New Jersey at 21,000 square kilometers. Id. These dead zones are known to result in proliferation of macroalgae that can degrade and destry coral reefs. See Joyce 2000, Exhibit 192 at 121, 122.

To make matter worse for corals, climate change is expected to further magnify coastal pollution problems. For example, "[d]ue to water circulation and oceanic volume changes, estuarine and coastal systems are predicted to experience . . . increased eutrophication, hypoxia, and anoxia." Roessig et al. 2004, Exhibit 29 at 258 (citations omitted). "More intense rains wash more fertilizer and sewage into coastal waters, and this runoff triggers algal blooms and consequent poisoning of fish and humans." Id. at 269 (citation omitted).

Coral reefs have already been exhibiting significant levels of deterioration due to anthropogenic impacts, and scientists believe that upwards of 70% of tropical and semi-tropical coral reefs, areas representing much of the range of the species Guardians are petitioning, may be lost within the next 40 years. See Hinrichsen Undated, Exhibit 43 at 2; Compagno 2002, Exhibit 44 at 204. A current, shocking example of this decline is the Caribbean, which had already experienced a four-fifths disappearance in coral reefs by 2003. See Hinrichsen Undated, Exhibit 43 at 2; Compagno 2002, Exhibit 44 at 204. As human populations continue to grow and require more resources, humans will exert further pressures on corals and significantly reduce the likelihood of their continued existence.

Sedimentation. At least two petitioned species are located in areas that are heavily impacted by either deforestation or mining activities, leading to increased sedimentation and overall habitat degradation. See Status Review Report, Exhibit 40 at 53; IUCN (Cantharellus noumeae) 2012, Exhibit 6 at 4, 5 (mining sedimentation); IUCN (Lithophyllon ranjithi) 2012, Exhibit 9 at 4, 5 (deforestation sedimentation). However, the other petitioned species also face more generalized terrestrial sedimentation risks as well. See, e.g., IUCN (Hydnophora bonsai) 2012, Exhibit 7 at 5. "There are two basic types of sediments that influence coral reefs: those that are terrestrially derived and those that are generated in situ through erosion and the skeletal material of calcifying organisms," such as corals and mollusks. Status Review Report, Exhibit 40 at 53. "Terrestrial sediments are[] likely to have greater impacts than marine sediments because of their physical and chemical characteristics." Id. For example, terrestrial sediments tend to be darker in color than marine sediments, and consequently terrestrial sediments reduce light more effectively than marine sediments when suspended in the water. Id. Terrestrial sediments are also often associated with harmful organic compounds, heavy metals, and harmful bacteria. Id.

"The most common direct effect of sediment is deposition on the coral surface, as sediment settles out from the water column." Id. Corals "can actively displace sediment using ciliary action or mucus production." Id. And while "[s]ome coral species can tolerate complete burial for several days . . . [i]f the corals are unsuccessful in removing the sediments, they can become smothered and die." Id. Sedimentation has been shown to have a greater impact on smaller coral colonies, often causing total mortality of the colony. Id.

Sedimentation also can induce "sublethal" effects in coral such as cellular and structural disruptions, reduced tissue thickness, polyp swelling, zooxanthellae loss, and excess mucus production. Id. at 54. Active sediment removal comes at an energetic cost, while sediment suspended in the water column reduces the amount of light available to the corals for photosynthesis and growth. Id. This combined shock both further stresses the corals and restricts them to shallower waters than might otherwise be the case. Id.

Combined, the above sedimentation threats have already contributed to the deterioration coral species populations and their coral reef habitats globally, severely threatening the long-term growth and survival of many of the petitioned coral species. See id. at 52.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

Corals are subject to a number of commercial pressures, both intentional and incidental, that are negatively impacting their continued existence. Corals are intentionally removed from reefs for a variety of economic reasons including mining for construction and calcium and harvesting for jewelry, curios, marine aquaria, and medical uses. CRA 2005, Exhibit 27 at 1. There is clear evidence that many of the "endangered" and "critically endangered" corals listed in this Petition are experiencing this type of damaging exploitation.[14]

The amount of coral subject to removal is immense. "According to the [Convention on International Trade in Endangered Species' ("CITES")] database, in 1996, permitted coral exports produced 2.5 million pieces of live coral, 739 tons (670,000 kg) of raw coral, and 31,000 colonies of black coral." CRA 2005, Exhibit 27 at 2. Of this amount, about 3,000 tons of coral is exported for use in aquariums. Id. "According to CITES, the United States is the largest importer of live coral and reef rock, bringing in more than 80% of the live-coral trade (more than 400,000 pieces a year)." Id. One limitation with these figures is that, though impressive themselves, they are likely under-representative of actual coral exploitation. This is because CITES can only track permitted exports and imports, so both those corals that are exported or imported illegally and those that are removed from reefs but kept within the country of origin are not counted towards the previous totals. See id.; "The Inadequacy of Existing Regulatory Mechanisms (Criterion D): CITES," infra. Since the United States is such a large importer of coral products, inclusion of the petitioned corals under the ESA would be very beneficial in halting this driver of coral extinction.

Corals are also incidentally harmed by a variety of human practices driven by commercial aspirations. Activities that incidentally harm corals include dynamite fishing, chemical fishing, and human recreation and tourism activities. See, e.g., IUCN (Acropora roseni) 2012, Exhibit 1 at 5. These commercial activities are having negative impacts on many of the petitioned corals and are contributing to the likelihood that they will become extinct.

Disease or Predation (Criterion C):

Coral Disease. Coral disease is having huge negative impacts on many of the petitioned coral species. The fact that coral disease is so devastating in the Indo-Pacific is very problematic for the petitioned species because nearly all of them live in this

[14] See IUCN (Acropora suharsonoi) 2012, Exhibit 2 at 5, 6 (aquarium trade); IUCN (Alveopora excelsa) 2012, Exhibit 3 at 5 (aquariums and the curio trade); IUCN (Alveopora minuta) 2012, Exhibit 4 at 5 (aquariums and curio trade); IUCN (Lobophyllia serratus) 2012, Exhibit 10 at 3, 5, 6 (likely collected for the aquarium trade under a different name); IUCN (Millepora boschmai) 2012, Exhibit 11 at 5 (curio and jewelry trade); IUCN (Millepora striata) 2012, Exhibit 12 at 5 (curio and jewelry trade); IUCN (Pectinia maxima) Exhibit 15 at 3, 5, 6 (aquarium trade); IUCN (Porites desilveri) 2012, Exhibit 17 at 3, 5, 6 (aquarium trade); IUCN (Porites eridani) 2012, Exhibit 18 at 3, 5, 6 (aquarium trade); IUCN (Porites ornata) 2012, Exhibit 19 at 3, 5, 6 (aquarium trade).

region.[15]

> Coral diseases were first reported from the [Indo-Pacific] and Red Sea in the late 1970s . . . In the mid to late 1990s, several new diseases emerged [], but these and other diseases were restricted to a few countries. [Indo-Pacific] diseases appear to be exhibiting a rapid expansion in range and in the types of disease since 2000. This includes reports from new regions that were previously unaffected [], a higher percentage of reefs in certain locations (e.g., Great Barrier Reef Australia) with diseases, an increasing incidence of diseases, and an emergence of several new conditions (fungal disease, [white syndrome, brown band disease, pink line syndrome]).

Bruckner Undated, Exhibit 28 at 91. While this shows severe and growing risk to all of the petitioned species living in the Indo-Pacific, several of the petitioned species are members of the fast-growing Acroporidae and Pocilloporidae families and are "affected by the largest number of diseases and are observed with disease more frequently than all other species." See IUCN (Acropora roseni) 2012, Exhibit 1 (family Acroporidae); IUCN (Acropora suharsonoi) 2012, Exhibit 2 (family Acroporidae); IUCN (Pocillopora fungiformis) 2012, Exhibit 16 (family Pocilloporidae).

Even those petitioned corals that do not live in the Indo-Pacific are far from safe. Of the three species that do not live in the Indo-Pacific, *Millepora striata* lives in the Caribbean, which has come to be known "as a 'hot spot' for coral diseases, due to the rapid spread, wide distribution, expanding host ranges, and increased virulence of these diseases;" *Siderastrea glynni* is potentially extinct in the wild after a 1997-98 catastrophic bleaching event likely exacerbated by global warming; and *Rhizopsammia wellingtoni* has not been seen since 2000 and is now possibly extinct. See IUCN (Millepora striata) 2012, Exhibit 12 at 4; IUCN (Siderastrea glynni) 2012, Exhibit 21 at 5; IUCN (Rhizopsammia wellingtoni) 2012, Exhibit 20 at 4.

Unfortunately, climate change may exacerbate many coral diseases and other infections. Certain coral diseases, harmful bacteria, and fungi that harm corals may become more prevalent due to climate change and cause further damage.

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[15] See IUCN (Acropora roseni) 2012, Exhibit 1 at 4 (Indian Ocean); IUCN (Acropora suharsonoi) 2012, Exhibit 2 at 4 (occurs in Indian Ocean); IUCN (Alveopora excelsa) 2012, Exhibit 3 at 4 (IndoPacific); IUCN (Alveopora minuta) 2012, Exhibit 4 at 4; IUCN (Cantharellus noumeae) 2012, Exhibit 5 at 4 (endemic to New Caledonia); IUCN (Ctenella chagius) 2012, Exhibit 6 at 4 (Indian Ocean); IUCN (Hydnophora bonsai) 2012, Exhibit 7 at 4 (Pacific); IUCN (Isopora togianensis) 2012, Exhibit 8 at 3 (restricted to central IndoPacific); IUCN (Lithophyllon ranjithi) 2012, Exhibit 9 at 4 (northeast Borneo); IUCN (Lobophyllia serratus) 2012, Exhibit 10 at 4 (IndoPacific); IUCN (Millepora boschmai) 2012, Exhibit 11 at 3-4 (possibly Indonesia); IUCN (Montipora setosa) 2012, Exhibit 13 at 4 (IndoPacific); IUCN (Parasimplastrea sheppardi) 2012, Exhibit 14 at 4 (Indo-Pacific); IUCN (Pectinia maxima) 2012, Exhibit 15 at 4 (Indo-Pacific); IUCN (Pocillopora fungiformis) 2012, Exhibit 16 at 4 (Indian Ocean); IUCN (Porites desilveri) 2012, Exhibit 17 at 4 (Indian Ocean); IUCN (Porites eridani) 2012, Exhibit 18 at 4 (Indo-Pacific); IUCN (Porites ornata) 2012, Exhibit 19 at 4 (Indo-Pacific); IUCN (Stylophora madagascarensis) 2012, Exhibit 22 at 4 (Indian Ocean); but see IUCN (Millepora striata) 2012, Exhibit 12 at 4 (Caribbean); IUCN (Siderastrea glynni) 2012, Exhibit 21 at 4 (Pacific, but near Panama); IUCN (Rhizopsammia wellingtoni) 2012, Exhibit 20 at 4 (Galápagos Archipelago).

> Three coral pathogens (*Aspergillus sydowii*, *Vibrio shiloi*, and Black Band Disease) grow well at temperatures close to or exceeding probable host optima, suggesting that their population sizes would increase in warmer waters. Certain bacteria (e.g., *V. shiloi*) cause bleaching of certain coral species . . . while fungi grow optimally at temperatures that coincide with thermal stress and bleaching in corals. This may lead to a co-occurrence of bleaching and infection . . . [T]he leftover dead coral surfaces can become colonized by macroalage, which support the proliferation of toxic dinoflagellates.

Roessig et al. 2004, Exhibit 29 at 269 (internal citations omitted). Mass blooms of such dinoflagellates can cause destructive effects including toxic red tides. Latz Laboratory Undated, Exhibit 30 at 2. Also, co-occurrence of bleaching followed by coral disease has already been seen in 2005 when unprecedented high water temperatures caused massive bleaching in the U.S. Virgin Islands and the Florida Keys followed soon after by coral disease. See Karl et al. 2009 Exhibit 31 at 84. Therefore, increased ocean temperatures mean a plethora of increased threats to corals and the coral reef ecosystems that depend on them.

Predation by Crown-of-Thorns Starfish. Crown-of-thorns starfish can have very negative effects on coral colonies and have been seen preferentially feeding on at least three of the petitioned species of corals. See Oceana Undated, Exhibit 32 at 1; IUCN (Acropora roseni) 2012, Exhibit 1 at 3, 5; IUCN (Acropora suharsonoi) 2012, Exhibit 2 at 3, 5; IUCN (Montipora setosa) 2012, Exhibit 13 at 3, 5. The crown-of-thorns starfish can grow to a massive 20 inches in diameter and lives on coral reefs in the tropical waters of the Indian and Pacific oceans. Oceana Undated, Exhibit 32 at 1. These starfish feed on corals by turning their stomachs out through their mouth and digesting the corals' living tissue, leaving behind pure white coral skeletons. Id. Occasional population explosions of these starfish have decimated large areas of the Great Barrier Reef in Australia and the western Pacific reefs. Id. These plagues appear to be human-caused, probably brought on by overfishing of the few mollusks and fish that can eat the starfish given its formidable covering of long, venomous spines. Id. Attempts in some areas to control the starfish's numbers by poisoning or removing them have been met with only limited success. Id. If overfishing continues - or likely increases as the human population both generally and at the coasts continues to explode - the continuing absence of effective control mechanisms keeping the crown-of-thorns starfish's numbers in check will increase the threat of predation on listed corals.[16]

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

While a number of regulatory mechanisms exist to protect the petitioned species of corals, none have been effective at removing these species from the IUCN's "critically endangered" or "endangered" species lists. Furthermore, as a result of these inadequate

[16] See "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Human Population Growth," infra.

regulatory mechanisms, only one of the petitioned coral species is characterized as having a stable population by the IUCN, and this is only because every existing colony was brought to the Smithsonian Tropical Research Institute after having been found in a bleached and very unhealthy state. None of the petitioned coral species is characterized as having an increasing population.[17] Therefore, the existing regulatory mechanisms have proven inadequate in protecting these species and they should receive ESA protections.

CITES. CITES is an international agreement with 176 parties, including the United States, that aims to ensure that international trade in wild plants and animals does not threaten their existence. See CITES Undated 1, Exhibit 33 entire; CITES Undated 2, Exhibit 34 at 1. However, it has thus far proven to be insufficient. Although **all** corals are listed on CITES Appendix II and non-scleractinian corals are listed under both CITES Appendix I and II, all of the species of corals listed in this Petition, including several non-scleractinian species, are still considered "endangered" or "critically endangered" by the IUCN and none of them has an increasing population. See, e.g., IUCN (Porites ornata) 2012, Exhibit 19 at 3, 5 (scleractinian, "endangered"); IUCN (Millepora Boschmai) 2012, Exhibit 11 at 3, 6 (non-scleractinian, "critically endangered"); FN 17 (listing population statuses for all petitioned coral species).

CITES only applies to **international trade** in endangered species. See CITES Undated 2, Exhibit 34 at 1. This level of protection is insufficient because, although it may provide some level of benefit to those species which are subject to international trade, those species which are not traded do not necessarily benefit from CITES listing. CITES' focus is too narrow to protect corals from the many other threats that they face including habitat loss and destruction, disease, predation, and climate change impacts. CITES can only potentially offer real protection from threats arising under ESA Criterion B, Overutilization for Commercial, Recreational, Scientific, or Educational Purposes. CITES' protections are only partial even for these threats, however, as it doesn't address activities such as dynamite and chemical fishing that can harm corals, harmful recreation, and other negative overutilization impacts that do not involve trading in the species. Also, CITES, while very inclusive, does not cover every nation. See CITES Undated 1, Exhibit 33 entire. Therefore, the protections offered by CITES are not universal. This lack of

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[17] See IUCN (Siderastrea glynni) 2012, Exhibit 21 at 4 (Stable, with only known existing colonies living in Smithsonian Tropical Research Institute aquaria after being found in bleached and unhealthy state); but see IUCN (Acropora roseni) 2012, Exhibit 1 at 4 (Decreasing); IUCN (Acropora suharsonoi) 2012, Exhibit 2 at 4 (Decreasing); IUCN (Alveopora excelsa) 2012, Exhibit 3 at 4 (Unknown); IUCN (Alveopora minuta) 2012, Exhibit 4 at 4 (Unknown); IUCN (Cantharellus noumeae) 2012, Exhibit 5 at 4 (Unknown); IUCN (Ctenella chagius) 2012, Exhibit 6 at 4 (Decreasing); IUCN (Hydnophora bonsai) 2012, Exhibit 7 at 4 (Unknown); IUCN (Isopora togianensis) 2012, Exhibit 8 at 4 (Decreasing); IUCN (Lithophyllon ranjithi) 2012, Exhibit 9 at 4 (Unknown); IUCN (Lobophyllia serratus) 2012, Exhibit 10 at 4 (Unknown); IUCN (Millepora boschmai) 2012, Exhibit 11 at 5 (Unknown); IUCN (Millepora striata) 2012, Exhibit 12 at 4 (Decreasing); IUCN (Montipora setosa) 2012, Exhibit 13 at 4 (Decreasing); IUCN (Parasimplastrea sheppardi) 2012, Exhibit 14 at 4 (Decreasing); IUCN (Pectinia maxima) 2012, Exhibit 15 at 4 (Unknown); IUCN (Pocillopora fungiformis) 2012, Exhibit 16 at 4 (Unknown); IUCN (Porites desilveri) 2012, Exhibit 17 at 4 (Unknown); IUCN (Porites eridani) 2012, Exhibit 18 at 4 (Unknown); IUCN (Porites ornata) 2012, Exhibit 19 at 4 (Unknown); IUCN (Rhizopsammia wellingtoni) 2012, Exhibit 20 at 4 (Decreasing); IUCN (Stylophora madagascarensis) 2012, Exhibit 22 at 4 (Unknown); IUCN (Tubastraea floreana) 2012, Exhibit 23 at 4 (Decreasing).

universal applicability undercuts the effectiveness of the measures taken by allowing covered species to be transferred from or through a non-party country thus avoiding the export restrictions Appendix II species are subject to. See CITES Undated 3, Exhibit 35 at 3. This is problematic because, even in nations that are parties to CITES, the mere possession of a listed species is not illegal. Therefore, corals can be removed from the oceans and kept by collectors domestically without CITES' requirements even being implicated. Furthermore, even in those countries covered by CITES, once a specimen has been smuggled into a country it would be very difficult to ascertain if it had come there illegally. CITES essentially just adds a level of protection as species enter or exit the borders of party countries in international trade.

NMFS acknowledged the unsatisfactory effect of even restrictive Appendix I listings in its determination for the listing of the largetooth sawfish under the ESA, when it stated that illegal foreign trade of the sawfish continued "in spite of the CITES listing and national laws, due to lack of enforcement." See 76 Fed. Reg. 40822 (July 12, 2011), Exhibit 36 at 40832; NOAA Undated at 3, Exhibit 37; see also, e.g., IUCN (Millepora boschmai) 2012, Exhibit 11 at 6. While CITES listing is important and represents a clear recognition by the international community that the species are threatened and must be protected, this protection is not sufficient, and the petitioned coral species should be offered the further protections of the ESA.

Indonesian Limit on Catches of *Porites* and *Montipora*. Indonesia has imposed a catch quota on the genus *Porites*, of which the petitioned species *Porites eridani* and *Porites ornata* are members. See IUCN (Porites eridani) 2012, Exhibit 18 at 5; IUCN (Porites ornata) 2012, Exhibit 19 at 5. This quota was set at 55,500 per year. See IUCN (Porites eridani) 2012, Exhibit 18 at 5; IUCN (Porites ornata) 2012, Exhibit 19 at 5. However, both *Porites eridani* and *Porites ornata* are still listed as "endangered" by the IUCN. See IUCN (Porites eridani) 2012, Exhibit 18 at 3; IUCN (Porites ornata) 2012, Exhibit 19 at 3. Indonesia has also set an export quota for all species of the genus *Montipora*, of which the petitioned *Montipora setosa* is a member. IUCN (Montipora setosa) 2012, Exhibit 13 at 5. This quota was set at 19,200 pieces even though *Montipora setosa* is also listed as "endangered" by the IUCN. Id. at 3, 5.

While catch quotas are necessary to ensure that species that have not yet become "endangered" are not harvested in unsustainable numbers, they are inappropriate measures for species that have already become "endangered." By listing a species as "endangered," IUCN is saying that the species is facing threats to its existence that create a "very high risk of extinction in the wild." IUCN Undated, Exhibit 38 at 17-20. If a species is facing a "very high risk of extinction in the wild," then the catch quota for that species should be set at zero. These types of half-measures are inappropriate to halt species extinctions, and this is why the more restrictive prohibitions represented by ESA protection are desperately needed for these species.

Marine Protected Areas ("MPAs"). Many of the petitioned species of corals have at least part of their range in MPAs.[18] MPAs are a protective designation for marine areas worldwide. However, they represent a relatively small area of the marine environment. For example, as of 2007, only 0.65% of the world's oceans and 1.6% of the total marine area within national Exclusive Economic Zones were protected within approximately 5,000 MPAs worldwide. See IUCN 2008, Exhibit 39 at 11. These MPAs collectively encompass 2.58 million square kilometers. Id. However, designated "no-take areas" (areas where extractive uses are prohibited) collectively encompass only 0.08% of the world's oceans and 0.2% of the total marine area under national jurisdiction. Id. Of these MPAs, approximately 980 contain coral reef ecosystems. Mora et. al 2006, Exhibit 174 at 1750. However, only 27 percent of reefs are within MPAs, many of which are only partially effective. See Figure 2, infra.

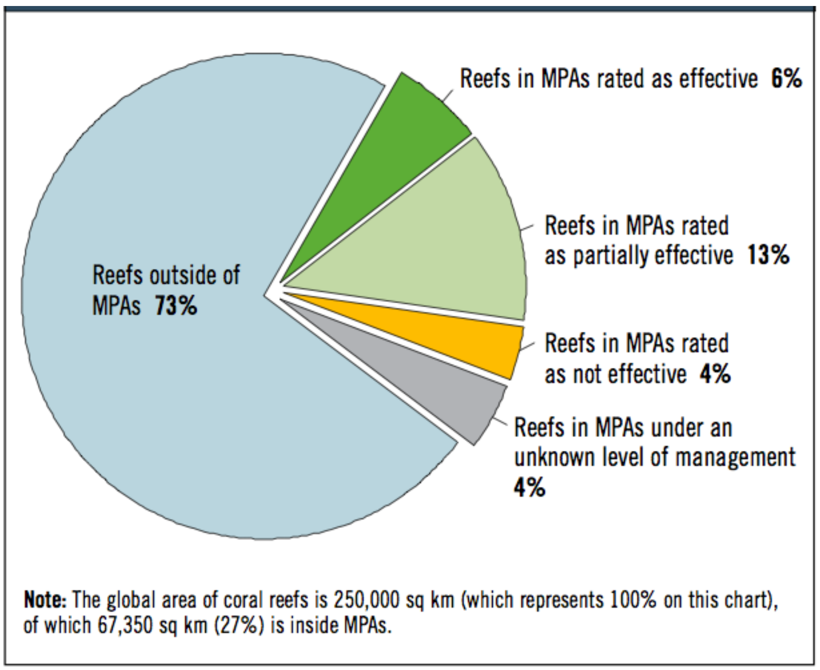

Figure 2: Coral Reefs by MPA Coverage and Effectiveness Level.
Source: Burke et al. 2011, Exhibit 41 at 6.

Creation of MPAs is clearly a good thing from a conservation standpoint. However, their effectiveness in protecting corals is debatable and incomplete. While

[18] See IUCN (Acropora roseni) 2012, Exhibit 1 at 6; IUCN (Acropora suharsonoi) 2012, Exhibit 2 at 6; IUCN (Alveopora excelsa) 2012, Exhibit 3 at 5; IUCN (Alveopora minuta) 2012, Exhibit 4 at 5; IUCN (Cantharellus noumeae) 2012, Exhibit 5 at 5; IUCN (Ctenella chagius) 2012, Exhibit 6 at 5; IUCN (Hydnophora bonsai) 2012, Exhibit 7 at 5; IUCN (Isopora togianensis) 2012, Exhibit 8 at 6; IUCN (Lithophyllon ranjithi) 2012, Exhibit 9 at 5; IUCN (Lobophyllia serratus) 2012, Exhibit 10 at 5; IUCN (Millepora boschmai) 2012, Exhibit 11 at 6; IUCN (Millepora striata) 2012, Exhibit 12 at 5; IUCN (Montipora setosa) 2012, Exhibit 13 at 6; IUCN (Parasimplastrea sheppardi) 2012, Exhibit 14 at 5; IUCN (Pectinia maxima) 2012, Exhibit 15 at 6; IUCN (Pocillopora fungiformis) 2012, Exhibit 16 at 5; IUCN (Porites desilveri) 2012, Exhibit 17 at 5; IUCN (Porites eridani) 2012, Exhibit 18 at 5; IUCN (Porites ornata) 2012, Exhibit 19 at 5; IUCN (Rhizopsammia wellingtoni) 2012, Exhibit 20 at 5; IUCN (Stylophora madagascarensis) 2012, Exhibit 22 at 5; IUCN (Tubastraea floreana) 2012, Exhibit 23 at 5.

more MPAs are designated every year, the conservation value of MPAs has so far been severely limited by uneven global distribution, poor management, and weak enforcement. See IUCN 2008, Exhibit 39 at 11, 97-110. While designating MPAs is crucial to prevent some forms of direct human impact to corals, they cannot protect them from long-term global threats (such as those arising from anthropogenic climate change). Also, since not all of the petitioned species are protected in existing MPAs; some of the protected areas that do support petitioned corals are likely not designated as more restrictive no-take areas; and, of the species protected in existent MPAs, many petitioned species are protected by MPAs in only a portion of their range, these MPAs do not represent sufficient protection for species at high risk of extinction. ESA listing for the petitioned species would provide complimentary protection for all of the petitioned species having some or all of their range in MPAs and would extend that protection throughout their ranges. It would also serve to protect those species that are currently not protected within any MPAs. Therefore, these species should be listed as "threatened" or "endangered" under the ESA.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

The manmade factors affecting these corals' continued existence are staggering. "In general, the major threat to corals is global [anthropogenic] climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of ENSO events[19] and storms, and ocean acidification." See, e.g., IUCN (Acropora suharsonoi) 2012, Exhibit 2 at 5. "Corals [additionally] face a host of [other] challenges associated with human activities such as poorly regulated tourism, destructive fishing, and pollution, in addition to climate change-related stresses." Karl et al 2009, Exhibit 31 at 84. In discussing the proximate threats to coral, NMFS said in its recent report entitled "Status Review Report of 82 Candidate Coral Species Petitioned Under the U.S. Endangered Species Act" ("Status Review Report") that "[t]he ultimate factor for each of these proximate threats, excepting natural physical damage and changes in insolation, is growth in human population and consumption of natural resources." Status Review Report, Exhibit 40 at 86. This was accompanied by the following chart listing the most prominent threats to corals, ordered by NMFS' estimate of the threat's importance for extinction risk.

[19] El Niño-Southern Oscillation, or ENSO, is a "quasi-periodic shift in the distribution of heat across the tropical Pacific." Earth Gauge Undated, Exhibit 47 at 1. The *Southern Oscillation* refers to "the periodic shift in atmospheric pressure differences between Tahiti (in the southeastern Pacific) and Darwin Australia (near Indonesia)." Id. El Niño causes the *Southern Oscillation* to essentially stop functioning causing warm waters to cover all or most of the tropical Pacific. Id. at 2. While the cold phase, La Niña, corresponds to abnormally cool eastern tropical Pacific temperatures. Id.

Section	Scale	Proximate Threat	Importance
3.2.1	Global	Ocean Warming	High
3.3.2	Local	Disease	High
3.2.2	Global	Ocean Acidification	Med-High
3.3.4	Local	Reef Fishing—Trophic Effects	Medium
3.3.1	Local	Sedimentation	Low-Medium
3.3.1	Local	Nutrients	Low-Medium
3.2.3	Global	Sea-Level Rise	Low-Medium
3.3.1	Local	Toxins	Low
3.2.4	Global	Changing Ocean Circulation	Low
3.2.5	Global	Changing Storm Tracks/Intensities	Low
3.3.3	Local	Predation	Low
3.3.5	Local	Reef Fishing—Habitat Impacts /Destructive Fishing Practices	Low
3.3.6	Local	Ornamental Trade	Low
3.3.7	Local	Natural Physical Damage	Low
3.3.8	Local	Human-induced Physical Damage	Negligible-Low
3.3.9	Local	Aquatic Invasive Species	Negligible-Low
3.3.1	Local	Salinity	Negligible
3.2.6	Local	African/Asian Dust	Negligible
3.2.7	Global	Changes in Insolation	Probably Negligible

Figure 3: NMFS Ranking of Threats to Coral Existence
Source: Status Review Report, Exhibit 40 at 86.

Most, or likely all, of the threats cited by NMFS in the above chart are either a direct result of human exploitation or are exacerbated by human impacts, most notably anthropogenic climate change. Id. at 19. Several of the factors cited as having the highest level of importance will be addressed below and in the individual species accounts that follow.

Anthropogenic Climate Change. Climate change will only be partially discussed as its own threat because, while rising ocean temperatures threaten to render coral habitat unsuitable, climate change also serves to exacerbate many of the other, more specific threats to corals as well. Therefore, climate change will be discussed where it also interacts with other threats, and those threats are not limited to exacerbating the effects of human-caused pollution as discussed above. As global climate change progresses, corals' environment will continue to deteriorate, thus increasing the pressures they face.

"Ultimately the only clear solution to this threat will be a concerted and successful global effort to reduce atmospheric greenhouse gas emissions and to stabilize atmospheric concentrations [of those gases] somewhere around or below current levels." WRI 2011, Exhibit 41 at 31. So far, the U.S. has not been part of this solution. FWS acknowledges this shortcoming in its "warranted but precluded" finding for the meltwater lednian stonefly, which is primarily threatened by climate change:

> The United States is only now beginning to address global climate change through the regulatory process (e.g., Clean Air Act). We have no information on what regulations may eventually be adopted, and when implemented, if they would address the changes in meltwater lednian

> stonefly habitat that are likely to occur in the foreseeable future. Consequently, we conclude that existing regulatory mechanisms are not adequate to address the threat of habitat loss and modification resulting from the environmental changes due to climate change to the meltwater lednian stonefly in the foreseeable future.

76 Fed. Reg. 18684 (April 5, 2011), Exhibit 45 at 18694. With global temperatures already rising, no imminent solution to global climate change, and the negative effects on corals that the lack of such a solution entails, climate change represents a significant manmade threat to these corals' continued existence.

Bleaching. "Corals are, quite obviously, central to coral reef ecosystems," and vice versa. See Hoegh-Guldberg 2006, Exhibit 25 at 3. Corals are essentially small marine animals that host symbiotic algae, which help nourish the animals and give the corals their color. Karl et al. 2009, Exhibit 31 at 84. "Coral bleaching occurs when the photosynthetic symbionts of corals (zooxanthellae) become increasingly vulnerable to damage by light at higher than normal temperatures. The resulting damage leads to the expulsion of these important organisms from the coral host. Corals tend to die in great numbers immediately following coral bleaching events, which may stretch across thousands of square kilometers of ocean." Hoegh-Guldberg 2006, Exhibit 25, Executive Summary. These bleaching events have been increasing both in terms of intensity and extent due to worldwide anthropogenic climate increases and will continue to cause severe damage to corals and coral reefs. Id. Thus far, these events have led to the death or severe damage of about one-third of the world's corals. Karl et al. 2009, Exhibit 31 at 84.

Photo: Bleached Coral
Source: http://oceanservice.noaa.gov/facts/coral_bleach.html

Many of the petitioned corals are physiologically optimized to their local long-term seasonal variations in temperatures and an increase of only 1º C – 2º C above the normal local seasonal maximum can induce bleaching. See Status Review Report, Exhibit 40 at 31. While some coral species are relatively resistant to the effects of bleaching, "there is general agreement that thermal stress has led to accelerated bleaching and mass mortality during the past 25 years." Id. Based on NOAA's own data, a recent analysis of global thermal stress and reported coral bleaching events for the 10-year period from 1998 to 2007 shows that bleaching is a widespread threat that has already had significant effects on most coral reefs around the world. In particular, the Indian Ocean, home of many of the petitioned species, recently experienced an extensive mass bleaching in 2010, halting and potentially reversing recovery from the 1998 mass bleaching in the same region. Id.

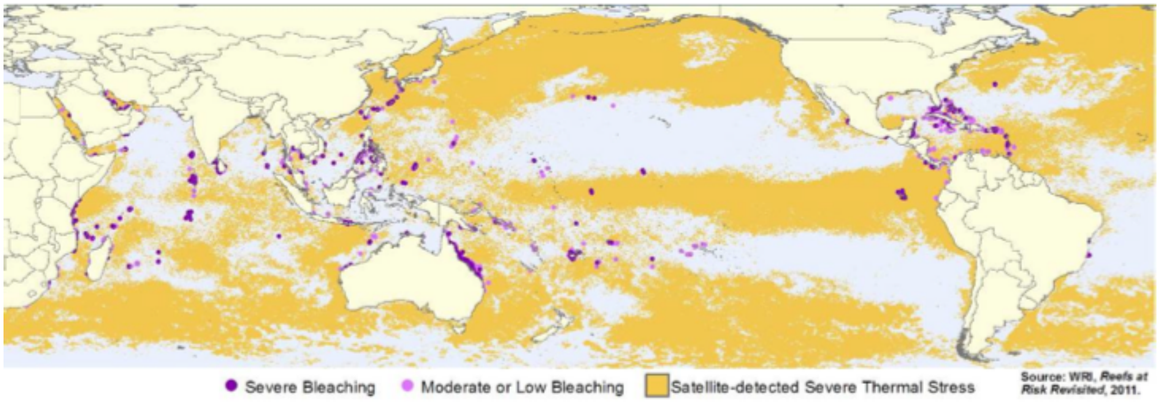

Figure 4: Global Map of Reef Areas Affected by Thermal Stress From 1998-2007
Source: Status Review Report, Exhibit 40 at 31.

The rapidity of the 2010 mass coral bleaching following previous bleaching events raises the likelihood that anthropogenic climate change has already passed the point at which mass bleaching events will begin to happen too frequently for reefs to recover. Id. The accelerating frequency of bleaching events and the slow recovery rate of coral species are thus likely to result in significant mortality rates and reef decline in general. Id. at 32. Even though corals do have some capacity to adapt to rising temperatures, they are unlikely to be able to adapt sufficiently to prevent further widespread bleaching and mortality. Id. Furthermore, this threat is not limited to the Indian Ocean, as widespread thermal stress resulting in coral bleaching has been documented in various parts of the world during the years 1983, 1987, 1995, 1998, and 2005. Id.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species in the Indo-Pacific and elsewhere. See id. at 52. Most of the petitioned coral species are particularly susceptible to bleaching.[20] This means that they will be disproportionately affected by increasing frequency and duration of these

[20] See IUCN (Acropora roseni) 2012, Exhibit 1 at 3, 4, 5; IUCN (Acropora suharsonoi) 2012, Exhibit 2 at 3, 4, 5; IUCN (Alveopora excelsa) 2012, Exhibit 3 at 3, 4, 5; IUCN (Alveopora minuta) 2012, Exhibit 4 at 3, 4, 5; IUCN (Ctenella chagius) 2012, Exhibit 6 at 3, 4, 5; IUCN (Hydnophora bonsai) 2012, Exhibit 7 at 3, 4, 5; IUCN (Isopora togianensis) 2012, Exhibit 8 at 3, 4, 5; IUCN (Lobophyllia serratus) 2012, Exhibit 10 at 3, 4, 5; IUCN (Millepora boschmai) 2012, Exhibit 11 at 4, 5; IUCN (Millepora striata) 2012, Exhibit 12 at 3, 4, 5; IUCN (Montipora setosa) 2012, Exhibit 13 at 3, 4, 5; IUCN (Parasimplastrea sheppardi) 2012, Exhibit 14 at 3, 4, 5; IUCN (Pectinia maxima) 2012, Exhibit 15 at 3, 4, 5; IUCN (Pocillopora fungiformis) 2012, Exhibit 16 at 3, 4, 5; IUCN (Porites desilveri) 2012, Exhibit 17 at 4; IUCN (Porites eridani) 2012, Exhibit 18 at 4; IUCN (Porites ornata) 2012, Exhibit 19 at 3, 4, 5; IUCN (Siderastrea glynni) 2012, Exhibit 21 at 4, 5.

bleaching events. Since they are already considered "endangered" or "critically endangered," this threat represents a serious threat to their continued existence.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Status Review Report, Exhibit 40 at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

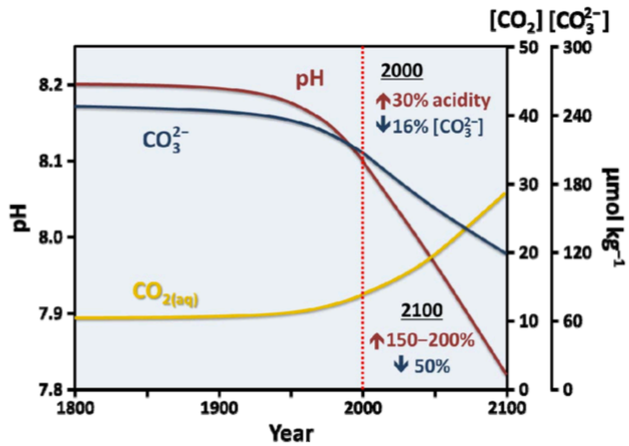

Figure 5: Projected Changes in Ocean Chemistry From Increased Atmospheric CO_2
Source: Status Review Report, Exhibit 40 at 36.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally id. § 3.2.3. So far, "[a]bout one-third of the carbon dioxide emitted by human activities has been absorbed by the ocean, resulting in a decrease in the ocean's pH." Karl et al. 2009, Exhibit 31 at 151. "The effects [of this pH decrease] on reef-building corals are likely to be particularly severe during this century. Coral calcification rates are likely to decline by more than 30 percent under a doubling of atmospheric carbon dioxide concentrations, with erosion outpacing reef formation at even lower concentrations. In addition, the reduction in pH also affects photosynthesis, growth, and reproduction." Id.

First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Status Review Report, Exhibit 40 at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id.

Ocean acidification will hamper, and potentially eventually halt, calcification of reef building corals if ocean pH continues to drop as predicted. There is no indication that emissions of CO_2 will be reduced sufficiently and therefore, this eventuality becomes more and more likely as time goes on. Lack of calcification will mean corals cannot form the calcite crystals that make up their skeletons and the reefs they live on, hampering colony formation and eventually resulting in destroyed coral reef habitat the corals will have no way of rebuilding. As a result of these threats, ocean acidification represents a severe threat to the petitioned corals' continued existence.

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of the petitioned coral species. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted). The combination of threats to the petitioned corals and their 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." Id. at 453 (internal citations omitted). Since all of the petitioned coral species face a multitude of threats it is likely that the synergistic effects of those threats will cause extinction pressure greater than their additive impact alone. As such, the synergistic effects of the aforementioned threats represent yet another reason why these species should be extended ESA protections.

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INDIVIDUAL CORAL SPECIES ACCOUNTS

(1) Scientific Name: *Acropora roseni*

Common Name: coral

IUCN Status: Endangered **CITES Status:** Appendix II

Range: This species of coral is found in the southwest Indian Ocean. Including Mauritius and Madagascar. IUCN (Acropora roseni) 2012, Exhibit 1 at 4. *Acropora roseni* is found in a restricted range and is uncommon. Id.

Habitat and Ecology: This species occurs in shallow, tropical reef environments from 3-12 meters in depth. It is found on upper reef slopes exposed to strong wave action. "The age of first maturity of most reef building corals is typically three to eight years," and, therefore, that is the estimated age of first maturity for *Acropora roseni*. Id. at 4-5 (citing Wallace 1999).

Population Status: There is no species-specific population information available for this species. Id. at 4. However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species. Id. This species is particularly susceptible to bleaching, disease, and other threats and therefore population decline is based on both the percentage of destroyed reefs and critical reefs that are likely to be destroyed within 20 years. Id. (citing Wilkinson 2004). It is assumed that most, if not all, mature individuals will be removed from a destroyed reef and that on average the number of individuals on reefs is equal across its range. Id.

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Acropora roseni is estimated to experience habitat degradation and loss of 58% over the next 30 years. Id. at 4. This represents a serious threat to their continued existence.

Disease or Predation (Criterion C):

Coral Disease. Members of this genus have a low resistance and low tolerance to bleaching and disease, and are slow to recover from such problems. Id. at 5. "Coral disease has emerged as a serious threat to coral reefs worldwide and a major cause of reef deterioration." Id. (citing Weil et al. 2006). "The numbers of diseases and coral species affected, as well as the distribution of diseases have all increased dramatically within the last decade." Id. (citing Porter et al. 2001; Green & Bruckner 2000; Sutherland et al. 2004; Weil 2004). Coral disease has resulted in significant losses of coral cover and has been implicated in the dramatic decline of *acroporids* in the Indio-Pacific. Id.

Similarly, according to a recent report by NMFS entitled "Status Review Report of 82 Candidate Coral Species Petitioned Under the U.S. Endangered Species Act," coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, especially bleaching, with disease outbreaks often either accompanying or immediately following bleaching events. Status Review Report, Exhibit 40 at 34. This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Combined with the increased frequency of bleaching events, disease is a major threat to the long-term survival of *Acropora roseni*. See id.; IUCN (Acropora roseni) 2012, Exhibit 1 at 5.

Predation by Crown-of-Thorns Starfish. Additionally, *Acanthaster planci*, the crown-of-thorns starfish, has been observed preferentially preying upon corals of the genus *Acropora*. IUCN (Acropora roseni) 2012, Exhibit 1 at 3, 5 (citing Colgan 1987). Crown-of-thorns starfish are found throughout the Pacific and Indian Oceans, and the Red Sea. Id. at 5. These starfish are voracious predators of reef-building corals, with a preference for branching and tubular corals like *Acropora roseni*. Id. Populations of the crown-of-thorns starfish have greatly increased since the 1970s and have been known to wipe out large areas of coral reef habitat. Id. Increased breakouts of crown-of-thorns starfish have become a major threat, and have contributed to the overall decline and destruction of reefs in the Indo-Pacific region. Id.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to corals, including *Acropora roseni*, is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. Id. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse. Id.

Human Population Growth. According to the recent Status Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts to corals, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. aiding in increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of coastal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities, and despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id. Therefore, human population growth represents a significant threat to this species' continued existence.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Id. at 25. Following the Industrial Revolution, "atmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally id. § 3.2.3. First among the adverse consequences for corals of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of the *Acropora* genus of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, ocean acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Some corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id. Therefore, ocean acidification represents a severe threat to this species' continued existence.

Bleaching. Members of this genus have an especially low resistance and low tolerance to bleaching. IUCN (Acropora roseni) 2012, Exhibit 1 at 3, 4, 5. Bleaching, caused in large part by increasing ocean temperatures, happens when a coral expels its symbiotic zooxanthellae in response to thermal stress. Status Review Report, Exhibit 40 at 31. While most corals can withstand mild to moderate bleaching given enough recovery time, severe, repeated or prolonged bleaching can lead to colony mortality even in populations with normal resistance and tolerance to bleaching events. Id.

Many corals are physiologically optimized to their local long-term seasonal variations in temperatures and an increase of only 1º C – 2º C above the normal local seasonal maximum can induce bleaching. See id. While some coral species are relatively resistant to the effects of bleaching, "there is general agreement that thermal stress has led to accelerated bleaching and mass mortality during the past 25 years." Id. Based on NOAA's own data, a recent analysis of global thermal stress and reported coral bleaching events for the 10 year period from 1998 to 2007 shows that bleaching is a widespread threat that has already had significant effects on most coral reefs around the world. Id. In particular, the Indian Ocean, home of *Acropora roseni,* recently experienced an extensive mass bleaching in 2010, halting and potentially reversing recovery from the 1998 mass bleaching in the same region. See id.

The rapidity of the 2010 mass coral bleaching following previous bleaching events raises the likelihood that the world has already passed the point at which mass bleaching events will begin to happen too frequently for reefs to have sufficient time to recover in time for the next bleaching event. Id. The accelerating frequency of bleaching events and the slow recovery rate of this coral species are thus likely to result in significant mortality rates and reef decline in general. Id. at 32. Even though corals do have some capacity to adapt to rising temperatures, it is generally thought that corals are unlikely to be able to adapt sufficiently to prevent further widespread bleaching and mortality. Id. Given the low resistance and low tolerance of this species to bleaching and its already low reproductive output, *Acropora roseni* is at high risk of extinction. See IUCN (Acropora roseni) 2012, Exhibit 1 at 4-5.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species, including *Acropora roseni*. See Status Review Report, Exhibit 40 at 52. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(2) Scientific Name: *Acropora suharsonoi*

Common Name: coral

IUCN Status: Endangered **CITES Status:** Appendix II

Range: This species is found in the central Indo-Pacific. It is also found in south central Indonesia. IUCN (Acropora suharsonoi) 2012, Exhibit 2 at 4. Known from the Lesser Sunda Islands, this species has a restricted range and is uncommon. Id.

Habitat and Ecology: This species is found on lower reef slopes and submerged walls, 15-25 m depth. Id. "The age of first maturity of most reef building corals is typically three to eight years," and is the estimated age of first maturity for *Acropora suharsonoi*. Id. (citing Wallace 1999).

Population Status: "This is an uncommon species." Id. "There is no species-specific population information available for this species. However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species. This species is particularly susceptible to bleaching, disease, and other threats and therefore population decline is based on both the percentage of destroyed reefs and critical reefs that are likely to be destroyed within 20 years." Id. (citing Wilkinson 2004).

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

"This species is in an area likely to be heavily impacted by anthropogenic disturbance." Id. at 5. This species has a generally low reproductive capacity and therefore is slow to recover. Id. "Members of this genus have a low resistance and low tolerance to bleaching and disease." Id. "Escalating anthropogenic stressors combined with the threats associated with global climate change . . . place coral reefs in the Indo-Pacific at high risk of collapse." Id.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Acropora suharsonoi is expected to experience an estimated habitat degradation and loss of 66% over 30 years. Id. at 4. This habitat loss represents a significant threat to the species' continued survival.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

Acropora suharsonoi is specifically targeted by collectors for the aquarium trade. Id. at 5. "The total number of corals (live and raw) exported for this species in 2005 was 175." Id. This number obviously includes only reported specimens, and therefore the actual number exported is likely higher. Any trade in a species determined to be "endangered" by the IUCN with a declining population is inappropriate. Therefore, the aquarium trade represents a significant threat to the species' continued existence.

Disease or Predation (Criterion C):

Coral Disease. Coral disease has emerged as a serious threat to coral reefs worldwide and a major cause of reef deterioration." Id. (citing Weil et al. 2006). "The numbers of diseases and corals species affected, as well as the distribution of diseases have all increased dramatically within the last decade." Id. (citing Porter et al. 2001; Green & Bruckner 2000; Sutherland et al. 2004; Weil 2004). Coral diseases have resulted in significant losses of coral cover and have been implicated in the increased rate of disease in the Indo-Pacific, with outbreaks recently reported from the Great Barrier Reef, Marshall Islands, and the northwestern Hawaiian Islands. Id. (citing Aeby 2006; Jacobson 2006; Willis et al. 2004). "Increased coral disease levels on the [Great Barrier Reef] were correlated with increased ocean temperatures supporting the prediction that disease levels will increase with higher sea surface temperatures." Id. (citing Willis et al. 2007).

Similarly, according to a recent report by NMFS, coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, especially bleaching, with disease outbreaks often either accompanying or immediately following bleaching events. Status Review Report, Exhibit 40 at 34. This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Combined with the increased frequency of bleaching events, disease is a major threat to the long-term survival of *Acropora suharsonoi*. See id.; IUCN (Acropora suharsonoi) 2012, Exhibit 2 at 5-6.

Predation by Crown-of-Thorns Starfish. "*Acanthaster planci*, the crown-of-thorns starfish, has been observed preferentially preying upon corals of the genus *Acropora*, although this is a deep-water species not likely to be heavily impacted by [crown-of-thorns starfish]." IUCN (Acropora suharsonoi) 2012, Exhibit 2 at 5 (citing Colgan 1987). However, these starfish are voracious predators of reef building corals, and have been known to wipe out large areas of coral reef habitat. Id. The effects of a crown-of-thorns outbreak include the reduction of abundance and surface cover of living coral, reduction of species diversity and composition, and overall reduction in habitat area. Id. Increased outbreaks of crown-of-thorns starfish have thus contributed to the overall decline of *Acropora suharsonoi* as well as all coral species in the Indo-Pacific region and represent a significant threat to their continued survival. See id.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Acropora suharsonoi*, is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. Id. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse. Id.

Human Population Growth. According to the recent Status Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts to corals, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of coastal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities and that, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Bleaching. Members of this genus have an especially low resistance and low tolerance to bleaching. IUCN (Acropora suharsonoi) 2012, Exhibit 2 at 3, 4, 5. Bleaching, caused in large part by increasing ocean temperatures, happens when a coral expels its symbiotic zooxanthellae in response to thermal stress. Status Review Report, Exhibit 40 at 31. While most corals can withstand mild to moderate bleaching given enough recovery time, severe, repeated or prolonged bleaching can lead to colony mortality. Id.

Many corals are physiologically optimized to their local long-term seasonal variations in temperatures and an increase of only 1º C – 2º C above the normal local seasonal maximum can induce bleaching. Id. While some coral species are relatively resistant to the effects of bleaching, "there is general agreement that thermal stress has led to accelerated bleaching and mass mortality during the past 25 years." Id. Based on NOAA's own data, a recent analysis of global thermal stress and reported coral bleaching events for the 10 year period from 1998 to 2007 shows that bleaching is a widespread threat that has already had significant effects on most coral reefs around the world. Id. In particular, the Indian Ocean, home of *Acropora suharsonoi,* recently experienced an extensive mass bleaching in 2010, halting and potentially reversing recovery from the 1998 mass bleaching in the same region. See id.

The rapidity of the 2010 mass coral bleaching following previous bleaching events raises the likelihood that the world has already passed the point at which mass bleaching events will begin to happen too frequently for reefs to recover in time for the next bleaching event. Id. The accelerating frequency of bleaching events and the slow recovery rate of this coral species are thus likely to result in significant mortality rates and reef decline in general. Id. at 32. Even though corals do have some capacity to adapt to rising temperatures, it is generally thought that corals are unlikely to be able to adapt sufficiently to prevent further widespread bleaching and mortality. Id. Given the low resistance and low tolerance of this species to bleaching, combined with its already low reproductive output, *Acropora suharsonoi* is at high risk of extinction. See IUCN (Acropora suharsonoi) 2012, Exhibit 2.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Status Review Report, Exhibit 40 at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm. Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. see generally Status Review Report, Exhibit 40 § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of the *Acropora* genus of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species, including *Acropora suharsonoi*. Id. at 52. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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For More Information, See:

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(3) Scientific Name: ***Alveopora excelsa***

Common Name: coral

IUCN Status: Endangered **CITES Status:** Appendix II

Range: This species is found in the central Indo-Pacific; South-east Asia; Japan; and the South China Sea. IUCN (Alveopora excelsa) 2012, Exhibit 3 at 4. "This species is fairly widespread and is uncommon throughout its range." Id. at 3.

Habitat and Ecology: "[T]his species is restricted to reef habitat and is particularly susceptible to bleaching, harvesting for aquarium trade, and extensive reduction of coral reef habitat due to a combination of threats." Id. (citing Wilkinson 2004). "The age of first maturity of most reef building corals is typically three to eight years," and, therefore, that is the estimated age of first maturity for *Alveopora excelsa*. Id. at 4 (citing Wallace 1999). "This species is primarily found on exposed shallow reef slopes, although it can occur to a depth of 30 meters." Id. at 5.

Population Status: This species is uncommon throughout its range. Id. at 3,4. There is no species-specific population information available for this species. Id. at 4. "However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species. This species is particularly susceptible to bleaching, disease, and other threats and therefore population decline is based on both the percentage of destroyed reefs and critical reefs that are likely to be destroyed within 20 years." Id. (citing Wilkinson 2004).

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

There will be an overall estimated habitat degradation and loss of 64% over the next 30 years. Id. (citing Wilkinson 2004). This habitat reduction represents a significant threat to the species' continued existence.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"Species of this genus are attractive to the aquarium trade due to their physical appearance." Id. at 5. Coral removal and harvesting for display in aquariums and for the curio trade is, therefore, a major threat to this species. Id.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Alveopora excelsa*, is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. Id. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Id. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse.

Human Population Growth. According to the recent NMFS Status Review Report, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of coastal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Bleaching. Members of this genus have an especially low resistance and low tolerance to bleaching. IUCN (Alveopora excelsa) 2012, Exhibit 3 at 3, 4, 5. Coral of the *Alveopora* genus have been "ranked as having the highest bleaching response and is in the top ten genera for extinction risk in the Western Indian Ocean." Id. at 5 (citing McClanahan et al. 2007). Bleaching, caused in large part by increasing ocean temperatures, happens when a coral expels its symbiotic zooxanthellae in response to thermal stress. Status Review Report, Exhibit 40 at 31. While most corals can withstand mild to moderate bleaching given enough recovery time, severe, repeated or prolonged bleaching can lead to colony mortality. Id.

Many corals are physiologically optimized to their local long-term seasonal variations in temperatures and an increase of only 1º C – 2º C above the normal local seasonal maximum can induce bleaching. Id. While some coral species are relatively resistant to the effects of bleaching, "there is general agreement that thermal stress has led to accelerated bleaching and mass mortality during the past 25 years." Id. Based on NOAA's own data, a recent analysis of global thermal stress and reported coral bleaching events for the 10 year period from 1998 to 2007 shows that bleaching is a widespread threat that has already had significant effects on most coral reefs around the world. In particular, the Indian Ocean, home of *A. excelsa,* recently experienced an extensive mass bleaching in 2010, halting and potentially reversing recovery from the 1998 mass bleaching in the same region. See id.

The rapidity of the 2010 mass coral bleaching following previous bleaching events raises the likelihood that the world has already passed the point at which mass bleaching events will begin to happen too frequently for reefs to have sufficient time to recover in time for the next bleaching event. Id. The accelerating frequency of bleaching events and the slow recovery rate of this coral species are thus likely to result in significant mortality rates and reef decline in general. Id. at 32. Even though corals do have some capacity to adapt to rising temperatures, it is generally thought that corals are unlikely to be able to adapt sufficiently to prevent further widespread bleaching and mortality. Id. Given the low resistance and low tolerance of this species to bleaching and its already low reproductive output, *Alveopora excelsa* is at high risk of extinction. See id. at 3, 4.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Id. at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm. Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification." Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally id. § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species, including *Alveopora excelsa*. See id. at 52. These threats qualify the species as "threatened" or "endangered" under the ESA, and it should be protected to avoid its extinction.

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(4) Scientific Name: *Alveopora minuta*

Common Name: coral

IUCN Status: Endangered **CITES Status:** Appendix II

Range: **"**This species is found in the central Indo-Pacific, including the Solomon Islands." IUCN (Alveopora minuta) 2012, Exhibit 4 at 4. This species is relatively widespread, but is rare throughout its range. Id.

Habitat and Ecology: **"**This species is found on rocky surfaces exposed to currents, generally to depths of 20 m." Id. at 5. "The first age of maturity of most reef building corals is typically three to eight years," and, therefore, that is the estimated age of first maturity for *Alveopora minuta*. Id. at 4 (citing Wallace 1999). The number of individuals on reefs is assumed to be equal across its range and proportional to the percentage of destroyed reefs. Id.

Population Status: This is a rare species and there is no species-specific population information available for this species. Id. "However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species." Id. This species is particularly susceptible to bleaching, disease, and other threats and therefore population decline is based on both the percentage of destroyed reefs and critical reefs that are likely to be destroyed within 20 years. Id. at 3, 4, 5 (citing Wilkinson 2004).

Population Trend: Unknown. Id. at 4.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Alveopora minuta is expected to experience an estimated habitat degradation and loss of 66% over the next 30 years. Id. This reduction in habitat represents a significant threat to the species' continued existence.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"Species of this genus are attractive to the aquarium trade due to their physical appearance." Id. at 5. A major threat to this species, therefore, is coral removal and harvesting for display in aquariums and for the curio trade. See id.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Alveopora minuta*, is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. Id. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Id. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse.

Human Population Growth. According to the NMFS Status Review Report, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of coastal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Bleaching. Members of this genus have an especially low resistance and low tolerance to bleaching. IUCN (Alveopora minuta) 2012, Exhibit 4 at 3, 4, 5. "[T]he *Alveopora* genus was ranked as having the highest bleaching response and is in the top ten genera for extinction risk in the Western Indian Ocean." Id. (citing McClanahan et al. 2007). Bleaching, caused in large part by increasing ocean temperatures, happens when a coral expels its symbiotic zooxanthellae in response to thermal stress. Status Review Report, Exhibit 40 at 31. While most corals can withstand mild to moderate bleaching given enough recovery time, severe, repeated or prolonged bleaching can lead to colony mortality. Id.

Many corals are physiologically optimized to their local long-term seasonal variations in temperatures and an increase of only 1º C – 2º C above the normal local seasonal maximum can induce bleaching. Id. While some coral species are relatively resistant to the effects of bleaching, "there is general agreement that thermal stress has led to accelerated bleaching and mass mortality during the past 25 years." Id. Based on NOAA's own data, a recent analysis of global thermal stress and reported coral bleaching events for the 10 year period from 1998 to 2007 shows that bleaching is a widespread threat that has already had significant effects on most coral reefs around the world. In particular, the Indian Ocean, home of *A. minuta,* recently experienced an extensive mass bleaching in 2010, halting and potentially reversing recovery from the 1998 mass bleaching in the same region. See id.

The rapidity of the 2010 mass coral bleaching following previous bleaching events raises the likelihood that the world has already passed the point at which mass bleaching events will begin to happen too frequently for reefs to have sufficient time to recover in time for the next bleaching event. Id. The accelerating frequency of bleaching events and the slow recovery rate of this coral species are thus likely to result in significant mortality rates and reef decline in general. Id. at 32. Even though corals do have some capacity to adapt to rising temperatures, it is generally thought that corals are unlikely to be able to adapt sufficiently to prevent further widespread bleaching and mortality. Id. Given the low resistance and low tolerance of this species to bleaching and its already low reproductive output, *Alveopora minuta* is at high risk of extinction. See id. at 3, 4, 5.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Status Review Report, Exhibit 40 at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally Status Review Report, Exhibit 40 § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species, including *Alveopora excelsa*. See id. at 52. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(5) Scientific Name: *Cantharellus noumeae*

Common Name: coral

IUCN Status: Endangered **CITES Status:** Appendix II

Range: This species is only confirmed in New Caledonia. IUCN (Cantharellus noumeae) 2012, Exhibit 5 at 4.

Historical Range: Fossil records indicate that this species was at one time found as far west as Indonesia. Id. (citing Hoeksema 1989).

Habitat and Ecology: "This species is endemic to New Caledonia with a restricted range size, and is naturally rare." Id. "This species is found in deep water close to sediment in sheltered bays. The maximum size is 7cm in diameter. It is an attached stalked species." Id. (citing Hoeksema & Best 1984). This species occurs in waters from 10-20 meters in depth. Id. "The age of first maturity of most reef building corals is typically three to eight years," and, therefore, that is the estimated age of first maturity for *Cantharellus noumeae*. Id. (citing Wallace 1999).

Population Status: "There is no species-specific population information available for this species. However, there is evidence that overall coral reef habitat has declined," and this can be used as a proxy for population decline for this species. See id.

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

"The main threat to this species is mining activities causing sedimentation and habitat degradation." Id. Also, "[e]scalating anthropogenic stressors combined with the threats associated with global climate change of increases in coral disease, frequency and duration of coral bleaching and ocean acidification place coral reefs in the Indo-Pacific at high risk of collapse." Id. at 5.

Disease or Predation (Criterion C):

Coral Disease. "Coral disease has emerged as a serious threat to coral reefs worldwide and a major cause of reef deterioration." Id. (citing Weil et al. 2006). "The numbers of diseases and coral species affected, as well as the distribution of diseases have all increased dramatically within the last decade." Id. (citing Porter et al. 2001; Green & Bruckner 2000; Sutherland et al. 2004; Weil 2004). Coral diseases have resulted in significant losses of coral cover and have been implicated in the increased rate of disease in the Indo-Pacific, with outbreaks recently reported from the Great Barrier Reef, Marshall Islands, and the northwestern Hawaiian Islands. Id. (citing Aeby 2006; Jacobson 2006; Willis et al. 2004). "Increased coral disease levels on the [Great Barrier Reef] were correlated with increased ocean temperatures supporting the prediction that disease levels will increase with higher sea surface temperatures." Id. (citing Willis et al. 2007).

Similarly, according to NMFS' own recent Status Review Report, coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, especially bleaching, with disease outbreaks often either accompanying or immediately following bleaching events. Status Review Report, Exhibit 40 at 34). This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Combined with the increased frequency of bleaching events, disease is a major threat to the long-term survival of *Cantharellus noumeae*.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Cantharellus noumeae*, is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. IUCN (Cantharellus noumeae) 2012, Exhibit 5 at 5. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Id. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse.

Human Population Growth. According to the recent Status Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of costal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities, and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Id. at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2

levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally id. § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, ocean acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id. Therefore, ocean acidification represents an imminent threat to the species' continued survival.

Sedimentation. As stated above, this species is located in an area that is heavily impacted by mining activities, leading to increased sedimentation and overall habitat degradation. See id. at 53. "There are two basic types of sediments that influence coral reefs: those that are terrestrially derived and those that are generated in situ through erosion and the skeletal material of calcifying organisms," such as corals and mollusks. Id. "Terrestrial sediments are[] likely to have greater impacts than marine sediments because of their physical and chemical characteristics." Id. For example, terrestrial sediments tend to be darker in color than marine sediments, and consequently terrestrial sediments reduce light more effectively than marine sediments when suspended in the water. Id. Terrestrial sediments are also often associated with harmful organic compounds, heavy metals, and harmful bacteria. Id.

"The most common direct effect of sediment is deposition on the coral surface, as sediment settles out from the water column." Id. Corals "can actively displace sediment using ciliary action or mucus production." Id. And while "[s]ome coral species can tolerate complete burial for several days . . . [i]f the corals are unsuccessful in removing the sediments, they can become smothered and die." Id. Sedimentation has been shown to have a greater impact on smaller coral colonies, often causing total mortality of the colony. Id.

Sedimentation also can induce "sublethal" effects in coral such as cellular and structural disruptions, reduced tissue thickness, polyp swelling, zooxanthellae loss, and excess mucus production. Id. at 54. Active sediment removal comes at an energetic cost, while sediment suspended in the water column reduces the amount of light available to the corals for photosynthesis and growth. Id. This combined shock both further stresses the corals while restricting them to shallower waters than might otherwise be the case. Id.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species, including *Cantharellus noumeae*. See id. at 52. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(6) Scientific Name: ***Ctenella chagius***

Common Name: coral

IUCN Status: Endangered **CITES Status:** Appendix II

Range: This species has a very restricted range and is only found in the Chagos Archipelago, located in the central Indian Ocean. IUCN (Ctenella chagius) 2012, Exhibit 6 at 3-4.

Habitat and Ecology: This species is found on reef slopes and lagoons at depths of 3-45 m. Id. at 5.

Population Status: "This species has a very restricted range which falls into a region of high coral reef habitat reduction." Id. at 3. Specific species population trends for this species are unknown. However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species. Id. at 4. This species is particularly susceptible to bleaching, disease, and other anthropogenic threats. Id. Population decline can be inferred from declines in habitat quality based on the combined estimates of both destroyed reefs and reefs at the critical stage of degradation within its range. Id. (citing Wilkinson 2004).

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Ctenella chagius is estimated to experience habitat degradation and loss of 58% over the next 30 years. Id. at 4. This reduction in habitat represents a significant threat to the species' continued survival.

Disease or Predation (Criterion C):

Coral Disease. This species is particularly susceptible to disease. Id. at 4, 5. "Coral disease has emerged as a serious threat to coral reefs worldwide and a major cause of reef deterioration." Id. at 5 (citing Weil et al. 2006). "The numbers of diseases and coral species affected, as well as the distribution of diseases have all increased dramatically within the last decade." Id. (citing Porter et al. 2001; Green & Bruckner 2000; Sutherland et al. 2004; Weil 2004). Coral disease outbreaks have resulted in significant losses of coral cover. Id. Increased coral disease levels have been correlated with increased ocean temperatures, supporting the prediction that disease levels will be increasing with higher sea surface temperatures. See id. (citing Willis et al. 2007).

Similarly, according to NMFS' own recent Status Review Report, coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, especially bleaching, with disease outbreaks often either accompanying or immediately following bleaching events. Status Review Report, Exhibit 40 at 34. This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Combined with the increased frequency of bleaching events, disease is a major threat to the long-term survival of *Ctenella chagius*. See id. at 34; IUCN (Ctenella chagius) 2012, Exhibit 6 at 4-5.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Ctenella chagius,* is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. IUCN (Ctenella chagius) 2012, Exhibit 6 at 5. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Id. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse.

Human Population Growth. According to the recent Status Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of costal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Id. at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean as the ocean itself soaks up atmospheric CO_2. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally id. § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id. Therefore, ocean acidification represents an imminent threat to the species' continued survival.

Bleaching. Members of this genus have an especially low resistance and low tolerance to bleaching. IUCN (Ctenella chagius) 2012, Exhibit 6 at 3, 4, 5. Bleaching, caused in large part by increasing ocean temperatures, happens when a coral expels its symbiotic zooxanthellae in response to thermal stress. Status Review Report Exhibit 40 at 31. While most corals can withstand mild to moderate bleaching given enough recovery time, severe, repeated or prolonged bleaching can lead to colony mortality. Id.

Many corals are physiologically optimized to their local long-term seasonal variations in temperatures and an increase of only 1º C – 2º C above the normal local seasonal maximum can induce bleaching. See id. While some coral species are relatively resistant to the effects of bleaching, "there is general agreement that thermal stress has led to accelerated bleaching and mass mortality during the past 25 years." Id. Based on NOAA's own data, a recent analysis of global thermal stress and reported coral bleaching events for the 10 year period from 1998 to 2007 shows that bleaching is a widespread threat that has already had significant effects on most coral reefs around the world. In particular, the Indian Ocean, home of *Ctenella chagius,* recently experienced an extensive mass bleaching in 2010, halting and potentially reversing recovery from the 1998 mass bleaching in the same region. See id.

The rapidity of the 2010 mass coral bleaching following previous bleaching events raises the likelihood that the world has already passed the point at which mass bleaching events will begin to happen too frequently for reefs to have sufficient time to recover in time for the next bleaching event. Id. The accelerating frequency of bleaching events and the slow recovery rate of this coral species are thus likely to result in significant mortality rates and reef decline in general. Id. at 32. Even though corals do have some capacity to adapt to rising temperatures, it is generally thought that corals are unlikely to be able to adapt sufficiently to prevent further widespread bleaching and mortality. Id. Given the low resistance and low tolerance of this species to bleaching and its already low reproductive output, *Ctenella chagius* is at high risk of extinction. See id. at 3, 4.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species, including *Ctenella chagius*. See Status Review Report, Exhibit 40 at 52. Escalating anthropogenic stressors combined with the threats associated with global climate change place reefs in the Indo-Pacific at high risk of collapse. This represents a significant threat to the species. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(7) Scientific Name: ***Hydnophora bonsai***

Common Name: coral

IUCN Status: Endangered **CITES Status:** Appendix II

Range: "This species has a limited range and is uncommon." IUCN (Hydnophora bonsai) 2012, Exhibit 7 at 3. It has a restricted distribution in Vietnam, Raja Ampats (West Papua, Indonesia), Japan, and the East China Sea. Id. at 4. It is also found in the Philippines. Id.

Habitat and Ecology: This species is found in rocky foreshores and reef slopes at depths between 5 and 15 meters. Id. at 5. This species is typically small (up to 15 cm) and conspicuous. Id.

Population Status: This species is rare in South Vietnam and is uncommon elsewhere throughout its range. Id. at 4. "There is no species-specific population information available for this species. However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species." Id. "This species is particularly susceptible to bleaching, disease, and other threats and therefore population decline is based on both the percentage of destroyed reefs and critical reefs that are like to be destroyed within 20 years." Id. (citing Wilkinson 2004).

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

This species is estimated to experience habitat degradation and loss of 64% over the next 30 years. Id. This loss of habitat represents a significant threat the the species' continued survival.

Disease or Predation (Criterion C):

Coral Disease. "Coral disease has emerged as a serious threat to coral reefs worldwide and is a major cause of reef deterioration." Id. (citing Weil et al. 2006). The number of diseases and coral species affected has increased dramatically within the last decade, and coral disease outbreaks have resulted in significant losses of coral cover. Id. (citing Aronson & Precht 2001; Porter et al. 2001; Patterson et al. 2002; Green & Bruckner 2000, Sutherland et al. 2004, Weil 2004). In the Indo-Pacific, coral disease is on the rise, which has been correlated with increased ocean temperatures, supporting the prediction that disease levels will be increasing as ocean temperatures continue to rise as a result of anthropogenic climate change. Id. (citing Willis et al. 2007).

Similarly, according to NMFS' own recent Status Review Report, coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, especially bleaching, with disease outbreaks often either accompanying or immediately following bleaching events. Status Review Report, Exhibit 40 at 34. This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Combined with the increased frequency of bleaching events, disease is a major threat to the long-term survival of *Hydnophora bonsai*.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Hydnophora bonsai,* is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. IUCN (Hydnophora bonsai) 2012, Exhibit 7 at 5. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Id. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse.

Human Population Growth. According to the recent Status Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of costal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Id. at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean as the ocean itself soaks up atmospheric CO_2. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally id. § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id.

Bleaching. Members of this genus have an especially low resistance and low tolerance to bleaching. IUCN (Hydnophora bonsai) 2012, Exhibit 7 at 3, 4, 5. Bleaching, caused in large part by increasing ocean temperatures, happens when a coral expels its symbiotic zooxanthellae in response to thermal stress. Status Review Report, Exhibit 40 at 31. While most corals can withstand mild to moderate bleaching given enough recovery time, severe, repeated or prolonged bleaching can lead to colony mortality. Id.

Many corals are physiologically optimized to their local long-term seasonal variations in temperatures and an increase of only 1º C – 2º C above the normal local seasonal maximum can induce bleaching. Id. While some coral species are relatively resistant to the effects of bleaching, "there is general agreement that thermal stress has led to accelerated bleaching and mass mortality during the past 25 years." Id. Based on NOAA's own data, a recent analysis of global thermal stress and reported coral bleaching events for the 10 year period from 1998 to 2007 shows that bleaching is a widespread threat that has already had significant effects on most coral reefs around the world. Id. Additionally, in 2010 there was another significant mass-bleaching event in the Indian Ocean at the edge of this species' known range. See id.

The rapidity of the 2010 mass coral bleaching following previous bleaching events raises the likelihood that the world has already passed the point at which mass bleaching events will begin to happen too frequently for reefs to have sufficient time to recover in time for the next bleaching event. Id. The accelerating frequency of bleaching events and the slow recovery rate of this coral species are thus likely to result in significant mortality rates and reef decline in general. Id. at 32. Even though corals do have some capacity to adapt to rising temperatures, it is generally thought that corals are unlikely to be able to adapt sufficiently to prevent further widespread bleaching and mortality. Id. Given the low resistance and low tolerance of this species to bleaching and its already low reproductive output, *Hydnophora bonsai* is at high risk of extinction. See id. at 3, 4.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species, including *Hydnophora bonsai*. See Status Review Report, Exhibit 40 at 52. Escalating anthropogenic stressors combined with the threats associated with global climate change place reefs in the Indo-Pacific at high risk of collapse. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(8) Scientific Name: *Isopora togianensis*

Common Name: coral

IUCN Status: Endangered **CITES Status:** Appendix II

Range: This species is only found in the central Indo-Pacific in the Togian Islands of Sulawsi, Indonesia and western Papua New Guinea. IUCN (Isopora togianensis) 2012, Exhibit 8 at 4.

Habitat and Ecology: This species occurs in shallow, tropical reef environments, especially exposed upper reef slopes and flats at depths between 8 and 20 meters. It is found subtidally on sandy slopes and fringing reefs. Id. at 5 (citing Wallace 1999). This is a brooder species and therefore has a smaller sexual reproductive output and limited dispersal capacity. Id. This species, like most reef building corals, likely reaches first maturity between at least three and eight years. Id. at 4 (citing Wallace 1999).

Population Status: This species is locally common, but species specific population numbers are not available. Id. "However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species. This species is particularly susceptible to bleaching, disease, and other threats and therefore population decline is based on both the percentage of destroyed reefs and critical reefs that are likely to be destroyed within 20 years." Id. (citing Wilkinson 2004). This species' "threat susceptibility increases the likelihood of being lost within one generation in the future from reefs at a critical stage." Id.

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The major threat to this species is global climate change and its concurrent impacts. Id. at 5. This species has a low resistance and low tolerance to bleaching and disease, and is slow to recover. Id. at 3, 4, 5.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Isopora togianensis is estimated to experience habitat degradation and loss of 66% over the next thirty years. Id. at 4. This represents a significant threat to the species' continued survival.

Disease or Predation (Criterion C):

Coral Disease. "Coral disease has emerged as a serious threat to coral reefs worldwide and is a major cause of reef deterioration." Id. at 5 (citing Weil et al. 2006). The number of diseases and coral species affected has increased dramatically within the last decade, and coral disease outbreaks have resulted in significant losses of coral cover. Id. (citing Porter et al. 2001; Green & Bruckner 2000; Sutherland et al. 2004; Weil 2004; Aeby 2006; Jacobson 2006; Willis et al. 2004). In the Indo-Pacific, coral disease is on the rise, which has been correlated with increased ocean temperatures, supporting the prediction that disease levels will be increasing as ocean temperatures continue to rise as a result of anthropogenic climate change. Id. (citing Willis et al. 2007).

Similarly, according to NMFS' own recent Status Review Report, coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, especially bleaching, with disease outbreaks often either accompanying or immediately following bleaching events. Status Review Report, Exhibit 40 at 34. This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Combined with the increased frequency of bleaching events, disease is a major threat to the long-term survival of *Isopora togianensis*.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Isopora togianensis,* is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. IUCN (Isopora togianensis) 2012, Exhibit 8 at 5. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Id. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse.

Human Population Growth. According to the recent Statue Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of costal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities, and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Id. at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean as the ocean itself soaks up atmospheric CO_2. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally id. § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cement. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id.

Bleaching. Members of this genus have an especially low resistance and low tolerance to bleaching. IUCN (Isopora togianensis) 2012, Exhibit 8 at 3, 4, 5. Bleaching, caused in large part by increasing ocean temperatures, happens when a coral expels its symbiotic zooxanthellae in response to thermal stress. Status Review Report, Exhibit 40 at 31. While most corals can withstand mild to moderate bleaching given enough recovery time, severe, repeated or prolonged bleaching can lead to colony mortality. Id.

Many corals are physiologically optimized to their local long-term seasonal variations in temperatures and an increase of only 1º C – 2º C above the normal local seasonal maximum can induce bleaching. Id. While some coral species are relatively resistant to the effects of bleaching, "there is general agreement that thermal stress has led to accelerated bleaching and mass mortality during the past 25 years." Id. Based on NOAA's own data, a recent analysis of global thermal stress and reported coral bleaching events for the 10 year period from 1998 to 2007 shows that bleaching is a widespread threat that has already had significant effects on most coral reefs around the world. Id. In particular, the Indian Ocean, home of *Isopora togianensis,* recently experienced an extensive mass bleaching in 2010, halting and potentially reversing recovery from the 1998 mass bleaching in the same region. See id.

The rapidity of the 2010 mass coral bleaching following previous bleaching events raises the likelihood that the world has already passed the point at which mass bleaching events will begin to happen too frequently for reefs to have sufficient time to recover in time for the next bleaching event. Id. The accelerating frequency of bleaching events and the slow recovery rate of this coral species are thus likely to result in significant mortality rates and reef decline in general. Id. at 32. Even though corals do have some capacity to adapt to rising temperatures, it is generally thought that corals are unlikely to be able to adapt sufficiently to prevent further widespread bleaching and mortality. Id. Given the low resistance and low tolerance of this species to bleaching and its already low reproductive output, *Isopora togianensis* is at high risk of extinction. See id. at 3, 4, 5.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species in the Indo-Pacific, including *Isopora togianensis*. See Status Review Report, Exhibit 40 at 52. Escalating anthropogenic stressors combined with the threats associated with global climate change place reefs in the Indo-Pacific at high risk of collapse. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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<u>(9) Scientific Name:</u> *<u>Lithophyllon ranjithi</u>*

Common Name: coral

IUCN Status: Endangered **CITES Status:** Appendix II

Range: This species has a very restricted range, being found only in Darvel Bay in northeast Borneo (Malaysia and Indonesia). IUCN (Lithophyllon ranjithi) 2012, Exhibit 9 at 4. "It has suffered extensive reduction of coral reef habitat due to a combination of threats." <u>Id.</u> at 3. Its current area of occurrence is only 243 km^2. <u>Id.</u>

Historic Range: Historically, this species was found as far north as the Philippines. <u>Id.</u>

Habitat and Ecology: This species is found commonly below a depth of 10 meters in the inner part of Darvel Bay on steep, hard substratum, although is can be found as deep as 20 meters. <u>Id.</u> at 4 (citing Ditlev 2003).

Population Status: There is no species-specific population information available for this species. However, there is evidence that overall coral reef habitat has declined, which is used as a proxy for population decline in this species. <u>See</u> <u>id.</u>

Population Trend: Unknown. <u>Id.</u>

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

This species is very localized, with the major threat to its survival being local deforestation, leading to increased sedimentation (see below). <u>Id.</u>

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

This species has suffered extensive habitat reduction, due in large part to sedimentation from deforestation along the coasts near its habitat. <u>See</u> <u>id.</u> at 4, 5. This habitat reduction represents a significant threat to the species' continued existence, especially given its extremely small area of occurrence.

Disease or Predation (Criterion C):

Coral Disease. "Coral disease has emerged as a serious threat to coral reefs worldwide and a major cause of reef deterioration" <u>Id.</u> at 4 (citing Weil et al. 2006). The number of diseases and coral species affected, as well as the distribution of diseases, has increased dramatically within the last decade. <u>Id.</u> (citing Porter et al. 2001; Green &

Bruckner 2000; Sutherland et al. 2004; Weil 2004). Coral diseases have resulted in significant losses of coral cover and have been implicated in the increased rate of disease in the Indo-Pacific, with outbreaks recently reported from the Great Barrier Reef, Marshall Islands, and the northwestern Hawaiian Islands. Id. at 4-5 (citing Aeby 2006; Jacobson 2006; Willis et al. 2004). Increased coral disease levels on the [Great Barrier Reef] were correlated with increased ocean temperatures supporting the prediction that disease levels will increase with higher sea surface temperatures Id. at 5 (citing Willis et al. 2007).

Similarly, according to NMFS' own recent Status Review Report, coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, especially bleaching, with disease outbreaks often either accompanying or immediately following bleaching events. Status Review Report, Exhibit 40 at 34. This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Combined with the increased frequency of bleaching events, disease is a major threat to the long-term survival of *Lithophyllon ranjithi*.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Lithophyllon ranjithi*, is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. IUCN (Lithophyllon ranjithi) 2012, Exhibit 9 at 4. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse. Id. at 5.

Human Population Growth. According to the Status Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of costal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities, and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Sedimentation. As stated above, this species is located in an area that is heavily impacted by deforestation, leading to increased sedimentation and overall habitat degradation. See id. at 53. "There are two basic types of sediments that influence coral reefs: those that are terrestrially derived and those that are generated in situ through erosion and the skeletal material of calcifying organisms," such as corals and mollusks. Id. "Terrestrial sediments are[] likely to have greater impacts than marine sediments because of their physical and chemical characteristics." Id. For example, terrestrial sediments tend to be darker in color than marine sediments, and consequently terrestrial sediments reduce light more effectively than marine sediments when suspended in the water. Id. Terrestrial sediments are also often associated with harmful organic compounds, heavy metals, and harmful bacteria. Id.

"The most common direct effect of sediment is deposition on the coral surface, as sediment settles out from the water column." Id. Corals "can actively displace sediment using ciliary action or mucus production." Id. And while "[s]ome coral species can tolerate complete burial for several days . . . [i]f the corals are unsuccessful in removing the sediments, they can become smothered and die." Id. Sedimentation has been shown to have a greater impact on smaller coral colonies, often causing total mortality of the colony. Id.

Sedimentation also can induce "sublethal" effects in coral such as cellular and structural disruptions, reduced tissue thickness, polyp swelling, zooxanthellae loss, and excess mucus production. Id. at 54. Active sediment removal comes at an energetic cost, while sediment suspended in the water column reduces the amount of light available to the corals for photosynthesis and growth. Id. This combined shock both further stresses the corals while restricting them to shallower waters than might otherwise be the case. Id.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species, including *Lithophyllon ranjithi.* See id. at 52. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(10) Scientific Name: *Lobophyllia serratus*

Common Name: coral

IUCN Status: Endangered **CITES Status:** Appendix II

Range: This species is restricted to Southeast Asia, particularly in Papua New Guinea, and is rare throughout its range. IUCN (Lobophyllia serratus) 2012, Exhibit 10 at 3-4 (citing Fenner).

Habitat and Ecology: This species is found on reef slopes, from 4-15 meters in depth. Id. at 5. The first age of maturity is estimated to be three to eight years. Id. at 4 (citing Wallace 1999).

Population Status: This species is rare throughout its range. Id. at 3, 4. "There is no species-specific population information available for this species. However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species. Id. at 4. This species is particularly susceptible to bleaching, disease, and other threats associated with climate change and therefore population decline is based on both the percentage of destroyed reefs and critical reefs that are likely to be destroyed within 20 years. Id. (citing Wilkinson 2004).

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Lobophyllia serratus has already experienced extensive reduction of coral reef habitat due to a combination of threats. Id. at 3. The species is estimated to experience further habitat degradation and loss of 66% over the next 30 years. Id. at 4. This represents a significant threat to the species' continued survival.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

This species is likely collected for the aquarium trade under a different name. Id. at 3, 5, 6. Collection of a species facing this level of endangerment is inappropriate and ESA protection should be extended to this species to prevent its further progress towards extinction.

Disease or Predation (Criterion C):

Coral Disease. "Coral disease has emerged as a serious threat to coral reefs worldwide and a major cause of reef deterioration." Id. at 5 (citing Weil et al. 2006). "The number of diseases and coral species affected, as well as the distribution of diseases, have all increased dramatically within the last decade." Id. (citing Porter et al. 2001; Green & Bruckner 2000; Sutherland et al. 2004; Weil 2004). Coral diseases have resulted in significant losses of coral cover and have been implicated in the increased rate of disease in the Indo-Pacific, with outbreaks recently reported from the Great Barrier Reef, Marshall Islands, and the northwestern Hawaiian Islands. Id. (citing Aeby 2006; Jacobson 2006; Willis et al. 2004). "Increased coral disease levels on the [Great Barrier Reef] were correlated with increased ocean temperatures supporting the prediction that disease levels will increase with higher sea surface temperatures." Id. (citing Willis et al. 2007).

Similarly, according to NMFS' own recent Status Review Report, coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, especially bleaching, with disease outbreaks often either accompanying or immediately following bleaching events. Status Review Report, Exhibit 40 at 34. This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Combined with the increased frequency of bleaching events, disease is a major threat to the long-term survival of *Lobophyllia serratus*.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

Collectors for the aquarium trade target this species and thus greater fisheries management is required to ensure this species' long-term survival. IUCN (Lobophyllia serratus) 2012, Exhibit 10 at 6. This management should be accomplished through extending the species protection under the ESA.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Lobophyllia serratus,* is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. Id. at 5. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Id. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse.

Human Population Growth. According to the recent Status Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of costal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities, and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Id. at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean as the ocean itself soaks up atmospheric CO_2. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally id. § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id.

Bleaching. Members of this genus have an especially low resistance and low tolerance to bleaching. IUCN (Lobophyllia serratus) 2012, Exhibit 10 at 3, 4, 5. Bleaching, caused in large part by increasing ocean temperatures, happens when a coral expels its symbiotic zooxanthellae in response to thermal stress. Status Review Report, Exhibit 40 at 31. While most corals can withstand mild to moderate bleaching given enough recovery time, severe, repeated or prolonged bleaching can lead to colony mortality. Id.

Many corals are physiologically optimized to their local long-term seasonal variations in temperatures and an increase of only 1º C – 2º C above the normal local seasonal maximum can induce bleaching. See id. While some coral species are relatively resistant to the effects of bleaching, "there is general agreement that thermal stress has led to accelerated bleaching and mass mortality during the past 25 years." Id. Based on NOAA's own data, a recent analysis of global thermal stress and reported coral bleaching events for the 10 year period from 1998 to 2007 shows that bleaching is a widespread threat that has already had significant effects on most coral reefs around the world. Id. In particular, the Indian Ocean, home of *Lobophyllia serratus,* recently experienced an extensive mass bleaching in 2010, halting and potentially reversing recovery from the 1998 mass bleaching in the same region. See id.

The rapidity of the 2010 mass coral bleaching following previous bleaching events raises the likelihood that the world has already passed the point at which mass bleaching events will begin to happen too frequently for reefs to have sufficient time to recover in time for the next bleaching event. Id. The accelerating frequency of bleaching events and the slow recovery rate of this coral species are thus likely to result in significant mortality rates and reef decline in general. Id. at 32. Even though corals do have some capacity to adapt to rising temperatures, it is generally thought that corals are unlikely to be able to adapt sufficiently to prevent further widespread bleaching and mortality. Id. Given the low resistance and low tolerance of this species to bleaching and its already low reproductive output, *Lobophyllia serratus* is at high risk of extinction.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species in the Indo-Pacific, including *Lobophyllia serratus.* See Status Review Report, Exhibit 40 at 52. Escalating anthropogenic stressors combined with the threats associated with global climate change place reefs in the Indo-Pacific at high risk of collapse. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(11) Scientific Name: *Millepora boschmai*

Common Name: Coral

IUCN Status: Critically Endangered **CITES Status:** Appendix I and II

Range: This species is thought to exist, if at all, only in the Gulf of Chiriquí, on the eastern side of Panama. See IUCN (Millepora boschmai) 2012, Exhibit 11 at 3-6. However, a specimen collected in Indonesia was recently attributed to this species, although this claim has yet to be confirmed. Id. at 3 (citing Razak & Hoeksema 2003). It is possible that this species is now extinct, at least in the Eastern Tropical Pacific. Id. at 5.

Historical Range: Prior to 1983, this species was reported throughout the Gulf of Chiriquí. Id. at 4. However, following the 1982-83 and 1997-98 ENSO events, further searches for this species have discovered no further living specimens within the region. Id. Observed population decline since 1983 in the Eastern Tropical Pacific is estimated as 100%. Id.

Habitat and Ecology: This species was reported from the upper forereef slope (2 meters depth) to deep, sand and rubble slopes (18 meters depth). Id. However, it was most abundant at the reef base (5-6 meters depth) and deeper outer slopes (to a depth of 12-15 meters). Id. (citing de Weerdt & Glynn 1991). Species of this genus are generally found in inshore areas characterized by turbidity, and exhibit a tolerance for sedimentation. Id.

Population Status: *Millepora boschmai* is considered rare and possibly extinct. Id. According to the IUCN, *Millepora boschmai* was already the least abundant of the three *Millepora* species known from the Gulf of Chiriquí. Id. (citing de Weerdt & Glynn 1991). This species was reported as eliminated following the 1982-83 ENSO event and detailed searches from 1984 through 1990 across the former range revealed only dead colonies. Id. (citing Glynn and Feingold 1992). In the early 1990's, eight live colonies were found in the Gulf of Chiriquí. Id. (citing Glynn & Feingold 1992; Glynn et al. 2001). However, after the 1997-98 ENSO event, all known colonies were found dead. Id. (citing Glynn et al. 2001). "Since then, no live colonies have been observed, despite targeted searches throughout the former distribution." Id.

Though no species-specific population information is available, "there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species." Id. "This species is particularly susceptible to bleaching, disease, and other threats and therefore population decline is based on both the percentage of destroyed reefs and critical reefs that are likely to be destroyed within 20 years." Id. (citing Wilkinson 2004).

Population Trend: Unknown, possibly extinct. See id. at 4, 5.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

This species is particularly susceptible to bleaching, disease, and other threats associated with global climate change and "is thought to have completely disappeared from the majority of its range in the Eastern Tropical Pacific following recent bleaching events." See id. at 4, 5 (citing de Weerdt and Glynn 1991).

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

Despite its endangerment, this species is still sometimes collected for curio and jewelry trade. See id. at 5. This is inappropriate for a species facing this level of endangerment and the species should be extended protection under the ESA to help prevent this harmful collection.

Disease or Predation (Criterion C):

Coral Disease. "Coral disease has emerged as a serious threat to coral reefs worldwide and a major cause of reef deterioration." Id. (citing Weil et al. 2006). The number of diseases and coral species affected, as well as the distribution of diseases, has increased dramatically within the last decade. Id. (citing Porter et al. 2001; Green & Bruckner 2000; Sutherland et al. 2004; Weil 2004). Coral diseases have resulted in significant losses of coral cover and have been implicated in the increased rate of disease in the Indo-Pacific, with outbreaks recently reported from the Great Barrier Reef, Marshall Islands, and the northwestern Hawaiian Islands. Id. (citing Aeby 2006; Jacobson 2006; Willis et al. 2004). "Increased coral disease levels on the Great Barrier Reef were correlated with increased ocean temperatures supporting the prediction that disease levels will increase with higher sea surface temperatures." Id. at 5-6 (citing Willis et al. 2007).

Similarly, according to NMFS' own recent Status Review Report, coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, especially bleaching, with disease outbreaks often either accompanying or immediately following bleaching events. Status Review Report, Exhibit 40 at 34. This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Combined with the increased frequency of bleaching events, disease is a major threat to the long-term survival of *Millepora boschmai*. See Status review report, Exhibit 40 at 34; IUCN (Millepora boschmai) 2012, Exhibit 11 at 4, 5-6.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Millepora boschmai*, is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. IUCN (Millepora boschmai) 2012, Exhibit 11 at 5. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Id. at 6. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse.

Human Population Growth. According to the recent Status Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of costal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities, and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Id. at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally Status Review Report, Exhibit 40 § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id.

Bleaching. Members of this genus and species have an especially low resistance and low tolerance to bleaching. See IUCN (Millepora boschmai) 2012, Exhibit 11 at 4, 5. Bleaching, caused in large part by increasing ocean temperatures, happens when a coral expels its symbiotic zooxanthellae in response to thermal stress. Status Review Report, Exhibit 40 at 31. While most corals can withstand mild to moderate bleaching given enough recovery time, severe, repeated or prolonged bleaching can lead to colony mortality. Id.

Many corals are physiologically optimized to their local long-term seasonal variations in temperatures and an increase of only 1º C – 2º C above the normal local seasonal maximum can induce bleaching. See id. While some coral species are relatively resistant to the effects of bleaching, "there is general agreement that thermal stress has led to accelerated bleaching and mass mortality during the past 25 years." Id. Based on NOAA's own data, a recent analysis of global thermal stress and reported coral bleaching events for the 10 year period from 1998 to 2007 shows that bleaching is a widespread threat that has already had significant effects on most coral reefs around the world. Id.

The rapidity of recent mass coral bleaching following previous bleaching events raises the likelihood that the world has already passed the point at which mass bleaching events will begin to happen too frequently for reefs to have sufficient time to recover in time for the next bleaching event. Id. The accelerating frequency of bleaching events and the slow recovery rate of this coral species are thus likely to result in significant mortality rates and reef decline in general. Id. at 32. Even though corals do have some capacity to adapt to rising temperatures, it is generally thought that corals are unlikely to be able to adapt sufficiently to prevent further widespread bleaching and mortality. Id. Given the susceptibility of this species to bleaching and its already low reproductive output, *Millepora boschmai* is at high risk of extinction. See id. at 4, 5.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species in the Indo-Pacific, including *Millepora boschmai*. See Status Review Report, Exhibit 40 at 52. Escalating anthropogenic stressors combined with the threats associated with global climate change place reefs in the Indo-Pacific at high risk of collapse. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(12) Scientific Name: *Millepora striata*

Common Name: coral

IUCN Status: Endangered **CITES Status:** Appendix I and II

Range: This species has a restricted range in the Caribbean and is known only from Guadeloupe, San Blas (Panama), Venezuela, Colombia, and Belize. IUCN (Millepora striata) 2012, Exhibit 12 at 4 (citing de Weerdt 1990; Fenner 1999).

Habitat and Ecology: This species is not well known. Id. at 5. *Millepora* species are generally found in inshore areas characterized by turbidity, and exhibit a tolerance for sedimentation. Id.

Population Status: This is a rare and poorly known species. Id. at 4, 5. "There is no species-specific population information available for this species. However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species." Id. at 4.

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

While poorly known, it is thought that this species is susceptible to bleaching and is sometimes collected for the curio and jewelry trade. Id. at 3, 5.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

This species is estimated to experience habitat degradation and loss of 50% over the next 30 years. Id. at 4. This habitat reduction represents a significant threat to the species' continued existence.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

Despite its endangerment, this species is still sometimes collected for the curio and jewelry trade. See id. at 5. ESA protection should be extend to the species to help prevent further collection.

Disease or Predation (Criterion C):

Coral Disease. "Coral disease has emerged as a serious threat to coral reefs worldwide and is a major cause of reef deterioration." Id. at 5 (citing Weil et al. 2006). Both the number of diseases and coral species affected have increased dramatically within the last decade. Id. (citing Porter et al. 2001; Green & Bruckner 2000; Sutherland et al. 2004; Weil 2004). Importantly for *Millepora striata,* coral disease outbreaks have resulted in significant losses of coral cover in the nearby Florida Keys. Id. (citing Aronson & Precht 2001; Porter et al. 2001; Patterson et al. 2002).

Additionally, according to NMFS' own recent Status Review Report, coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, especially bleaching, with disease outbreaks often either accompanying or immediately following bleaching events. Status Review Report, Exhibit 40 at 34. This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Combined with the increased frequency of bleaching events, disease is a major threat to the long-term survival of *Millepora striata*.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Millepora striata*, is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. IUCN (Millepora striata) 2012, Exhibit 12 at 5. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Id. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse.

Human Population Growth. According to the recent Status Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of costal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities, and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Id. at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally Status Review Report, Exhibit 40 § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id.

Bleaching. Members of this genus have be especially susceptible to bleaching. IUCN (Millepora striata) 2012, Exhibit 12 at 3, 4, 5. Bleaching, caused in large part by increasing ocean temperatures, happens when a coral expels its symbiotic zooxanthellae in response to thermal stress. Status Review Report, Exhibit 40 at 31. While most corals can withstand mild to moderate bleaching given enough recovery time, severe, repeated or prolonged bleaching can lead to colony mortality. Id.

Most corals are physiologically optimized to their local long-term seasonal variations in temperatures and an increase of only 1º C – 2º C above the normal local seasonal maximum can induce bleaching. Id. While some coral species are relatively resistant to the effects of bleaching, "there is general agreement that thermal stress has led to accelerated bleaching and mass mortality during the past 25 years." Id. Based on NOAA's own data, a recent analysis of global thermal stress and reported coral bleaching events for the 10 year period from 1998 to 2007 shows that bleaching is a widespread threat that has already had significant effects on most coral reefs around the world. Id.

The rapidity of recent mass coral bleaching following previous bleaching events raises the likelihood that the world has already passed the point at which mass bleaching events will begin to happen too frequently for reefs to have sufficient time to recover in time for the next bleaching event. Id. The accelerating frequency of bleaching events and the slow recovery rate of this coral species are thus likely to result in significant mortality rates and reef decline in general. Id. at 32. Even though corals do have some capacity to adapt to rising temperatures, it is generally thought that corals are unlikely to be able to adapt sufficiently to prevent further widespread bleaching and mortality. Id. The susceptability of this species to bleaching severely reduces this species' potential for long-term survival.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species in the Caribbean, including *Millepora striata*. See Status Review Report, Exhibit 40 at 52. Escalating anthropogenic stressors combined with the threats associated with global climate change place reefs in the Caribbean at high risk of collapse. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(13) Scientific Name: *Montipora setosa*

Common Name: coral

IUCN Status: Endangered **CITES Status**: Appendix II

Range: This species is native to the central Indo-Pacific region in Australia, Indonesia, Malaysia, the Philippines, Singapore, and Thailand, though it may be more widely distributed. IUCN (Montipora setosa) 2012, Exhibit 13 at 4. This species is rare throughout its range. Id. at 3, 4.

Habitat and Ecology: *Montipora setosa* is found in shallow, protected reef environments, including upper reef slopes, at depths of up to at least 20 meters. Id. at 5.

Population Status: "This is a rare species." Id. at 4. "There is no species-specific population information available for this species. However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species. Id. "This species is particularly susceptible to bleaching, disease, and other threats and therefore population decline is based on both the percentage of destroyed reefs and critical reefs that are likely to be destroyed within 20 years. Id. (citing Wilkinson 2004).

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

This species is particularly susceptible to bleaching, disease, and other threats. Id. at 3-6.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

This species is estimated to experience habitat degradation and loss of 66% over the next 30 years. Id. at 4. This reduction in habitat places the species at increased risk of extinction.

Disease or Predation (Criterion C):

Coral Disease. "Coral disease has emerged as a serious threat to coral reefs worldwide and a major cause of reef deterioration." Id. at 5 (citing Weil et al. 2006). "The numbers of diseases and coral species affected, as well as the distribution of diseases[,] have all increased dramatically within the last decade." Id. (citing Porter et al.

2001; Green & Bruckner 2000; Sutherland et al. 2004; Weil 2004). Coral diseases have resulted in significant losses of coral cover and have been implicated in the increased rate of disease in the Indo-Pacific, with outbreaks recently reported from the Great Barrier Reef, Marshall Islands, and the northwestern Hawaiian Islands. Id. (citing Aeby 2006; Jacobson 2006; Willis et al. 2004). "Increased coral disease levels on the [Great Barrier Reef] were correlated with increased ocean temperatures supporting the prediction that disease levels will increase with higher sea surface temperatures." Id. (citing Willis et al. 2007).

Similarly, according to NMFS' own recent Status Review Report, coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, especially bleaching, with disease outbreaks often either accompanying or immediately following bleaching events. Status Review Report, Exhibit 40 at 34. This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Combined with the increased frequency of bleaching events, disease is a major threat to the long-term survival of *Montipora setosa*.

Predation by Crown-of-Thorns Starfish. Additionally, *Acanthaster planci*, the crown-of-thorns starfish, has been observed preferentially preying upon corals of the genus *Montipora*. IUCN (Montipora setosa) 2012, Exhibit 13 at 5 (citing Colgan 1987). Crown-of-thorns starfish are found throughout the Pacific and Indian Oceans, and the Red Sea. Id. These starfish are voracious predators of reef-building corals, with a preference for branching and tubular corals like *Montipora setosa*. Id. "Populations of the crown-of-thorns starfish have greatly increased since the 1970s and have been known to wipe out large areas of coral reef habitat." Id. Increased breakouts of crown-of-thorns starfish has become a major threat, and have contributed to the overall decline and reef destruction in the Indo-Pacific region. Id.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Montipora setosa*, is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. Id. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Id. at 5-6. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse.

Human Population Growth. According to the recent Status Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of costal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities, and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Id. at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally Status Review Report, Exhibit 40 § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id.

Bleaching. *Montipora setosa* is especially susceptible to bleaching. IUCN (Montipora setosa) 2012, Exhibit 13 at 3, 4, 5. Bleaching, caused in large part by increasing ocean temperatures, happens when a coral expels its symbiotic zooxanthellae in response to thermal stress. Status Review Report, Exhibit 40 at 31. While most corals can withstand mild to moderate bleaching given enough recovery time, severe, repeated or prolonged bleaching can lead to colony mortality. Id.

Most corals are physiologically optimized to their local long-term seasonal variations in temperatures and an increase of only 1º C – 2º C above the normal local seasonal maximum can induce bleaching. Id. While some coral species are relatively resistant to the effects of bleaching, "there is general agreement that thermal stress has led to accelerated bleaching and mass mortality during the past 25 years." Id. Based on NOAA's own data, a recent analysis of global thermal stress and reported coral bleaching events for the 10 year period from 1998 to 2007 shows that bleaching is a widespread threat that has already had significant effects on most coral reefs around the world. In particular, the Indian Ocean, home of *Montipora setosa,* recently experienced an extensive mass bleaching in 2010, halting and potentially reversing recovery from the 1998 mass bleaching in the same region. Id.

The rapidity of the 2010 mass coral bleaching following previous bleaching events raises the likelihood that the world has already passed the point at which mass bleaching events will begin to happen too frequently for reefs to have sufficient time to recover in time for the next bleaching event. Id. The accelerating frequency of bleaching events and the slow recovery rate of this coral species are thus likely to result in significant mortality rates and reef decline in general. Id. at 32. Even though corals do have some capacity to adapt to rising temperatures, it is generally thought that corals are unlikely to be able to adapt sufficiently to prevent further widespread bleaching and mortality. Id. Given the susceptibility of this species to bleaching and its already low reproductive output, *Montipora setosa* at high risk of extinction. See id. at 3, 4, 5.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species in the Indo-Pacific, including *Montipora setosa*. See id. at 52. Escalating anthropogenic stressors combined with the threats associated with global climate change place reefs in the Indo-Pacific at high risk of collapse. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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Weil, E. 2006. Coral, Ocotocoral and sponge diversity in the reefs of the Jaragua National Park, Dominican Republic. *Rev. Bio. Trop.* 54(2): 423-443.

Wilkinson, C. 2004. *Status of coral reefs of the world: 2004.* Australian Institute of Marine Science, Townsville, Queensland, Australia.

(14) Scientific Name: *Parasimplastrea sheppardi*

Common Name: coral

IUCN Status: Endangered **CITES Status**: Appendix II

Range: This species is endemic to the west and northwest Indian Ocean and the Arabian Gulf. IUCN (Parasimplastrea sheppardi) 2012, Exhibit 14 at 4.

Habitat and Ecology: This species occurs to a depth of 20 meters in marginal reef environments, mainly in the Arabian Gulf region. Id. at 5. It is also found on subtidal rock and rocky reefs, on the back and foreslopes of the reef, and in lagoons. Id.

Population Status: "This is an uncommon species." Id. at 4. "There is no species-specific population information available for this species. However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species." Id. "This species is particularly susceptible to bleaching, disease, and other threats associated with global climate change, and therefore population decline is based on both the percentage of destroyed reefs and critical reefs that are likely to be destroyed within the next 20 years." Id. (citing Wilkinson 2004).

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

This species is estimated to experience habitat degradation and loss of 57% over the next thirty years. Id. This reduction in habitat places the species at increased risk of extinction.

Disease or Predation (Criterion C):

Coral Disease. This species is particularly susceptible to coral disease. Id. at 3, 4. "Coral disease has emerged as a serious threat to coral reefs worldwide and a major cause of reef deterioration." Id. at 5 (citing Weil et al. 2006). "The numbers of diseases and coral species affected, as well as the distribution of diseases have all increased dramatically within the last decade." Id. (citing Porter et al. 2001; Green & Bruckner 2000; Sutherland et al. 2004; Weil 2004). Coral diseases have resulted in significant losses of coral cover and have been implicated in the increased rate of disease in the Indo-Pacific, with outbreaks recently reported from the Great Barrier Reef, Marshall Islands, and the northwestern Hawaiian Islands. Id. (citing Aeby 2006; Jacobson 2006;

Willis et al. 2004). "Increased coral disease levels on the [Great Barrier Reef] were correlated with increased ocean temperatures supporting the prediction that disease levels will increase with higher sea surface temperatures. Id. (citing Willis et al. 2007).

Similarly, according to NMFS' own recent Status Review, coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, especially bleaching, with disease outbreaks often either accompanying or immediately following bleaching events. Status Review Report, Exhibit 40 at 34. This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Combined with the increased frequency of bleaching events, disease is a major threat to the long-term survival of *Parasimplastrea sheppardi*.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Parasimplastrea sheppardi*, is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. IUCN (Parasimplastrea sheppardi) 2012, Exhibit 14 at 5. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Id. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse.

Human Population Growth. According to the recent Status Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of costal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities, and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Id. at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally id. § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id.

Bleaching. *Parasimplastrea sheppardi* is especially susceptible to bleaching. IUCN (Parasimplastrea sheppardi) 2012, Exhibit 14 at 4. Bleaching, caused in large part by increasing ocean temperatures, happens when a coral expels its symbiotic zooxanthellae in response to thermal stress. Status Review Report, Exhibit 40 at 31. While most corals can withstand mild to moderate bleaching given enough recovery time, severe, repeated or prolonged bleaching can lead to colony mortality. Id.

Most corals are physiologically optimized to their local long-term seasonal variations in temperatures and an increase of only 1º C – 2º C above the normal local seasonal maximum can induce bleaching. Id. While some coral species are relatively resistant to the effects of bleaching, "there is general agreement that thermal stress has led to accelerated bleaching and mass mortality during the past 25 years." Id. Based on NOAA's own data, a recent analysis of global thermal stress and reported coral bleaching events for the 10 year period from 1998 to 2007 shows that bleaching is a widespread threat that has already had significant effects on most coral reefs around the world. Id. In particular, the Indian Ocean, home of *Parasimplastrea sheppardi,* recently experienced an extensive mass bleaching in 2010, halting and potentially reversing recovery from the 1998 mass bleaching in the same region. Id.

The rapidity of the 2010 mass coral bleaching following previous bleaching events raises the likelihood that the world has already passed the point at which mass bleaching events will begin to happen too frequently for reefs to have sufficient time to recover in time for the next bleaching event. Id. The accelerating frequency of bleaching events and the slow recovery rate of this coral species are thus likely to result in significant mortality rates and reef decline in general. Id. at 32. Even though corals do have some capacity to adapt to rising temperatures, it is generally thought that corals are unlikely to be able to adapt sufficiently to prevent further widespread bleaching and mortality. Id. Given susceptibility of this species to bleaching and its already low reproductive output, *Parasimplastrea sheppardi* is at high risk of extinction. See id. at 3, 4.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species in the Indo-Pacific, including *Parasimplastrea sheppardi*. See Status Review Report, Exhibit 40 at 52. Escalating anthropogenic stressors combined with the threats associated with global climate change place reefs in the Indo-Pacific at high risk of collapse. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(15) Scientific Name: *Pectinia maxima*

Common Name: coral

IUCN Status: Endangered **CITES Status**: Appendix II

Range: This species is found in the so-called Coral Triangle, including the Solomon Islands, Australia, Indonesia, and Papua New Guinea. IUCN (Pectinia maxima) 2012, Exhibit 15 at 4. It is not widespread and is uncommon throughout its range. Id. at 3.

Habitat and Ecology: "This species is found in shallow reef environments, protected from wave action and where the water is slightly turbid." Id. at 5. "*Pectinia* colonies occasionally reach 1 meter or more in diameter." Id. (citing Wood 1993). It is usually found at depths of 3-25 meters. Id. Species of this genus are typically conspicuous. Id. (citing Veron 1995).

Population Status: This species is overall uncommon, but is also highly distinctive. See id. at 4. "There is no species-specific population information available for this species. However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species." Id. "This species is particularly susceptible to bleaching, disease, and other threats and therefore population decline is based on both the percentage of destroyed reefs and critical reefs that are likely to be destroyed within the next 20 years." Id. (citing Wilkinson 2004).

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Pectinia maxima is expected to experience an estimated habitat degradation and loss of 66% over the next thirty years. Id. This reduction in habitat places the species at increased risk of extinction.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

This species is threatened by overharvest because of targeting by the aquarium trade. See id. at 3, 5, 6. In fact, in Lampung, Southern Sumatra, species of the genus *Pectinia*, which would include *Pectinia maxima*, are in the top 25 genera collected for the aquarium trade. See id. at 5 (citing Terangi Indonesian Coral Reef Foundation). ESA protection should be extended to the species to help halt further collection.

Disease or Predation (Criterion C):

Coral Disease. This species is particularly susceptible to coral disease. IUCN (Pectinia maxima) 2012, Exhibit 15 at 4, 5. "Coral disease has emerged as a serious threat to coral reefs worldwide and a major cause of reef deterioration." Id. at 5 (citing Weil et al. 2006). "The numbers of diseases and coral species affected, as well as the distribution of diseases have all increased dramatically within the last decade." Id. (citing Porter et al. 2001; Green & Bruckner 2000; Sutherland et al. 2004; Weil 2004). Coral diseases have resulted in significant losses of coral cover and have been implicated in the increased rate of disease in the Indo-Pacific, with outbreaks recently reported from the Great Barrier Reef, Marshall Islands, and the northwestern Hawaiian Islands. Id. (citing Aeby 2006; Jacobson 2006; Willis et al. 2004). "Increased coral disease levels on the [Great Barrier Reef] were correlated with increased ocean temperatures supporting the prediction that disease levels will increase with higher sea surface temperatures." Id. (citing Willis et al. 2007).

Similarly, according to NMFS' own recent Status Review Report, coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, especially bleaching, with disease outbreaks often either accompanying or immediately following bleaching events. Status Review Report, Exhibit 40 at 34. This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Combined with the increased frequency of bleaching events, disease is a major threat to the long-term survival of *Pectinia maxima*.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Pectinia maxima*, is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. IUCN (Pectinia maxima) 2012, Exhibit 15 at 5. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Id. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse.

Human Population Growth. According to the recent Status Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of costal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities, and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Id. at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally Status Review Report, Exhibit 40 § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id.

Bleaching. *Pectinia maxima* is especially susceptible to bleaching. IUCN (Pectinia maxima) 2012, Exhibit 15 at 3, 4, 5. Bleaching, caused in large part by increasing ocean temperatures, happens when a coral expels its symbiotic zooxanthellae in response to thermal stress. Status Review Report, Exhibit 40 at 31. While most corals can withstand mild to moderate bleaching given enough recovery time, severe, repeated or prolonged bleaching can lead to colony mortality. Id.

Many corals are physiologically optimized to their local long-term seasonal variations in temperatures and an increase of only 1º C – 2º C above the normal local seasonal maximum can induce bleaching. Id. While some coral species are relatively resistant to the effects of bleaching, "there is general agreement that thermal stress has led to accelerated bleaching and mass mortality during the past 25 years." Id. Based on

NOAA's own data, a recent analysis of global thermal stress and reported coral bleaching events for the 10 year period from 1998 to 2007 shows that bleaching is a widespread threat that has already had significant effects on most coral reefs around the world. Id. In particular, the Indian Ocean, home of *Pectinia maxima,* recently experienced an extensive mass bleaching in 2010, halting and potentially reversing recovery from the 1998 mass bleaching in the same region. Id.

The rapidity of the 2010 mass coral bleaching following previous bleaching events raises the likelihood that the world has already passed the point at which mass bleaching events will begin to happen too frequently for reefs to have sufficient time to recover in time for the next bleaching event. Id. The accelerating frequency of bleaching events and the slow recovery rate of this coral species are thus likely to result in significant mortality rates and reef decline in general. Id. at 32. Even though corals do have some capacity to adapt to rising temperatures, it is generally thought that corals are unlikely to be able to adapt sufficiently to prevent further widespread bleaching and mortality. Id. Given the susceptibility of this species to bleaching and its already low reproductive output, *Pectinia maxima* is at high risk of extinction. See id. at 3, 4, 5.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species in the Indo-Pacific, including *Pectinia maxima*. See Status Review Report, Exhibit 40 at 52. Escalating anthropogenic stressors combined with the threats associated with global climate change place reefs in the Indo-Pacific at high risk of collapse. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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Pratchett, Morgan S. 2007. Feeding Preferences of Acanthaster planci (Echinodermata: Asteroidea) under Controlled Conditions of Food Availability. *Pacific Science* 61(1): 113- 120.

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(16) Scientific Name: *Pocillopora fungiformis*

Common Name: coral

IUCN Status: Endangered　　　　　　　　　　**CITES Status**: Appendix II

Range: This species is restricted to Madagascar, an area of high habitat degradation, and is uncommon throughout this limited range. IUCN (Pocillopora fungiformis) 2012, Exhibit 16 at 3, 4.

Habitat and Ecology: "This species is found in shallow reef environments exposed to strong wave action." Id. at 5. Its maximum size is 2 meters across. Id.

Population Status: "This is an uncommon species." Id. at 4. "There is no species-specific population information available for this species. However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species." Id. This decline in reef habitat is especially pronounced around Madagascar. See id. at 3. "This species is particularly susceptible to bleaching, disease, and other threats and therefore population decline is based on both the percentage of destroyed reefs and critical reefs that are likely to be destroyed within 20 years." Id. at 4 (citing Wilkinson 2004).

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Pocillopora fungiformis is estimated to experience habitat degradation and loss of 58% over the next thirty years. Id. This habitat reduction places the species at increased risk of extinction.

Disease or Predation (Criterion C):

Coral Disease. This species is particularly susceptible to coral disease. Id. at 3, 4. "Coral disease has emerged as a serious threat to coral reefs worldwide and a major cause of reef deterioration." Id. at 5 (citing Weil et al. 2006). "The numbers of diseases and coral species affected, as well as the distribution of diseases have all increased dramatically within the last decade." Id. (citing Porter et al. 2001; Green & Bruckner 2000; Sutherland et al. 2004; Weil 2004). Coral diseases have resulted in significant losses of coral cover and have been implicated in the increased rate of disease in the Indo-Pacific, with outbreaks recently reported from the Great Barrier Reef, Marshall

Islands, and the northwestern Hawaiian Islands. Id. (citing Aeby 2006; Jacobson 2006; Willis et al. 2004). "Increased coral disease levels on the [Great Barrier Reef] were correlated with increased ocean temperatures supporting the prediction that disease levels will increase with higher sea surface temperatures." Id. (citing Willis et al. 2007).

Similarly, according NMFS' own recent Status Review Report, coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, especially bleaching, with disease outbreaks often either accompanying or immediately following bleaching events. Status Review Report, Exhibit 40 at 34. This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Combined with the increased frequency of bleaching events, disease is a major threat to the long-term survival of *Pocillopora fungiformis*.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Pocillopora fungiformis*, is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. IUCN (Pocillopora fungiformis) 2012, Exhibit 16 at 5. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Id. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse.

Human Population Growth. According to the recent Status Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of costal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities, and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Id. at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally id. § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id.

Bleaching. This Species is especially susceptible to bleaching. IUCN (Pocillopora fungiformis) 2012, Exhibit 16 at 3, 4. Bleaching, caused in large part by increasing ocean temperatures, happens when a coral expels its symbiotic zooxanthellae in response to thermal stress. Status Review Report, Exhibit 40 at 31. While most corals can withstand mild to moderate bleaching given enough recovery time, severe, repeated or prolonged bleaching can lead to colony mortality. Id.

Many corals are physiologically optimized to their local long-term seasonal variations in temperatures and an increase of only 1º C – 2º C above the normal local seasonal maximum can induce bleaching. Id. While some coral species are relatively resistant to the effects of bleaching, "there is general agreement that thermal stress has led to accelerated bleaching and mass mortality during the past 25 years." Id. Based on NOAA's own data, a recent analysis of global thermal stress and reported coral bleaching events for the 10 year period from 1998 to 2007 shows that bleaching is a widespread threat that has already had significant effects on most coral reefs around the world. In particular, the Indian Ocean, home of *Pocillopora fungiformis*, recently experienced an extensive mass bleaching in 2010, halting and potentially reversing recovery from the 1998 mass bleaching in the same region. Id.

The rapidity of the 2010 mass coral bleaching following previous bleaching events raises the likelihood that the world has already passed the point at which mass bleaching events will begin to happen too frequently for reefs to have sufficient time to recover in time for the next bleaching event. Id. The accelerating frequency of bleaching events and the slow recovery rate of this coral species are thus likely to result in significant mortality rates and reef decline in general. Id. at 32. Even though corals do have some capacity to adapt to rising temperatures, it is generally thought that corals are unlikely to be able to adapt sufficiently to prevent further widespread bleaching and mortality. Id. Given the susceptibility of this species to bleaching and its already low reproductive output, *Pocillopora fungiformis* is at high risk of extinction. See id. at 3, 4.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species in the Indo-Pacific, including *Pocillopora fungiformis*. See Status Review Report, Exhibit 40 at 52. Escalating anthropogenic stressors combined with the threats associated with global climate change place reefs in the Indo-Pacific at high risk of collapse. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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<u>(17) Scientific Name</u>: <u>*Porites desilveri*</u>

Common Name: coral

IUCN Status: Endangered **CITES Status**: Appendix II

Range: This species is known only from Sri Lanka. IUCN (Porites desilveri) 2012, Exhibit 17 at 4.

Habitat and Ecology: "This species is found in shallow reef environments, especially lagoons. It is not known to which depth this species generally occurs. <u>Id.</u> at 5.

Population Status: "This species is common throughout its very restricted range in a region with high reef destruction." <u>Id.</u> at 3. "There is no species-specific population information available for this species. However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species." <u>Id.</u> at 4. "This species is particularly susceptible to bleaching, disease, and other threats and therefore population decline is based on both the percentage of destroyed reefs and critical reefs that are likely to be destroyed within 20 years. <u>Id.</u> (citing Wilkinson 2004).

Population Trend: Unknown. <u>Id.</u>

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Porites desilveri is estimated to experience habitat degradation and loss of 55% over the next 30 years. <u>Id.</u> This habitat reduction places the species at increased risk of extinction.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

This species, and others of the genus *Porites*, are heavily collected for the aquarium trade. <u>Id.</u> at 3, 5, 6. ESA protection should be extended to the species to help halt further collection.

Disease or Predation (Criterion C):

Coral Disease. *Porites desilveri* is more prone to disease than many other corals. <u>Id.</u> at 3, 4, 5. "Coral disease has emerged as a serious threat to coral reefs worldwide and a major cause of reef deterioration." <u>Id.</u> at 5 (citing Weil et al. 2006). The numbers of diseases and coral species affected, as well as the distribution of diseases, has increased dramatically within the last decade. Id. (citing Porter et al. 2001; Green & Bruckner 2000; Sutherland et al. 2004; Weil 2004). Coral diseases have resulted in significant losses of coral cover and have been implicated in the increased rate of disease in the Indo-Pacific, with outbreaks recently reported from the Great Barrier Reef, Marshall Islands, and the northwestern Hawaiian Islands. Id. (citing Aeby 2006; Jacobson 2006; Willis et al. 2004). "Increased coral disease levels on the [Great Barrier Reef] were correlated with increased ocean temperatures supporting the prediction that disease levels will increase with higher sea surface temperatures." Id. (citing Willis et al. 2007).

Similarly, according to NMFS' own recent Status Review Report, coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, including oceanic acidification. Status Review Report, Exhibit 40 at 34. This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Given its greater susceptibility, coral disease is a major threat to the long-term survival of *Porites desilveri*.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Porites desilveri*, is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. IUCN (Porites desilveri) 2012, Exhibit 17 at 5. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Id. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse.

Human Population Growth. According to the recent Status Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of costal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities, and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Id. at

25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See Status Review Report, Exhibit 40 § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species in the Indo-Pacific, including *Porites desilveri*. See Status Review Report, Exhibit 40 at 52. Escalating anthropogenic stressors combined with the threats associated with global climate change place reefs in the Indo-Pacific at high risk of collapse. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(18) Scientific Name: *Porites eridani*

Common Name: coral

IUCN Status: Endangered **CITES Status**: Appendix II

Range: This species is found in the central Indo-Pacific, Southeast Asia, the South China Sea, Palau, and the Marianas Islands. IUCN (Porites eridani) 2012, Exhibit 18 at 4 (citing Randall 1995).

Habitat and Ecology: "This species is found in shallow, protected reef environments, generally to depths of 20 m[eters]." Id. at 5.

Population Status: Though relatively widespread, this species is uncommon throughout its range. Id. at 3. "There is no species-specific population information available for this species. However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline in this species. Id. at 4. This species is particularly susceptible to bleaching, disease, and other threats and therefore population decline is based on both the percentage of destroyed reefs and critical reefs that are likely to be destroyed within 20 years." Id. (citing Wilkinson 2004).

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Porites eridani is expected to experience an estimated habitat degradation and loss of 58% over the next thirty years. Id. This reduction in habitat will increase the species' risk of extinction.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

This species is heavily collected for the aquarium trade, along with other species of this genus. Id. at 3, 5, 6. The Indonesian catch quota for species of this genus is 55,500 per year. Id. at 5. This is an unacceptable protection for a species facing these threats. ESA protection should be extended to the species to help halt further collection.

Disease or Predation (Criterion C):

Coral Disease. This species of coral is more prone to disease than many other corals. Id. at 3, 4, 5. "Coral disease has emerged as a serious threat to coral reefs worldwide and a major cause of reef deterioration." Id. at 5 (citing Weil et al. 2006). The number of diseases and coral species affected, as well as the distribution of diseases, has increased dramatically within the last decade. Id. (citing Porter et al. 2001; Green & Bruckner 2000; Sutherland et al. 2004; Weil 2004). Coral diseases have resulted in significant losses of coral cover and have been implicated in the increased rate of disease in the Indo-Pacific, with outbreaks recently reported from the Great Barrier Reef, Marshall Islands, and the northwestern Hawaiian Islands. Id. (citing Aeby 2006; Jacobson 2006; Willis et al. 2004). "Increased coral disease levels on the [Great Barrier Reef] were correlated with increased ocean temperatures supporting the prediction that disease levels will increase with higher sea surface temperatures." Id. (citing Willis et al. 2007).

Similarly, according to NMFS' own recent Status Review Report, coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, including oceanic acidification. Status Review Report, Exhibit 40 at 34. This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Given its greater susceptibility, coral disease is a major threat to the long-term survival of *Porites eridani*.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

"*Porites* species are heavily collected for the aquarium trade. In Indonesia, the catch quota for this genus is 55,500 per year." IUCN (Porites eridani) 2012, Exhibit 18 at 5. While catch quotas are necessary to ensure that species that have not yet become "endangered" are not harvested in unsustainable numbers, they are inappropriate measures for species that have already become "endangered." By listing a species as "endangered," IUCN is saying that the species is facing threats to its existence that create a "very high risk of extinction in the wild." IUCN Undated, Exhibit 38 at 17-20. If a species is facing a "very high risk of extinction in the wild," then the catch quota for that species should be set at zero. These types of half-measures are inappropriate to halt species extinctions, and this is why the more restrictive prohibitions represented by ESA protection are desperately needed for this species.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Porites eridani*, is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. Id. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse. Id.

Human Population Growth. According to the recent Status Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of costal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities, and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Id. at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally Status Review Report, Exhibit 40 § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species in the Indo-Pacific, including *Porites eridani*. See id. at 52. Escalating anthropogenic stressors combined with the threats associated with global climate change place reefs in the Indo-Pacific at high risk of collapse. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(19) Scientific Name: *Porites ornata*

Common Name: coral

IUCN Status: Endangered **CITES Status**: Appendix II

Range: This species is found in the central Indo-Pacific, in the so-called Coral Triangle. IUCN (Porites ornata) 2012, Exhibit 19 at 4.

Habitat and Ecology: "This species is found in shallow, protected reef environments, generally to depths of 15 m[eters]." Id. at 4-5.

Population Status: This species is uncommon or rare throughout its range. Id. at 4. "There is no species-specific population information available for this species. However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species. Id. This species of *Porites* is particularly susceptible to bleaching, disease, and other threats and therefore population decline is based on both the percentage of destroyed reefs and critical reefs that are likely to be destroyed within 20 years. Id.

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Porites ornata is expected to experience an estimated habitat degradation and loss of 66% over the next thirty years. Id. This reduction in habitat will increase the species' risk of extinction.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

This species is heavily collected for the aquarium trade. Id. at 3, 5, 6. The Indonesian catch quota for the genus alone is 55,500 individuals per year. Id. at 5. This protection is unacceptable for a species facing these types of threats. ESA protection should be extended to the species to help halt further harmful collection.

Disease or Predation (Criterion C):

Coral Disease. *Porites ornata* are more prone to disease than many other corals. Id. at 3, 4, 5. "Coral disease has emerged as a serious threat to coral reefs worldwide and a major cause of reef deterioration." Id. at 5 (citing Weil et al. 2006). The number of diseases and coral species affected, as well as the distribution of diseases, has increased dramatically within the last decade. Id. (citing Porter et al. 2001; Green & Bruckner 2000; Sutherland et al. 2004; Weil 2004). Coral diseases have resulted in significant losses of coral cover and have been implicated in the increased rate of disease in the Indo-Pacific, with outbreaks recently reported from the Great Barrier Reef, Marshall Islands, and the northwestern Hawaiian Islands. Id. (citing Aeby 2006; Jacobson 2006; Willis et al. 2004). "Increased coral disease levels on the Great Barrier Reef were correlated with increased ocean temperatures supporting the prediction that disease levels will increase with higher sea surface temperatures." Id. (citing Willis et al. 2007).

Similarly, according to NMFS' own recent Status Review Report, coral disease has a synergistic relationship with increasing water temperatures and its concomitant effects, including bleaching and oceanic acidification, with disease outbreaks often either accompanying or immediately following bleaching events. Status Review Report, Exhibit 40 at 34. This relationship is most likely the result of higher than normal summer temperatures that increase pathogen virulence while decreasing the coral's resistance by reducing the antibiotic activity of the host coral's microbial flora. Id. Combined with the increased frequency of bleaching events, disease is a major threat to the long-term survival of *Porites ornata*.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

"*Porites* species are heavily collected for the aquarium trade. In Indonesia, the catch quota for this genus is 55,500 per year." IUCN (Porites ornata) 2012, Exhibit 19 at 5. While catch quotas are necessary to ensure that species that have not yet become "endangered" are not harvested in unsustainable numbers, they are inappropriate measures for species that have already become "endangered." By listing a species as "endangered," IUCN is saying that the species is facing threats to its existence that create a "very high risk of extinction in the wild." IUCN Undated, Exhibit 38 at 17-20. If a species is facing a "very high risk of extinction in the wild," then the catch quota for that species should be set at zero. These types of half measures are inappropriate to halt species extinctions, and this is why the more restrictive prohibitions represented by ESA protection are desperately needed for this species.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Porites ornata*, is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. IUCN (Porites ornata) 2012, Exhibit 19 at 5. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Id. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse.

Human Population Growth. According to the recent Status Review Report by NMFS, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of costal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities, and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Ocean Acidification. Ocean acidification is one of the primary threats facing corals and is the direct result of anthropogenic increases in atmospheric CO_2 levels. Id. at 25. Following the Industrial Revolution, "[a]tmospheric CO_2 has increased rapidly from its preindustrial level of 280 ppm to over 390 ppm." Id. This dramatic increase in CO_2 levels has not only warmed the planet significantly but is also changing ocean chemistry, through acidification. Id.

As the level of atmospheric CO_2 has continued to rise, there has been a concurrent increase in the relative level of CO_2 in the ocean. Id. An important result of this increase in oceanic CO_2 levels is a reduction in the overall pH balance of the ocean (acidification), which in turn has several important, negative effects on corals and the reefs they build and inhabit. See generally Status Review Report, Exhibit 40 § 3.2.3. First among the adverse consequences of oceanic acidification is a reduction in the ability of corals to create the calcite crystals that form their skeletons and ultimately the reefs they live on. Id. at 40. One study showed a decrease in calcification rates in branching corals of 11% to as high as 37%. Id. This decline in calcification rates is expected to increase as CO_2 emissions also increase over the next century. Id.

Additionally, oceanic acidification has the potentially devastating consequence of reducing the structural stability of corals and reefs, resulting both from increases in bioerosion and decreases in reef cementation. Id. at 45. Increased oceanic acidity causes new reef formations to calcify more slowly, increasing the damage caused from bioerosion, and ultimately resulting in poorly cemented, unstable, and fragile reef frameworks. Id. Corals themselves may be able to persist in the absence of a carbonate skeleton, but a lack of accretion and increased erosion would essentially eliminate coral reefs and much of the ecosystem goods and services they provide. Id. This could begin as early as mid-century when doubling of preindustrial CO_2 concentrations are predicted. Id.

Bleaching. Branching forms of the genus *Porites*, including *Porites ornata*, have almost twice the "bleaching response" as other forms in the genus, placing branching *Porites*, including *Porites ornata*, within the top ten genera for susceptibility to bleaching. Id. at 5 (citing McClanahan et al. 2007). This means that *Porites ornata* have an extremely strong negative reaction to bleaching events. Id. Bleaching, caused in large part by increasing ocean temperatures, happens when a coral expels its symbiotic zooxanthellae in response to thermal stress. Status Review Report, Exhibit 40 at 31. While most corals can withstand mild to moderate bleaching given enough recovery time, severe, repeated or prolonged bleaching can lead to colony mortality. Id.

Many corals are physiologically optimized to their local long-term seasonal variations in temperatures and an increase of only 1º C – 2º C above the normal local seasonal maximum can induce bleaching. Id. While some coral species are relatively resistant to the effects of bleaching, "there is general agreement that thermal stress has led to accelerated bleaching and mass mortality during the past 25 years." Id. Based on NOAA's own data, a recent analysis of global thermal stress and reported coral bleaching events for the 10 year period from 1998 to 2007 shows that bleaching is a widespread threat that has already had significant effects on most coral reefs around the world. In particular, the Indian Ocean, home of *Porites ornata*, recently experienced an extensive mass bleaching in 2010, halting and potentially reversing recovery from the 1998 mass bleaching in the same region. Id.

The rapidity of the 2010 mass coral bleaching following previous bleaching events raises the likelihood that the world has already passed the point at which mass bleaching events will begin to happen too frequently for reefs to have sufficient time to recover in time for the next bleaching event. Id. The accelerating frequency of bleaching events and the slow recovery rate of this coral species are thus likely to result in significant mortality rates and reef decline in general. Id. at 32. Even though corals do have some capacity to adapt to rising temperatures, it is generally thought that corals are unlikely to be able to adapt sufficiently to prevent further widespread bleaching and mortality. Id. Given the susceptibility of this species to bleaching and its already low reproductive output, *Porites ornata* is at high risk of extinction.

Combined, the above threats have already contributed to the deterioration of coral reefs and coral species populations globally, severely threatening the long-term growth and survival of many coral species in the Indo-Pacific, including *Porites ornata*. See Status Review Report, Exhibit 40 at 52. Escalating anthropogenic stressors combined with the threats associated with global climate change place reefs in the Indo-Pacific at high risk of collapse. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(20) Scientific Name: *Rhizopsammia wellingtoni*

Common Name: Wellington's Solitary Coral

IUCN Status: Critically Endangered **CITES Status**: Appendix II

Range: This species is found only in a few localized areas in the Galápagos Archipelago. See IUCN (Rhizopsammia wellingtoni) 2012, Exhibit 20 at 4 (citing Well 1983; Cairns 1991; Reyes-Bonilla 2002; Hickman 2005).

Habitat and Ecology: This species occurs under rock ledges, overhangs, and ceilings of underwater caves, at depths of 2-45 meters. Id. (citing Wells 1983; Cairns 1991; Hickman 2005).

Population Status: Prior to the 1982-83 ENSO event, this species was reported as being most abundant, comprising approximately 13% of mean surface coverage, at 15 meters depth in Tagus Cove, Isabela. Id. (citing Glynn and Wellington 1983). Following the 1982-83 ENSO event, most colonies of this species were destroyed, except for a few isolated colonies at Cousins and Gordons Rocks, both part of the Galápagos chain. See id. (citing Hickman 2005). Despite isolated findings through the 1990s, *Rhizopsammia wellingtoni* populations have continued to decline rapidly and the species has not been observed anywhere within its range since 2000, and is now considered possibly extinct. Id. (citing Witman and Smith 2003).

Population Trend: Decreasing; possibly already extinct. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

Although *Rhizopsammia wellingtoni* is listed on Appendix II of CITES, it has nevertheless suffered a dramatic reduction in numbers since 1983, to the point of near extinction. Id. at 4, 5. Listing this species under the ESA could greatly increase its chances of recovery and long-term survival.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Despite no specific information on the thermal tolerance limits of this species, the dramatic, possibly 100%, reduction in its population immediately after the 1982-83 ENSO event suggests that this species is "particularly sensitive to thermal anomalies" associated with global climate change. See id. According to the recent NMFS Status Review Report, a recent analysis of threats to coral reefs found that thermal stress from increased ocean temperatures has detrimental effects on virtually every life history stage of reef corals, as impaired fertilization, developmental abnormalities, mortality, and impaired settlement success of coral larva have all been documented. Status Review Report, Exhibit 40 at 29. The ongoing threats from oceanic warming and ENSO events have already placed *Rhizopsammia wellingtoni* at high risk of extinction.[21] These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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[21] See "Corals Introduction," supra (for more information regarding global climate change and its concomitant impacts on corals worldwide which likely also effect *Rhizopsammia wellingtoni*).

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(21) Scientific Name: *Siderastrea glynni*

Common Name: coral

IUCN Status: Critically Endangered **CITES Status**: Appendix II

Range: *Siderastrea glynni* is an endemic species of Panama, and is only known from a single location; Uraba Island, Panama Bay, near the Pacific opening of the Panama Canal. IUCN (Siderastrea glynni) 2012, Exhibit 21 at 4. This species has an area of occupancy of less than 10 km^2 and is extremely fragmented. Id. at 3.

Current Range: Currently, the only known individuals of this species are housed in the aquaria of the Smithsonian Tropical Research Institute. Id. at 4, 5.

Habitat and Ecology: "The known colonies of *Siderastrea glynni* were reported to be unattached and occur along the upper sand-coral rubble reef slope at a depth of 7 to 8.5 m[eters]." Id. at 4.

Population Status: This species was first discovered in September 1992. Id. This species is extremely rare, endemic only to Panama. Id. at 4, 5. "[O]nly five individual colonies have ever been discovered, and only four currently survive." Id. at 4. Following the discovery of this species, extensive but not exhaustive surveys in presumptively suitable habitats failed to reveal additional populations. Id. at 3, 4. Following the removal of the four known colonies to the Smithsonian due to bleaching, no extant colonies are known in the wild. Id. at 4, 5. However, there is a possibility that it still exists elsewhere in the wild and is yet undiscovered. Id. at 3.

Population Trend: Stable due to captivity. See id. at 4, 5.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Should this species ever be returned to the wild, it faces considerable habitat degradation from coastal development and oil production and transportation activities in the Gulf of Panama and Panama Canal. See id. at 5. "In the case of habitat destruction resulting from coastal development, the severity of impacts is high with low reversibility." Zamora-Arroyo et al. 2005, Exhibit 66 at 58. These threats to the species' habitat represent a significant impediment to its reintroduction to the wild and, therefore, its continued existence.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

"During the 1997-98 ENSO event, the four known colonies of *S. glynni* began to deteriorate, displaying bleaching and tissue loss." IUCN (Siderastrea glynni) 2012, Exhibit 21 at 5 (citing Fenner 2001; Glynn 2001). "Due to the unhealthy state of the corals, the four colonies were moved to the Smithsonian Tropical Research Institute aquaria. However, the original rareness of this species has been related to unknown causes, and not to the ENSO event. Nevertheless, such small populations typically display low genetic variability, thus lowering their capacity to survive environmental perturbations." Id. (citing Maté 2003; Glynn 1997).

Climate change, ENSO events, and their concomitant effects also represent significant threats to *Siderastrea glynni*.[22] These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(22) Scientific Name: *Stylophora madagascarensis*

Common Name: coral

IUCN Status: Endangered **CITES Status**: Appendix II

Range: This species is entirely restricted to Madagascar. IUCN (Stylophora madagascarensis) 2012, Exhibit 22 at 3.

Habitat and Ecology: This species is found in "shallow reef environments exposed to some wave action and in sheltered lagoons" to a depth of 20 meters. Id. at 4. The maximum size of an individual is approximately 25 cm across. Id.

Population Status: This species is common throughout its range. Id. at 4. "There is no species-specific population information available for this species. However, there is evidence that overall coral reef habitat has declined, and this is used as a proxy for population decline for this species." Id. Population decline is estimated using the percentage of destroyed reefs in its range. Id. (citing Wilkinson 2004).

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

This species is found in an area of "extensive reduction of coral reef habitat due to a combination of threats," with estimated habitat degradation and loss of 58% over thirty years. Id. at 3-4. This reduction in habitat represents a significant threat to the species' continued survival.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

In general, the major threat to coral species, including *Stylophora madagascarensis*, is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of El Niño Southern Oscillation (ENSO) events and storms, and ocean acidification. Id. at 5. Other threats include human development, pollution from agriculture and industry, and human recreation and tourism activities. Id. Combined, these threats place coral reefs in the Indo-Pacific at high risk of collapse.

Human Population Growth. According to NMFS' own recent Status Review, the common root of all the threats to coral populations worldwide is the number of humans populating the planet and the level of human consumption of natural resources, both of which are increasing in most areas around the globe. See Status Review Report, Exhibit 40 § 3. These combined pressures are directly responsible for escalating atmospheric carbon dioxide (CO_2) buildup and associated impacts, both direct (e.g. ocean warming, ocean acidification, and sea level rise) and indirect (e.g. influential in the increased prevalence of many coral diseases, decreased ability of corals to deposit calcium carbonate skeletons, increased energy for storms, and the potential of increased input and resuspension of costal sediments by changing precipitation patterns and sea-level rise). Id. at 19. Recent studies show that reef deterioration and coral mortality are directly attributable to adjacent human population densities, and, despite concerted efforts on the part of governments and non-governmental organizations, coral reefs are continuing to deteriorate around the world. Id.

Climate change is also likely having negative effects on the continued existence of *Stylophora madagascarensis*.[23] These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(23) Scientific Name: *Tubastraea floreana*

Common Name: Floreana Coral

IUCN Status: Critically Endangered **CITES Status**: Appendix II

Range: This species is endemic to the Galápagos Archipelago, known only from a small number of sites. IUCN (Tubastraea floreana) 2012, Exhibit 23 at 4 (citing Wells 1983; Cairns 1991; Hickman 2005).

Habitat and Ecology: This species occurs in "cryptic habitats; on ceilings of caves, ledges and rock overhangs." Id. (citing Wells 1983; Cairns 1991; Hickman 2005). It has been reported to occur at depths of 2-46 meters. Id. (citing Wells 1983; Cairns 1991; Hickman 2005).

Population Status: Before 1983, *Tubastraea floreana* was known from several sites around the Galápagos Archipelago. Id. (citing Wells 1983; Cairns 1991). However, after the 1982-83 ENSO event, this species was not reported from any site until the early 1990s, when three colonies were reported, all at one site. Id. However, these colonies have since disappeared, last being observed in 2001, leaving a single known site. Id. Thus, decline following the 1982-83 ENSO event is estimated to exceed 80%, while the threat of ENSO events has not ceased. Id.

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Corals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

"Despite a lack of information on the thermal tolerances of *Tubastraea floreana*, the dramatic reduction in its distribution immediately after the 1982-83 [ENSO] event suggests that this mortality resulted from the event." Id. at 5.

According to the recent NMFS Status Review Report, a recent analysis of threats to coral reefs found that thermal stress from increased ocean temperatures has detrimental effects on virtually every life history stage of reef corals, as impaired fertilization, developmental abnormalities, mortality, and impaired settlement success of coral larva have all been documented. Status Review Report, Exhibit 40 at 29. The ongoing threats from oceanic warming and ENSO events have already placed *Tubastraea floreana* at high risk of extinction.[24] As a result of these declines and the likelihood that their probable cause will continue to occur periodically, the species should qualifies for ESA protection.

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[24] See also "Corals Introduction," supra (discussing global climate change and its concomitant impacts on corals worldwide that are likely also affecting *Tubastraea floreana*).

B. FISH

FISH INTRODUCTION

WildEarth Guardians is petitioning the Secretary to list 14 fish species from IUCN's lists of "endangered" and "critically endangered" species (Species Accounts 24-37) under the ESA as "threatened" or "endangered" species. The petitioned fish species face a variety of threats to their continued existence. Some of these common threats will be discussed in this introductory section ("Fish Introduction"). Fish Introduction is to be considered as incorporated by reference in each of the individual fish species accounts that follow ("Individual Fish Species Accounts").

The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range (Criterion A):

Human Population Growth. While general human population has a substantial negative effect on fish populations due to increased fishing pressure, those human populations that are located near the coasts have an even stronger negative impact. This is very problematic because NMFS' own recent Status Review Report estimates that the total human population will be roughly 9 billion by 2045-2050, and cited one source putting that total at an even larger 10.6 billion. Status Review Report, Exhibit 40 at 20 (citations omitted). Currently, worldwide, approximately 2.5 billion people live within just **100 km** of the coastline. See WRI 2011, Exhibit 41 at 21. By 2020, an astonishing **75%** of the expanded human population is expected to live within just **60 km** of the coastline. Knip et al. 2010, Exhibit 42 at 2 (citation omitted). This increasing concentration of people near the coasts means that the negative effect of the general population increase will be magnified greatly.

Impacts from population growth do not occur evenly. Increased economic growth in coastal cities is a major cause of ocean habitat destruction. With growth comes an increase in consumption and development. This is reflected in an increase in construction projects, some of which occur on reef communities; dredging of harbors and shipping channels; dumping of waste, run-off pollution and increased sedimentation; deforestation; and increased tourism. As a result of these factors, the coasts around virtually all urban areas are "beset by a pattern of pollution and over-development." Hinrichsen Undated, Exhibit 43 at 2. "Coastal urban areas dump increasing loads of toxic wastes into the sea. In fact, waters around many coastal cities have turned into virtual cesspools, so thick with pollution that virtually no marine life can survive." Id. at 4.

This urban pollution is contributing to increasing "dead zones," amongst other things. These dead zones are areas where dissolved oxygen content is so low that no marine life, apart from microorganisms, can live. A 2007 study identified 200 of these dead zones, which represents an increase of 51 such zones found just four years earlier. Id. at 5. Worse yet, these dead zones are not only becoming more numerous, they are also greatly expanding "due mainly to high nutrient pollution levels brought in by rivers and streams and washed off coastal land." Id. One striking example is that the Gulf of Mexico dead zone, the world's second largest, has now reached the size of the state of New Jersey at 21,000 square kilometers. Id.

Furthermore, climate change is expected to magnify these coastal pollution problems. For example, "[d]ue to water circulation and oceanic volume changes, estuarine and coastal systems are predicted to experience . . . increased eutrophication, hypoxia, and anoxia." Roessig et al. 2004, Exhibit 29 at 258 (citations omitted). "More intense rains wash more fertilizer and sewage into coastal waters, and this runoff triggers algal blooms and consequent poisoning of fish and humans." Id. at 269 (citation omitted).

Several of the petitioned fish species are already facing negative impacts from this human population growth and many more likely will as the population continues to explode and become increasingly concentrated on the coasts.[25] Therefore, this human population growth represents a serious threat to many of the petitioned species.

Coral Reef Loss. To begin with a stark statement, "UN scientists are predicting that coral reefs around the world, can disappear by the end of the century" due to climate change. Freeport News 2012, Exhibit 26 at 1. This would make coral reefs the first entire ecosystem to have been destroyed by humans. Id. This threat is palpable as an estimated 20 percent of the world's reefs have already been lost in the last several decades. Id. at 2. Coral reef loss is an overwhelming threat to many types of marine biodiversity. This is because of the richness represented by these vibrant, compact pieces of habitat. Several of the petitioned species directly rely on coral reefs and, therefore, their loss is a significant threat to those species.[26] However, loss of these coral reefs will likely affect even those species that do not take advantage of these areas as habitat through decreasing prey that are reliant on coral reefs and other indirect effects.

The threats to coral reefs often stem from threats to the tiny corals themselves whose skeletons form these important pieces of habitat. The threats to coral reefs include removal of both living and dead coral for economic reasons such as mining them for construction and calcium and harvesting them for jewelry, curios, marine aquaria, and medical use.[27] Corals are also incidentally harmed by human activities including dynamite fishing, chemical fishing, and human recreation and tourism activities. Id.

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[25] See, e.g., IUCN (Argyrosomus hololepidotus) 2012, Exhibit 48 at 3, 4 (population is expanding in range, also ties increased fishing pressure to this population rise directly); IUCN (Mycteroperca fusca) 2012, Exhibit 54 at 5 ("Both *M. fusca* (along with *Epinephelus marginatus*) showed the strongest responses to variations in fishing intensity and human population among the Canary Islands, thus supporting the hypothesis that major human intervention has affected the abundance and biomass of both species across the Archipelago"); IUCN (Paraclinus magdalenae) 2012, Exhibit 56 at 4; Zamora-Arroyo et al. 2005, Exhibit 66 at 54, 58 (*Colpichthys hubbsi*); "Individual Fish Species Accounts: (30) *Latimeria chalumnae*," infra (expanding population leading to increased siltation and other environmental/habitat degradation).

[26] See IUCN (Chaetodontoplus vanderloosi) 2012, Exhibit 50 at 3, 4; IUCN (Halichoeres socialis) 2012, Exhibit 53 at 4; IUCN (Pterapogon kauderni) 2012, Exhibit 59 at 8, 11; IUCN (Scarus trispinosus) 2012, Exhibit 60 at 5.

[27] See "A. Corals: Corals Introduction: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra.

Corals are subject to coral disease, which can eliminate healthy corals making rebuilding of damaged reefs impossible.[28] Likewise, unnaturally heavy predation by the crown-of-thorns starfish can render large areas of coral barren, leading to reef building stagnation.[29] Human population growth and anthropogenic climate change will continue to cause and exacerbate many threats to reefs.[30] Bleaching and sedimentation will also increase stress on corals, killing many, and hampering reef-building activities.[31] Ocean acidification legitimately threatens to halt reef building entirely if the pH of the ocean becomes too low for corals to form the calcite skeletons that form reefs, making repair and replacement of damaged or removed reef material impossible.[32] Finally, the synergistic effects of these multiple threats to coral habitat may have a larger combined effect than their mere additive impact.[33]

While it is possible that at least some corals could survive the loss of reefs as obscure invertebrates, many others will likely become "extinct, and the others are going to be very, very rare." Freeport News 2012, Exhibit 26 at 1, 2. While this is tragic in itself, it also means that fish, including several petitioned fish species, and other species that rely on reefs for habitat will face increased pressure and likely extinctions. Reefs will slowly disappear and will not be rebuilt, effectively removing this habitat until ocean pH returns to a level where reef building can occur. This could take thousands of years, or may never occur. Therefore, loss of coral reefs represents a major threat to the reef-reliant petitioned species of fish.

Mangroves. Several of the petitioned species of fish rely on mangroves for some or all of their lives.[34] This is problematic because mangroves are facing extensive removal threats. These threats are often due to coastal resort development. See, e.g., IUCN (Halichoeres socialis) 2012, Exhibit 53 at 4-5. The threat has gotten so bad that in all of Costa Rica and Panama, as of 2000, there was estimated to be only 2,000 km^2 of mangroves in the two countries combined, and mangrove reduction has not ceased since that time. See IUCN (Tomicodon abuelorum) 2012, Exhibit 61 at 4. This is very problematic because surveys have shown that reduction of mangroves in other regions

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[28] See "A. Corals: Corals Introduction: Disease or Predation (Criterion C): Coral Diseases," supra.
[29] See "A. Corals: Corals Introduction: Disease or Predation (Criterion C): Predation by Crown-of-Thorns Starfish," supra.
[30] See "A. Corals: Corals Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Human Population Growth," supra; "A. Corals: Corals Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Anthropogenic Climate Change," supra.
[31] See "A. Corals: Corals Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Bleaching," supra; "A. Corals: Corals Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Sedimentation," supra.
[32] See "A. Corals: Corals Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Ocean Acidification," supra.
[33] See "A. Corals: Corals Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Synergistic Effects," supra.
[34] See IUCN (Argyrosomus hololepidotus) 2012, Exhibit 48 at 4; IUCN (Halichoeres socialis) 2012, Exhibit 53 at 4, 5; IUCN (Paralabrax albomaculatus) 2012, Exhibit 58 at 5; IUCN (Pterapogon kauderni) 2012, Exhibit 59 at 8; IUCN (Scarus trispinosus) 2012, Exhibit 60 at 5; IUCN (Tomicodon abuelorum) 2012, Exhibit 61 at 3, 4.

has brought some fish species to extinction. Id. The continuing removal of mangroves from many areas around the world threatens the petitioned fish species that are mangrove-dependant with further habitat loss and puts them at further risk of extinction.

Pollution. Pollution from human sources threatens several of the petitioned fish species.[35] Whether this pollution comes in the form of agricultural runoff, sewage, sediment, or toxics, it is always a threat to the relevant petitioned species' habitat. Sometimes this pollution can lead to dead zones in the ocean, and these dead zones have been observed in at least some of these species' habitats already. This human caused pollution threatens these species' habitat and represents a threat to their continued existence requiring ESA protection.

Coastal Development. Several petitioned species are also being negatively impacted by coastal development. See IUCN (Halichoeres socialis) 2012, Exhibit 53 at 4, 5; IUCN (Mycteroperca jordani) 2012, Exhibit 55 at 6; IUCN (Paraclinus magdalenae) 2012, Exhibit 56 at 4; IUCN (Paraclinus walkeri) 2012, Exhibit 57 at 3, 4; IUCN (Pterapogon kauderni) 2012, Exhibit 59 at 11; IUCN (Tomicodon abuelorum) 2012, Exhibit 61 at 3-4; "Individual Fish Species Accounts: (27) *Colpichthys hubbsi*: The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A): Coastal Development," infra; IUCN (Halichoeres socialis) 2012, Exhibit 53 at 4-5. This coastal development can damage or destroy the species' habitat and can also result in increased pollution which then damages or destroys the habitat. "In the case of habitat destruction resulting from coastal development, the severity of impacts is high with low reversibility." Zamora-Arroyo et al. 2005, Exhibit 66 at 58. Therefore, this development represents a significant threat to the relevant species.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

Many fish species have been, and continue to be, overutilized by commercial fisheries. To date there has been insufficient regulation of this exploitative industry and this lack of regulation has caused unsustainable practices leading to population declines and extinctions amongst species.

> Around the world, fish populations are decreasing as demand for fish is increasing. Within the first 15 years of industrialized fishery operation, fish populations have been decreased by 80 percent on average. For example, in

[35] This list is likely underinclusive as dead zones have been poorly mapped to date and therefore there are likely even more petitioned fish species threatened by these destructive occurrences. See IUCN (Paraclinus magdalenae) 2012, Exhibit 56 at 4 (pollution); IUCN (Pterapogon kauderni) 2012, Exhibit 59 at 6, 11 (pollution); Greenpeace 2008, Exhibit 63 at 16-17 (Gulf of California dead zones potentially implicating *Paraclinus magdalenae*, *Colpichthys hubbsi*, *Mycteroperca jordani*, and possibly others); Zamora-Arroyo et al. 2005, Exhibit 66 at 58 (Gulf of California dead zones potentially implicating *Paraclinus magdalenae*, *Colpichthys hubbsi*, *Mycteroperca jordani*, and possibly others); see generally "Individual Fish Species Accounts: (27) *Colpichthys hubbsi*," infra; "Individual Fish Species Accounts: (30) *Latimeria chalumnae*," infra (damaging agricultural practices, overgrazing, deforestation, destruction of wetlands, and mining leading to increased siltation and other pollution).

> the Gulf of Thailand, 60 percent of large finfish, sharks and skate were lost within the first five years of commercial trawl fishing.
>
> The decline of large mature fish has led to an increase in the intensity of fishing and to an increase in the number of juveniles and non food fish caught (e.g., bycatch). Water pollution is also threatening spawning grounds and inshore of many fish species.
>
> The use of some fishing techniques such as heavy trawls destroys the ocean floor ecosystem on which the fish depend. Studies in Australia indicated that even 15 years after closing an area to all fishing, the sea floor habitat had not recovered from the effects of trawling. Dynamiting coral reefs and using poisons for fishing has devastative impacts on marine ecosystems for decades or longer.

ESI Undated, Exhibit 81 at 1; see also Zamora-Arroyo et al. 2005, Exhibit 66 at 59 (benthic trawling causes high impacts with low reversibility. It results in "disruption of the physical substrate and its benthos, incidental catch and mortality of nontarget fish and marine mammals, exposed species susceptible to predation, and changes in benthic community composition.").

The species negatively impacted by directed, out of control commercial fishing include several of those listed in this Petition. See, e.g., IUCN (Argyrosomus hololepidotus) 2012, Exhibit 48 at 3-4; IUCN (Mycteroperca fusca) 2012, Exhibit 54 at 4, 5; IUCN (Mycteroperca jordani) 2012, Exhibit 55 at 3-4, 5, 6; IUCN (Paralabrax albomaculatus) 2012, Exhibit 58 at 4, 5; IUCN (Scarus trispinosus) 2012, Exhibit 60 at 5. It is also likely that commercial fisheries are negatively impacting several of the other petitioned species, but there is just not enough information currently available on catch rates to show this. After all, if fishing occurs in a petitioned species' habitat, it is unlikely that the species could avoid fishers' hooks and nets as bycatch, even if they were not the fishers' intended targets, and fishing is extremely widespread.[36]

It is, therefore, clear that a significant number of the petitioned species are threatened by commercial overutilization that is negatively affecting their continued existence. This threat is only likely to grow as human population continues to explode and require more food thus leading to increased fishing pressure.[37]

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[36] There is evidence that at least several petitioned species are being impacted through bycatch. See IUCN (Argyrosomus hololepidotus) 2012, Exhibit 48 at 4 (likely being bycaught); "Individual Fish Species Accounts: (30) *Latimeria chalumnae* :Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," infra; "Individual Fish Species Accounts: (53) *Rhinobatos cemiculus*: The Inadequacy of Existing Regulatory Mechanisms (Criterion D): West Africa: Guinea-Bissau," infra (Blackchin guitarfish likely still bycaught in marine reserve); "Individual Fish Species Accounts: (54) *Rhinobatos horkelii*: The Inadequacy of Existing Regulatory Mechanisms (Criterion D)," infra (discussing bycatch).

[37] See "The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range (Criterion A): Human Population Growth," supra.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

The fish species included in this Petition are all lacking adequate regulatory mechanisms to ensure their continued survival. Many species have no protections at all in place and the others have insufficient levels of protection. As a result, only one of the petitioned fish species is characterized as having a stable population by the IUCN, though it is still subject to significant threats, and none of the petitioned fish species is characterized as having an increasing population.[38] This lack of adequate protection is another threat to the petitioned species' continued survival.

CITES. CITES is an international agreement with 176 parties, including the United States, that aims to ensure that international trade in wild plants and animals does not threaten their existence. See CITES Undated 1, Exhibit 33 entire; CITES Undated 2, Exhibit 34 at 1. Unfortunately, to date the petitioned species of fish have been largely ignored by CITES with only one receiving CITES listing and another having been proposed for listing (though that proposal was later withdrawn). See IUCN (Latimeria chalumnae) 2012, Exhibit 67 at 4 (listed under CITES Appendix I); IUCN (Pterapogon kauderni) 2012, Exhibit 59 at 13 (CITES listing proposed, but then withdrawn). This means that currently only one of the petitioned species has been listed under CITES. See, e.g., IUCN (Latimeria chalumnae) 2012, Exhibit 67 at 4; IUCN (Pterapogon kauderni) 2012, Exhibit 59 at 13. Despite the limitations inherent in CITES listings, they do at least offer some protection when the species are the subject of trade.[39] As discussed in "Fish Introduction: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra, and the individual fish species accounts that follow, many of the petitioned fish species face commercial threats that could be ameliorated by trade restrictions on those species. Unfortunately, apart from one example, none of the petitioned species even have this limited protection standing between them and extinction. While CITES listing represents a clear recognition by the international community that the listed species or subpopulation is threatened with extinction and must be protected, absence of such listing does not mean that the species or subpopulation is not threatened with extinction. A species may be denied listing for political and economic reasons or may not be considered at all (such consideration requires a party country to bring a proposal). A good example of the sometimes unscientific basis for withdrawing listing proposals is the Banggai Cardinalfish (*Pterapogon kauderni*), the species referenced above whose proposal for CITES listing was withdrawn. This proposal was

[38] See IUCN (Paraclinus magdalenae) 2012, Exhibit 56 at 4 (Stable, but facing a variety of threats that could destroy this single isolated population); but see IUCN (Argyrosomus hololepidotus) 2012, Exhibit 48 at 4 (Unknown); IUCN (Azurina eupalama) 2012, Exhibit 49 at 4 (Unknown); IUCN (Chaetodontoplus vanderloosi) 2012, Exhibit 50 at 4 (Decreasing); IUCN (Colpichthys hubbsi) 2012, Exhibit 51 at 4 (Unknown); IUCN (Enneapterygius namarrgon) 2012, Exhibit 52 at 4 (Unknown); IUCN (Halichoeres socialis) 2012, Exhibit 53 at 4 (Unknown); IUCN (Mycteroperca fusca) 2012, Exhibit 54 at 5 (Decreasing); IUCN (Mycteroperca jordani) 2012, Exhibit 55 at 5 (Decreasing); IUCN (Paraclinus walkeri) 2012, Exhibit 57 at 4 (Unknown); IUCN (Paralabrax albomaculatus) 2012, Exhibit 58 at 4 (Decreasing); IUCN (Pterapogon kauderni) 2012, Exhibit 59 at 7 (Decreasing); IUCN (Scarus trispinosus) 2012, Exhibit 60 at 4 (Decreasing); IUCN (Tomicodon abuelorum) 2012, Exhibit 61 at 4 (Decreasing).

[39] See "A. Corals: Corals Introduction: The Inadequacy of Existing Regulatory Mechanisms (Criterion D): CITES," supra (for discussion of CITES' function and limitations).

brought by the United States, proving a U.S. recognition that the species is faced with extinction due to trade pressures, and failed only due to political decisionmaking by the local government of the Indonesian province where the fish is located. The provincial government's decision was based on a desire to continue profiting from sales of the fish for the aquarium trade, not on the basis of whether the species was endangered by trade. See Indrawan & Suseno 2008, Exhibit 175 at 13-15; see also "Individual Fish Species Accounts: (36) *Pterapogon kauderni*," infra. Therefore, while CITES listing is a factor that should weigh towards finding the relevant species is "threatened" or "endangered" under the ESA, its absence should not be taken to show the species is not "threatened" or "endangered."

MPAs. MPAs are a protective designation for marine areas worldwide. However, they represent a relatively small area of the marine environment. For example, as of 2007, only 0.65% of the world's oceans and 1.6% of the total marine area within national Exclusive Economic Zones are protected within approximately 5,000 MPAs worldwide. See IUCN 2008, Exhibit 39 at 11. These MPAs collectively encompass 2.58 million square kilometers. Id. While this is a large area, designated no-take areas, those areas where extractive uses are prohibited, collectively only encompass 0.08% of the world's oceans and 0.2% of the total marine area under national jurisdiction. Id.

Creation of MPAs is clearly a good thing from a conservation standpoint. However, their effectiveness is often not at the level that it could be. While more MPAs are continually being designated every year, the conservation value of MPAs has so far been severely limited by uneven global distribution, poor management, and weak enforcement. See id. at 11, 97-110; see also IUCN (Mycteroperca jordani) 2012, Exhibit 55 at 6 (exists in protected MPA, but is still subject to threats because enforcement of the area is "severely lacking"). While designating MPAs is crucial to prevent some direct human impacts to fish, they cannot protect them from long-term global threats (such as anthropogenic climate change). Also, since not all of the petitioned species are protected in existent MPAs;[40] some of the protected areas that do support petitioned fish are not designated as more restrictive no-take areas;[41] and, of the species protected in existent MPAs, many petitioned species are protected by MPAs in only a portion of their range,[42] these MPAs do not represent suitable protection for species at high risk of extinction.[43] ESA listing for the petitioned fish species would provide complimentary protection for all of them throughout their ranges, even in those portions of the ranges that occur within existing MPAs. Therefore, these species should be listed as "threatened" or "endangered" species under the ESA.

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[40] See, e.g., IUCN (Chaetodontoplus vanderloosi) 2012, Exhibit 50 at 3-4, 5.

[41] See, e.g., IUCN (Paralabrax albomaculatus) 2012, Exhibit 58 at 4, 5 (present in an MPA, but still commercially targeted there).

[42] See, e.g., IUCN (Azurina eupalama) 2012, Exhibit 49 at 5; IUCN (Scarus trispinosus) 2012, Exhibit 60 at 4, 5 (vast majority of range and population outside MPAs); IUCN (Mycteroperca fusca) 2012, Exhibit 54 at 5; IUCN (Mycteroperca jordani) 2012, Exhibit 55 at 6; IUCN (Tomicodon abuelorum) 2012, Exhibit 61 at 4.

[43] See also IUCN (Paraclinus walkeri) 2012, Exhibit 57 at 4 (all of range is in protected lagoon, but this small area of habitat is still subject to many threats).

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Restricted Ranges. Several of the petitioned species are already limited to extremely small ranges. See, e.g., IUCN (Halichoeres socialis) 2012, Exhibit 53 at 3, 4 (estimated range of less than $10km^2$); Fricke 2001, Exhibit 86 at 333 (coelacanths very loyal to range covering mere several kilometers of coastline). This obviously leaves those species very vulnerable to localized pressures. Such vulnerability increases extinction pressure on those petitioned fish species.

Synergistic Effects. The synergistic effects of aforementioned threats, and those threats described in the individual species accounts, could conspire to cause the extinction of the petitioned fish species. “Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction.” Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted).

The combination of threats to the petitioned fish species and their habitats could cause a greater and faster reduction in their remaining populations 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.” Id. at 453 (internal citations omitted).

Several of the petitioned fish are already at risk as low-fecundity or K-selected species, rendering them even 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.” Id. at 455 (internal citations omitted).

Since most, if not all, of the petitioned fish species face a multitude of threats it is likely that the synergistic effects of those threats will cause extinction pressure more severe than their additive impact alone. As such, the synergistic effects of the aforementioned threats represent yet another reason why these species qualify as “threatened” or “endangered” and should be extended ESA protections.

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INDIVIDUAL FISH SPECIES ACCOUNTS

(24) Scientific Name: *Argyrosomus hololepidotus*

Common Name: Madagascar Kob / Madagascar Meagre

IUCN Status: Endangered **CITES Status**: N/A

Range: This species of large fish is endemic to the southeast coast of Madagascar, with an area of occupancy of less than 500 km^2. IUCN (Argyrosomus hololepidotus) 2012, Exhibit 48 at 4.

Habitat and Ecology: Juveniles of this species occur in mangroves and estuaries along the Madagascar coast. Id. Adults are found off sandy beaches, in estuaries, and shallow marine waters. Id. This species is a benthic carnivore feeding on other fish, crustaceans, and mollusks. Id. Both sexes of this species have "drumming muscles" for producing rudimentary vocalizations. See id.

Population Status: The population of Argyrosomus hololepidotus is estimated to possibly number less than 10,000 mature individuals, all of which are in a single population, which is undergoing continuing decline. Id. Current declines are estimated at about 10% over the last three generations. Id. Generation length is unknown, "but similar large members of this family are distinguished by relatively long lifespans and long generation lengths." Id.

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Fish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Various pollutants, brought in as a result of the expanding human population in the region, are increasingly, negatively impacting the inshore areas and estuaries that form this species' nursery areas. Id. "This species also has a low capacity to tolerate environmental impacts without suffering irreversible change." Id. Therefore, these changes are likely to have a negative impact on the species' continued existence.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"Fisheries data and fishery-independent data appears non-existent for this species, however, it is likely caught both deliberately and accidentally as bycatch." Id. Local people eat this species. Id. This consumption is primarily for subsistence, but there is some documented trade in the species as well. Id. For a species with a population as small as *Argyrosomus hololepidotus*, any level of fishing is inappropriate and threatens the species' continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are currently no conservations measures in place for this species. See id. at 5. Such a complete lack of conservation measures leaves the species completely unprotected and increases the likelihood that it will go extinct.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

"This species . . . has a low capacity to tolerate environmental impacts without suffering irreversible change." Id. This natural characteristic of the species increases the likelihood that the variety of anthropogenic impacts that *Argyrosomus hololepidotus* faces will subject it to extinction.

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

References:

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For More Information, See:

IUCN Bibliography

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(25) Scientific Name: *Azurina eupalama*

Common Name: Galápagos Damsel

IUCN Status: Critically Endangered **CITES Status**: N/A

Range: This species is endemic to the eastern Pacific Ocean, and is only found in the waters around the Galápagos Islands. IUCN (Azurina eupalama) 2012, Exhibit 49 at 4. However, there have been no recent sightings of this species, and it may have even disappeared from the Galápagos during the intense El Niño (ENSO) event of 1982-1983 when greatly increased sea temperatures had strong adverse effects on the islands' marine flora and fauna. Id. (citing Grove 1985). "Its sister species, [*Azurina*] *hirundo*, occurs in a similar environment, the Revillagigedos Islands, near the northern limit of the Eastern Tropical Pacific," and thus it may be possible that small populations of *Azurina eupalama* still exist around other islands off Peru that match the warm temperate conditions of the Galápagos. Id.

Habitat and Ecology: This species inhabits rocky inshore reefs to depths of 30 meters, most frequently spotted in open water near drop-offs. Id.

Population Status: "This species may already be extinct." Id. (citing Robertson & Allen 2006). It was considered "occasional" in 1977, and prior to the 1982 ENSO event, was recorded throughout the Galápagos archipelago. Id. "Numbers of this species were greatly reduced during the 1982-1983 El Niño, and there have been no sightings since that time." Id. (citing Grove 1985).

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Fish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are no conservation measures in place for the species. Id. at 5. It has historically been present in the Galápagos Islands Marine Protected Area, but that protection did not stop these precipitous declines. See id. Protection in an MPA cannot protect a species from ENSO threats and, therefore, appears to have been insufficient to protect the species in this case. Therefore, this species should be protected under the ESA in order to protect the species in its known range and in any other areas where it is found to exist outside that range.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

"Oceanographic environmental changes associated with the 1982 ENSO event [are] presumably responsible for the apparent disappearance of this species from the Galápagos. The frequency and duration of ENSO events in this region of the Eastern Tropical Pacific (e.g., the up-welling zone off the coast of Peru, Ecuador, Colombia and other associated offshore islands) appears to be increasing," placing further strain on this already devastated, possibly extirpated, population. Id. These catastrophic declines and the likelihood that they will happen again qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid the species' extinction.

References:

Exhibits:

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(26) Scientific Name: *Chaetodontoplus vanderloosi*

Common Name: coral reef fish

IUCN Status: Endangered **CITES Status**: N/A

Range: *Chaetodontoplus vanderloosi* has one of the smallest ranges of all known Indo-Pacific coral reef fish, extending only a mere 275 km^2 between Samarai Island and the southeastern corner of Basilaki Island near Papua New Guinea. IUCN (Chaetodontoplus vanderloosi) 2012, Exhibit 50 at 3-4. Its estimated actual area of occupancy within this habitat is an even smaller area measuring roughly 15 km^2. Id. at 3, 4.

Habitat and Ecology: This species is confined to a very limited area despite extensive searching throughout its possible range. Id. at 4. This species is associated with relatively cool water temperatures, preferring temperatures between 22 ºC – 24 ºC as compared to the normal 26 ºC – 28 ºC in other parts of the region. Id. (citing Allen 1998). These cooler temperatures in *Chaetodontoplus vanderloosi*'s range seem to be caused by strong currents sweeping southward through narrow passes between islands causing displacement of surface waters and consequent upwelling of colder waters from below. Id.

Population Status: The total population of this species is thought to be less than 1,500 individuals, and a definite decline in population has been observed over the past 25 years. Id.

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Fish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

This species prefers the relatively cooler temperatures found in its extremely narrow range. Id. Therefore, as ocean surface temperature continues to increase, this species' range will continue to shrink from its already tiny 15 km^2, and will likely disappear entirely. See id. at 3, 4; see also Status Review Report, Exhibit 40 § 3.2.2. This threatened reduction, and possible complete loss, of *Chaetodontoplus vanderloosi*'s habitat places it at increased risk of extinction.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are currently no conservation measures in place for this species. See generally IUCN (Chaetodontoplus vanderloosi) 2012, Exhibit 50. This lack of conservation measures is inappropriate for a species facing the types of threats that *Chaetodontoplus vanderloosi* is.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

"The threats to this species are not well understood." Id. at 4. "The species is clearly dependent on a pattern of cool-water upwelling from" the deep ocean, and climate-associated changes in ocean circulation and increasing temperatures may be responsible for the observed decrease in this species. Id. As discussed in "The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A)," supra, rising ocean temperatures may already be harming this species and will almost certainly do so in the future, thus necessitating a high level of protection to prevent *Chaetodontoplus vanderloosi*'s extinction. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

References:

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(27) Scientific Name: *Colpichthys hubbsi*

Common Name: Delta Silverside

IUCN Status: Endangered **CITES Status**: N/A

Range: This species is endemic to the Eastern Pacific, and is found only in the uppermost part of the Gulf of California and the Colorado River Delta. IUCN (Colpichthys hubbsi) 2012, Exhibit 51 at 3, 4. "It has an extent of occurrence of 5,000 km^2, but its area of occupancy is not known given the current degraded state of its delta habitat." Id.

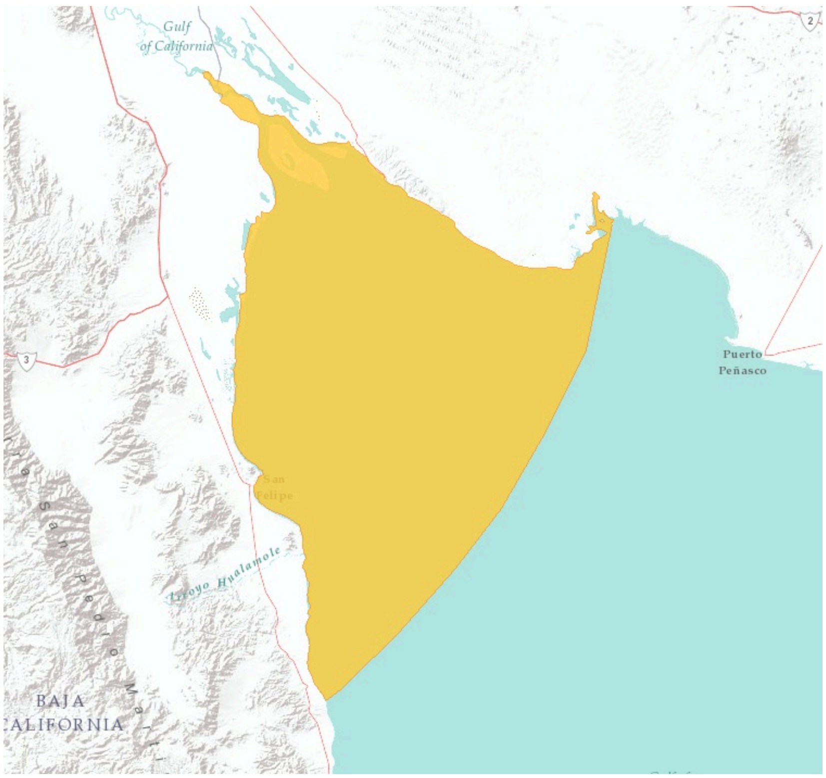

Figure 6: *Colpichthys hubbsi*'s Extent of Occurrence
Source: http://maps.iucnredlist.org/map.html?id=183457

Habitat and Ecology: "This species is found in shallow water over mud, and over muddy sandy substrates, to depths of four m[eters]." Id. at 4. *Colpichthys hubbsi* adults feed on crustaceans, gastropods, and may take in sand. EOL Undated, Exhibit 62 at 1.

Population Status: "No population information is available for this species." IUCN (Colpichthys hubbsi) 2012, Exhibit 51 at 4.

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Fish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Cessation of Flow From the Colorado River. This species is mainly threatened by habitat degradation "due to the cessation of flow from the Colorado River." Id. "Estuaries, riparian, wetland, and tidal areas of the Colorado River delta have been reduced by over 90% since dam construction began in the early 20th century. Currently, this species has an extremely restricted [and fractured] geographic range . . . and likely represents a relict population." Id. Currently, the Colorado River rarely reaches the sea. See Waterman 2012, Exhibit 65 at 1. As a result of "decades of population growth, climate change and damming in the American Southwest" the once lush Colorado River Delta has turned into a desert. Id. This has led to the endangerment of dozens of species, including *Colpichthys hubbsi*. See id.; IUCN (Colpichthys hubbsi) 2012, Exhibit 51 at 3. Habitat degradation will only get worse as climate change is predicted to further reduce runoff by 10-30% by 2050. Waterman 2012, Exhibit 65 at 2. This lack of water has already changed the character of the estuary from an area in which salinity increased "toward the open Gulf to one in which evaporation causes hypersaline conditions at the river's mouth." Zamora-Arroyo et al. 2005, Exhibit 66 at 55. It is clear that the current degraded state of this habitat is threatening *Colpichthys hubbsi*'s survival and that, as habitat degradation worsens due to climate change, *Colpichthys hubbsi*'s continued existence will become less and less likely.

There is also evidence that crustacean and gastropod species in *Colpichthys hubbsi*'s habitat exhibit increased productivity when the Colorado River actually makes it to the ocean and decreases salinity. See id. at 56, 58. Since this rarely happens, the prey species *Colpichthys hubbsi* relies on are less populous and therefore less likely to recover from fishing pressure.[44] This results in degraded habitat for *Colpichthys hubbsi* as the Gulf becomes denuded of adequate prey species.

In discussing the Colorado River Delta, a group of 55 participants, collectively representing over 400 years of experience in the Delta, said that, "[u]ntil the U.S. and Mexican federal governments greatly increase their commitment, the health of these ecosystems cannot be assured . . . and large-scale improvements in ecosystem health will remain unattainable." Zamora-Arroyo et al. 2005, Exhibit 66 at 68. Protection under the ESA could represent one big step towards improving this ecosystem so as to enable *Colpichthys hubbsi*'s survival. Without such improvement, the cessation of flow from the Colorado River will continue to threaten the species' continued survival.

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[44] Unsustainable trawling and artisanal fishing practices have targeted, and depleted stocks of, species including the crustaceans and gastropods that *Colpichthys hubbsi* relies on. Id. at 55; EOL Undated, Exhibit 62 at 1.

Coastal Development. The El Borrascoso area of *Colpichthys hubbsi*'s Northern Gulf of California habitat in particular is threatened by planned development. See id. at 54; see also Figure 6, supra. Housing and development plans for the region could destroy offshore habitats through dredging and destroy geologic outcrops with construction activity. Zamora-Arroyo et al. 2005, Exhibit 66 at 54. "In the case of habitat destruction resulting from coastal development, the severity of impacts is high with low reversibility." Id. at 58. Also, in this area, "[c]oastal lagoons adjacent to newly developed areas could be modified for shrimp mariculture resulting in damage from construction and pollution from effluents." Id. at 58; see also IUCN (Colpichthys hubbsi) 2012, Exhibit 51 at 4 (discussing shrimp farming threat); "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," infra (for more information on dangers resulting from shrimp farming).

Furthermore, shrimp farming would not be the only pollution source from this development. In general, increased growth in coastal cities is a major cause of coastal habitat destruction. With growth comes an increase in consumption and development. This is reflected in an increase in construction projects, some of which occur on reef communities; dredging of harbors and shipping channels; dumping of waste, run-off pollution and increased sedimentation; deforestation; and increased tourism. As a result of these factors, the coasts around virtually all urban areas are "beset by a pattern of pollution and over-development." Hinrichsen Undated, Exhibit 43 at 2. "Coastal urban areas dump increasing loads of toxic wastes into the sea. In fact, waters around many coastal cities have turned into virtual cesspools, so thick with pollution that virtually no marine life can survive." Id. at 4.

This urban pollution is contributing to increasing "dead zones," amongst other things. These dead zones are areas where dissolved oxygen content is so low that no marine life, apart from microorganisms, can live. A 2007 study identified 200 of these dead zones, which represents an increase of 51 such zones found just four years earlier. Id. at 5. Worse yet, these dead zones are not only becoming more numerous, they are also greatly expanding "due mainly to high nutrient pollution levels brought in by rivers and streams and washed off coastal land." Id.

Climate change is expected to further magnify these coastal pollution problems. For example, "[d]ue to water circulation and oceanic volume changes, estuarine and coastal systems are predicted to experience . . . increased eutrophication, hypoxia, and anoxia." Roessig et al. 2004, Exhibit 29 at 258 (citations omitted). "More intense rains wash more fertilizer and sewage into coastal waters, and this runoff triggers algal blooms and consequent poisoning of fish and humans." Id. at 269 (citation omitted). This runoff entering the oceans will cause new dead zones to emerge and already-existing dead zones to expand. Unfortunately, this threat is already visible in *Colpichthys hubbsi*'s Gulf of California habitat. Researchers have observed multiple blooms in the Gulf measuring 577 km^2 in one case and leading to mass fish mortality, which produced as estimated 60 tons of fish carcasses on the beach, in another. See Greenpeace 2008, Exhibit 63 at 16-17. The threat to *Colpichthys hubbsi* represented by these Gulf dead zones is very real as "[s]uch dead zones have occurred in the past at nearby Puerto Peñasco, for example, and possibly on one occasion at El Golfo de Santa Clara[, an area well within *Colpichthys hubbsi*'s range]." Zamora-Arroyo et al. 2005, Exhibit 66 at 58; see also Figure 6, supra. As the population of humans in the area increases and agricultural runoff continues to enter the Northern Gulf, this threat to *Colpichthys hubbsi*'s habitat will continue. This loss of habitat puts *Colpichthys hubbsi* at greater risk of extinction.

Sedimentation and General Water Quality. Not only has this ecosystem faced enormous reductions in freshwater flow and increased incidence of dead zones, but the water and sediment in *Colpichthys hubbsi*'s habitat are also now of generally inferior quality.

> Agricultural drainwater influences the overall quality of water reaching these habitats and contributes to nutrient loading. Low-water periods and resulting erosion may enhance release of captured nutrients. Another major difference between the pre-dam Upper Gulf and the ecosystems there today is the decrease in sediment inputs. Re-establishing sediment deliveries will be difficult given the extensive system of dams upstream that block delivery of sediments originating as far as 1,000 miles (1,600 kilometers) to the north. Reduced freshwater flow contributes to erosion of the Delta, the filling in of off-channel areas, and ultimately creates navigation obstacles . . . Despite the reduction of instream flows, sediments originating upstream on the Colorado River remain the most important source of sediments to the region. The distribution of sediment type influences distribution of some species of finfish.

Zamora-Arroyo et al. 2005, Exhibit 66 at 57 (internal citations omitted); see also "The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A): Development," supra. The decreased or entirely ceased flow of the Colorado River and the influx of agricultural runoff, amongst other impacts, is clearly decreasing water quality in *Colpichthys hubbsi*'s habitat. The decrease in needed sediments is also problematic for *Colpichthys hubbsi*'s habitat as the species lives in "shallow water over mud, and over muddy sandy substrates." See IUCN (Colpichthys hubbsi) 2012, Exhibit 51 at 4. Overall, these changes to *Colpichthys hubbsi*'s habitat are sure to harm the species both in the short term and the long term until they are remedied.

Tidal Power Development. *Colpichthys hubbsi* also faces potential habitat destruction from tidal power development in its range. "Potential development of tidal power, if implemented, will result in severe impacts and irreversible loss of the Upper Gulf habitat." Zamora-Arroyo et al. 2005, Exhibit 66 at 59. This potential loss of habitat is yet another threat to *Colpichthys hubbsi*'s survival as a species.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

While *Colpichthys hubbsi* does not seem to be directly commercially targeted, its primary food sources have been negatively affected by the unsustainable trawling and artisanal fishing practices that occur in its habitat. See id. at 55. These practices have targeted the benthic fauna of the Upper Gulf, including the crustaceans and gastropods that *Colpichthys hubbsi* relies on, and have resulted in depleted stocks. See id.; EOL Undated, Exhibit 62 at 1. Benthic trawling causes high impacts with low reversibility. Zamora-Arroyo et al. 2005, Exhibit 66 at 59. It results in "disruption of the physical substrate and its benthos, incidental catch and mortality of nontarget fish and marine mammals, exposed species susceptible to predation, and changes in benthic community composition." Id.

Also, shrimp farming in the area can threaten *Colpichthys hubbsi*. "Shrimp farming may cause mortality of estuarine organisms at water intake screens, escape of disease and viral pathogens from the ponds to the open Gulf, and increase eutrophication from pond effluent discharge into coastal areas." Id. at 58.

Therefore, *Colpichthys hubbsi* is threatened by commercial overutilization even though it does not appear to be a target species. Rather, it is threatened by a variety of externalities resulting from commercial exploitation of other marine species within its habitat. These externalities include loss of prey species, disruption of habitat, incidental catch, death at shrimp intake screens, disease from shrimp ponds, and increased eutrophication from pollution leaving shrimp ponds. Commercial overutilization is thus yet another threat to *Colpichthys hubbsi*'s continued survival.

Disease or Predation (Criterion C):

Shrimp farming in *Colpichthys hubbsi*'s range causes increased threat of disease. This occurs as fish experience the "escape of disease and viral pathogens from the ponds to the open Gulf." Id. Shrimp farming may increase as "[c]oastal lagoons adjacent to newly developed areas could be modified for shrimp mariculture . . ." Id. Therefore, the disease threat to *Colpichthys hubbsi* represented by shrimp farming is likely to increase as development of the coasts adjacent to its range continues.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are currently no species-specific conservation measures in place for this species. IUCN (Colpichthys hubbsi) 2012, Exhibit 51 at 4. It is, however, found in the Colorado River Delta Biosphere Reserve. Id. While this location does extend the species some level of protection, it is inadequate. This is in part due to the fact that currently the management of the Biosphere Reserve is not effective to protect Colpichthys hubbsi. In discussing opportunities to improve conservation in the Biosphere Reserve, a group of 55 participants, collectively representing over 400 years of experience in the Colorado River Delta, recommended "stricter implementation of the Biosphere Reserve management plan, enforcement of existing resource-use regulations, and application of land-use planning principles (Ordenamiento Ecologico Territorial), to mitigate coastal development impacts, overuse of resources, and pollution." Zamora-Arroyo et al. 2005, Exhibit 66 at 59.

The major threat to *Colpichthys hubbsi* is the cessation of flow from the Colorado River, and the Biosphere Reserve is not tailored to meet this threat. See IUCN (Colpichthys hubbsi) 2012, Exhibit 51 at 4. The Biosphere Reserve designation does nothing to replenish the flow of the Colorado River. See id. It does nothing to remove the upstream dams stopping water from reaching the Gulf of California or increase the amount of water that they release. See Waterman 2012, Exhibit 65 at 1. It will do nothing to stop climate change from further reducing this flow. See id. at 2. It apparently has not even been able to stop shrimp aquaculture projects from threatening the species. See IUCN (Colpichthys hubbsi) 2012, Exhibit 51 at 4.

Essentially, while the creation of the Biosphere Reserve is commendable and *Colpichthys hubbsi*'s location inside the Reserve may offer some level of protection, it is not sufficient to halt the species' march towards extinction. Management of such a reserve is difficult and, ultimately, such a designation is incapable of addressing the primary threats faced by this species.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

The synergistic effects of aforementioned threats could conspire to cause the extinction of *Colpichthys hubbsi*. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted). Since *Colpichthys hubbsi* faces a multitude of different threats, it may be pushed towards extinction more quickly than the mere additive effect of those threats themselves would indicate. See id. at 453; see also "Fish Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Synergistic Effects," supra.

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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For More Information, See:

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(28) Scientific Name: *Enneapterygius namarrgon*

Common Name: Lightning Man Triplefin

IUCN Status: Endangered **CITES Status**: N/A

Range: This species of fish is endemic to Gove Peninsula, south of Cape Arnhem in the Northern Territory of Australia. IUCN (Enneapterygius namarrgon) 2012, Exhibit 52 at 4 (citing Fricke 1997). The Lightning Man Triplefin is distributed across a very small area of approximately 317 km^2. Id.

Habitat and Ecology: The Lightning Man Triplefin is a coastal species and is found exclusively on bauxite rocks. Id.

Population Status: There is no population information available for this species. Id.

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Fish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

"*Enneapterygius namarrgon* is only found on bauxite rocks of the Gove Peninsula, Australia." Id. "Bauxite is the most important aluminum ore" and "[o]ver 85% of the bauxite mined globally is converted to alumina for the production of aluminum metal." Id. Australia is the world's leading producer of bauxite, accounting for 36% of world production, and the mine in Gove contains the highest-grade bauxite deposits in the world. Id. "Due to its restricted association with bauxite rock, it is likely that this species is being threatened by bauxite mining." Id. "It is predicted that the resource life for existing bauxite operations is around 70 to 75 years, therefore the threat to this species will continue into the future." Id. This threat to the species' continued survival necessitates protection for *Enneapterygius namarrgon* under the ESA.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are currently no known species-specific conservation measures in place for the Lightning Man Triplefin. Id. at 4-5. Such a complete lack of protection for a species facing such an extensive threat to its only habitat is inappropriate and ESA protection should be afforded to *Enneapterygius namarrgon*.

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<u>(29) Scientific Name</u>: <u>*Halichoeres socialis*</u>

Common Name: Social Wrasse

IUCN Status: Critically Endangered **CITES Status**: N/A

Range: This species of fish is found only in the Pelican Keys, Belize, and has an extremely small estimated range of less than 10 km^2. <u>See</u> IUCN (Halichoeres socialis) 2012, Exhibit 53 at 3, 4.

Habitat and Ecology: Adults of this species are reef associated, while juveniles are mangrove and shallow reef dependent. <u>Id.</u> at 4. It is commonly "found in shallow coral reefs over coral, sand, rubble, or sea grass substrata" to a depth of 10 meters. <u>Id.</u> (citing Randall & Lobel 2003). "Juveniles feed on zooplankton and form evasive, compact schools when threatened." <u>Id.</u>

Population Status: "Currently, population size and trends have not been assessed." <u>Id.</u> From the original description in 2003, juveniles are abundant where they occur and yet adult individuals are rarely observed. <u>Id.</u>

Population Trend: Unknown. <u>Id.</u>

Known Threats/Listing Criteria

All of the threats and information discussed in "Fish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

This species is threatened by extensive habitat destruction within and around its very restricted range. <u>Id.</u> at 4. "Habitat loss is due to continued extensive mangrove and coral removal and dredging for coastal resort development." <u>Id.</u> at 4-5. This is particularly problematic because, "[i]n the case of habitat destruction resulting from coastal development, the severity of impacts is high with low reversibility." Zamora-Arroyo et al. 2005, Exhibit 66 at 58. Such threats to *Halichoeres socialis*'s already very limited habitat pose an extreme threat to its continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

The Pelican Key is a World Heritage Site comprising part of *Halichoeres socialis*'s range, "but there is no actual protection" afforded this species. <u>Id.</u> at 5. Therefore, *Halichoeres socialis* is provided only nominal protection, which is inappropriate for a species that faces such intense pressures to its already limited habitat. ESA protection should be given to the species to correct this inadequacy.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

There has been an observed lack of adult *Halichoeres socialis* specimens. Id. at 4. This lack of adults is also likely to increase as the coral reef habitat adults rely on is damaged by removal and other negative impacts. Id. at 4-5. This lack of adults likely means that there are few opportunities for the species to breed and increases the species' vulnerability to extinction. This lack of adults is another reason to extend *Halichoeres socialis* protection under the ESA.

References:

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(30) Scientific Name: ***Latimeria chalumnae***[45]

Common Name: Coelacanth / Gombessa

IUCN Status: Critically Endangered **CITES Status:** Appendix I

Background: Scientists long thought that *Latimeria chalumnae* (the terms "coelacanth," "Gombessa," "Gombessa Coelacanth," and "*Latimeria chalumnae*" will be used interchangeably in this Petition to refer to *Latimeria chalumnae*) went extinct approximately 70 million years ago, until a fisherman caught a living specimen in 1938 near East London, South Africa. Balon 1991, Exhibit 69 at 9; Nicholson Undated, Exhibit 70 at 1. The originally rediscovered coelacanth is *Latimeria chalumnae,* sometimes referred to as Gombessa. IUCN (Latimeria chalumnae) 2012, Exhibit 67 at 3. Coelacanths are among the most ancient species on earth, appearing 410 million years ago in the Devonian era. Rogers 2007, Exhibit 71 at 1. "Because of their unusual rediscovered status, they are often considered a Lazarus species," and are essentially a living fossil. See id. Finding a living coelacanth was truly a momentous occasion and sparked much interest as it may provide answers to some very interesting evolutionary questions. McGrouther 2012, Exhibit 72 at 3.

Species Description: Coelacanths have many unique anatomical features that make them distinct from most other living fish. Coelacanths are "sarcopterygian, or lobe-finned fish, distantly related to the lungfish." Nicholson Undated, Exhibit 71 at 1. The coelacanth's four pectoral and pelvic fins are muscular, limb-like appendages, which distinguishes them from other bony fish. Id. These leg-like fins are able to rotate over 180°, allowing the [coelacanth] to swim forwards, backwards, and upside down." Id. While swimming, the coelacanth moves its fins like a quadruped walking on land, moving its front left and right rear fins together and then the front right and left rear. Id. The evolutionary link between fish and amphibians, and thus all land dwellers, would have had a similar fin structure. Id. "Coelacanths are [also] the only living animals to have a fully functional intercranial joint, which is a division separating the ear and brain from the nasal organs and eye. The intercranial joint allows the front part of the head to be lifted when the fish is feeding." McGrouther 2012, Exhibit 72 at 1. Coelacanth is Greek for "hollow spine." Dinofish Undated 1, Exhibit 77 at 3. Coelacanths evolved with a central reinforced cord, an oil-filled tube, instead of a skeletal spine. Id. This cord constitutes evolution beyond the notochord of lower species but represents a complete divergence from most living species, which evolved the calcified skeleton. See Prehistoric Wildlife, Exhibit 76 at 2.

Some of the coelacanth's unique adaptations are particularly suited to their deep-sea habitat. Coelacanths inhabit coastal deep-sea caves and overhangs near vertical marine reefs, approximately 200 meters below the ocean surface, off newly formed volcanic islands. Id. at 3. Coelacanths apparently cannot live off coasts with significant

[45] This species is genetically distinct from *Latimeria menadoensis*, which is listed as vulnerable by IUCN. See IUCN (Latimeria menadoensis) 2012, Exhibit 68 at 3-4; IUCN (Latimeria chalumnae) 2012, Exhibit 67. However, Guardians requests that *Latimeria menadoensis* also be listed under the ESA based on its similarity of appearance to *Latimeria chalumnae*. See "Similarity of Appearance Listing: *Latimeria menadoensis*," infra.

siltation. Springer 1998, Exhibit 73 at 453. The coelacanth has a tapetum lucidem behind the retina of its eyes that reflects light back to the retina, improving its vision in dark waters. Wildlife Museum Undated, Exhibit 74 at 1. Their small gills absorb oxygen more slowly than other fish and they move more slowly to conserve the oxygen they do get, an adaptation to living in the cooler depths. Malory Undated, Exhibit 75 at 1. Gombessa coelacanths have dark, thick, steel blue scales unique to this order, but they fade to grey or brown on death. See Rogers 2007, Exhibit 71 at 2; McGrouther 2012, Exhibit 72 at 2. As a result of their adaptation to deep ocean pressure, coelacanths do not survive long in captivity or in shallow waters, usually no more than a few hours. See Nicholson Undated, Exhibit 70 at 2; Prehistoric Wildlife Undated, Exhibit 76 at 3.

Coelacanths are large and long-lived animals that can be 2 meters long and can weigh 98 kilograms. See Dinofish Undated 1, Exhibit 77 at 2. Males are generally smaller than females of the species and are approximately 1.65 meters long. Id. There is some disagreement as to coelacanth longevity, but scientists believe that coelacanths may live as long as 80-100 years. See Rogers 2007, Exhibit 71 at 2; but see Dinofish Undated 1, Exhibit 77 at 2 (citing 60 years as the likely maximum coelacanth age). Scientists also believe that they can slow their bodily functions to hibernate when resources are scarce. Rogers 2007, Exhibit 71 at 2. Coelacanths eat a variety of prey including lantern fishes, cuttlefish, small sharks, squid, and eel that inhabit deep-sea reefs and slopes. See Dinofish Undated 1, Exhibit 77 at 2. Coelacanths are epibenthic or bottom drift feeders. Springer 1998, Exhibit 73 at 454. They spend the day inactive in deep caves and hunt at night in shallower waters. Id. They are generally slow swimmers but are capable of quicker moves for short durations. Id.

The coelacanth is ovoviviparous, meaning that the mother retains the eggs in her uterus while the embryos develop, nourished by a yolk sac. Nicholson Undated, Exhibit 70 at 1. The young, called pups, are fully developed at birth, and late-term litters of five and twenty-six pups have been observed. See Fricke 1992, Exhibit 78 at 476. Their gestation period appears to be about three years, exceeding the two-year maximum gestation period known for vertebrates. Froese & Palomeres, Exhibit 79 at 49. This, coupled with the estimated age of first maturity for females of 16 years, means that females cannot produce a litter of pups until they are about 19 years of age. See id. However, at least one estimate put the age of maturity at an even longer 35 years of age. See id. Scientists currently do not know anything about coelacanth mating behavior or juvenile habitat. Dinofish Undated 1, Exhibit 77 at 3.

There are four main classes of living fish: Amphioxi, Cyclostomata, Elasmobranchii, and Teleostomi. Teleostomi, or bony fish, encompasses most ordinary fish living today; however, the vast majority of these are in its subclass Actinopterygii, or rayfins. McAllister 1971, Exhibit 80 at 7. The other subclasses within Teleostomi are Dipneusti, or lungfish, and Crossopterygii, or lobefins. Id. Crossopterygii is subdivided into superorders: Osteolopides, or rhipidistians, which are the fish ancestors of amphibians, and Coelacanthi, consisting of coelacanths. Id. The Gombessa Coelacanth, *Latimeria chalumnae*, and Sulawesi Coelacanth, *Latimeria menadoensis,* are the only living members of subclass Crossopterygii, little changed morphologically for 400 million years. ESI Undated, Exhibit 81 at 1. Paleontologist knew crossopterygii only through the fossil record until fishermen caught the Gombessa Coelacanth in 1938. Balon 1991, Exhibit 69 at 9. Coelacanth fossils have appeared on every continent except Antarctica, indicating a once global range. See Dinofish Undated 1, Exhibit 77 at 2.

Range: Fishermen caught the first modern coelacanth in 1938 off the south end of South Africa, near the Chalumna River. McGrouther 2012, Exhibit 72 at 1.

Figure 7: Gombessa Coelacanth Catch Sites
Source: http://www.dinofish.com/image5.htm

Most of the known Gombessa Coelacanth populations are off the coast of southeastern Africa: primarily at the Comoros Islands, northwest of Madagascar and east of Tanzania, with scattered populations and individuals found off the northern tip of Tanzania and off the coasts of Madagascar, South Africa, and Mozambique. Springer 1998, Exhibit 73 at 453. Scientists who study the Gombessa Coelacanth debated whether these scattered individuals are strays from the Comoros Islands or are separate populations, and the consensus is that these are both strays and small populations created by strays. See Dinofish Undated 1, Exhibit 82 at 1.

Habitat and Ecology: Gombessa Coelacanths inhabit deep-sea caves, canyons, and cliffs and water temperatures between typically below 18°C, although water temperatures in the caves they inhabit sometimes approached 23°C. See, e.g., Springer 1998, Exhibit 73 at 454. Coelacanths congregate in these volcanic caves and canyons and may form groups of up to ten individuals. See Spicer 2002, Exhibit 83 at 1; Prehistoric Wildlife, Exhibit 76 at 3. Although the coelacanth rises to shallower waters to feed, it cannot tolerate these shallower depths for long and dies after just a few hours if kept from the depths. See Joyce 1989, Exhibit 84 at 1; Nicholson Undated, Exhibit 70 at 2; Prehistoric Wildlife Undated, Exhibit 76 at 3; Springer 1998, Exhibit 73 at 454. "No fish has lived for more than 20 hours at the surface." Joyce 1989, Exhibit 84 at 1.

Scientists have established that individual coelacanths are loyal to a particular home range, living there for over 14 years. Fricke 2001, Exhibit 86 at 333. This home range encompasses hundreds of meters of vertical depth between diurnal deep-sea cave habitat and nocturnal shallower feeding waters, sometimes over several kilometers of coastline. Id. Because living coelacanths have such specific habitat needs, scientists have begun to map potential habitat using bathymetric methods; however, this has not led to finding many additional individuals or populations of coelacanths. See generally Green et al. 2009, Exhibit 87. Therefore, it appears that scientists are unlikely to find as yet undiscovered Gombessa Coelacanth populations.

Population Status: The IUCN considered *Latimeria chalumnae* to be "critically endangered." IUCN (Latimeria chalumnae) 2012, Exhibit 67 at 2, 3. Population trends of the Gombessa Coelacanth are unknown, this is likely because scientists do not have a way to accurately find and count living individuals. See id. at 4. The Gombessa Coelacanth exhibits low fecundity because it bears few live young at a time that may gestate for as long as three years. See Nicholson Undated, Exhibit 70 at 2; Froese & Palomeres 1999, Exhibit 79 at 49. Scientists estimate that there are fewer than 500 Gombessa Coelacanths. See, e.g., Dinofish Undated 2, Exhibit 82 at 2.

Population Trend: The IUCN describes the population trend as "[u]nknown." IUCN (Latimeria chalumnae) 2012, Exhibit 67 at 4. However, there is evidence that in just a three-year period the average number of coelacanths per cave off Comoros fell from 20.5 to a mere 6.5, indicating a massive reduction in population. See Browne 1995, Exhibit 188 at 1.

Known Threats/Listing Criteria

All of the threats and information discussed in "Fish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Guardians believes that four of five ESA listing criteria have played a role in bringing the Gombessa Coelacanth to its current perilous condition. The most immediate threat to the species is the human capture of the fish from bycatch as fishers trawl deeper waters in their range, both for scientific purposes for use by collectors. See Joyce 1989, Exhibit 84 at 1-2; Rogers 2007, Exhibit 71 at 1-2; McGrouther 2012, Exhibit 72 at 2, 3; Prehistoric Wildlife Undated, Exhibit 76 at 2, 3; Dinofish Undated 2, Exhibit 82 at 1. Because the total number of living coelacanths is unknown, it is not possible to determine the percentage of the population decimated by capture for scientific research, for personal gain, and as bycatch. However, a significant number of Gombessa Coelacanths have been caught and killed, threatening the survival of the species.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

It is clear that the coelacanth has suffered a dramatic curtailment of its range over geologic time, so much so that scientists believed them to be extinct until the last century. See, e.g., Nicholson Undated, Exhibit 70 at 1. The coelacanth's once global range is now limited to isolated pockets of habitat. See, e.g., Springer 1998, Exhibit 73 at 453.

More importantly, scientists have hypothesized that coelacanths live in volcanic deep-sea caves where there is not significant siltation. Id. Currently, "East African countries, particularly those along the coast, are experiencing massive population increases and demographic changes which are resulting in environmental degradation." Marsh 2002, Exhibit 85 at 22. This has led to a variety of negative environmental impacts in the area including damaging agricultural practices, overgrazing, deforestation, destruction of wetlands, and mining. See id. These practices increase the load of silt moving off the coast and into the coelacanths' coastal habitat. See id.; Springer 1998, Exhibit 73 at 453. Many of these East African countries are still developing. See Marsh 2002, Exhibit 85 at 22. This means that these countries are characterized by high population growth, limited industrial and infrastructure development, and a tendency to subsistence economies. Id. As a result of these factors, environmental conservation is not a local priority and the negative impacts to coelacanth habitat are likely to continue. See id. Furthermore, the coastal development happening in this area is problematic because, "[i]n the case of habitat destruction resulting from coastal development, the severity of impacts is high with low reversibility." Zamora-Arroyo et al. 2005, Exhibit 66 at 58.

Scientists have established that individual coelacanths are loyal to a particular home range, living there for over 14 years. Fricke 2001, Exhibit 86 at 333. This range likely covers a mere several kilometers of coastline. Id. This tie to an extremely localized range means that coelacanths are unlikely to be able to leave habitat degraded by siltation and may experience local extinctions based on this impact. Furthermore, though scientists have begun to use bathymetric methods to search for coelacanths in potential habitat, this has led to disappointing results with little success. See generally Green et al. 2009, Exhibit 87. Therefore, it appears that scientists may have found most or all of the existing Gombessa Coelacanths and that habitat loss threatening those individuals could cause total extinction of the species. Loss of their limited habitat, therefore, represents a severe threat to the species' continued existence.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

Eugene Balon, a Gombessa Coelacanth expert, has said that all scientists agree that, "[n]one should be brought up." Joyce 1989, Exhibit 84 at 2. Unfortunately, however, coelacanths are being captured for a variety of reasons. See id. These reasons include keeping carcasses as trophies, using carcasses for scientific research, capture for televised entertainment, capture for rendering to remove its notochordial fluid for Asian longevity serums, and accidental capture as bycatch. See id.; Froese & Palomeres 1999, Exhibit 79 at 51.

Overutilization for Scientific Purposes. The paleontological importance of coelacanths as a prehistoric species and as a link between fish and tetrapods, puts pressure on the species for educational and scientific research purposes. See Joyce 1989, Exhibit 84 at 2; McGrouther 2012, Exhibit 72 at 3; Dinofish Undated 1, Exhibit 77 at 1; ESI Undated, Exhibit 81 at 1. The interest from museums, universities, and research institutes creates a market for these fish that is quite lucrative. See Joyce 1989, Exhibit 84 at 2. Current statistics and facts are hard to come by, but, as of 1989, Gombessa Coelacanths could only be sold legally to the Comorian government. Id. The official price was $150, an amount that was over one and a half times the average Comorian yearly income. See id. This value, however, was dwarfed by the then recently emergent black market price for the species of $2,000, **a price exceeding twenty years of the average Comorian income**. See id. This bounty, representing a small fortune for poor Comorian fishers, makes intentional capture of the coelacanth for sale to scientific interests highly likely. See id. This scientific research has also had the problematic effect of creating a private demand for the species' notochordial fluid, as discussed below.

Overutilization for Commercial Purposes. Though the Gombessa's meat is unpalatable, there is still significant commercial demand for the species. See id. The high value specimens can fetch, especially in relation to the average Comorian income, creates incentive for fishers to capture and sell them for profit. See id.; Monster Fish Keepers 2009, Exhibit 186 at 1-2. In fact, as of 1989, the black market price was $2,000, **exceeding 20 years of income for the average Comorian**. See Joyce 1989, Exhibit 84 at 2. Now, it is seems as if the price may exceed $4,500 for a dead specimen, with the price potentially going much higher if someone were able to produce one alive. See Monster Fish Keepers 2009, Exhibit 186 at 1-2. There is evidence of black market trade in coelacanths by private collectors and a market among museums and scientists for specimens. See SGForums 2006, Exhibit 88 at 1-5; Maybe Now Undated, Exhibit 89 at 1; Monster Fish Keepers 2009, Exhibit 186 at 1-2; Joyce 1989, Exhibit 84 at 2; Nicholson Undated, Exhibit 70 at 2. This pressure is even more of a threat because coelacanths cannot survive for very long in the decreased pressure and oxygen present at shallow depths, so those captured would likely be dead before officials were able to confiscate them. In fact, most specimens do not live for more than a few hours after capture, and none have lived for more than 20 hours at the surface. See Prehistoric Wildlife Undated, Exhibit 76 at 3; Joyce 1989, Exhibit 84 at 1.

This commercial trade has been exacerbated by a, now debunked, 1987 study that claimed the coelacanth could be used to create a longevity serum. In 1987, Japanese scientists purported to have isolated a substance in the coelacanth's notochordial fluid that promoted long life, making headlines worldwide and creating a demand for coelacanths in Asia. See Fricke 2001, Exhibit 86 at 334-35; Joyce 1989, Exhibit 84 at 2.

As mentioned above, coelacanths are not valued as a food source because they are oily and unpalatable. Fricke 2001, Exhibit 86 at 335. However, they are still threatened by fishing operations in their habitat. Id. This is because one of the worst threats to the coelacanth is bycatch by fishers fishing in known coelacanth habitat. Id. Because this type of fishing is a substantial industry in these rural communities, the associated incidental catch of coelacanths is inevitable, and "[s]ince the daily survival of the residents of the coastal areas takes precedence over the well-being of an 'old fish' . . . deep-sea fishing cannot be prohibited from" Gombessa habitat. Id. The harm caused by this bycatch is made worse by the fact that coelacanths cannot survive for long at the ocean surface and there is no proven way to return them to the deep ocean quickly enough to reduce their chances of mortality. See Prehistoric Wildlife Undated, Exhibit 76 at 3; Joyce 1989, Exhibit 84 at 1; Bruton 1999, Exhibit 187 at 464-65. However, discussion of a desire to return the coelacanth to the ocean alive after capture likely disregards the actual state of affairs. See Browne 1995, Exhibit 188 at 2. This is because, as a result of their illegal status, fishers usually just kill the fish and throw it away after retrieving the valuable fishhooks from their mouths. Id.

There have been some international efforts to decrease coelacanth deaths from bycatch. Efforts were made to move fishing further off the coasts using motorized fish attractors to keep fishers away from coelacanths, but, after the machine broke sometime before 1998, it was never repaired and fishing moved back in towards the shores and consequently towards coelacanth habitat. Id. There was also another machine designed and installed to intercept and revive bycaught coelacanths in Comoros, but it was dismantled by the Comorian people in 1997 after only one inconclusive use. See Bruton 1999, Exhibit 187 at 464. Therefore, there is no evidence that fish could actually successfully survive upon re-submerging even if this machine did still exist. See id. There was also an attempt made to create simple gear that would help Comorian fishers release coelacanths back to sufficient depths for survival, but there is no evidence this gear has been implemented to save any coelacanths yet. Id. at 464-65.

Therefore, while international assistance has attempted to step in to aid in avoiding coelacanth bycatch mortality, it has thus far proven unsuccessful. Bycatch mortality remains a severe threat to the continued existence of the coelacanth. Since there is no proven way to revive a caught coelacanth or quickly return it to the deep sea, even seemingly willing fishers who accidentally catch the species are unlikely to be able to save it from the almost-certainly-fatal consequences of its capture.

Curio/Trophy Trade. Worldwide, coelacanths are sought after as a trophy because they are fish come alive from the fossil record. See Froese & Palomeres 1999, Exhibit 79 at 51. Some collectors seek coelacanths for aquariums, as a dinosaur come alive, a prehistoric oddity; however, no individual has survived at the surface for more than 20 hours. See SGForums 2006, Exhibit 88 at 1-5; Maybe Now Undated, Exhibit 89 at 1; Monster Fish Keepers 2009, Exhibit 186 at 1-2; Joyce 1989, Exhibit 84 at 1. The capture of the Gombessa to satisfy personal curiosities even extends to the president of the Comoro Islands. Joyce 1989, Exhibit 84 at 1-2. He has, what was at the time, the largest coelacanth specimen ever caught, measuring 183 cm, stuffed and hung up on the wall of his home. Id. If even the president of the islands representing the Gombessa's most important habitat cannot recognize the value of conserving these creatures and cannot escape the lure of owning one, then that bodes poorly for a species with such low numbers. See id.; Springer 1998, Exhibit 73 at 453. This is especially true when it appears that collectors would pay as much as $4,500 for a dead fish and a "[l]ive one is worth way more than that." Monster Fish Keepers, Exhibit 186 at 1-2. Therefore, commercial overutilization represents a significant threat to the Gombessa.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

Comorian National Protection. The local government of the Comoros Islands has instituted fishing regulations for the coelacanth. See Browne 1995, Exhibit 188 at 2. One bans the landing of coelacanths. Id. The law, however, does nothing to prevent bycatch, which is equally fatal. See id.; Prehistoric Wildlife Undated, Exhibit 76 at 3;

Joyce 1989, Exhibit 84 at 1; Bruton 1999, Exhibit 187 at 464-65. Additionally, several other countries where coelacanths live do not have similar regulations. This makes these limited regulations insufficient to protect the coelacanth against bycatch in Comoros and fishing of all types in much of the rest of its range.

Local Protection. The Comorian national protection is supplemented by the fact that the Islamic Sunni of at least 11 villages on the island of Grand Comoro have adopted the Gombessa. Firkce 2001, Exhibit 86 at 336. Anyone who hurts it in any way “violates the code of the Sunni and is shunned by the community.” Id. Such community protection, while laudable, does not present sufficient protection for a species with such small numbers. It also cannot address bycatch of the species, does not seem to cover all villages on Grand Comoro, and certainly does not cover all areas of Gombessa habitat, thus further hampering its effectiveness.

International Protection. The Gombessa received protection under CITES in 1989, but this protection is also inadequate. See Wildlife Museum Undated, Exhibit 74 at 1; IUCN (Latimeria chalumnae) 2012, Exhibit 67 at 4. CITES is an international agreement with 176 parties, including the United States, that aims to ensure that international trade in wild plants and animals does not threaten their existence. See CITES Undated 1, Exhibit 33 entire; CITES Undated 2, Exhibit 34 at 1. However, it also represents one example of the protections for the Gombessa that exist, but have proven to be insufficient. This is because from 1991-1994 the observed populations of these fish went from 20.5 per cave to a mere 6.5, even though CITES protections had been in place since 1989. See Browne 1995, Exhibit 188 at 1; Wildlife Museum Undated, Exhibit 74 at 1; IUCN (Latimeria chalumnae) 2012, Exhibit 67 at 4. Such a precipitous drop in population is a strong indication that the level of protection CITES can offer, while probably somewhat beneficial, is certainly not sufficient.

The Gombessa Coelacanth is listed in Appendix I of CITES. See Wildlife Museum Undated, Exhibit 74 at 1; IUCN (Latimeria chalumnae) 2012, Exhibit 67 at 4. Appendix I is a list of species “threatened with extinction which are or may be affected by trade.” CITES Undated 4, Exhibit 189 at 2. Trade restrictions for Appendix I species are the strictest among CITES-listed species, allowing the trade only in “exceptional circumstances.” See id. Trade in Appendix I species requires an export permit by the exporting country and an import permit from the importing country. Id. The individual signatory countries enforce the CITES restrictions. Id. at 4. Yet, the CITES listing is neither effective at deterring catches in the rural fishing villages near the coelacanths’ habitat where villagers likely do not know of the restriction and may not intend on shipping the captured Gombessa out of the country, nor could it deter unintentional bycatch, which is no less fatal to the coelacanth than an intentional catch. Considering the estimated size of the existing population, this is unacceptable.

These problems are in part due to the fact that CITES listing offers insufficient protection to species. CITES only applies to **international trade** in endangered species. See CITES Undated 2, Exhibit 34 at 1. This protection is problematic for the Gombessa because, although it may provide some level of benefit to the species by deterring international trade, those specimens which die without being traded or are smuggled do not benefit. This focus only on trade means that CITES' focus is too narrow to protect the Gombessa from the many other threats that they face apart from trade.

CITES' narrow focus and the ease of CITES circumvention demonstrate the inadequacy CITES listing in the protection of the Gombessa. NMFS acknowledged the unsatisfactory effect of Appendix I listings in its determination for the listing of the largetooth sawfish under the ESA, when it stated that illegal foreign trade of the species continued "in spite of the CITES listing and national laws, due to lack of enforcement." See 76 Fed. Reg. 40822 (July 12, 2011), Exhibit 36 at 40832. While CITES listing is important, this protection is not sufficient and the petitioned Gombessa should be offered the further protections embodied by listing under the ESA.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Breeding Issues. Gombessa Coelacanths have reached such critically low numbers that the estimated world population is less than 500 individuals. See, e.g., Springer 1998, Exhibit 73 at 454. Because the numbers are so low, the species is threatened by stochastic events and the possibility that male and female coelacanths can no longer encounter each other with sufficient frequency for successful breeding. This threat is exacerbated by the extremely low fecundity of this species. The coelacanth is ovoviviparous, meaning that the mother retains the eggs in her uterus while the embryos develop, nourished by a yolk sac. Nicholson Undated, Exhibit 70 at 1. The young, called pups, are fully developed at birth, and, while late-term litters of five and twenty-six pups have been observed, their gestation period appears to be about three years. See Fricke 1992, Exhibit 78 at 476; Froese & Palomeres, Exhibit 79 at 49. This gestation period is incredibly lengthy and exceeds the two-year maximum gestation period known for vertebrates. Froese & Palomeres, Exhibit 79 at 49. This long gestation period, coupled with the estimated age of first maturity for females of 16 years, means that females cannot produce a litter of pups until they are about 19 years of age. See id. However, at least one estimate put the age of maturity at an even later 35 years of age, making birth impossible until around 38 years of age. See id. These difficulties reproducing, its late age of maturity, and the tremendous effort that goes into carrying pups for three years highlight the difficulty the Gombessa faces in growing its numbers. Therefore, these factors exacerbate its extinction risk and show that ESA protection is appropriate for the Gombessa.

Similarity of Appearance Listing: *Latimeria menadoensis*

Latimeria chalumnae, which is listed as "critically endangered" by the IUCN and is petitioned for listing under the ESA in this Petition, is genetically distinct from *Latimeria menadoensis*, which is listed as "vulnerable" by the IUCN. See IUCN (Latimeria menadoensis) 2012, Exhibit 68 at 3-4; IUCN (Latimeria chalumnae) 2012, Exhibit 67 at 2, 3. Guardians requests that if *L. chalumnae* is listed, *L. menadoensis* also be listed based on similarity of appearance.

The grounds for such listing, independent of any decision on the merits as to whether *L. menadoensis* is worthy of "threatened" or "endangered" listing under the ESA through analysis of the ESA listing criteria from 16 U.S.C. § 1533(a)(1) on its own, is the similarity of appearance standard set forth in 16 U.S.C. § 1533(e). This standard provides that the Secretary may "treat any species as an endangered species or threatened species even though it is not listed pursuant to this section," when "such species so closely resembles in appearance, at the point in question, a species which has been listed pursuant to such section that enforcement personnel would have substantial difficulty in attempting to differentiate between the listed and unlisted species; the effect of this substantial difficulty is an additional threat to an endangered or threatened species; and such treatment of an unlisted species will substantially facilitate the enforcement and further the policy of this chapter." 16 U.S.C. § 1533(e).

L. menadoensis clearly meets the similarity of appearance requirements under 16 U.S.C. § 1533(e). The two species resemble each other so closely that scientists initially thought they were the same species. See, e.g., Springer 1999, Exhibit 73, entire.

The difficulty in distinguishing between the two species of coelacanths presents "an additional threat to [the] endangered or threatened species." 16 U.S.C. § 1533(e)(B). Since coelacanths cannot survive captivity, the specimens that enforcement personnel see will inevitably be dead. See Prehistoric Wildlife Undated, Exhibit 76 at 3; Joyce 1989, Exhibit 84 at 1. When dead, the Gombessa loses its telltale steel blue color and turns a grey brown color. See Rogers 2007, Exhibit 71 at 2; Prehistoric Wildlife Undated, Exhibit 76 at 2. *L. menadoensis* is already brown and also appears to fade to more of a grey brown at death. Enforcement personnel should not be expected to distinguish in the field between grey-brown, dead coelacanths. See Rogers 2007, Exhibit 71 at 2; Prehistoric Wildlife Undated, Exhibit 76 at 2. There is evidence of a black market trade in coelacanth notochord oil, and the source of notochord oil would not be determinable without DNA testing. See Joyce 1989, Exhibit 84 at 2.

If *L. chalumnae* is protected under the ESA, it will be imperative to protect *L. menadoensis* as well. Without this protection, fishing operations will be able to continue targeting *L. chalumnae* because, due to a lack of features easily differentiating the two species, especially after they are dead or processed into parts (see above). This would allow fishers and smugglers to evade detection merely by marketing their carcasses and other products as belonging *L. menadoensis*.

Protecting both *L. chalumnae* and *L. menadoensis* "will substantially facilitate the enforcement" of protections for *L. chalumnae*. 16 U.S.C. § 1533(e)(C). Enforcement personnel will be able to more readily identify and prevent the sale of *L. chalumnae* if they do not have to differentiate between the very similar looking carcasses and other products of *L. chalumnae* and *L. menadoensis*. Without similarity of appearance protections for *L. menadoensis*, enforcement personnel may have to go so far as to perform DNA testing to determine the species before they can enforce the ESA. As such, listing of *L. menadoensis* would make enforcement of *L. chalumnae*'s ESA protection more effective, and more effective enforcement furthers the policy of the ESA.

Accordingly, if *L. chalumnae* is listed under the ESA, as it should be for the reasons discussed above, Guardians urges the Secretary to list *L. menadoensis* based on its similarity of appearance to *L. chalumnae*.

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(31) Scientific Name: *Mycteroperca fusca*

Common Name: Comb Grouper / Island Grouper

IUCN Status: Endangered **CITES Status**: N/A

Range: This species is known only from the eastern Atlantic around the Azores and Madeira, Portugal, and Cape Verde and the Canary Islands, Spain. IUCN (Mycteroperca fusca) 2012, Exhibit 54 at 4.

Habitat and Ecology: The Comb Grouper is a "demersal species that occurs near the bottom in rocky area at depths from 1 to 200" meters. Id. at 5. Juveniles are also found in tide pools. Id.

Population Status: In general, "*Mycteroperca fusca* has a limited range and was previously abundant, but due to fishing pressure is now locally rare. Id. at 4. Researchers have observed local extinctions in the most intensively fished areas in the islands of the Canary Archipelago. Id.

Population Trend: Decreasing. Id. at 5.

Known Threats/Listing Criteria

All of the threats and information discussed in "Fish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

The major threat to *Mycteroperca fusca* is pressure from fishing targeted at this species' "spawning aggregations, which for other serranids of similar life history has resulted in population declines, altered sex ratio, and aggregation extirpation." Id. This species has shown one of the "strongest responses to variations in fishing intensity and human population among the Canary Islands, thus supporting the hypothesis that major human intervention has affected the abundance and biomass" of this species in the Canary Archipelago. Id. (citing Tuya et al. 2006). Intensive fishing has also already caused local extinctions, lending authority to the claim that fishing for *Mycteroperca fusca* presents an imminent threat to the survival of the entire species. Fishing for a species that has already exhibited this type of severely negative response to fishing pressures is inappropriate and represents a significant threat to its continued existence. Thus *Mycteroperca fusca* qualifies for protection under the ESA.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

This species' range includes several MPAs. Id. However, the species is still subject to fishing that is threatening its existence. While inclusion in MPAs is positive form a conservation standpoint, it does nothing to protect the species outside of these areas. A species facing threats of this severity should be protected throughout its range and ESA protection should be extended to the species to prevent its continued exploitation and progress towards extinction.

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Tuya, F., Jerez Sanchez and Ricardo, H.J. 2006. *Populations of inshore serranids across the Canarian Archipelago; relationships with human pressure and implications for conservation.*

(32) Scientific Name: *Mycteroperca jordani*

Common Name: Gulf Grouper

IUCN Status: Endangered **CITES Status**: N/A

Range: This species occurs in the Eastern Central Pacific Ocean from southern La Jolla, California, to Mazatlan, Mexico and also into the Gulf of California. IUCN (Mycteroperca jordani) 2012, Exhibit 55 at 4; Figure 8, infra.

Figure 8: Map of *Mycteroperca jordani*'s Range
Source: http://maps.iucnredlist.org/map.html?id=14049

Habitat and Ecology: In general, this species is found on rocky reefs and in kelp beds. Id. at 5. "Large adults are common in shallow water from southern California to Mexico." Id. "Juveniles are unknown in Californian waters and few large adults have been taken there," probably as vagrants from a more southerly breeding population. Id. Large adults feed on other fish and have been reported feeding on juvenile hammerhead sharks. Id. This is a large fish, with recorded maximum size of nearly two meters and maximum weight of 91 kg. Id. at 6.

Population Status: This species has a relatively restricted range and its population is currently in "severe decline" throughout the Gulf of California. Id. at 4. "Once abundant, this species is now rare" with local fishermen indicating a 50-70% decline in catch rates for this species since 1950 in the Gulf of California. Id. "Based on historical research, fishers' anecdotes, systematic documentation of naturalists' observation and grey literature," researchers have revealed that in the past this species was abundant in central Baja California and probably dominated the rocky-reef fish community in terms of biomass. Id. However, *Mycteroperca jordani* declined dramatically in the 1970s and is now scarce and in danger of complete disappearance. Id. "Based on changes in the number of individuals within spawning aggregations, the population decline from the 1940s to the present could be greater than 99%." Id. Similarly, surveys of fishery catch data show that this species comprised 45% of the total state finfish production in 1960, but had fallen to only 6% by 1972. Id. at 5. "More recent estimates suggest that [*Mycteroperca*] *jordani* comprises less than 1% of the total finfish catch." Id.

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Fish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Coastal Development. Development in the coastal northern Gulf of California, in particular, Bahia La Cholla Marina, is expected to promote reef habitat destruction. Id. at 6. With destruction of its important reef habitat, the species will likely experience even further decreases in its numbers. See id. at 5.

The El Borrascoso area of *Mycteroperca jordani*'s Gulf of California habitat is threatened by planned development in the region. See Zamora-Arroyo et al., Exhibit 66 at 54. Housing and development plans for the region could destroy offshore habitats through dredging and destroy geologic outcrops with construction activity. Id. "In the case of habitat destruction resulting from coastal development, the severity of impacts is high with low reversibility." Id. at 58. Also, in this area, "[c]oastal lagoons adjacent to newly developed areas could be modified for shrimp mariculture resulting in damage from construction and pollution from effluents." Id.; see also IUCN (Colpichthys hubbsi) 2012, Exhibit 51 at 4 (discussing shrimp farming threat to the Gulf of California).

Furthermore, pollution from shrimp farming is not the only pollution threat from this development. Increased growth in coastal cities is a major cause of coastal habitat destruction. With growth comes an increase in consumption and development. This is reflected in an increase in construction projects, some of which occur on reef communities; dredging of harbors and shipping channels; dumping of waste, run-off pollution and increased sedimentation; deforestation; and increased tourism. As a result of these factors, the coasts around virtually all urban areas are "beset by a pattern of pollution and over-development." Hinrichsen Undated, Exhibit 43 at 2. "Coastal urban areas dump increasing loads of toxic wastes into the sea. In fact, waters around many coastal cities have turned into virtual cesspools, so thick with pollution that virtually no marine life can survive." Id. at 4.

This urban pollution is contributing to increasing "dead zones," amongst other things. These dead zones are areas where dissolved oxygen content is so low that no marine life, apart from microorganisms, can live. A 2007 study identified 200 of these dead zones, which represents an increase of 51 such zones found just four years earlier. Id. at 5. Worse yet, these dead zones are not only becoming more numerous, they are also greatly expanding "due mainly to high nutrient pollution levels brought in by rivers and streams and washed off coastal land." Id.

Climate change is expected to further magnify these coastal pollution problems. For example, "[d]ue to water circulation and oceanic volume changes, estuarine and coastal systems are predicted to experience . . . increased eutrophication, hypoxia, and anoxia." Roessig et al. 2004, Exhibit 29 at 258 (citations omitted). "More intense rains wash more fertilizer and sewage into coastal waters, and this runoff triggers algal blooms and consequent poisoning of fish and humans." Id. at 269 (citation omitted). This runoff entering the oceans will cause new dead zones to emerge and already-existing dead zones to expand. Unfortunately, this threat is already visible in *Mycteroperca jordani*'s Gulf of California habitat. Researchers have observed multiple blooms in the Gulf measuring 577 km^2 in one case and leading to mass fish mortality, which produced as estimated 60 tons of fish carcasses on the beach, in another. See Greenpeace 2008, Exhibit 63 at 16-17. The threat to *Mycteroperca jordani* represented by these Gulf dead zones is very real as "[s]uch dead zones have occurred in the past at [] Puerto Peñasco, for example, and possibly on one occasion at El Golfo de Santa Clara[, both areas within *Mycteroperca jordani*'s range]." Zamora-Arroyo et al. 2005, Exhibit 66 at 58. As the population of humans in the area increases and agricultural runoff continues to enter the Gulf, this threat to *Mycteroperca jordani*'s habitat will continue. This loss of habitat puts *Mycteroperca jordani* at greater risk of extinction.

Human Population Growth. Human population is expected to swell and become more focused on the coasts.[46] As a fish that exploits the coasts in its relatively small range, this represents a significant threat to *Mycteroperca jordani*'s continued existence. It also will likely exacerbate the coastal development problems discussed above.

Tidal Power. *Mycteroperca jordani* also faces potential habitat destruction from tidal power development in its range. "Potential development of tidal power, if implemented, will result in severe impacts and irreversible loss of the Upper Gulf habitat." Zamora-Arroyo et al. 2005, Exhibit 66 at 59. This potential loss of habitat is yet another threat to *Mycteroperca jordani*'s survival as a species.

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[46] See "Fish Introduction: The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range (Criterion A): Human Population Growth," supra.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

This species is heavily targeted by recreational and sub-national fisheries throughout its range and is also incidentally caught by shrimp-trawlers in the Gulf of California. IUCN (Mycteroperca jordani) 2012, Exhibit 55 at 6. "*Mycteroperca jordani* is an aggregating spawner," with breeding populations likely restricted to the Mexican northwest. Id. at 5. Furthermore, these "spawning aggregations are heavily fished." Id. at 6. This is problematic because it makes it much easier for population-level numbers of *Mycteroperca jordani* to be effectively targeted by fishers at easily identifiable locations and times. While this means that higher numbers of specimens can be easily taken, that damage to the species is compounded by the fact that there is an increased likelihood that spawning will be interrupted, thus leading to additional declines in overall *Mycteroperca jordani* numbers. The area where these aggregations happen is also problematic because, in addition to the aforementioned commercial fishing pressure, this is the same area that experiences heavy targeting by recreational fishers from the United States. See id. at 6 ("Recreational fishers from the [United States] are a major contributor to overfishing of remaining stocks."). This threat will only increase as coastal development in northern Gulf of California will bring double the number of fishing boats to the area. See id. As explained above in "Population Status," as a result of this overexploitation and other factors, the species may be facing population declines of an incredible 99+% since the 1940s. Clearly such a threat shows that overutilization is pushing this species towards extinction.

Disease or Predation (Criterion C):

Shrimp farming in *Mycteroperca jordani*'s range causes increased threat of disease. This occurs as fish experience the "escape of disease and viral pathogens from the ponds to the open Gulf." Zamora-Arroyo et al. 2005, Exhibit 66 at 58. Such farming may increase as "[c]oastal lagoons adjacent to newly developed areas could be modified for shrimp mariculture . . ." Id. Therefore, the disease threat to *Mycteroperca jordani* represented by shrimp farming is likely to increase in the future as development of the coasts adjacent to its range continues.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

"This species occurs [partially] within the Alto Golfo Biosphere Reserve, however enforcement of that area is severely lacking." IUCN (Mycteroperca jordani) 2012, Exhibit 55 at 6. As a result, location in the Alto Golfo Biosphere Reserve likely offers nominal or minimal protection at best. Such a small level of protection is insufficient for a species that may have lost more than 99% of its population in the last 70 years. See id. at 4. This protection should be supplemented with protection for the species under the ESA.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Susceptibility to Fishing. "*Mycteroperca jordani* is an aggregating spawner," with breeding populations likely restricted to the Mexican northwest. Id. at 5. Furthermore, these "spawning aggregations are heavily fished." Id. at 6. This is problematic because it makes it much easier for population-level numbers of *Mycteroperca jordani* to be effectively targeted by fishers at easily identifiable locations and times. While this means that higher numbers of specimens can be easily taken, that damage to the species is compounded by the fact that there is an increased likelihood that spawning will be interrupted, thus leading to additional declines in overall *Mycteroperca jordani* numbers. The area where these aggregations happen is also problematic because, in addition to the aforementioned commercial fishing pressure, this is the same area that experiences heavy targeting by recreational fishers from the United States. See id. at 6. This threat will only increase as coastal development in northern Gulf of California will bring double the number of fishing boats to the area. See id.

Skewed Sex Ratio. Currently *Mycteroperca jordani* is experiencing a skewed sex ratio with females significantly outnumbering males. Id. at 5. This clearly decreases the likelihood of reproduction and increases the likelihood that the species will go extinct if the disparity continues.

K-Selected/K-Strategy Species. *Mycteroperca jordani* is also vulnerable to extinction in part because it is a K-selected or K-strategy species (they are large, have low productivity, and have low numbers of mature adults). See id. at 4-6; see also Goble & Freyfogle 2010, Exhibit 64 at 1058-60.

> K-strategy species are more extinction prone than are r-strategy species. The very efficiency with which K-strategy species exploit their environment is a liability *during periods of rapid or chaotic change.* The larger body size of individuals of a K-strategy species - while giving an advantage in interspecific competition and in defense against predators and allowing individuals to exploit a larger area - means that there are fewer individuals . . . At the same time, lower reproduction rates make it more difficult both for the species to recover if its population becomes depressed and for it to adapt to a changed environment because fewer offspring contain less genetic variability. Thus, the very "fittedness" of K-strategy species to a particular environment - which is advantageous during periods of stability - becomes a serious handicap when the habitat changes more rapidly than genes can be substituted in a population - and in species that reproduce slowly, genes are substituted slowly.

Goble & Freyfogle 2010, Exhibit 64 at 1059-60 (emphasis in original). *Mycteroperca jordani* are currently experiencing the type of rapid, chaotic change that makes their K-selected life history pattern a liability. This is because *Mycteroperca jordani* are not only losing habitat, but they are also being fished and removed from their remaining habitat at a rate greater than they can replenish their numbers.[47] As a result of these pressures, many of *Mycteroperca jordani*'s physical attributes and reproductive adaptations have gone from being beneficial to creating increased risk of species extinction. This type of life history pattern means that the species does not replenish itself as quickly as smaller, shorter-lived, r-selected species and is, therefore, more vulnerable when individuals are removed from the population or species reproduction is otherwise disrupted. This difficulty is likely exacerbated by the fact that the largest fish are both the fish most prized by fishers for the greatest economic return and those most likely to be sexually mature. Removing the few adults makes it impossible for younger fish to replace the larger individuals because they are not yet sexually mature, thus making it very difficult for the population to replenish itself. Removing the only members of a species that are capable of reproduction means that there is a substantial risk that the population will rapidly collapse. Steps must be taken to protect *Mycteroperca jordani* from this risk of extinction.

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of *Mycteroperca jordani*. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted).

The combination of threats to *Mycteroperca jordani* 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." Id. at 453 (internal citations omitted).

Mycteroperca jordani 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." Id. at 455 (internal citations omitted).

Since *Mycteroperca jordani* is threatened by multiple stressors and is a K-selected species, these multiple threats are likely to cause increased extinction pressure

[47] See "The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range (Criterion A)," supra; "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra; "Population Status," supra.

than the mere additive pressure of each threat alone. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(33) Scientific Name: *Paraclinus magdalenae*

Common Name: Magdalena Blenny

IUCN Status: Endangered **CITES Status**: N/A

Range: This species is known only from a few specimens found in the immediate vicinity of Magdalena Bay, Baja California, Mexico. IUCN (Paraclinus magdalenae) 2012, Exhibit 56 at 4. In 1969, researchers took samples at appropriate depths at other places along the Mexican coast and this species was not found in any other area. Id. The area of this species' distribution is approximately 1,131 km^2. Id.

Habitat and Ecology: This species was found at depths of 7-21 meters, on rocky substrates. Id.

Population Status: There is no population information available for this species. Id.

Population Trend: Stable. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Fish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Coastal Development and Pollution of the Magdalena Bay Area. This species is primarily threatened by "habitat loss from coastal development, urban and industrial pollution, massive tourism development and various potentially harmful extractive activities" within its restricted range. Id. (citing Hastings & Fischer 2001). "Effluent, including [untreated domestic] sewage and industrial waste is discharged directly into Magdalena Bay, and intertidal near-shore and wetland areas are being degraded. Id. (citing School for Field Studies 2004). This is complicated by the fact that, "[i]n the case of habitat destruction resulting from coastal development, the severity of impacts is high with low reversibility." Zamora-Arroyo et al. 2005, Exhibit 66 at 58. As a result of *Paraclinus magdalenae*'s very restricted range, the habitat loss occasioned by these threats puts *Paraclinus magdalenae* at serious risk of extinction.

Localized Human Population Growth. Human populations have a substantial negative effect on fish populations, especially human population located near the coasts. Worldwide, approximately 2.5 billion people live within 100 km of the coastline. WRI 2011, Exhibit 41 at 21. By 2020 an astonishing 75% of the expanded human population is expected to live within just 60 km of the coastline. Knip et al. 2010, Exhibit 42 at 2 (citation omitted). Magdalena Bay, *Paraclinus magdalenae*'s only known habitat, is already experiencing this population shift as "massive" coastal development related to the tourism industry continues and the people needed to support it. See IUCN (Paraclinus magdalenae) 2012, Exhibit 56 at 4. Impacts from population growth do not occur evenly. Increased economic growth in coastal cities is a major cause of ocean habitat destruction. With growth comes an increase in consumption and development. The coasts around virtually all urban areas are "beset by a pattern of pollution and over-development." Hinrichsen Undated, Exhibit 43 at 2. "Coastal urban areas dump increasing loads of toxic wastes into the sea. In fact, waters around many coastal cities have turned into virtual cesspools, so thick with pollution that virtually no marine life can survive." Id. at 4.

This urban pollution is contributing to increasing dead zones, areas where dissolved oxygen content is so low that no marine life, apart from microorganisms, can live. A 2007 study identified 200 of these dead zones, which represents an increase of 51 such zones found just four years earlier. Id. at 5. Worse yet, these dead zones are not only becoming more numerous, they are also greatly expanding "due mainly to high nutrient pollution levels brought in by rivers and streams and washed off coastal land." Id.

To make matters worse for *Paraclinus magdalenae*, climate change is expected to further magnify these coastal pollution problems. For example, "[d]ue to water circulation and oceanic volume changes, estuarine and coastal systems are predicted to experience . . . increased eutrophication, hypoxia, and anoxia." Roessig et al. 2004, Exhibit 29 at 258 (citations omitted). "More intense rains wash more fertilizer and sewage into coastal waters, and this runoff triggers algal blooms and consequent poisoning of fish and humans." Id. at 269 (citation omitted). This runoff entering the oceans will cause new dead zones to emerge and already-existing dead zones to expand. As the population of humans in the area increases and agricultural runoff continues to enter the Bay, this threat to *Paraclinus magdalenae*'s habitat will continue. This loss of habitat puts *Paraclinus magdalenae* at greater risk of extinction.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are no species-specific conservation measures in place for *Paraclinus magdalenae* at this time. IUCN (Paraclinus magdalenae) 2012, Exhibit 56 at 4. Such a lack of protection puts *Paraclinus magdalenae* at increased risk of extinction and necessitates ESA protection to halt this species' progress towards extinction.

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<u>(34) Scientific Name</u>: *<u>Paraclinus walkeri</u>*

Common Name: reef fish

IUCN Status: Critically Endangered **CITES Status**: N/A

Range: "This species is endemic to the Eastern Pacific, and is only known from the 40 km^2 Bahia San Quintin, Baja California Sur, Mexico." IUCN (Paraclinus walkeri) 2012, Exhibit 57 at 4 (citing Hubbs 1952).

Habitat and Ecology: "This species is found in shallow tide pools and upper reef flat to depths of six [meters]." <u>Id.</u>

Population Status: "No population information is available for this species. This species is currently considered to be very rare, although it was formerly considered to be common." <u>Id.</u>

Population Trend: Unknown. <u>Id.</u>

Known Threats/Listing Criteria

All of the threats and information discussed in "Fish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

"This species is threatened by habitat loss and degradation due to agricultural runoff and coastal development throughout its restricted range." <u>Id.</u> This threat is likely to increase as human populations especially those located near the coasts continue to grow.[48] Furthermore, these impacts are even more problematic because, "[i]n the case of habitat destruction resulting from coastal development, the severity of impacts is high with low reversibility." Zamora-Arroyo et al. 2005, Exhibit 66 at 58. Therefore, this habitat loss represents a significant threat to the species' continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

While the species is located only in Bahia de San Quintin, which is classified as protected habitat, and is therefore protected throughout its range, it has gone from being considered common to being considered very rare. IUCN (Paraclinus walkeri) 2012, Exhibit 57 at 4. This shows that this protection has been inadequate to protect the species. This is understandable as the protected habitat appears to only be the lagoon itself, and the threats to the species (e.g. agricultural runoff and coastal development) originate on

[48] <u>See</u> "Fish Introduction: The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A): Human Population Growth," supra.

land. Id. Furthermore, the fact that the entire population is located in one small area leaves them extremely vulnerable to localized events, thus further threatening the species. Therefore, more effective regulation under the ESA is necessary to address these threats and halt *Paraclinus walkeri*'s continued decline.

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(35) Scientific Name: *Paralabrax albomaculatus*

Common Name: Camotillo

IUCN Status: Endangered **CITES Status**: N/A

Range: This species is found only in the Galápagos Islands. IUCN (Paralabrax albomaculatus) 2012, Exhibit 58 at 4.

Habitat and Ecology: "This reef-associated [fish] species inhabits rocky reefs and nearby sand patches." Id. Depth of occurrence varies from 10-75 meters within the archipelago according to temperature, with a preference for cooler water. Id. (citing Reck 1983). This species' diet consists of "mobile benthic crustaceans, octopus, squid, and cuttle fishes." Id. Although exact generation length is unknown, "age of first maturity is estimated to be between 1-2 years and longevity estimated to be 10-12 yeas" based on other similar species, and therefore generation length is estimated to be around 5 years. Id.

Population Status: "There is no population information available for this species. However, a substantial decline (approximately 70%) in population numbers occurred between 1998 and 2001," as inferred from fish landings in the Galápagos, with no evidence of a decrease in fishing effort. Id. (citing Danulat and Edgar 2002).

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Fish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

As a species exhibiting a preference for cooler waters, *Paralabrax albomaculatus* will clearly lose habitat at its preferred depths as surface ocean temperatures rise due to anthropogenic climate change. See id.; Status Review Report, Exhibit 40 § 3.2.2. Such a loss of suitable habitat, seemingly especially important for juveniles, puts the species at increased risk of extinction. See IUCN (Paralabrax albomaculatus) 2012, Exhibit 58 at 4-5.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

Though this species' entire range is in the Galápagos Marine Protected Area, it is still subject to active commercial fishing. Id. at 5. Therefore, fishing for the species is at least exacerbating the pressures that it faces and is likely a factor in its continuing decline. See id. at 4.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

"Although this species' entire range is in the Galápagos Marine Protected Area, it is still subject to active commercial fishing." Id. at 5. The fact that the species lives only within the Galápagos MPA, but is still actively fished shows that this designation alone is not enough to protect the species. When a species is considered endangered with decreasing population, like *Paralabrax albomaculatus*, fishing for the species must be effectively halted. The inadequacy of current regulation shows that ESA protections are needed for this imperiled species.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

ENSO Events. "In the Eastern Tropical Pacific, severe localized fish species declines have occurred after strong ENSO events that result in shallow waters that are too warm and nutrient poor for extended periods of time." Id. at 4 (citing Grove 1985; Edgar et al. 2009); see also Earth Gauge Undated, Exhibit 47. "The frequency and duration of ENSO events in this region of the Eastern Tropical Pacific (e.g., the up-welling zone off the coast of Peru, Ecuador, and Colombia and associated offshore islands) appears to be increasing." IUCN (Paralabrax albomaculatus) 2012, Exhibit 58 at 4 (citing Glynn & Ault 2000; Soto 2001; Chen et al. 2004). "This deep-water species is unlikely to be directly affected by oceanographic changes caused by ENSO events and climate change. However, juveniles of this cool water species have primarily been observed in relatively shallow water including near mangroves, where they may be negatively affected by increased temperatures during severe [ENSO] events." Id. at 4-5. If juveniles experience a strong ENSO event and severe localized fish declines occur, then a huge portion of that year's juveniles may be lost during that ENSO event. As these ENSO events become more and more common, potentially wiping out every year's juveniles, the threat they represent to *Paralabrax albomaculatus*'s continued existence will become more and more severe.

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<u>(36) Scientific Name</u>: <u>*Pterapogon kauderni*</u>

Common Name: Banggai Cardinalfish

IUCN Status: Endangered **CITES Status**: N/A

Range: *Pterapogon kauderni* has a very restricted range and is endemic only to the Banggai Archipelago, which lies in the Banggai-Sula platform in eastern Indonesia. IUCN (Pterapogon kauderni) 2012, Exhibit 59 at 5. The natural geographic range of this species covers an area of approximately 5,500 km^2, however, within this range, the maximum potential available habitat is much smaller, measuring about 426 km of coastline extending from the shore to about 100 meters off the coast. <u>Id.</u> This creates a maximum available area of only about 34 km^2. <u>Id.</u> (citing Vagelli 2005). Within the Archipelago, this species has been recorded at 17 of the 20 major islands and at 10 of the 27 minor islands. <u>Id.</u>

Habitat and Ecology: The Banggai Cardinalfish occurs primarily in shallow sheltered bays and harbors, mainly on reef flats with sandy bottoms and sea grass beds. <u>Id.</u> at 7. Depth distribution generally ranges between 0.5-6 meters, but *Pterapogon kauderni* is most commonly found between 1.5-2.5 meters. <u>Id.</u> This species inhabits a variety of shallow habitats, including coral reefs, sea grass beds, and open areas of sand and rubble. <u>Id.</u> at 8. "It is most common in calm habitats on the protected side of larger islands; isolated populations also occur in areas affected by strong surge and moderate current." <u>Id.</u>

Juveniles of this species associate with sea grasses, sea urchins, sea stars, sea anemones, soft corals, and corals. <u>Id.</u> "Adults shelter between the spines of sea urchins but also among anemones, corals, stony hydrozoans, rocks and artificial structures such as jetties." <u>Id.</u> (citing Allen 2000; Vagelli and Erdmann 2002; Vagelli 2004a). "Census work showed that 43.7% of the groups were associated with hard corals." <u>Id.</u> (citation omitted). The Banggai Cardinalfish is a diurnal "carnivore-planktivore that feeds principally upon copepods, but it is also a generalist opportunistic species that feeds upon a variety of other taxa." <u>Id.</u>

This species has a relatively short life span, matures at an average age of 0.8 years, and has a generation length of 1.5 years, which are all usually indications of a relatively more resilient species. <u>Id.</u> at 10 (citing FishBase 2004). "Unfortunately, this species' small population size, limited distribution, low fecundity, great parental investment, and rate of extraction greatly lower this species' resilience" to human activity and environmental degradation. <u>Id.</u> Additionally, its extreme philopatry, sedentary nature and shallow habitat preference preclude this species from dispersing even to nearby islands. <u>Id.</u> Furthermore, the Banggai Cardinalfish is especially susceptible to indiscriminate collecting for the aquarium trade as its shallow habitat greatly facilitates capture while its lack of population dispersal makes it almost impossible for this species to re-colonize areas where it has been removed. <u>Id.</u> (citing Bernardi and Vagelli 2004). "This species is highly prized in the aquarium trade and thus is highly vulnerable to overfishing." Id. The species is further imperiled because it is also highly vulnerable to post-capture mortality and habitat destruction. Id. at 10-11.

Population Status: The earliest population surveys for this species, covering the entire Banggai Archipelago, identified *Pterapogon kauderni* on 27 out of the 50 islands. Id. at 7. Based on the average population density recorded by these initial surveys, the species was estimated to have a total population size of 2.4 million fish in 2001. Id. (citing Vagelli 2002, Vagelli and Erdmann 2002). "[*Pterapogon*] *kauderni* exhibits the highest degree of population structure that has been documented for a marine fish." Id. (citing Hoffman et al. 2005). This species is a unique case of stark genetic isolation in populations separated by extremely short distances. Id. (citing Bernardi & Vagelli 2004). Studies using both genetics and micro-satellites have shown that populations from different reefs on the same island, separated by only a few kilometers, are almost completely genetically isolated from one another. Id. "The lack of suitable habitats between subpopulations coupled with lack of dispersal mechanisms, are the most likely reasons for this isolation." Id.

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Fish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Local Threats. This species is threatened by habitat destruction caused by harbor dredging and associated pollution, as well as sedimentation from coastal development and use. Id. This is complicated by the fact that, "[i]n the case of habitat destruction resulting from coastal development, the severity of impacts is high with low reversibility." Zamora-Arroyo et al. 2005, Exhibit 66 at 58. Juveniles in particular are vulnerable to local population dynamics of anemones and sea urchins that act as this species' mutualistic microhabitat. IUCN (Pterapogon kauderni) 2012, Exhibit 59 at 7. This microhabitat is threatened by harvest for the aquarium or food trade in sea urchins and anemones and coral bleaching in anemones. Id. "Adults may be vulnerable to local population dynamics of sea grasses." Id.

Loss of Coral Reef Habitat. In addanthoition, the species' observed reliance on corals, coral reefs, and specific temperatures also threatens their continued existence as global climate change and threats to corals increase.[49] The following facts make the Banggai Cardinalfish's reliance on coral reefs, corals, and temperature maintenance clear: 51% of identified groups inhabit coral reefs, 43.7% of groups were associated with hard corals, and the species is associated with a relatively narrow band of temperatures

[49] See generally "A. Corals: Corals Introduction," supra.

between 28°C and 33°C. IUCN (Pterapogon kauderni) 2012, Exhibit 59 at 8 (citations omitted). Without coral reefs 51% of identified groups will have to move to new habitats. See id. Without hard corals that can form calcite crystals needed for skeleton building, 43.7% of groups will lose the hard corals they are associated with as those species cease to exist in a recognizable form, and possibly altogether. See id.; see also "A. Corals: Corals Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Ocean Acidification," supra. If sea temperatures continue to rise, then suitable *Pterapogon kauderni* habitat (areas that are within 100 meters of shore, are between 0.5-6 meters in depth, and are between 28°C and 33°C) will become more rare or will cease to exist entirely. See IUCN (Pterapogon kauderni) 2012, Exhibit 59 at 5, 7, 8. Since this species is so incapable of moving to new areas on its own, changes rendering habitat unsuitable will likely not lead to migrations to new suitable habitat, but will instead lead to isolated, but increasingly widespread, extinctions. See id. at 7.

Unfortunately, all of the changes in the previous paragraph are expected as anthropogenic climate change, and its associated impacts, continue to decimate corals and the coral reefs that they build.[50] As ocean acidification continues and the pH of the sea continues to drop, corals will become incapable of forming the calcite crystals that form their skeletons. This means that reef building will cease and existing reefs will begin to deteriorate. This will likely lead to mass coral extinctions, and those corals that remain, if any, will probably survive as tiny, obscure invertebrates, offering no shelter or habitat benefits to *Pterapogon kauderni*.[51] Increasing ocean temperatures and other effects of anthropogenic climate change also mean a host of other negative impacts to corals and, consequently, the species like the Banggai Cardinalfish that rely on them. These threats include habitat loss due to increased coral disease (including particularly increased coral disease in the Indo-Pacific where *Pterapogon kauderni* is located), increased threats from anthropogenic pollution, and coral bleaching.[52] A number of these problems will be exacerbated by human population growth.[53] Still others are caused directly by human exploitation of the sea, such as removal of corals for aquaria and curios, increased predation by crown-of-thorns starfish due to removal of starfish predators by humans, increased sedimentation from a variety of causes (including deforestation and mining activities), and incidental harm to corals from dynamite fishing,

[50] See generally "A. Corals: Corals Introduction: The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A)," supra; "A. Corals: Corals Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E)," supra.

[51] See generally "A. Corals: Corals Introduction: The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A)," supra; "A. Corals: Corals Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Ocean Acidification," supra.

[52] See "A. Corals: Corals Introduction: The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A)," supra; "A. Corals: Corals Introduction: Disease or Predation (Criterion C): Coral Diseases," supra; "A. Corals: Corals Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Human Population Growth," supra; "A. Corals: Corals Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Bleaching," supra; IUCN (Pterapogon kauderni) 2012, Exhibit 59 at 6.

[53] See "A. Corals: Corals Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Human Population Growth," supra.

chemical fishing, and human recreation and tourism activities.[54] Furthermore, the synergistic effects of these threats are likely to be higher than their additive impacts, and the existing regulatory mechanisms in place to protect corals are inadequate.[55] As a result of its reliance on corals and coral reefs, the threats to corals also threaten the existence of *Pterapogon kauderni* by promoting further habitat loss.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"The Banggai Cardinalfish is highly prized in the aquarium trade," and it has been heavily exploited by that sector since its rediscovery in 1994. IUCN (Pterapogon kauderni) 2012, Exhibit 59 at 11 (citing Allen 2000; Vagelli & Erdmann 2002; Kolm & Berglund 2003). "Despite claims that captive breeding has been successful, most aquarium specimens are still captured in the wild." Id. By 2001, at least 17 villages and 230 fishermen were involved in the *Pterapogon kauderni* trade, capturing an estimated minimum of 600,000 to 700,000 individuals per year. Id. (citing Vagelli & Erdmann 2002; Lunn & Moreau 2002; Lunn & Moreau 2004). Current harvest rates are even higher and are now believed to exceed 700,000 to 900,000 fish per year. Id. (citing Vagelli 2005). Some estimates put the sales total for Banggai Cardinalfish as high as 118,000 per month, but even that figure is likely under representative of actual sales because the number only takes into account sales to Tumbak and Palu-based buyers and does not take into consideration "individuals collected and shipped from alternate locations, or lost to pre-sale mortalities in fishers' holding cages." Id. at 12 (citing Wabnitz et al. 2003; Lunn & Moreau 2004). The fact that transshipment deaths are not taken into account is problematic because transshipment mortality is high as a result of the lengthy travel times between catch sites and export sites. Id. at 11 (citing Vagelli & Erdmann 2002) (transshipment mortality fact and "[a] minimum of four aquarium fish export companies operate in Bali; others exist in Kendary and Manado (Sulawesi)."). Therefore, the numbers of *Pterapogon kauderni* removed from the wild are likely much larger. The majority of these captured fish are destined for the United States, Europe, and Asia. Id.

"A recent study showed that, despite the use of non-destructive fishing methods, the fishery had a negative effect on fish density when sites with high fishing pressure were compared to sites with low fishing levels." Id. at 12 (citing Kolm & Berglund 2003). "Fishing also had a significant effect on group size," which has been shown to lead to strong negative impacts on individual fitness in the future. Id. (citing Stephens et al. 1999; Stephens & Sutherland 1999; Kolm & Berglund 2003).

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[54] See "A. Corals: Corals Introduction: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra; "A. Corals: Corals Introduction: Disease or Predation (Criterion C): Predation by Crown-of-Thorns Starfish," supra; "A. Corals: Corals Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Sedimentation," supra; "A. Corals: Corals Introduction: The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A)," supra.

[55] See "A. Corals: Corals Introduction: The Inadequacy of Existing Regulatory Mechanisms (Criterion D)," supra; "A. Corals: Corals Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Synergistic Effects," supra.

These facts make clear that fishing pressures are removing an unsustainable number of Banggai Cardinalfish from the wild. This type of pressure is very likely to contribute to the extinction of the species. In fact, the aquarium trade has already led to the extinction of at least one subpopulation off Limbo Island in 2004 and the near extinction of another subpopulation off Bakakan Island, also in 2004. Id. at 4. Since the United States is a major destination for these fish, ESA protection could have a very positive effect on removing the economic incentive for capturing the Banggai Cardinalfish. See id. at 11. Furthermore, as the trade appears to be expanding both "to new, previously unexploited areas [;] . . . to all of the major islands" where the Banggai Cardinalfish is found; and in terms of volume of fish removed, pressures on the species appear to be increasing steadily. See id. at 11-12. This, coupled with the species' relative inability to re-colonize areas once they have been removed, makes the need for ESA protection ever more important to avoid extinction of *Pterapogon kauderni*. See id. at 7.

Disease or Predation (Criterion C):

"This species is reportedly parasitized by four main parasite types," nematodes, digenetic trematodes, cestodes, and isopods affecting as much as 26.5% of all individuals analyzed. See id. at 12 (citing Vagelli & Erdmann 2002; Vagelli 2005). Furthermore, a newly emerging threat in the form of a viral disease has been documented in "wild-harvested individuals maintained in captivity." Id. The extent of this threat is currently under investigation, but could be very dangerous for a species subject to the types of pressures that the Banggai Cardinalfish is. See id. at 13.

There is also strong evidence that this species faces high predation pressures from a variety of sources. Id. at 12 (citing Vagelli 2005). These high predation pressures result in especially high mortality from predation during the fist days after settlement. Id. (citing Vagelli 2002). Therefore, both disease and predation pressures are increasing *Pterapogon kauderni*'s extinction risk.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

Despite a breeding program developed at the New Jersey State Aquarium, no concerted effort has been made in the aquarium trade to replace wild-caught fish with captive-bred fish. Id. at 13 (citing Vagelli 2002; Vagelli 2004b; Vagelli 1999). Any additional attempts at protection of the species have also only been insufficient half-measures. For instance, the Indonesian government does keep track of exported fish, but *Pterapogon kauderni* is simply lumped in the "aquarium fish" category making tracking of the number exported more difficult. See id. Also, limited local bans by private owners of bays and villages have resulted in some protection of local subpopulations, but these bans are seemingly driven by private interests such as pearl collection or disputes with outside collectors. See id. at 4, 5 (citing Vagelli 2005). Such protections do not indicate permanence and enforcement is unclear. For a species facing the types of concerted pressures and natural limitations that *Pterapogon kauderni* is facing, such half-measures are inappropriate and ESA protection should be extended to the species.

It is also worth noting that the United States itself proposed listing the Banggai Cardinalfish under Appendix II of CITES in 2007. See Indrawan & Suseno 2008, Exhibit 175 at 13. This represents a clear recognition by the United States that the species is facing significant threats to its continued existence through trade. However, this proposal was withdrawn due to political decisionmaking by the local government of the Indonesian province where the fish is located. The provincial government's decision was based on a desire to continue profiting from sales of the fish for the aquarium trade, not on the basis of whether the species was endangered by trade. See id. at 13-15; see also "Fish Introduction: The Inadequacy of Existing Regulatory Mechanisms (Criterion D): CITES," supra. This means that the U.S. should take action and list the species under the ESA to prevent its extinction. Protection under the ESA would be particularly effective for this species because the U.S. represents one of the largest importers of wild-caught Banggai Cardinalfish, and, therefore, ESA protection could cut much of the stress placed on this species by the U.S. market. See IUCN (Pterapogon kauderni) 2012, Exhibit 59 at 12; see also "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Reproduction, Maturity, and Longevity. *Pterapogon kauderni* possesses low fecundity. IUCN (Pterapogon kauderni) 2012, Exhibit 59 at 9-10. "Principal characteristics of the reproductive biology include: 1) parental care of an advanced degree, 2) an elevated level of energy investment per offspring, 3) low fecundity, 4) direct development, 5) a lengthy oral incubation period that includes the retention of free embryos after the eggs hatch [during which time the fish does not eat], 6) settlement of juveniles within the habitat of their parents." Id. at 10 (citing Vagelli & Volpedo 2004). These characteristics indicate that reproduction is physically taxing on the parents, which may be why fewer offspring are produced. Production of fewer offspring also means that *Pterapogon kauderni* is less able to replace lost members of its population. Longevity in captivity can reach 4 to 5 years with reproductive activity decreasing substantially after 2 to 3 years, however, most wild adult specimens are less than two years old. Id. This short lifespan is problematic for a species that does not mature until about 0.8 years of age and that faces the pressures *Pterapogon kauderni* does. See id. at 10, 11-13. Therefore, *Pterapogon kauderni*'s reproduction, maturity, and longevity characteristics represent another threat to its continued existence.

Susceptibility to Fishing. "[*Pterapogon*] *kauderni* is especially susceptible to indiscriminate collecting, e.g., its association with shallow microhabitats greatly facilitates its capture, while the lack of dispersal mechanisms make it almost impossible for this species to re-colonize areas where they have been depleted." Id. at 10. Such ease of fishing increases the threats faced by *Pterapogon kauderni*.

Pollution. "The Luwuk subpopulation . . . is restricted to a very small area inside [a] harbor [that] is exposed to high levels of pollution and contaminants. Despite thorough searching . . . no populations of [*Pterapogon*] *kauderni* were found outside the [harbor], despite that environmental conditions and substrate availability were much better than those inside the harbor. The closest subpopulation of [*Pterapogon*] *kauderni* to the one at Luwuk is located about 100 km southeast." Id. at 6. This shows that this isolated subpopulation is threatened by pollution emanating from the harbor it lives in. This subpopulation appears unlikely, or perhaps unable, to move to preferable habitat and, therefore, faces increased risk of extinction. Other subpopulations also likely face threats related to pollution and, if so, are probably similarly unable to relocate to unpolluted areas. Therefore, pollution represents yet another threat to *Pterapogon kauderni*'s existence.

Earthquakes. "Frequent earthquakes recently affected several zones within the Banggai Archipelago [and] had a potential[ly] detrimental impact on localized [*Pterapogon*] *kauderni* subpopulations." Such earthquakes are likely to happen again in the future and, when they do, they will likely threaten populations of *Pterapogon kauderni* again.

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of *Pterapogon kauderni*. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted). Since *Pterapogon kauderni* faces a multitude of different threats, it may be pushed towards extinction more quickly than the mere additive effect of those threats themselves would indicate. See id. at 453; see also "Fish Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Synergistic Effects," supra. Therefore, the species qualifies for listing as "threatened" or "endangered" under the ESA.

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<u>(37) Scientific Name</u>: <u>*Scarus trispinosus*</u>

Common Name: Greenback Parrotfish

IUCN Status: Endangered **CITES Status**: N/A

Range: This species is endemic to Brazil with a range from Manoel Luiz Reefs on the northern Brazilian coast to Santa Catarina on the southeastern Brazilian coast. IUCN (Scarus trispinosus) 2012, Exhibit 60 at 4. This species is absent from the Brazilian oceanic islands. <u>Id.</u>

Habitat and Ecology: This small fish is reef-associated and is usually found in seagrass, coral reefs, on algal and rocky reefs and on algal beds at depths of 1-45 meters. <u>Id.</u> "It exhibits a functional role in substrate use because it is an important excavator that often feeds on live coral." <u>Id.</u>

Population Status: During the period from 1996-1998, this species was the second most abundant species in Manoel Luis State Marine Park, being reported in 69% of underwater visual census surveys. <u>Id.</u> (citing Rocha & Rosa 2001). "On the Abrolhos Bank, the largest coral reef in the south Atlantic, this species represents about 28% of total fish biomass, and has shown 50% decline in the past five years." <u>Id.</u> (citing Francini-Filho 2005; Francini-Filho & Moura 2008). In the southeastern part of its range, "the biomass has declined by 60-70% over the last 15 years" based on underwater visual census surveys and interviews with fishers. <u>Id.</u> Overall, this species is experiencing a decline in population. <u>Id.</u>

Population Trend: Decreasing. <u>Id.</u>

Known Threats/Listing Criteria

All of the threats and information discussed in "Fish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

"Parrotfishes show varying degrees of habitat preference and utilization of coral reef habitats, with some species spending the majority of their life stages on coral reefs, while others primarily utilize seagrass beds, mangroves, algal beds, and/or rocky reefs. Although the majority of the parrotfishes occur in mixed habitat (primarily inhabiting seagrass beds, mangroves, and rocky reefs) approximately 78% of these mixed habitat species are experiencing greater than 30% loss of coral reef area and habitat quality across their distributions. Of those species that occur exclusively in coral reef habitat, more than 80% are experiencing a greater than 30% of coral reef loss and degradation across their distributions." <u>Id.</u> at 5. "Widespread coral reef loss and declining habitat conditions are particularly worrying for species that depend on live coral reefs for food and shelter especially as studies have shown that protection of pristine habitats facilitate the persistence of adult populations in species that have spatially separated adult and juvenile habitats. Furthermore, coral reef loss and declining habitat conditions are particularly worrying for some corallivorous excavating parrotfishes that play major roles in reef dynamics and sedimentation." Id. (citing Comeros-Raynal et al. 2012). The extensive loss of *Scarus trispinosus* habitat that is already occurring, and that will likely occur in the future as a result of threats to coral reefs from anthropogenic climate change and other human-related impacts, qualifies the species for protection under the ESA.[56]

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

This species is primarily threatened by spearfishing, net, and trap fishing throughout its range. IUCN (Scarus trispinosus) 2012, Exhibit 60 at 5. "Based on measured declines in at least two significant parts of its range[], along with observations that large individuals have become very rare, it is estimated that at least 50% of the global population has declined over the past 20 to 30 years. Id. These precipitous losses show that this species should receive protection under the ESA.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

"There are no species-specific conservation measures for this species." Id. A few populations are currently protected in no-take reserves, including some reefs. Id. "However, the number of protected areas within its range does not include a large proportion of this species[‘] population or habitat." Id. Since a large proportion of the species' population and habitat exists outside of these reserves, and there is no species specific conservation measures in place, the species by and large experiences no protections. This lack of protection is inappropriate for a species facing the types of declines and habitat threats that *Scarus trispinosus* is facing. Also, even the protected coral reefs that it inhabits will not be spared from the damaging effects brought on or exacerbated by anthropogenic climate change.[57] Therefore, this species should be provided with protection under the ESA.

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[56] See id.; see also "A. Corals: Corals Introduction," supra (for more information on the impacts that coral reefs are facing that will likely degrade and/or destroy substantial *Scarus trispinosus* habitat and prey).
[57] See "A. Corals: Corals Introduction," supra.

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(38) Scientific Name: *Tomicodon abuelorum*

Common Name: Grandparents Clingfish

IUCN Status: Endangered **CITES Status**: N/A

Range: "This species is endemic to the Eastern Central Pacific, where it is known from the Gulf of Nicoya, Costa Rica to Darien, in the Gulf of Panama." IUCN (Tomicodon abuelorum) 2012, Exhibit 61 at 4.

Habitat and Ecology: This small benthic species is "found only in areas with *Rhizophora* mangrove prop roots," where "[i]t is usually attached to root surfaces or moving about and feeding from them at high tide." Id. (citing Szelistowski 1990). "Juveniles have been recorded from floating mangrove leaves, which they may use as a dispersal mechanism into the mangrove root systems." Id. Surveys of stomach contents showed a diet of barnacle cirri and barnacle cyprid larvae, small oysters and other bivalves, amphipods, and harpacticoid copepods. Id. (citing Szelistowski 1990).

Population Status: In suitable mangrove habitat, this species is fairly common with a mean density of around 0.8-1.4 fish per mangrove root. Id. However, this species is currently in decline due to extensive mangrove extraction throughout its range. Id.

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Fish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

"The major threat to this species is extensive habitat loss from extraction of *Rhizophora* mangroves in Central American countries." Id. (citing Jiménez 1994). "Surveys in other regions show that the reduction of mangroves brought some fish species to extinction," and, as of 2000, the area of mangroves remaining in Costa Rica and Panama combined was estimated to be only around 2,000 km^2. Id. (citing Ferreira et al. 2005; FAO 2007). Mangrove extraction has not ceased since that estimate was made. See id. This reduction of *Tomicodon abuelorum*'s habitat increases the risk it will become extinct and necessitates protection for the species under the ESA.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

While the habitat of the species does overlap with several MPAs, "[i]mproved protection of remaining mangrove habitat in the range of the species is urgently needed."

Id. Despite the overlap of some of its range with some MPAs, the species is still endangered with populations decreasing. Id. This shows that the current regulatory mechanisms in place are insufficient to protect the species and ESA protection should be afforded to halt further declines. Furthermore, location in MPAs cannot stop global threats like anthropogenic climate change that will affect many species and have deleterious consequences for mangroves.

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C. HAGFISH

HAGFISH INTRODUCTION

WildEarth Guardians is petitioning the Secretary to list 3 hagfish species from IUCN's lists of "endangered" and "critically endangered" species (Species Accounts 39-41) under the ESA as "threatened" or "endangered" species. The petitioned hagfish species face a variety of threats to their continued existence. Some of these common threats will be discussed in this introductory section ("Hagfish Introduction"). Hagfish Introduction is to be considered as incorporated by reference in each of the individual hagfish species accounts that follow ("Individual Hagfish Species Accounts").

The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range (Criterion A):

Human Population Growth. While general human population has a substantial negative effect on fish populations due to increased fishing pressure, those human populations that are located near the coasts have an even stronger negative impact. This is very problematic because NMFS' own recent Status Review Report estimated the total number of people by 2045-2050 at around 9 billion, and cited one source putting that total at an even larger 10.6 billion. Status Review Report, Exhibit 40 at 20 (citations omitted). Currently, worldwide, approximately 2.5 billion people already live within just **100 km** of the coastline. See WRI 2011, Exhibit 41 at 21. By 2020, an astonishing 75% of the expanded human population is expected to live within just **60 km** of the coastline. Knip et al. 2010, Exhibit 42 at 2 (citation omitted). This increasing concentration of people near the coasts means that the negative effect of the general population increase will be magnified greatly.

Impacts from population growth do not occur evenly. Increased economic growth in coastal cities is a major cause of ocean habitat destruction. With growth comes an increase in consumption and development. This is reflected in an increase in construction projects, some of which occur on reef communities; dredging of harbors and shipping channels; dumping of waste, run-off pollution and increased sedimentation; deforestation; and increased tourism. As a result of these factors, the coasts around virtually all urban areas are "beset by a pattern of pollution and over-development." Hinrichsen Undated, Exhibit 43 at 2. "Coastal urban areas dump increasing loads of toxic wastes into the sea. In fact, waters around many coastal cities have turned into virtual cesspools, so thick with pollution that virtually no marine life can survive." Id. at 4. This is expecially problematic because, "[i]n the case of habitat destruction resulting from coastal development, the severity of impacts is high with low reversibility." Zamora-Arroyo et al. 2005, Exhibit 66 at 58.

This urban pollution is contributing to increasing "dead zones," amongst other things. These dead zones are areas where dissolved oxygen content is so low that no marine life, apart from microorganisms, can live. A 2007 study identified 200 of these dead zones, which represents an increase of 51 such zones found just four years earlier. Id. at 5. Worse yet, these dead zones are not only becoming more numerous, they are also greatly expanding "due mainly to high nutrient pollution levels brought in by rivers and streams and washed off coastal land." Id.

To make matter worse, climate change is expected to further magnify these coastal pollution problems. For example, "[d]ue to water circulation and oceanic volume changes, estuarine and coastal systems are predicted to experience . . . increased eutrophication, hypoxia, and anoxia." Roessig et al. 2004, Exhibit 29 at 258 (citations omitted). "More intense rains wash more fertilizer and sewage into coastal waters, and this runoff triggers algal blooms and consequent poisoning of fish and humans." Id. at 269 (citation omitted).

At least one of the petitioned hagfish species is already facing negative impacts from human population growth and the others likely will, if they are not already, as the population continues to explode and become increasingly concentrated on the coasts. See IUCN (Eptatretus octatrema) 2012, Exhibit 185 at 4. Therefore, this human population growth represents a serious threat to the petitioned species.

Trawling. Trawling represents a threat to the habitat of all of the petitioned hagfish. See IUCN (Eptatretus octatrema) 2012, Exhibit 185 at 4; IUCN (Myxine paucidens) 2012, Exhibit 96 at 4; IUCN (Paramyxine taiwanae) 2012, Exhibit 97 at 4.

> The use of some fishing techniques such as heavy trawls destroys the ocean floor ecosystem on which the fish depend. Studies in Australia indicated that even 15 years after closing an area to all fishing, the sea floor habitat had not recovered from the effects of trawling.

ESI Undated, Exhibit 81 at 1. This is because benthic trawling causes high impacts with low reversibility. Zamora-Arroyo et al. 2005, Exhibit 66 at 59. It disrupts this habitat through "disruption of the physical substrate and its benthos, incidental catch and mortality of nontarget fish and marine mammals, exposed species susceptible to predation, and changes in benthic community composition." Therefore, the negative effects on hagfish habitat that trawling is having are likely to continue well into the future and qualify the species for protection under the ESA.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

The aforementioned habitat destruction from trawling also threatens the petitioned species directly by resulting in their unintentional bycatch. This threat is affecting at least one petitioned species, but it likely threatens the others as well since bycatch is often not carefully recorded. See IUCN (Paramyxine taiwanae) 2012, Exhibit 97 at 4. There is also the danger that these species will be intentionally targeted in the future, especially as fish stocks continue to decline due to overexploitation. See id.; ESI Undated, Exhibit 81 at 1. This is because:

> Around the world, fish populations are decreasing as demand for fish is increasing. Within the first 15 years of industrialized fishery operation, fish populations have been decreased by 80 percent on average. For example, in the Gulf of Thailand, 60 percent of large finfish, sharks and skate were lost within the first five years of commercial trawl fishing.
>
> The decline of large mature fish has led to an increase in the intensity of fishing and to an increase in the number of juveniles and non food fish caught (e.g., bycatch).

ESI Undated, Exhibit 81 at 1. As fishing pressure increases new species will be targeted and those species may include the hagfish petitioned here. This increase in fishing pressure is likely to continue as human population continues to grow and bring with it an increased demand for protein.[58]

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are currently no conservation measures in place for any of the petitioned species of hagfish. See IUCN (Eptatretus octatrema) 2012, Exhibit 185 at 4; IUCN (Myxine paucidens) 2012, Exhibit 96 at 4; IUCN (Paramyxine taiwanae) 2012, Exhibit 97 at 4. Such a complete lack of protection is inappropriate for such rare species, and ESA protection should be extended to prevent the species' extinction.

CITES. CITES is an international agreement with 176 parties, including the United States, that aims to ensure that international trade in wild plants and animals does not threaten their existence. See CITES Undated 1, Exhibit 33 entire; CITES Undated 2, Exhibit 34 at 1. However, no petitioned hagfish are protected under CITES. See, e.g., IUCN (Eptatretus octatrema) 2012, Exhibit 185, entire. While CITES listing is insufficient, it can help protect species that are subject to international trade. Since the petitioned species may be subject to international trade presently or in the future, the absence of CITES listing is problematic for them.

While CITES listing represents a clear recognition by the international community that the listed species is threatened with extinction and must be protected, absence of such listing does not mean that the species is not threatened with extinction. A species may be denied listing for political and economic reasons or may not be considered at all (such consideration requires a party country to bring a proposal). Therefore, while CITES listing is a factor that should weigh towards finding the relevant species or subpopulation is "threatened" or "endangered" under the ESA, its absence should not be taken to show that it is not "threatened" or "endangered."

[58] See "The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range (Criterion A): Human Population Growth," supra.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

The exceeding rarity of these petitioned hagfish species makes it less likely that individuals will find each other in order to mate. See IUCN (Eptatretus octatrema) 2012, Exhibit 185 at 5; IUCN (Myxine paucidens) 2012, Exhibit 96 at 4; UCN (Paramyxine taiwanae) 2012, Exhibit 97 at 4. Therefore, the species' rarity represents another threat to their continued existence.

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INDIVIDUAL HAGFISH SPECIES ACCOUNTS

(39) Scientific Name: *Eptatretus octatrema*

Common Name: Eightgilled Hagfish / Eightgill Hagfish

IUCN Status: Critically Endangered **CITES Status**: N/A

Range: This species is known only from a few specimens off Cape Saint Blaize, South Africa dating back to 1900. IUCN (Eptatretus octatrema) 2012, Exhibit 185 at 4. "[I]ts extent of occurrence is estimated as 100 km^2." Id.

Habitat and Ecology: "This species is found on the continental shelf, at depths of 49 to 66 m[eters]." Id. "The copulatory organ is absent for this species." Id. "The gonads of hagfish are situated in the peritoneal cavity," and "[t]he ovary is found in the anterior portion of the gonad, [with] the testis found in the posterior part." Id. "The animal becomes female if the cranial part of the gonad develops or male if the caudal part undergoes differentiation." Id. "If none develops, the animal is sterile," but if both anterior and posterior parts develop, "then the animal becomes a functional hermaphrodite. However, functional hermaphroditism needs to be validated by more reproduction studies." Id. (citing Patzner 1998).

Population Status: Population information for this species is based only on two holotype specimens collected in 1899 and 1900. Id. "Since then, only one unconfirmed specimen has been recorded in the past 100 years, despite extensive and systematic scientific surveying . . . conducted twice a year in the area." Id. Other deep-water species of hagfish in this area have been "significantly" recorded when these surveys have been conducted. Id.

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Hagfish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Hake and shrimp trawling are extensive in the area where specimens of this species have been previously recorded and are "causing a continual decline in the quality of the habitat." Id. "Given this species' shallow water habitat, it is also likely to be vulnerable to coastal development, dredging," and other land-based, negative impacts to its habitat. Id. These activities represent significant threats to *Eptatretus octatrema*'s very small area of habitat, making ESA protection for this extremely rare species appropriate.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

"There are no conservation measures in place for this species." Id. at 5. Such a lack of conservation measures for a species that is so rare and faces significant threats to its habitat is unacceptable. ESA protection could fill this regulatory gap.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

The exceeding rarity of this species makes it less likely that individuals will find each other in order to mate. See id. at 4. Therefore, the species' rarity represents another threat to its continued existence.

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

References:

Exhibits:

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For More Information, See:

IUCN Bibliography

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Barnard, K.H. 1923. Diagnoses of new species of marine fishes from South African waters. *Annals of the South African Museum* 13: 439-444.

Fernholm, B. 1986. Myxinidae. In: M.M. Smith and P.C. Heemstra (eds), *Smiths' sea fishes,* pp. 35-36. Macmillan, Johannesburg.

Fernholm, B. 1998. Hagfish systematics. In: J.M. Jørgensen, J.P. Lomholt, R.E. Weber and H. Malte (eds), *The Biology of Hagfishes,* pp. 33-44. Chapman & Hall, London.

Patzner, R.A. 1998. Gonads and reproduction in hagfishes. In: J.M. Jørgensen, J.P. Lomholt, R.E. Weber, and H. Malte (eds), *The biology of hagfishes,* pp. 378-395. Chapman & Hall, London.

Smith, M.M. 1975. *Common and scientific names of the fishes of Southern Africa. Part 1. Marine fishes.* J.L.B. Smith Institute of Ichthyology Special Publication.

(40) Scientific Name: *Myxine paucidens*

Common Name: hagfish

IUCN Status: Endangered **CITES Status**: N/A

Range: This species is known only from five individuals "from the type locality, Hyalonema ground and from Sagami Nada, Honshu, Japan." IUCN (Myxine paucidens) 2012, Exhibit 96 at 3. It is possibly endemic to this region making its range very small. Id.

Habitat and Ecology: This species is found on the continental slope at depths from 450-631 meters. Id. at 4. Of the five specimens this species is known from, four were taken from Hyalonema and the other taken from Sagami Nada, Japan. Id. "The copulatory organ is absent in this species," and the "gonads of hagfishes are situated in the peritoneal cavity." Id. "The ovary is found in the anterior portion of the gonad, and the testis is found in the posterior part. The animal becomes female if the cranial part of the gonad develops or male if the caudal part undergoes differentiation." Id. If neither develops, the animal is sterile. Id. If both develop, then the animal becomes a functional hermaphrodite. Id.

Population Status: "The population of this species is only known from five museum specimens," with the last record dating back to 1972. Id. No recorded specimens "have been picked up as bycatch or in scientific surveys in this heavily studied area." Id.

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Hagfish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

The location of known specimens is within the range of extensive trawling activity and the quality of this species' habitat is continuing to decline due to this activity. Id. The decline of this rare species' habitat threatens its continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are no conservation measures currently in place for this species. Id. Such a complete lack of protection is inappropriate for a species that is this rare and ESA protection should be afforded to the species to meet this regulatory gap.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

The exceeding rarity of this species makes it less likely that individuals will find each other in order to mate. See id. Therefore, the species' rarity represents another threat to its continued existence. As a result of these threats and its rarity, *Myxine paucidens* qualifies for listing under the ESA.

References:

Exhibits:

Mincarone, M.M. ("IUCN (Myxine paucidens) 2012"). 2011. *Myxine paucidens*. IUCN. Online at: http://www.iucnredlist.org/details/196066/0 [Accessed February 1, 2013] [Exhibit 96].

For More Information, See:

IUCN Bibliography

Honma, Y. 1998. Asian hagfishes and their fisheries biology. In: J.M. Jørgensen, J.P. Lomholt, R.E. Weber and H. Malte (eds), *The biology of hagfishes,* pp. 45-56. Chapman & Hall, London.

McMillan, C.B. and Wisner R.L. 2004. Review of the hagfishes (Myxinidae, Myxiniformes) of the northwestern Pacific Ocean, with descriptions of three new species, *Eptatretus fernholmi, Paramyxine moki,* and *P. walkeri. Zoological Studies* 43(1): 51-73.

Nakabo, T. 2002. Myxinidae. In: T. Nakabo (ed.), *Fishes of Japan with pictorial keys to the species, English edition I.,* pp. 107-109. Tokai University Press, Tokyo.

Patzner, R.A. 1998. Gonads and reproduction in hagfishes. In: J.M. Jørgensen, J.P. Lomholt, R.E. Weber, and H. Malte (eds), *The biology of hagfishes,* pp. 378-395. Chapman & Hall, London.

Regan, C.T. 1913. A revision of the myxinoids of the genus *Myxine. Annals and Magazine of Natural History* 11(8): 395-398.

(41) Scientific Name: *Paramyxine taiwanae*

Common Name: hagfish

IUCN Status: Endangered **CITES Status**: N/A

Range: This species of hagfish is restricted to the waters off northeastern Taiwan. IUCN (Paramyxine taiwanae) 2012, Exhibit 97 at 4. Extensive surveys of the surrounding regions have confirmed that it is restricted to this limited area. Id.

Habitat and Ecology: "This species is found on the shelf and upper slope, at depths from 120-427 m[eters]." Id. This is a dwarf species maturing at less than 300 mm total length. Id. (citing McMillan & Wisner 2004). "The copulatory organ is absent in this species. The gonads of hagfishes are situated in the peritoneal cavity. The ovary is found in the anterior portion of the gonad, and the testis is found in the posterior part. The animal becomes female if the cranial part of the gonad develops or male if the caudal part undergoes differentiation. If none develops, then the animal becomes sterile. If both anterior and posterior parts develop, then the animal becomes a functional hermaphrodite." Id. (citing Patzner 1998).

Population Status: "The population information for this species is known from approximately 150 specimens." Id.

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Hagfish Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

This species is vulnerable to habitat loss from extensive deep sea trawling and trapping within its restricted distribution and depth range. Id. Such threats to the species' habitat make it more prone to extinction.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

The aforementioned trawling also represents overutilization for commercial purposes. Id. This is because it leaves the species vulnerable to capture as bycatch from these commercial operations. Id. Furthermore, its relatively large body size increases the risk that it will be intentionally exploited in the future for food and the leather industry. Id. Such pressures threaten the species' continued survival.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are no conservation measures currently in place for this species. Id. Such a complete lack of protection is inappropriate for such a rare species, and ESA protection should be extended to meet this regulatory void.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

The seemingly very small numbers of these fish also decreases the likelihood of mating in the wild. See id. Such complications further reduce the species' chances of survival.

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

References:

Exhibits:

Mincarone, M.M. & H.K. Mok ("IUCN (Paramyxine taiwanae) 2012"). 2011. *Paramyxine taiwanae.* IUCN. Online at: www.iucnredlist.org/details/196087/0 [Accessed February 1, 2013] [Exhibit 97].

For More Information, See:

IUCN Bibliography
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Fernholm, B. and Quattrini, A.M. 2008. A new species of hagfish (Myxinidae: *Eptatretus)* associated with deep-sea coral habitat in the western North Atlantic. *Copeia* 1: 126-132.

Honma, Y. 1998. Asian hagfishes and their fisheries biology. In: J.M. Jørgensen, J.P. Lomholt, R.E. Weber and H. Malte (eds), *The biology of hagfishes,* pp. 45-56. Chapman & Hall, London.

Kuo, C.-H., Huang, K.-F. and Mok, H.-K. 1994. Hagfishes of Taiwan (I): a taxonomic revision with description of four new *Paramyxine* species. *Zoological Studies* 33(2): 126-139.

Kuo, C-H, Lee, S-C and Mok, H-K. 2010. A new species of hagfish *Eptatretus rubicundus* (Myxinidae: Myxiniformes) from Taiwan, with reference to Its phylogenetic position based on Its mitochondrial DNA sequence. *Zoological Studies* 49(6): 885-864.

McMillan, C.B. and Wisner R.L. 2004. Review of the hagfishes (Myxinidae, Myxiniformes) of the northwestern Pacific Ocean, with descriptions of three new species, *Eptatretus fernholmi, Paramyxine moki,* and *P. walkeri. Zoological Studies* 43(1): 51-73.

Mok, H.-K. and Chen, Y.-W. 2001. Distribution of hagfish (Myxinidae: Myxiniformes) in Taiwan. *Zoological Studies* 40(3): 233-239.

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Shen, S.-C. and Tao, H.-J. 1975. Systematic studies on the hagfish (Eptatretidae) in the adjacent waters around Taiwan with description of two new species. *Chinese Bioscience* 2: 65-80.

Wisner, R.L. 1999. Descriptions of two new subfamilies and a new genus of hagfishes (Cyclostomata: Myxinidae). *Zoological Studies* 38(3): 307-313.

D. MAMMALS

MAMMALS INTRODUCTION

WildEarth Guardians is petitioning the Secretary to list 2 marine mammal species and 3 marine mammal subpopulations from IUCN's lists of "endangered" and "critically endangered" species (Species/Subpopulation Accounts 42-46) under the ESA as "threatened" or "endangered" species and DPSs respectively. The petitioned mammal species and subpopulations face a variety of threats to their continued existence. Some of these common threats will be discussed in this introductory section ("Mammals Introduction"). Mammals Introduction is to be considered as incorporated by reference in each of the individual mammal species and subpopulation accounts that follow ("Individual Mammal Species/Subpopulation Accounts").

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

All of the petitioned mammal species and subpopulations are located in small areas of habitat.[59] As such, further reduction of this habitat can represent an extreme threat to the species' or subpopulations' continued existence. Pollution destroying habitat is one threat common to multiple petitioned species and subpopulations and can be the result of a variety of anthropogenic causes ranging from exposure to chemicals, including PCBs, to decreases in water temperature and salinity due to excessive water released from hydroelectric facilities. See IUCN (Cephalorhynchus hectori) 2012, Exhibit 91 at 4 (Hector's dolphin is threatened by pollution); IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 5 (extreme levels of PCBs in the Baltic Sea Harbour Porpoise's habitat are making the animals suffer from a variety of illnesses and may be reducing their reproductive effectiveness); IUCN (Sousa chinensis (eastern Taiwan Strait Subpopulation)) 2012, Exhibit 94 at 6 (facing reduction of freshwater flows, degradation of estuaries and adjacent coastal waters, pollution from industry, agricultural runoff, and residential, and other, sewage discharge with minimal to no treatment); IUCN (Tursiops truncatus (Fiordland Subpopulation)) 2012, Exhibit 95 at 4 (tailrace from hydroelectric power facility causing decreased salinity, decreased temperature, and alterations to sub-tidal community structures interfering with usual habits, health, and reproduction and calving).

These species and subpopulations are also facing increased threats as more people become present in their limited habitat areas. The pressures resulting from these tourism

[59] IUCN (Arctocephalus galapagoensis) 2012, Exhibit 90 at 5 (located only in the Galápagos Archipelago); IUCN (Cephalorhynchus hectori) 2012, Exhibit 91 at 4 (the species "has one of the most restricted distributions of any cetacean."); IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 4 (restricted to Baltic Sea, entirely absent in northeastern portion); IUCN Sousa chinensis (eastern Taiwan Strait Subpopulation) 2012, Exhibit 94 at 4 (occurring almost entirely in only two estuaries); IUCN (Tursiops truncatus (Fiordland Subpopulation)) 2012, Exhibit 95 at 4 (located only in a small area on the southwest of New Zealand's South Island).

activities and other forms of coastal development[60] funneling more humans into their limited area is already causing problems for petitioned species and subpopulations. See, e.g., IUCN (Sousa chinensis (eastern Taiwan Strait Subpopulation)) 2012, Exhibit 94 at 4 (land reclamation, development, and pile driving causing impacts); IUCN (Tursiops truncatus (Fiordland Subpopulation)) 2012, Exhibit 95 at 7, 9 (tourism boat traffic driving subpopulation from areas it normally uses and striking individuals). These impacts can be expected to increase as human coastal populations in these species' and subpopulations' ranges continue to grow.

NMFS' own recent Status Review Report estimates that the total number of people by 2045-2050 will be around 9 billion, and cited one source putting that total at an even larger 10.6 billion. Status Review Report, Exhibit 40 at 20 (citations omitted). Currently, worldwide, approximately 2.5 billion people live within just **100 km** of the coastline. See WRI 2011, Exhibit 41 at 21. By 2020, an astonishing 75% of the expanded human population is expected to live within just **60 km** of the coastline. Knip et al. 2010, Exhibit 42 at 2 (citation omitted). This increasing concentration of people near the coasts means that the negative effect of the general population increase will be magnified greatly.

Impacts from population growth do not occur evenly. Increased economic growth in coastal cities is a major cause of ocean habitat destruction. With growth comes an increase in consumption and development. This is reflected in an increase in construction projects, some of which occur on reef communities; dredging of harbors and shipping channels; dumping of waste, run-off pollution and increased sedimentation; deforestation; and increased tourism. As a result of these factors, the coasts around virtually all urban areas are "beset by a pattern of pollution and over-development." Hinrichsen Undated, Exhibit 43 at 2. "Coastal urban areas dump increasing loads of toxic wastes into the sea. In fact, waters around many coastal cities have turned into virtual cesspools, so thick with pollution that virtually no marine life can survive." Id. at 4.

This urban pollution is contributing to increasing "dead zones," amongst other things. These dead zones are areas where dissolved oxygen content is so low that no marine life, apart from microorganisms, can live. A 2007 study identified 200 of these dead zones, which represents an increase of 51 such zones found just four years earlier. Id. at 5. Worse yet, these dead zones are not only becoming more numerous, they are also greatly expanding "due mainly to high nutrient pollution levels brought in by rivers and streams and washed off coastal land." Id.

Furthermore, climate change is expected to further magnify these coastal pollution problems. For example, "[d]ue to water circulation and oceanic volume changes, estuarine and coastal systems are predicted to experience . . . increased eutrophication, hypoxia, and anoxia." Roessig et al. 2004, Exhibit 29 at 258 (citations

[60] The problems associated with coastal development are even more problematic because, "[i]n the case of habitat destruction resulting from coastal development, the severity of impacts is high with low reversibility." Zamora-Arroyo et al. 2005, Exhibit 66 at 58.

omitted). "More intense rains wash more fertilizer and sewage into coastal waters, and this runoff triggers algal blooms and consequent poisoning of fish and humans." Id. at 269 (citation omitted).

As discussed above and in the individual species and subpopulation accounts, several of the petitioned mammal species and subpopulations are already facing negative impacts from this human population growth and many more likely will as the population continues to explode and become increasingly concentrated on the coasts. Therefore, this human population growth represents a serious threat to many of the petitioned species and subpopulations of mammals. This is especially true since all of the petitioned mammals already exist in very confined areas where even small losses of habitat could have devastating effects.

While not all of the petitioned species are reliant on reefs for habitat, they will all still face threats brought on by ocean acidification. This disruption will be due to noise.

> A future more acidic ocean might be a noisier place for marine mammals such as whales and dolphins. Ocean chemists have known for decades that the absorption of sound in sea water changes withthe chemistry of the water itself. As sound moves through sea water, it causes groups of atoms to vibrate, absorbing sounds at specific frequencies. This involves a variety of chemical interactions that are not completely understood. However, the overall effect is strongly controlled by the acidity of the sea water: the more acidic the sea water, the less low and mid-frequency sound it absorbs.
>
> Thus, as the oceans become more acidic, sounds will travel farther underwater, apparently particularly sounds below about 3,000 cycles per second (two and one half octaves above "middle C" on a piano). This range of sounds includes most of the "low frequency" sounds used by marine mammals in finding food and mates. It also includes many of the underwater sounds generated by industrial and military activity, as well as by boats and ships. Such human-generated underwater noise has increased dramatically over the last 50 years, as human activities in the ocean have increased.
>
> Research suggests that sound already may be travelling 10% farther in the ocean than it did a few hundred years ago. However, it is predicted that by 2050, under conservative projections of ocean acidification, sounds could travel as much as 70% farther in some ocean areas (particularly in the Atlantic Ocean). This could dramatically improve the ability of marine mammals to communicate over long distances. It could also increase the amount of background noise that they have to live with.

Laffoley & Baxter 2009, Exhibit 191 at 4. While communication will be improved, this will expand the reach of current noisy areas rendering even larger areas unsuitable habitat. This is in addition to the dramatic increase in human generated underwater noise that has already occurred and will likely continue to occur. This threatened loss of habitat due to excessive underwater noise represents a significant threat the species continued existence. Therefore, these species and subpopulations should be extended protection under the ESA.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

Though it does not appear that commercial fisheries currently target any of the petitioned species or subpopulations, many are still subject to commercial overutilization. This is primarily the result of being caught as bycatch by commercial fishers trying to capture other species. See IUCN (Arctocephalus galapagoensis) 2012, Exhibit 90 at 7; IUCN (Cephalorhynchus hectori) 2012, Exhibit 91 at 5; IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 5; IUCN (Sousa chinensis (eastern Taiwan Strait Subpopulation)) 2012, Exhibit 94 at 6. There is also evidence that this bycatch is increasing in some areas and it will likely continue to do so as human populations continue to grow and place increased pressure on fisheries. See IUCN (Arctocephalus galapagoensis) 2012, Exhibit 90 at 7; see also "The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A)," supra. Whether a species or member of a subpopulation is caught intentionally or accidentally does not really matter. These species and subpopulations cannot afford to lose individuals, and any death caused by the fishing industry is unacceptable overutilization whether it is intentional or incidental and whether it is utilized or discarded.

Furthermore, the numbers of many of the petitioned species and subpopulations of mammals have been severely depleted by previous directed fisheries that have historically contributed to their endangerment. See IUCN (Arctocephalus galapagoensis) 2012, Exhibit 90 at 7; IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 5; IUCN (Sousa chinensis (eastern Taiwan Strait Subpopulation)) 2012, Exhibit 94 at 6 (likely). Therefore, even though they are not targeted now, the historical impacts of their previous targeting are still apparent in their decreased numbers and are still making recovery more difficult, "because rarity itself imparts higher risk [of extinction.]" Brook et al. 2008, Exhibit 46 at 455 (internal citations omitted).

In addition to commercial overutilization, at least two of the petitioned species and subpopulations are also subject to recreational overutilization. IUCN (Cephalorhynchus hectori) 2012, Exhibit 91 at 5 (entanglement in amateur gillnets); IUCN (Tursiops truncatus (Fiordland Subpopulation)) 2012, Exhibit 95 at 7, 9 (tourist boats chasing them from habitat, tourist boat strikes killing individuals, and tourism is increasing). These recreational pressures represent further overutilization of the species and subpopulations, further threatening their continued existence.

Disease or Predation (Criterion C):

A number of the petitioned species are also negatively affected by disease. See IUCN (Arctocephalus galapagoensis) 2012, Exhibit 90 at 7; IUCN (Cephalorhynchus hectori) 2012, Exhibit 91 at 5; IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 5. These impacts will be discussed in detail in the relevant individual mammal species and subpopulation accounts. Though these diseases do appear to be attributable to different vectors, they do all represent further pressures on the relevant mammals, pushing them further towards extinction.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

While a number of regulatory mechanisms exist to protect the petitioned species and subpopulations of mammals, none have been effective at removing these species and subpopulations from the IUCN's "critically endangered" and "endangered" species lists. Furthermore, as a result of these inadequate regulatory mechanisms, all of the petitioned mammal species and subpopulations are considered to have decreasing populations, with none categorized as increasing or even stable.[61] Therefore, the existing regulatory mechanisms have proven inadequate in protecting these species and subpopulations and they should receive ESA protections to remedy these inadequacies.

MPAs. Several of the petitioned species and subpopulations occur in protected areas. See IUCN (Arctocephalus galapagoensis) 2012, Exhibit 90 at 8; IUCN (Cephalorhynchus hectori) 2012, Exhibit 91 at 5; IUCN (Tursiops truncatus (Fiordland Subpopulation)) 2012, Exhibit 95 at 4. However, these areas are not equipped to deal with global issues (such as anthropogenic climate change), cannot prevent disease, seemingly do not adequately address pollution, often do not sufficiently protect against fishing in the areas that result in bycatch, and do not address tourism and a variety of other impacts. Therefore, while it is preferable that these protected areas exist, and while they do at least offer some level of protection, they are inadequate to halt the extinction of the mammals located therein.[62]

CITES. CITES is an international agreement with 176 parties, including the United States, that aims to ensure that international trade in wild plants and animals does not threaten their existence. See CITES Undated 1, Exhibit 33 entire; CITES Undated 2, Exhibit 34 at 1. However, it also represents one example of the protections for some of the petitioned species and subpopulations of mammals that exist, but have proven to be insufficient. This is because, although several are listed on CITES Appendices I and II,

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[61] See IUCN (Arctocephalus galapagoensis) 2012, Exhibit 90 at 6 (Decreasing); IUCN (Cephalorhynchus hectori) 2012, Exhibit 91 at 4 (Decreasing); IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 4 (Decreasing); IUCN (Sousa chinensis (eastern Taiwan Strait Subpopulation)) 2012, Exhibit 94 at 5 (Decreasing); IUCN (Tursiops truncatus (Fiordland Subpopulation)) 2012, Exhibit 95 at 6 (Decreasing).

[62] See "Individual Mammal Species/Subpopulation Accounts," infra; see also "A. Corals: Corals Introduction: The Inadequacy of Existing Regulatory Mechanisms (Criterion D): Marine Protected Areas ("MPAs")," supra.

all of the species and subpopulations of mammals listed in this Petition are still considered “endangered” or “critically endangered.”[63]

This is in part due to the fact that CITES listing offers insufficient protection to the petitioned mammals. CITES only applies to **international trade** in endangered species. See CITES Undated 2, Exhibit 34 at 1. This protection is problematic for the petitioned mammals because, although it may provide some level of benefit to those species which are subject to international trade, those species which are not traded do not necessarily benefit from CITES listing. This focus only on trade also means that CITES' focus is too narrow to protect mammals from the many other threats that they face.

CITES' narrow focus demonstrates the inadequacy of listing in the protection of mammals. NMFS acknowledged the unsatisfactory effect of the restrictive Appendix I listing in its determination for the listing of the largetooth sawfish under the ESA, when it stated that illegal foreign trade of the species continued “in spite of the CITES listing and national laws, due to lack of enforcement.” See 76 Fed. Reg. 40822 (July 12, 2011), Exhibit 36 at 40832.

Furthermore, while CITES listing represents a clear recognition by the international community that the listed species or subpopulation is threatened with extinction and must be protected, absence of such listing does not mean that the species or subpopulation is not threatened with extinction. A species may be denied listing for political and economic reasons or may not be considered at all (such consideration requires a party country to bring a proposal). Therefore, while CITES listing is a factor that should weigh towards finding the relevant species or subpopulation is “threatened” or “endangered” under the ESA, its absence should not be taken to show that it is not “threatened” or “endangered.”

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of the petitioned species and subpopulations of mammals. “Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction.” Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted).

The combination of threats to the petitioned species and subpopulations of mammals and their habitats could cause a greater and faster reduction in the remaining populations than might be expected from simply the additive impacts of the threats.

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[63] See IUCN (Arctocephalus galapagoensis) 2012, Exhibit 90 at 8 (CITES listing); IUCN (Cephalorhynchus hectori) 2012, Exhibit 91 at 5 (CITES listing); IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 6 (CITES listing); IUCN Sousa chinensis (eastern Taiwan Strait Subpopulation) 2012, Exhibit 94 at 6 (CITES listing); see also IUCN (Arctocephalus galapagoensis) 2012, Exhibit 90 at 3 (assessed as endangered by IUCN); IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 3 (assessed as “critically endangered” by IUCN).

"[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." Id. at 453 (internal citations omitted).

The petitioned species and subpopulations of mammals are already at risk as they tend to be members of low-fecundity or K-selected species, rendering them 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." Id. at 455 (internal citations omitted).

Since all of the petitioned mammal species and subpopulations face a multitude of threats, it is likely that the synergistic effects of those threats will cause extinction pressure more severe than their additive impact alone. As such, the synergistic effects of the aforementioned threats represent yet another reason why these species and subpopulations should be given ESA protections.

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INDIVIDUAL MAMMAL SPECIES/SUBPOPULATION ACCOUNTS

(42) Scientific Name: *Arctocephalus galapagoensis*

Common Name: Galápagos Fur Seal

IUCN Status: Endangered **CITES Status**: Appendix II

Range: These fur seals "are observed throughout the Galápagos archipelago. Lactating females make trips of relatively short duration, suggesting they do not go far from their colonies." IUCN (Arctocephalus galapagoensis) 2012, Exhibit 90 at 5. Most of this species' breeding colonies are located in the western and northern parts of the archipelago, close to productive upwelling areas offshore. Id. Reports of vagrants outside this area have not been confirmed. Id.

Habitat and Ecology: "Galápagos Fur Seals are the smallest and least sexually dimorphic otariid species," Id. at 6. These seals are "small and compact, and adult males are stocky in build. Pups are blackish brown, sometimes with grayish to whitish margins around the mouth and nose." Id. Galápagos Fur Seals mature at about 5 years old, "from which time females usually produce one pup a year but usually rear a pup only every other year for most of the rest of their lives." Id.

"Males do not become physically mature, and large enough to compete for a territory that will be used by females[,] until they are considerably older than the average age of maturity for females. Males hold territories that average 200 m^2, which is large compared to the average territory size of other otariid males," which is particularly notable given the Galápagos Fur Seal's small size. Id.

The behavior of this species has been extensively studied. Id. "They occasionally occur on nearly all of the islands in the archipelago, and prefer to haul-out on rocky coasts with large boulders and ledges that provide shade and the opportunity to rest in crevices and spaces between rocks. Galápagos Fur Seals have a fairly long pupping and breading season, lasting from mid-August to mid-November. The peak of pupping shifts little from year to year and usually occurs between the last week of September and the first week of October." Id. The pups are generally weaned in their third year, and "pups born prior to the weaning of an older sibling rarely survive, with most starving to death" and some being killed by the older sibling. Id. "Females will allow multiple pups to nurse[,] but this rarely lasts long enough for the youngest pup to get strong enough to survive." Id.

"Colonies are located close to foraging areas . . . with most foraging occurring at night with a mean depth of foraging dives of 26 meters." Id. This night foraging may be to exploit vertically migrating species when they come closer to the surface. Id. at 7. "The maximum dive depth recorded is 115 meters and the longest duration is 5 minutes." Id. at 6. While in the water, "Galápagos Fur Seals raft in postures typical of many of the southern fur seal species." Id. at 7. There is no evidence of migration in this species, "and they do not seem to spend prolonged periods of time at sea, except for males immediately before the period of territory tenure." Id. Galápagos Fur Seals consume a variety of small squids, a number of species of omastrephids, and a variety of fish species. Id.

Oceanic predators of the Galápagos Fur Seals include sharks and killer whales, while on land feral dogs have been known to decimate colonies, killing both pups and adults. Id.

Population Status: A census conducted for this species in 1978 yielded a population estimate of 30-40,000 animals. Id. at 6 (citing Trillmich 1987). "However, there was high mortality, especially among pups and yearlings[,] during the 1982-1983 El Niño [(ENSO) event], and the amount of recovery since [that] time is unknown." Id. Recent surveys show a population that appears to be fluctuating, and "population size is thought to have diminished markedly compared to the seventies." Id. (citing Alava & Salazar 2006). "[C]urrent abundance is estimated at around 10-15,000 animals," suggesting a "very concerning" decline "in excess of 50% over this period." Id.

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Mammals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

The Galápagos Fur Seals experienced severe population declines when they were exploited during the 19th century by sealers and whalers, driving them to the brink of extinction by the early 20th century. Id. at 7. More recently, there have been reports of Galápagos Fur Seals becoming trapped in fishers' nets set for other species, and there is evidence that this threat has increased over recent years. Id. Therefore, while not subject to the same sources of commercial exploitation as Galápagos Fur Seals in the 19th century, the present day Galápagos Fur Seal population is still subject to threats to its existence stemming from commercial overutilization.

Disease or Predation (Criterion C):

Feral dogs on Isabela Island, which decimated the fur seal populations there, have been exterminated. Id. However, "[t]his problem could erupt again if other feral dogs find their way to colony sites" on this or other islands. Id. Therefore, transmission of diseases from the dogs to the fur seals still represents "the most serious threat" to the species at this time. Id. Furthermore, not only did these dogs serve as disease vectors, they actually depredated on the seals directly as well. See id. These threats are obviously capable of reptition and, as such, represent an ongoing threat to the species' continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

"Fur seals were protected under Ecuadorian law in the 1930s, and since 1959 with the establishment of the Galápagos National Park, by the Administration of the Park. The waters around the islands are also protected by a 40 nautical mile no fishing zone. Tourism is regulated and a trained Park Naturalist escorts most visitors. It is [also] listed on CITES Appendix II." Id. at 8. These protections are very helpful, but, unfortunately, they cannot address all of the threats that the Galápagos Fur Seal population faces. For example, while fishing is not allowed in the no-fishing zone, unintentional catches by fishers appear to be increasing. See id. at 7, 8. Also, despite the various protections in place, the islands are still inhabited by people. These people will often have pet dogs and transmission of disease from dogs is "the most serious threat" to the species at this time. See id. at 7. Furthermore, these localized protections, while excellent for preserving habitat and protecting species from other localized threats, cannot always protect species from more global threats, such as those resulting from anthropogenic climate change. The protections in place for the Galápagos Fur Seals cannot protect them from the negative effects of future ENSO events, for example, which have caused massive loss of Galápagos Fur Seals in the past.[64] Therefore, while a great first step, the protections afforded the Galápagos Fur Seals currently are inadequate to protect them against the most serious threats to their continued existence. ESA protection should be given to the species to help prevent its extinction.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

During ENSO there is a dramatic reduction in the productivity of the waters around the Archipelago, which consequently dramatically elevates Galápagos Fur Seal mortality rates. IUCN (Arctocephalus galapagoensis) 2012, Exhibit 90 at 7. ENSO events have caused an estimated 80% reduction in Galápagos Fur Seals resulting from reduction in marine productivity around the Galápagos, but the exact extent of population reduction in this species, though rapid, is not clear. Id. (citing Trillmich & Dellinger 1991; Salazar 2002; Alava & Salazar 2006). The effects of the 1982-1983 ENSO event in particular caused very high mortality, especially among pups and yearlings. Id. at 6. "Therefore, although the effects of global climate change on this species and its habitat are uncertain at this time, it is clear that any [climate] change related disruption of present day ocean currents, levels of marine productivity, or increased air temperatures at haul out sites would adversely affect the species." Id. at 7. ENSO events appear to be increasing in frequency and duration and therefore this threat to the Galápagos Fur Seals will only continue to grow.

"Like all fur seals, Galápagos Fur Seals are vulnerable to oil spills because of their dependence on their thick pelage for thermoregulation. Although there is limited

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[64] See "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E)," infra.

large vessel traffic in the Galápagos, numerous small and medium sized vessels operate in the area that could release moderate quantities of oil" and other pollutants if involved in a marine accident. Id. This vulnerability to oil represents yet another threat to the species.

"Despite their population size, the Galápagos Fur Seal population will always be vulnerable to a variety of threats[, both natural and anthropogenic,] because of the species' restricted distribution to a relatively small Archipelago of islands." Id. at 7. Such a restricted range makes the entire population vulnerable to extinction from a localized catastrophe or other stochastic events. Due to this variety of threats to the species' continued existence, it should be protected under the ESA.[65]

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(43) Scientific Name: *Cephalorhynchus hectori*

Common Name: Hector's Dolphin

IUCN Status: Endangered **CITES Status**: Appendix II

Range: "Hector's dolphin is endemic to New Zealand, and it has one of the most restricted distributions of any cetacean." IUCN (Cephalorhynchus hectori) 2012, Exhibit 91 at 4 (citing Dawson & Slooten 1988; Dawson 2002). "They are most common off the South Island and the West Coast of the North Island. There are at least three genetically separate populations in the South Island, and a single small North Island population." Id. (citing Baker et al. 2002).

Habitat and Ecology: "The habits and biology of Hector's dolphin have been well studied in the last couple of decades, and this is undoubtedly the best-known species of the genus." Id. at 5 (citing Dawson 2002). "It is found in shallow coastal waters, almost always within about 15 km of shore and [less than] 100 meters deep." Id. It concentrates in shallow, turbid waters close to shore in summer and disperses more widely in winter. Id. (citing Slooten et al. 2006a). "Photo-identification studies have demonstrated that at least some individuals [of this species] are resident in small areas [of coastline] year-round," and no two sightings of the same individual have been more than 106 km apart. Id. (citing Slooten et al. 1993; Bräger et al. 2002). "Hector's dolphin feeds on several species of small fish and squid." Id. (citing Dawson 2002). "The diet is more varied on the east coast of the South Island (8 species make up 80% of the diet) than on the west coast (only 4 species make up 80%)." Id.

Population Status: Genetic studies show that North Island Hector's dolphins are genetically distinct from any South Island subpopulation. Id. at 4 (citing Pichler et al. 1998). This level of genetic isolation over such a small geographic scale has not been observed in any other marine mammal. Id. (citing Dawson et al. 2001). "The North Island subpopulation of Hector's Dolphin was recognized recently as a subspecies *Cephalorhynchus hectori maui,* and [the IUCN] assessed [it] separately." Id. at 3 (citing Baker et al. 2002). Therefore, this Petition is focused on the South Island subspecies and petitions for listing as an endangered or threatened species and not as a DPS.

Recent surveys indicate that the South Island Hector's dolphin populations collectively number about 7,270 individuals and the North Island subspecies is estimated to number about 111. Id. at 4 (citing Dawson et al. 2001, 2004; Gormley et al. 2005; Slooten et al. 2006b). The northern population's abundance and range appear to have been declining rapidly over the past 30 years. Id. (citing Slooten et al. 2006b; Dawson et al. 2001).

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Mammals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

"Hector's dolphin faces serious pressures from human activities given its limited coastal distribution." Id. at 5. Hector's dolphin is threatened by "pollution,[] vessel traffic, and habitat modification." Id. (citing Stone & Yoshinaga 2000). Such damage to Hector's dolphin habitat, when the species has such a small range, threatens their continued existence.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"The main threat to the species in general is entanglement in gillnets, with trawl fisheries also causing some mortality." Id. (citing Dawson 1991; Slooten & Lad 1991; Dawson & Slooten 1993; Martien et al. 1999; Secchi 2006; Slooten 2007; DOC & Mfish 2007). "Amateur gillnetting (as opposed to commercial gillnetting) is a significant part of the problem." Id. (citing Dawson & Slooten 2005). "Sixty percent of all dead Hector's dolphins for which cause of death could be determined, had died as a result of gillnet entanglement." Id. (citing DOC & Mfish 2007). "Risk analyses for Hector's and Maui's dolphins indicate that recent levels of mortality are unsustainable," this conclusion being "robust to the uncertainty in abundance, mortality, and vital rates." Id. (citing Slooten & Lad 1991; Marten et al. 1999; Slooten et al. 2000; Burkhart & Slooten 2003; Slooten 2007; DOC & Mfish 2007). "The most recent population viability analysis indicates continued population declines." Id. (citing Slooten 2007).

These deaths from gillnets and trawling show that the species is being threatened by overutilization for commercial, and recreational in the case of amateur gillnetting, purposes. Even though it does not appear that fishers target Hector's dolphins, they are being taken incidentally as bycatch. Evidence shows that the levels of mortality caused by these activities are "unsustainable," and, with a population that is so small to begin with, unsustainable practices can quickly wipe out the species. Therefore, Hector's dolphin faces significant threats to its continued existence as a result of commercial and recreational overutilization.

Disease or Predation (Criterion C):

Hector's dolphin faces additional threats to its continued existence from disease. Id. This threat from disease threatens the species' continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

CITES. "The species is listed in CITES Appendix II." Id. CITES is an international agreement with 176 parties, including the United States, that aims to ensure that international trade in wild plants and animals does not threaten their existence. See CITES Undated 1, Exhibit 33 entire; CITES Undated 2, Exhibit 34 at 1. However, it also represents one example of the protections for Hector's dolphin that exist, but have proven to be insufficient. This is because, although Hector's dolphin is listed on CITES Appendix II, the species is still considered endangered with a decreasing population. See IUCN (Cephalorhynchus hectori) 2012, Exhibit 91 at 3, 4, 5.

This is in part due to the fact that CITES listing offers insufficient protection to Hector's dolphin. To begin with, as the name of the convention suggests, CITES only applies to **international trade** in endangered species. See CITES Undated 2, Exhibit 34 at 1. This protection is problematic for Hector's dolphin because, although it may provide some level of benefit to those species which are subject to international trade, those species, like Hector's dolphin, which are not traded do not necessarily benefit from CITES listing. This focus only on trade also means that CITES' focus is too narrow to protect Hector's dolphin from the many other threats that they face (like incidental catch, disease, habitat degradation, etc.). See IUCN (Cephalorhynchus hectori) 2012, Exhibit 91 at 5.

CITES' narrow focus that does not get at the main threats to Hector's dolphin demonstrates the inadequacy of this listing in the protection of the species. While CITES listing is important and represents a clear recognition by the international community that the species is threatened with extinction, this protection is not sufficient and Hector's dolphin should be offered the further protections embodied by listing under the ESA.

New Zealand National Conservation Measures. "The New Zealand Government has created two protected areas to promote the conservation of *C. hectori*, and it is thought that these areas have contributed to reduced mortality in recent years. The Banks Peninsula Marine Mammal Sanctuary was established in 1988 under the Marine Mammals Protection Act to protect Hector's dolphins. The 1,170 km2 sanctuary extends 70 nautical miles alongshore around the Banks Peninsula to the Rakaia River and out to 4 nautical miles offshore." Id. (citing Dawson & Slooten 2005). "Its effectiveness has been compromised by the interests of sports and commercial fishermen and by the fact that the dolphins' offshore distribution extends beyond the protected area." Id. (citing Dawson & Slooten 1993). "At Banks Peninsula the dolphins are found further offshore than elsewhere, probably because the bathymetry there slopes more gradually. Up to 65% of the dolphins in the area occur outside the sanctuary boundaries in winter months. Id. (citing Slooten et al. 2006a).

While Guardians commends the efforts New Zealand has currently implemented to protect Hector's dolphins from continued mortality, it is clear that they have thus far not been sufficient to protect the species. The effectiveness of these measures should be bolstered by ESA protection to address the issues that have compromised the existing protected areas.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of Hector's dolphin. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted).

The combination of threats to Hector's dolphin 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." Id. at 453 (internal citations omitted).

Hector's dolphin 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." Id. at 455 (internal citations omitted). These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(44) Scientific Name: *Phocoena phocoena* (Baltic Sea Subpopulation)

Common Name: Harbour Porpoise

IUCN Status: Critically Endangered **CITES Status**: Appendix II

Range: "In the Baltic Sea, the historic range [for the Harbor Porpoise] apparently included all of the Kattegat/Skagerrak area, the Gulfs of Riga, Finland, and Bothnia, and much of the Baltic Sea proper." IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 4. "However, in the latter half of the 1900s, the range was reduced considerably, and currently porpoises are considered to be virtually absent in the north-eastern Baltic." Id. (citing Koschinski 2002).

Habitat and Ecology: "The Baltic Sea is a semi-enclosed, relatively shallow shelf sea with some deeper basins of more than 200 m[eters] depth. There is a gradient in salinity with declining salinity towards the east and north. Winter sea-ice normally covers the northern and eastern parts of the Baltic Sea." Id. In the Baltic, the Harbour Porpoise's main prey species are herring, sprat, and cod. Id. at 5 (citing Read 1999; Boerjesson et al. 2003). Many prey species are benthic or demersal. Id. (citing Read 1999; Boerjesson et al. 2003).

Population Status: The Baltic Sea Subpopulation has been estimated at around 600 individuals, 50% of which are likely to be mature. Id. at 4 (citing Hiby and Lovell 1996; Taylor et al. 2007). This means there are only about 300 mature Harbour Porpoises in this entire population. Id. Using a precautionary approach, however, yields a population of mature individuals of just 192. Id. "Although there are no reliable estimates of pre-exploitation subpopulation size, harbour porpoises were once numerous in the Baltic proper." Id. (citing Kinze 1995).

Population Trend: Decreasing. Id.

Qualifications as a DPS

NMFS and FWS have jointly published a policy document defining the statutory requirements for finding a DPS. 61 Fed. Reg. 4,722. This joint policy employs a three-part analysis to determine the status of a possible DPS as endangered or threatened under the ESA: (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. at 4,725.

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 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.

Id. at 4,725. The Baltic Sea Subpopulation of Harbour Porpoises meets both of these requirements.

1. Markedly Separate From Other Populations

"Several genetic and morphometric studies have concluded that the Baltic porpoises are a separate subpopulation distinct from those living in Kattegat, Skagerrak and North Sea." IUCN (Phocoena phocoena) 2012, Exhibit 92 at 3 (citing Tiedeman et al. 1996; Huggenberger et al. 2002); see also Gillespie et al. 2005, Exhibit 176 at 51 (same). However, the differences between these genetically isolated subpopulations do not rise to the level of rendering the Baltic Sea Subpopulation a distinct subspecies. IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 3 (citing Palme et al. 2004). Therefore, due to the fact that this subpopulation is markedly separate from other populations, it meets the "*discreteness*" requirement for listing as a DPS.

Significance. The joint policy provides that if a population segment is considered "*discrete*" under one or both of the above conditions, its biological and ecological significance will then be considered. 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 DPS in an ecological setting unusual or unique for the taxon;
2. Evidence that loss of the DPS would result in a significant gap in the range of a taxon;
3. Evidence that the DPS 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 DPS differs markedly from other populations of the species in its genetic characteristics.

61 Fed. Reg. at 4,725.

The Baltic Sea Subpopulation of Harbour Porpoises is significant to the species because loss of the subpopulation "would result in a significant gap in the range of the taxon." Id. Due to the aforementioned lack of genetic connectivity between the Baltic Sea Subpopulation and other subpopulations, it appears highly unlikely that harbour porpoises from other populations would be able to fill the gap if this subpopulation were extirpated. See IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 3 (citing Tiedeman et al. 1996; Huggenberger et al. 2002); Gillespie et al. 2005, Exhibit 176 at 51. The discrete subpopulation of Baltic Sea Harbour Porpoises differs from other subpopulations in its genetic characteristics.[66] Therefore, the Baltic Sea Subpopulation of Harbour Porpoises qualifies as a DPS under both the "*discreteness*" and "*significance*" requirements.

Although these guidelines are not regulations and serve only as policy guidance for the agencies (61 Fed. Reg. at 4,723), they have been upheld as a reasonable interpretation of ambiguous statutory language. Maine v. Norton, 257 F. Supp. 2d 357 (D. Me. 2003). Accordingly, if the responsible agency determines a potential DPS of vertebrate fish or wildlife is both discrete and significant, it will then evaluate the population segment's conservation status under the ESA as though the DPS were in fact a species, and consider it eligible for listing. The Baltic Sea Subpopulation of Harbour Porpoises are vertebrates that meets the "*discreteness*" and "*significance*" requirements set forth above, and therefore should be considered for listing based on the listing criteria below.

Known Threats/Listing Criteria

All of the threats and information discussed in "Mammals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual subpopulation account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Extreme levels of PCBs in the Baltic Sea Harbour Porpoise's habitat are rendering the subpopulation's entire habitat unsuitable. As a result of PCB poisoning, the animals suffer from a variety of illnesses and their reproductive effectiveness may be reduced. IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 5. It is obvious that a population that cannot live healthy lives or reproduce effectively in its habitat will have a much-reduced likelihood of continued survival. Pollution is destroying the Baltic Sea Harbour Porpoises' habitat and is threatening their continued existence.[67]

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

Historically, large commercial catches occurred when porpoises migrated through the Danish Straights, mainly during winter and spring. IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 5. Annual catch levels in the Baltic Sea averaged as many as 2,000 Harbour Porpoises (a number more than triple the total current

[66] See "Discreteness: 1. Markedly Separate From Other Populations," supra.
[67] See also "Disease or Predation (Criterion C)," infra; "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E)," infra.

estimated population) at the end of the 19th century and continued at a high level through at least the 1940s. See id. at 4, 5.

Currently, "the most significant threat to this subpopulation is incidental catches in fishing nets, primarily various types of gillnets." Id. at 5 (citing Berggren 1994; Koschinski 2002). "Harbour Porpoises are also taken in smaller numbers by trawls." Id. (citing Berggren 1994). The current bycatch, numbering at least seven individuals per year and reaching at least ten in 2003-2004, is unsustainable, "and Baltic porpoises may become extinct in the near future unless actions are taken to prevent future anthropogenic mortality." Id. (citing ASCOBANS 2000). During the period 1990-1999 researchers recorded information on 62 individual Harbour Porpoises in the Baltic. Id. (citing Skóra & Kuklik 2003). Of these, 45 (representing 75.6% of those observed) were reported as bycatch in fishing gear. Id. "The bycatches occurred mostly in semi-driftnets (anchored at one end) set for salmonids and bottom-set gillnets set for cod." Id.

It is clear that commercial fishing in the Baltic is subjecting this Harbour Porpoise subpopulation to unacceptable levels of bycatch. The Baltic Sea Subpopulation suffered severe anthropogenic losses in the past that have left a very small number of survivors. The remaining individuals cannot sustain the continuous threat represented by bycatch.

Disease or Predation (Criterion C):

The negative effects the Baltic Sea Harbour Porpoise is currently experiencing due to pollution can be considered a disease. The extremely high presence of PCBs in their habitat is causing a variety of illnesses including pneumonia, liver fibrosis, arthrosis, abscesses in the muscles, lungs, and other organs, skin lesions, and heavy attacks from parasites. See id. (citing Siebert et al. 1999; Clausen & Andersen 1988). The heavy attacks by parasites also represent increased predation on the subpopulation. These harms to the few remaining Baltic Sea Harbour Porpoises represent a grave threat to their continued existence.[68]

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

CITES. This subpopulation is listed under Appendix II of CITES. IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 6. CITES is an international agreement with 176 parties that aims to ensure that international trade in wild plants and animals does not threaten their existence. See CITES Undated 1, Exhibit 33 entire; CITES Undated 2, Exhibit 34 at 1. However, it has proven to be insufficient. Although Baltic Sea Harbour Porpoises are listed on CITES Appendix II, the subpopulation is still considered "critically endangered" with a decreasing population by the IUCN. See IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 3, 4, 6.

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[68] See also "The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A)," supra; "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E)," supra.

CITES only applies to **international trade** in endangered species. See CITES Undated 2, Exhibit 34 at 1. This level of protection is insufficient because species and subpopulations like the Baltic Sea Harbour Porpoises, which are not traded internationally, do not necessarily benefit from CITES listing. CITES' focus is too narrow to protect the Baltic Sea Harbour Porpoises from the many other threats that they face (like incidental catch, disease, habitat degradation, etc.). See IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 5; see also "Known Threats/Listing Criteria," entire. While CITES listing is important and represents a clear recognition that the species is threatened with extinction, this protection is not sufficient and the Baltic Sea Harbour Porpoises should be offered further protections under the ESA.

European Union Regulation. The European Union has instituted a regulation aimed at reducing bycatch of small cetaceans in drift net fisheries generally. IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 6. While this may have positive effects, there is no information on its efficacy thus far. Id. It is likely that it will not address all bycatch, which is needed for such a small population. Furthermore, the regulation does not cover trawling, which is another source of Harbour Porpoise mortality. See id. at 5, 6. Finally, though this regulation partially addresses the bycatch threat, it does nothing to address the threats from PCBs and other toxic compounds that are causing a host of health problems for the Baltic Sea Harbour Porpoises and are likely negatively impacting their ability to reproduce. Id. at 5; see also "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E)," infra.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Pollution. "Pollution is of particular concern in the Baltic Sea where toxic compounds (in particular [Polychlorinated biphenyls (PCBs)]) have been described as the likely source for reduced fertility and population decline in Baltic Sea pinnipeds." IUCN (Phocoena phocoena (Baltic Sea Subpopulation)) 2012, Exhibit 92 at 5 (citing Helle et al. 1976; Helle 1980; Bergman & Olsson 1986; Bergman 1999). Porpoises from the Baltic have up to 254% higher mean levels of PCBs than corresponding porpoise samples from nearby waters, and a number of lesions and pathological changes are reported from the Baltic Sea Harbour Porpoises. Id. (citing Siebert et al. 1999; Clausen & Andersen 1988). These maladies include pneumonia, liver fibrosis, arthrosis, abscesses in the muscles, lungs, and other organs, skin lesions, and heavy attacks from parasites. Id. (citing Siebert et al. 1999; Clausen & Andersen 1988). "Therefore, pollution cannot be excluded as a contributing factor in the past decline in abundance [of this subpopulation] in the Baltic Sea." Id. Pollution will likely continue to have severe negative effects on the subpopulation because PCBs are persistent, bioaccumulative, and toxic. See EPA Undated, Exhibit 159 at 1.

Synergistic Effects. The synergistic effects of the aforementioned threats could conspire to cause the extinction of this subpopulation of Harbour Porpoises. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted).

The combination of threats to the Baltic Sea Harbour Porpoise and its habitat could cause a greater and faster reduction in the remaining population than might be expected from simply the additive impacts of 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." Id. at 453 (internal citations omitted).

The Baltic Sea Subpopulation of Harbour Porpoises is already at risk as a member of 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." Id. at 455 (internal citations omitted). These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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For More Information, See:

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<u>(45) Scientific Name:</u> <u>*Sousa chinensis* (eastern Taiwan Strait Subpopulation)</u>

Common Name: Indo-Pacific Humpback Dolphin

IUCN Status: Critically Endangered **CITES Status**: Appendix I

Range: "The primary range of this subpopulation consists of coastal western Taiwan from the estuaries of the Houlong and Jhonggang rivers (Miaoli County) in the north to Waishanding Zhou (a large sandbar off Chaiyi County) in the south." IUCN (Sousa chinensis (eastern Taiwan Strait Subpopulation)) 2012, Exhibit 94 at 4. "However, one sighting of about 20 dolphins has been confirmed from the inshore waters of Tainan County and a [single] dolphin, almost certainly a 'stray,' was observed at the mouth of Fugang Harbor (Taitung County) where adjacent waters are deep and oceanic," not the preferred habitat of this species. <u>Id.</u> "All sightings [of this species] have been within 3 k[ilometers] of the shore with the exception of the mud flats/littoral zone in the Changhua County . . . where extensive oyster mariculture structures and associated activities likely exclude dolphins physically." <u>Id.</u> (citing Wang et al. 2007b). "Most of the dolphins in this subpopulation have been sighted in and around the two main estuaries of western Taiwan." <u>Id.</u> (citing Wang et al. 2007a; Wang et al. 2007b).

Habitat and Ecology: "The [eastern Taiwan Strait] dolphins appear to be year-round residents of the coastal waters of central western Taiwan[,] where dedicated surveys have resulted in sightings mostly from April to August." <u>Id.</u> at 5 (citing Wang et al. 2007a). "[A]s of December 2007, the only months with no confirmed sightings were January, February, and March when conditions and opportunities for observations are poor. <u>Id.</u> "In late winter and early spring, grey mullet[] fishermen report seeing humpback dolphins near their nets." <u>Id.</u> "Recreational shore fishermen [also] report that the dolphins are seen most commonly in the winter months in the Dadu River estuary. Although reports by fishermen need to be viewed skeptically because of the possibility of misidentification, other species of dolphins are generally not present in the near-shore waters of western Taiwan so the chances of confusion are relatively small in this instance." <u>Id.</u> (citing Wang et al. 2007b). "All sightings [of this subpopulation] have been in waters less than 25 m[eters] deep, most in less than 15 m[eters,] and within 3 k[ilometers] of shore." <u>Id.</u>

"Schools of dolphins often patrol parallel to the coastline just off the surf zone and large sandbars. Estuaries are likely where most of their foraging occurs." <u>Id.</u> Feeding behind active trawlers has not been observed as it has in other areas, but dolphins in this subpopulation do move along the length of set trammel or gill nets, "possibly searching for injured or net-entangled fish." <u>Id.</u> "Indo-Pacific humpback dolphins appear to be opportunistic feeders," taking "a wide variety of near-shore, estuarine, and reef fishes. They also eat cephalopods in some areas, although crustaceans appear to be rare in [their] diet." <u>Id.</u> (citing Jefferson & Karczmarski 2001; Ross 2002; Ross et al. 1994). "Little is known about the specific feeding habits of the [eastern Taiwan Strait S]ubpopulation[,] but these dolphins have been observed feeding on" croakers, mullets, threadfins, and herring. <u>Id.</u> (citing Wang et al. 2007b).

Population Status: This subpopulation was estimated to number around 99 individuals in the mid-2000s. Id. at 4-5 (citing Wang et al. 2007a). "By analogy with the Pearl River Estuary subpopulation of [the same species], mature individuals most likely constitute about 60% of this subpopulation or about 60." Id. at 5 (citing Jefferson 2000). However, a default estimate would put the number at 50, and only 30 have been catalogued at this time. Id. (citing Taylor et al. 2007). Therefore, the extent number of mature individuals may be 30 or less.

Population Trend: Decreasing. Id.

Qualifications as a DPS

NMFS and FWS have jointly published a policy document defining the statutory requirements for finding a DPS. 61 Fed. Reg. 4,722. This joint policy employs a three-part analysis to determine the status of a possible DPS as endangered or threatened under the ESA: (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. at 4,725.

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 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.

Id.

The eastern Taiwan Strait Subpopulation of Indo-Pacific Humpback Dolphins meets both of these requirements.

1. Markedly Separate From Other Populations

"The eastern Taiwan Strait [] subpopulation of Indo-Pacific humpbacked dolphins was only recently discovered. IUCN (Sousa chinensis (eastern Taiwan Strait Subpopulation)) 2012, Exhibit 94 at 3 (citing Wang et al. 2004a). They have differing physical charateristics, namely, "[d]olphins from this subpopulation have pigmentation that differs consistently from that of nearby subpopulations along the coast of mainland

China (specifically those of western Taiwan Strait/Jiulong River Estuary [] and the Pearl River Estuary . . . Id. (citing Wang et al., in review; see also Jefferson 2000; Jefferson & Hung 2004; Wang et al. 2007b). They are behaviorally different and inhabit a specific ecological niche: "[m]ost of the dolphins in this subpopulation have been sighted in and around the two main estuaries of western Taiwan (Dadu and Joushuei rivers of Taichung, Changhua and Yunlin counties)" where they appear to be "year-round residents," indicating a limited, closed range. Id. at 4, 5. (citing Wang et al. 2007a; Wang et al. 2007b). This isolation is likely the reason for their differing physical and behavioral characteristics. Therefore, due to the fact that this subpopulation is markedly separate from other populations, it meets the "*discreteness*" requirement for listing as a DPS.

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 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 DPS in an ecological setting unusual or unique for the taxon;
2. Evidence that loss of the DPS would result in a significant gap in the range of a taxon;
3. Evidence that the DPS 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 DPS differs markedly from other populations of the species in its genetic characteristics.

61 Fed. Reg. at 4,725.

The eastern Taiwan Strait Subpopulation of Indo-Pacific Humpbacked Dolphins is significant to the species because loss of the subpopulation "would result in a significant gap in the range of the taxon." Id. Due to the apparent lack of genetic connectivity between the eastern Taiwan Strait Subpopulation and other subpopulations (including those along the coast of mainland China) as evidenced by their differing pigmentation, it appears highly unlikely that Indo-Pacific humpbacked dolphins from other populations would be able to fill the gap if this subpopulation were extirpated. See IUCN (Sousa chinensis (eastern Taiwan Strait Subpopulation)) 2012, Exhibit 94 at 3 (citing Wang et al., in review; Jefferson 2000; Jefferson & Hung 2004; Wang et al. 2007b).[69] Also, the discrete subpopulation of eastern Taiwan Strait Indo-Pacific Humpbacked Dolphins differs from other subpopulations in its genetic characteristics (as evidenced by their differing pigmentation).[70] The best available scientific information

[69] See also Wang & Yang, Exhibit 193 at 5 (noting that the eastern Taiwan Strait subpopulation is isolated from other subpopulations because there is "a considerable expanse of deep water in the Taiwan Strait and movements of this species appear to be restricted to water depths of about 25 m or less.")
[70] IUCN (Sousa chinensis (eastern Taiwan Strait Subpopulation)) 2012, Exhibit 94 at 3; "Discreteness: 1. Markedly Separate From Other Populations," supra.

thus provides that the subpopulation differs markedly in its genetic characteristics from other subpopulations.

Therefore, the eastern Taiwan Strait Subpopulation of Indo-Pacific Humpbacked Dolphins qualifies as a DPS by satisfying both the "*discreteness*" and "*significance*" requirements. Although these guidelines are not regulations and serve only as policy guidance for the agencies (61 Fed. Reg. at 4,723), they have been upheld as a reasonable interpretation of ambiguous statutory language. Maine v. Norton, 257 F. Supp. 2d 357 (D. Me. 2003). Accordingly, if the responsible agency determines a potential DPS of vertebrate fish or wildlife is both "*discrete*" and "*significant*," it will then evaluate the DPS's conservation status under the ESA and consider it eligible for listing. The eastern Taiwan Strait Subpopulation of Indo-Pacific Humpbacked Dolphins are vertebrates that meet the "*discreteness*" and "*significance*" requirements set forth above, and therefore should be considered for listing based on the listing criteria described below.

Known Threats/Listing Criteria

All of the threats and information discussed in "Mammals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual subpopulation account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

"Reduction of freshwater flow and other kinds of degradation of estuaries and adjacent coastal waters (e.g. land reclamation) are almost certainly having an impact on this dolphin subpopulation." Id. at 6 (citing Wang et al. 2004b; Wang et al. 2007b). "[T]here are continuing proposals for [further] large-scale industrial development projects involving land reclamation," one of the major causes of habitat destruction in this subpopulation's range. Id. (citing Wang et al. 2004b; Wang et al. 2007b). In addition to physical removal of habitat, the activities associated with land reclamation, such as pile driving, can also cause disturbance or even direct harm to the dolphins. Id.

Another major anthropogenic threat to this subpopulation's habitat is pollution from industry, agricultural runoff, and residential waste discharge with minimal to no treatment. Id. (citing Clarke et al. 2000; Parsons 2004). The eastern Taiwan Strait Subpopulation inhabits coastal and estuarine waters "where there is minimal treatment for residential and other sewage." Id. Therefore, "a high rate of ingestion of contaminants of many kinds is to be expected, with associated concerns for the health" of the subpopulation. Id. "Spills of oil and other toxic substances by commercial ships could be catastrophic for a population so small and limited in its distribution." Id.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"This population is not known to be hunted presently[,] but is likely to have been hunted[,] at least opportunistically[,] in the past." Id. at 6. Currently, the greatest direct and immediate source of anthropogenic mortality for the eastern Taiwan Strait Subpopulation is incidental catch in fishing gear, including trammel nets, gillnets, and trawls. Id. (citing Wang et al. 2007b). "Thousands of trammel and gillnets operate in the coastal waters of western Taiwan and this clearly represents on of the most serious threats to this species subpopulation." Id. Although not directly targeted by fishers, the eastern Taiwan Strait Subpopulation is still threatened by commercial overutilization.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

CITES. This subpopulation is currently listed under Appendix I of CITES. Id. at 6. CITES is an international agreement with 176 parties that aims to ensure that international trade in wild plants and animals does not threaten their existence. See CITES Undated 1, Exhibit 33 entire; CITES Undated 2, Exhibit 34 at 1. However, it has thus far proven to be insufficient. Although the eastern Taiwan Strait Subpopulation of Indo-Pacific Humpback Dolphins is listed on CITES Appendix I, the subpopulation is still considered "critically endangered" with a decreasing population by the IUCN. See IUCN (Sousa chinensis (eastern Taiwan Strait Subpopulation)) 2012, Exhibit 94 at 3, 5, 6.

CITES listing offers insufficient protection to the eastern Taiwan Strait Subpopulation. CITES only applies to **international trade** in endangered species. See CITES Undated 2, Exhibit 34 at 1. This protection insufficient for species and subpopulations, like the eastern Taiwan Strait Subpopulation, which are not traded and therefore do not necessarily benefit from CITES listing. CITES' focus is too narrow to protect the eastern Taiwan Strait Subpopulation of Indo-Pacific Humpback Dolphins from the many other threats that they face (like incidental catch, habitat degradation, etc.). See IUCN (Sousa chinensis (eastern Taiwan Strait Subpopulation)) 2012, Exhibit 94 at 6.

While CITES listing is important and represents a consensus amongst the international community that this species requires protection, this protection is not sufficient, and the eastern Taiwan Strait Subpopulation of Indo-Pacific Humpback Dolphins should be offered the further protections of the ESA.

Other Regulatory Mechanisms. "Efforts are being made to characterize this dolphin population and the threats it faces, and to integrate relevant information into Taiwan's environmental impact assessment and mitigation processes." Id. at 7 (citing Wang et al. 2007b). There is no evidence that this integration of threats into the environmental impact assessment and mitigation process has been implemented to date or what level of protection the subpopulation would be offered even if this were implemented. As such, this effort cannot represent sufficient protection, especially for a subpopulation facing the serious threats and having the extremely limited population that the eastern Taiwan Strait Subpopulation of Indo-Pacific Humpback Dolphins does.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Synergistic Effects. The synergistic effects of the aforementioned threats could conspire to cause the extinction of the eastern Taiwan Strait Subpopulation of Indo-Pacific Humpback Dolphins. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted).

The combination of threats to the eastern Taiwan Strait Subpopulation of Indo-Pacific Humpback Dolphins 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." Id. at 453 (internal citations omitted). Therefore, the synergistic effects of multiple threats to this extremely small subpopulation may conspire to speed the subpopulation's current decline towards extinction, and ESA protection should be given to the species to avoid this outcome.

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<u>(46) Scientific Name:</u> <u>*Tursiops truncatus* (Fiordland Subpopulation)</u>

Common Name: Fiordland Bottlenose Dolphin

IUCN Status: Critically Endangered **CITES Status**: Appendix II

Range: "The Fiordland Bottlenose Dolphins comprise a regional subpopulation inhabiting the coastal fiords and bays of Fiordland, a mountainous, rainforest-covered World Heritage Area in the southwest of New Zealand's South Island." IUCN (Tursiops truncatus (Fiordland Subpopulation)) 2012, Exhibit 95 at 4. "The subpopulation is located at the southern limit of the species' worldwide range and is genetically and geographically isolated from other coastal New Zealand subpopulations." <u>Id.</u> (citing Tezanos-Pinto et al. 2008). "The nearest subpopulation seen regularly in coastal waters is located more than 500 km north in the Marlborough Sounds. Sightings of *Tursiops* in other South Island areas are uncommon and sporadic." <u>Id.</u> "The subpopulation is subdivided into three discrete local units: one local unit ranges among the smaller fiords and bays of the northern Fiordland coast while two local units reside within the complexes formed by Doubtful and Thompson Sounds, and Dusky and Breaksea Sounds." <u>Id.</u> (citing Williams et al. 1993; Bräger & Schneider 1998; Lusseau & Slooten 2002; Currey et al. 2007; Currey et al. 2008a). "These local units are largely isolated from each other, but there have been records of exchange between units, suggesting the units require management as a collective subpopulation." <u>Id.</u> (citing Lusseau et al. 2006).

"The Doubtful-Thompson Sound local unit has exhibited a consistent, high degree of site fidelity since 1990." <u>Id.</u> (citing Currey et al. 2007; Currey et al. 2008b). "The Dusky-Breaksea Sound local unit has also shown a high degree of site fidelity . . . to date." <u>Id.</u> (citing Currey et al. 2008a). "Members of the Northern Fiordland local unit have a larger distribution, having been photo-identified in Milford Sound, Sutherland Sound, Bligh Sound, George Sound, Caswell Sound, Charles Sound and Lake McKerrow, which connects to the sea." <u>Id.</u> (citing Bräger & Schneider 1998; Lusseau & Slooten 2002; Lusseau 2003b; Boisseau 2004; Currey 2006; Currey 2009).

"The minimum extent of occurrence [] of the subpopulation is approximately 450 km^2, representing the sum of the established home ranges of the local units. A reasonable upper estimate of [the maximum extent of occurrence] for the subpopulation is approximately 2,400 km^2, encompassing the inshore waters of Fiordland and a coastal range that extends 325 km from Puysegur Point, just south of Dusky Sound to Jackson Bay, north of Lake McKerrow and offshore for 5 km." <u>Id.</u> at 5.

Habitat and Ecology: "The Fiordland bottlenose dolphins exhibit many characteristics that appear to reflect constraints imposed by their cold-water habitat. They are physically larger than coastal conspecifics found in warmer waters, with rotund bodies and comparatively shorter flukes, fins and rostrum." <u>Id.</u> at 6 (citing Schneider 1999). "The dolphins are found in large groups, sometimes comprising an entire local unit, and show strong, long-lasting associations within and between sexes, unlike the fission-fusion societies typical of many other bottlenose dolphin subpopulations." <u>Id.</u> (citing Connor et al. 2000; Lusseau et al. 2003).

More specifically, "[t]he Doubtful-Thompson Sound local unit's habitat use changes seasonally in apparent response to water temperature [changes]." Id. (citing Schneider 1999). "Water temperatures in the inner parts of the fiords are cooler than [the] open coast in winter and warmer in summer. In winter, the dolphins avoid the inner regions of the fiord, remaining closer to the open ocean, while in summer the dolphins are found in the inner section of the fiord where they can calve in the warmer waters." Id. (citing Schneider 1999; Haase & Schneider 2001). "Seasonal patterns in bottlenose dolphin distribution relating to water temperature are unusual and are typically only observed in subpopulations in cool-temperature latitudes." Id. (citing Wilson et al. 1997; Ingram & Rogan 2002). "Stable isotope studies of exfoliated skin show that the dolphins are reliant on local productivity, feeding primarily on sub-tidal reef fish." Id. (citing Lusseau & Wing 2006).

Population Status: "In 2008, the Fiordland subpopulation was estimated to contain 205 individuals [], of which 123 [] were estimated to be mature." Id. at 5 (citing Currey et al. 2009). "These estimates were derived using abundance estimates for the three discrete local units that comprise the Fiordland subpopulation's range:" the Northern Fiordland local unit is estimated at 47 individuals; the Doubtful-Thompson Sound local unit is estimated at 56 individuals; and the Dusky Breaksea Sound local unit is estimated at 102 individuals. Id. (citing Boisseau 2003; Currey & Rowe 2008; Currey et al. 2008a). "All estimates were produced using similar capture-recapture analysis of photo identification data." Id. (citing Williams et al. 1993; Currey et al. 2007). "In the case of Doubtful-Thompson Sound and Dusky-Breaksea Sound, capture-recapture analyses were complemented with a complete photo-identification census, yielding identical abundance estimates." Id.

"Dolphin abundance has declined by an estimated 34-39%" between the years 1995-2007 for the Doubtful-Thompson Sound local unit. Id. (citing Currey et al. 2007). "The key demographic cause of this decline was a reduction in the survival of calves in the first year of life since 2002, coupled with a reduction in recruitment that reflected both reduced calf survival (less than one year old) and a separate reduction in juvenile survival (1-3 years old) prior to 2002." Id. (citing Currey et al. 2008b; Curry et al. submitted). "The present level of calf survival [] is thought to be the lowest recorded for Bottlenose Dolphins." Id. "Further, the reduction in calf survival since 2002 has resulted in a more than 100-fold increase in the risk of extirpation in Doubtful Sound over the next 50 years." Id. (citing Currey et al. 2008b). Using sophisticated statistical models, "the Fiordland subpopulation was projected to decline by 31.4% over one generation," and an average of 81.2% over three generations. See id. at 6 (citing Currey et al. 2009; Currey et al. 2008b). Furthermore, based on these estimates the Fiordland subpopulation has a 10.1% chance of extinction over the next five generations, "and as much as 22.5% depending on the level of movement between local units and survival rates of calves and sub-adults." Id. (citing Currey et al. 2009).

Population Trend: Decreasing. Id.

Qualifications as a DPS

NMFS and FWS have jointly published a policy document defining the statutory requirements for finding a DPS. 61 Fed. Reg. 4,722. This joint policy employs a three-part analysis to determine the status of a possible DPS as endangered or threatened under the ESA: (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. at 4,725.

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 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.

Id.

The Fiordland Bottlenose Dolphins meet both of these requirements.

1. Markedly Separate From Other Populations

The Fiordland Bottlenose Dolphins (*Tursiops truncatus*) are so different from other common bottlenose dolphins in other areas that there was concern recently as to whether they were in fact *Tursiops truncatus*. IUCN (Tursiops truncatus (Fiordland Subpopulation)) 2012, Exhibit 95 at 3 (citing Lusseau et al. 2003; Lusseau & Wing 2006; Currey et al. 2007; Currey et al. 2008b). A recent genetic study has confirmed that they are indeed correctly identified. Id. (citing Tezanos-Pinto et al. 2008). The physical differences causing the initial confusion as to classification seem likely to have developed "to reflect constraints imposed by their cold-water habitat." Id. at 6. The Fiordland Bottlenose Dolphins "are physically larger than coastal conspecifics found in warmer waters, with rotund bodies and comparatively shorter flukes, fins and rostrum." Id. (citing Schneider 1999). This subpopulation is also behaviorally distinct: they are "found in large groups, sometimes comprising an entire local unit, and show strong, long-lasting associations within and between sexes, unlike the fission-fusion societies typical of many other bottlenose dolphin subpopulations." Id. (citing Lusseau et al. 2003; Connor et al. 2000).

They are physically separated from other subpopulations: "[t]he nearest subpopulation seen regularly in coastal waters is located more than 500 km north" and "[s]ightings of *Tursiops* in other South Island areas are uncommon and sporadic." Id. at 4. "Estimates of female migration rates per generation reflected this isolation, with low levels of exchange between Fiordland and Northland (4.89 female migrants per generation 95% CI: 0.02–20.32; 0.19 female emigrants per generation 95% CI: 0.00–1.70) and between Fiordland and the Marlborough Sounds (0.31 female migrants per generation 95% CI: 0.00–3.12; 0.29 female emigrants per generation 95% CI: 0.00–2.01; Tezanos-Pinto et al. 2008). This isolation ensures the Fiordland Bottlenose Dolphins qualify as a discrete subpopulation…" Id. at 3. This small subpopulation is split into three smaller local units. Id. at 4. "[O]ne local unit ranges among the smaller fiords and bays of the northern Fiordland coast while two local units reside within the complexes formed by Doubtful and Thompson Sounds, and Dusky and Breaksea Sounds." Id. (citing Williams et al. 1993; Bräger & Schneider 1998; Lusseau & Slooten 2002; Currey et al. 2007; Currey et al. 2008a). "These local units are largely isolated from each other, but there have been records of exchange between units, suggesting the units require management as a collective subpopulation." Id. (citing Lusseau et al. 2006).

Furthermore, even within New Zealand, "coastal subpopulations [] show a high degree of isolation from each other." Id. at 3 (citing $F_{ST} = 0.171$, $\Phi_{ST} = 0.206$, $P < 0.001$; Tezanos-Pinto et al. 2008). "Pair-wise comparison revealed the Fiordland Bottlenose Dolphins were isolated from both other Bottlenose Dolphin subpopulations in New Zealand: Northland ($F_{ST} = 0.150$, $P < 0.001$, $\Phi_{ST} = 0.197$, $P < 0.05$) and the Marlborough Sounds ($F_{ST} = 0.239$, $P < 0.001$, $\Phi_{ST} = 0.298$, $P < 0.05$; Tezanos-Pinto et al. 2008)." Id.

Significance. NMFS' and FWS' 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 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 DPS in an ecological setting unusual or unique for the taxon;
2. Evidence that loss of the DPS would result in a significant gap in the range of a taxon;
3. Evidence that the DPS 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 DPS differs markedly from other populations of the species in its genetic characteristics.

61 Fed. Reg. at 4,725.

The Fiordland Bottlenose Dolphin lives in an ecological setting that is unusual for the taxon, the coastal fiords and bays of Fiordland. IUCN (Tursiops truncatus (Fiordland Subpopulation)) 2012, Exhibit 95 at 4. Fiordland is a "mountainous, rainforest-covered

World Heritage Area in the southwest of New Zealand's South Island. The subpopulation is located at the southern limit of the species' worldwide range and is genetically and geographically isolated from other coastal New Zealand subpopulations." Id. (citing Tezanos-Pinto et al. 2008). "The nearest subpopulation seen regularly in coastal waters is located more than 500 km north in the Marlborough Sounds. Sightings of *Tursiops* in other South Island areas are uncommon and sporadic." Id. Not only does this indicate that the Fiordland Bottlenose Dolphin lives in an unusual ecologocial setting for the taxon, but it has also led to marked genetic differences from other populations of the species. There is very little migration between this subpopulation and other populations and the subpopulation exhibits a high degree of isolation both amongst subpopulations and even amongst local units within the subpopulation. Id. at 3-4. This has led to differences so substantial that there was doubt as to the classification of Fiordland Bottlenose Dolphins. Id. at 3 (citing Lusseau et al. 2003; Lusseau & Wing 2006; Currey et al. 2007; Currey et al. 2008b). A recent genetic study has confirmed that they are indeed correctly identified as a subpopulation and are not a subspecies. Id. (citing Tezanos-Pinto et al. 2008). The differences exhibited by this subpopulation seem likely to have developed "to reflect constraints imposed by their cold-water habitat." Id. at 6. The Fiordland Bottlenose Dolphins "are physically larger than coastal conspecifics found in warmer waters, with rotund bodies and comparatively shorter flukes, fins and rostrum." Id. (citing Schneider 1999). Loss of this subpopulation would result in a significant gap in the range of the taxon, removing the species' southernmost population. Due to the lack of migration and the high degree of isolation experienced by the subpopulation, re-colonization of the area appears to be unlikely. For these reasons, the Fiordland Bottlenose Dolphins meet the "*significance*" requirement for listing as a DPS.

Therefore, the Fiordland Bottlenose Dolphins qualify as a DPS by satisfying both the "*discreteness*" and "*significance*" requirements. Although these guidelines are not regulations and serve only as policy guidance for the agencies (61 Fed. Reg. at 4,723), they have been upheld as a reasonable interpretation of ambiguous statutory language. Maine v. Norton, 257 F. Supp. 2d 357 (D. Me. 2003). Accordingly, if the responsible agency determines a potential DPS of vertebrate fish or wildlife is both "*discrete*" and "*significant*," it will then evaluate the DPS's conservation status under the ESA and consider it eligible for listing. The Fiordland Bottlenose Dolphins are vertebrates that meet the "*discreteness*" and "*significance*" requirements set forth above, and therefore should be considered for listing based on the listing criteria described below.

Known Threats/Listing Criteria

All of the threats and information discussed in "Mammals Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual subpopulation account.

The Fiordland Bottlenose Dolphins are exposed to three main threats: "(1) disturbance and boat strikes associated with boat-based tourism in Milford and Doubtful Sounds; (2) increased freshwater discharge into Doubtful Sound from hydroelectric power generation; (3) reduced prey availability caused by environmental degradation and overfishing throughout Fiordland." Id. at 7 (citing Currey et al. 2008b; Currey et al. 2009).

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Anthropogenic Climate Change. Since the subpopulation lives at the extreme southern end of the species' global range, it is likely that the habitat is already suboptimal. See id. at 8. This means that there is increased "risk that in time, the subpopulation's existing range may be rendered [further] suboptimal by climate change." Id. Eventually this could lead to the habitat becoming completely unsuitable, which would lead to the certain extirpation of the subpopulation.

Hydroelectric Power Generation. The tailrace[71] from the Lake Manapouri hydroelectric power station is altering the subpopulation's habitat in Doubtful-Thompson Sound. Id. There is evidence suggesting negative impacts of increased freshwater input from this tailrace, including "four times higher severity of skin lesions," "smaller calves and more restricted calving season," "and a less clear seasonal pattern of habitat use in Doubtful-Thompson Sound than in the Dusky-Breaksea Sound, all of these are consistent with exposure to cold fresh water." Id. (citing Rowe et al. 2008). "The additional freshwater has had other ecological effects, altering sub-tidal community structures within Doubtful Sound, resulting in declining species richness." Id. (citing Boyle et al. 2001; Tallis et al. 2004; Rutger & Wing 2006). The tailrace has already had a damaging effect on the subpopulation's habitat in this area, and it appears that this impact will continue until cessation of the power station's use. Impacts may also increase if a third tailrace tunnel is added, just as they seem to have when the second was added. Id.; see also "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Hydroelectric Power Generation," infra.

Tourism. Tourism has led to alterations in the areas that the subpopulation uses.[72] Such curtailment of use effectively removes the suitability of this habitat and represents yet another threat to the subpopulation as it is forced into smaller and smaller areas as tourism increases. See id.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

The boat strikes, disruption of normal activities, and habitat curtailment stemming from whale watching ships encroaching on the subpopulation's habitat represent a recreational overutilization of the subpopulation. See id. This represents a threat to the subpopulation's continued existence as discussed below.

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[71] When dealing with hydroelectric power generation, a tailrace refers to the passage by which water leaves the dam and re-enters the watercourse after having gone through the dam's turbines. Adding additional tailraces allows water to be released from the dam more quickly.

[72] See "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Tourism," infra.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

In response to the observed impacts of tourism on the Fiorldand Subpopulation, "in 2006 a voluntary code of practice was established for tour boats in Milford and Doubtful Sounds to improve boat behavior around the dolphins." Id. at 7; see also "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E)," infra (discussing tourism impacts). "This was [formalized] into a Code of Management for Doubtful Sound in January 2008, including Dolphin Protection Zones (DPZs) in which vessel activity is limited. These zones extend 200m out from shore in regions of the fiord that include some of the local unit's most frequently used habitats." Id. (citing Lusseau & Higham 2004; Lusseau et al. 2006). "The Code of Management is voluntary at present, and of unknown efficacy. Non-compliance with the Marine Mammals Protection Act [of] 1978 (i.e. excessive boat speeds, unsafe approaches to dolphin groups) has been frequently observed in Fiordland in the past, and voluntary codes of practice appear to be of limited effectiveness in other locations." Id. (citing Lusseau 2003a, 2006; Scarpaci et al. 2003; Scarpaci et al. 2004; Whitt & Read 2006; Wiley et al. 2008). "Given these factors, the negative effects of boat-based tourism are therefore likely to continue in Milford and Doubtful Sounds." Id.

There are several MPAs in the subpopulation's range. Id. at 8. However, these MPAs are only designed to protect fish stocks. While this decreases overfishing pressure and dolphin prey removal, it does not adequately protect against other threats faced by the subpopulation and is, therefore, inadequate. See id.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Tourism. "Tourism in Fiordland is increasing." Id. at 7 (citing Lusseau & Higham 2004). "Tour boats have been demonstrated to have direct impacts on the [behavior] of dolphins in Doubtful Sound, increasing the dive interval of both males and females, as well as disturbing resting and [socializing behaviors], resulting in increased travelling." Id. (citing Lusseau 2003a). "Tourism also appears to have influenced the residency patterns of the northern Fiordland [local unit], with the dolphins avoiding the fiord entirely when tour boat activity is at its peak." Id. (citing Lusseau 2005). "In both Milford and Doubtful Sounds, dolphins have been observed with scars from boat strikes and[,] in one case, a calf was killed by a boat strike." Id. (citing Lusseau et al. 2002; Boisseau 2003). "This evidence led the International Whaling Commission Scientific Committee to issue a consensus statement that whale watching and vessel traffic have a significant impact on this subpopulation." Id. (citing IWC Scientific Committee report 2006).

"The isolation of the Dusky-Breaksea local unit ensures that these dolphins are presently exposed to fewer tour boat interactions than [the other] local units. However, as tourism activities have increased in the most accessible parts of Fiordland, they have begun to spill over to more remote regions, such as Dusky Sound. Large vessels and helicopters now regularly visit for multi-day hunting, fishing, and sightseeing trips." Id.

The impacts of this new tourism are unclear, "although the effects observed elsewhere in Fiordland suggest impacts are likely to occur, or may already be occurring." Id.

Therefore, it appears that increased tourism is affecting the habits of the subpopulation and is likely largely responsible for the observed declines. The measures taken to remedy this have been insufficient and increased protections are needed for this small, fragile subpopulation to ensure its continued existence.

Hydroelectric Power Generation. "In addition to tour boat activity, the Doubtful-Thompson Sound local unit is subject to the effects of freshwater discharge from the Lake Manapouri hydroelectric power station tailrace. The tailrace discharge into Deep Cove, Doubtful Sound, is [around 450-510 cubic meters per second], two to three times larger than the mean inflow from precipitation, and results in a distinct low-salinity layer significantly deeper than found in neighboring fiords." Id. at 7-8 (citing Gibbs et al. 2000; Gibbs 2001). "The low-salinity layer shows significant seasonal temperature variation . . . while the underlying marine waters maintain a relatively constant [temperature] year round . . . " Id. at 8 (citing Gibbs 2001; Peake et al. 2001).

"A marked reduction in calf survival observed in the Doubtful-Thompson Sound local unit [] coincided with the opening of a second tailrace tunnel for the hydroelectric power station." Id. (citing Currey et al. 2008b). "That the second tailrace increased the mean discharge only marginally [] has been used to argue that it was not the cause" of this increase in mortality. Id. (citing DuFresne & Mattlin 2009). However, there is evidence suggesting negative impacts of increased freshwater input, including "four times higher severity of skin lesions," "smaller calves and more restricted calving season," "and a less clear seasonal pattern of habitat use in Doubtful-Thompson Sound than in the Dusky-Breaksea Sound, all of these are consistent with exposure to cold fresh water." Id. (citing Rowe et al. 2008). "The additional freshwater has had other ecological effects, altering sub-tidal community structures within Doubtful Sound, resulting in declining species richness." Id. (citing Boyle et al. 2001; Tallis et al. 2004; Rutger & Wing 2006).

It is clear that the Lake Manapouri hydroelectric power station tailrace is having significant effects in Doubtful-Thompson Sound. These effects on the environment appear to be negatively impacting members of the Fiordland Subpopulation. These impacts include disruption of normal travel, health impacts, and disruption of, and other negative impacts on, calving. Such impacts pose a significant threat to the continued survival of this subpopulation and necessitate increased protection for it, which should be accomplished through listing the subpopulation under the ESA.

Non-Anthropogenic Threats. "In addition to anthropogenic threats, the Fiordland Bottlenose Dolphins face the inherent risks associated with small subpopulation size and residing at the edge of the species' range. Small subpopulation size increases vulnerability to stochastic effects such as demographic stochasticity, environmental stochasticity, catastrophes and genetic deterioration, all of which can result in increased extinction risk, even in the absence of further human impacts." Id.

(citing Caughley 1994; Hedrick et al. 1996). "Residing at the southern-most limit of the species' range may also have significant implications for subpopulation viability. If the habitat is marginal, it may result in increased energetic costs – a factor that may help to explain the apparent energy limitation observed among females in Doubtful-Thompson Sound." Id. (Lusseau 2003c). These non-anthropogenic threats represent further threats to the subpopulation.

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of the Fiordland Subpopulation of Bottlenose Dolphins. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted).

The combination of threats to the Fiordland Subpopulation and its habitat could cause a greater and faster reduction in the remaining individuals 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." Id. at 453 (internal citations omitted). Therefore, the synergistic effects of multiple threats to this extremely small subpopulation may conspire to speed the subpopulation's current decline towards extinction. These threats qualify the subpopulation as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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E. RAYS AND SKATES

RAYS AND SKATES INTRODUCTION

WildEarth Guardians is petitioning the Secretary to list 10 species of rays and skates from IUCN's lists of "endangered" and "critically endangered" species (Species Accounts 47-56) under the ESA as "threatened" or "endangered" species. The petitioned species of rays and skates face a variety of threats to their continued existence. Some of these common threats will be discussed in this introductory section ("Rays and Skates Introduction"). Rays and Skates Introduction is to be considered as incorporated by reference in each of the individual ray and skate species accounts that follow ("Individual Ray and Skate Species Accounts").

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

At least several of the petitioned species of rays and skates appear to be suffering from habitat destruction or modification through pollution. See IUCN (Dasyatis margarita) 2012, Exhibit 101 at 4 (agricultural chemicals and light industry development); IUCN (Electrolux addisoni) 2012, Exhibit 102 at 6 (runaway coastal housing development, boating, commercial shipping, holiday-making, beach utilization, and extensive pollution and habitat degradation of inshore environments); IUCN (Okamejei pita) 2012, Exhibit 103 at 5 (deteriorating water quality, hydrocarbon pollution, and radiological, chemical or biotic contamination); IUCN (Pastinachus solocirostris) 2012, Exhibit 104 at 4 (aquaculture/shrimp farms, mining and coastal development). Rapid coastal development represents another threat to several of the petitioned species. See IUCN (Okamejei pita) 2012, Exhibit 103 at 5; IUCN (Electrolux addisoni) 2012, Exhibit 102 at 6; IUCN (Pastinachus solocirostris) 2012, Exhibit 104 at 4. While there is specific information relating to these threats for the cited species, it is likely that other petitioned species of rays and skates are also facing such impacts. Such impacts are particularly problematic as, "[i]n the case of habitat destruction resulting from coastal development, the severity of impacts is high with low reversibility." Zamora-Arroyo et al. 2005, Exhibit 66 at 58.

These impacts will only increase as the human population continues to grow and become more focused on the coasts. Therefore, not only do these pressures represent current threats to the petitioned species, but they also represent an increasing future threat. Without adequate habitat, the petitioned species will certainly become extinct, and, therefore, protecting this habitat from the aforementioned threats is critical to conservation of the petitioned species.

NMFS' own recent Status Review Report estimates that the total number of people by 2045-2050 will be around 9 billion, and cited one source putting that total at an even larger 10.6 billion. Status Review Report, Exhibit 40 at 20 (citations omitted).

Currently, worldwide, approximately 2.5 billion people live within just **100 km** of the coastline. See WRI 2011, Exhibit 41 at 21. By 2020, an astonishing 75% of the expanded human population is expected to live within just **60 km** of the coastline. Knip et al. 2010, Exhibit 42 at 2 (citation omitted). This increasing concentration of people near the coasts means that the negative effect of the general population increase will be magnified greatly.

Impacts from population growth do not occur evenly. Increased economic growth in coastal cities is a major cause of ocean habitat destruction. With growth comes an increase in consumption and development. This is reflected in an increase in construction projects, some of which occur on reef communities; dredging of harbors and shipping channels; dumping of waste, run-off pollution and increased sedimentation; deforestation; and increased tourism. As a result of these factors, the coasts around virtually all urban areas are "beset by a pattern of pollution and over-development." Hinrichsen Undated, Exhibit 43 at 2. "Coastal urban areas dump increasing loads of toxic wastes into the sea. In fact, waters around many coastal cities have turned into virtual cesspools, so thick with pollution that virtually no marine life can survive." Id. at 4.

This urban pollution is contributing to increasing "dead zones," amongst other things. These dead zones are areas where dissolved oxygen content is so low that no marine life, apart from microorganisms, can live. A 2007 study identified 200 of these dead zones, which represents an increase of 51 such zones found just four years earlier. Id. at 5. Worse yet, these dead zones are not only becoming more numerous, they are also greatly expanding "due mainly to high nutrient pollution levels brought in by rivers and streams and washed off coastal land." Id.

Climate change is expected to further magnify these coastal pollution problems. For example, "[d]ue to water circulation and oceanic volume changes, estuarine and coastal systems are predicted to experience . . . increased eutrophication, hypoxia, and anoxia." Roessig et al. 2004, Exhibit 29 at 258 (citations omitted). "More intense rains wash more fertilizer and sewage into coastal waters, and this runoff triggers algal blooms and consequent poisoning of fish and humans." Id. at 269 (citation omitted).

As discussed above and in the individual species accounts, several of the petitioned ray and skate species are already facing negative impacts from this human population growth and many more likely will as the population continues to explode and become increasingly concentrated on the coasts. Therefore, this human population growth represents a serious threat to many, if not all, of the petitioned species of rays and skates.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

Commercial overutilization is the main threat to most of the petitioned species of rays and skates. See, e.g., IUCN (Dasyatis margarita) 2012, Exhibit 101 at 5. This overutilization is due to both directed fishing and bycatch. See, e.g., IUCN (Bathyraja griseocauda) 2012, Exhibit 100 at 5 (discussing both intentional catches and bycatch).

These catches have caused extensive decreases in all of the species' populations where population data is available. See, e.g., id. at 5-6. It has even caused localized extirpations from some areas of habitat. See, e.g., IUCN (Rhinobatos cemiculus) 2012, Exhibit 106 at 5-6; IUCN (Rhinobatos rhinobatos) 2012, Exhibit 108 at 6. Many of the petitioned species are threatned by trawling activities. See, e.g., IUCN (Bathyraja griseocauda) 2012, Exhibit 100 at 5. This is particularly problematic as benthic trawling causes high impacts with low reversibility. Zamora-Arroyo et al. 2005, Exhibit 66 at 59. It results in "disruption of the physical substrate and its benthos, incidental catch and mortality of nontarget fish and marine mammals, exposed species susceptible to predation, and changes in benthic community composition." Id. Therefore, this fishing pressure is related to decreased numbers of petitioned species through both bycatch and habitat degradation. This has led to a decrease in size of captured individuals, indicating decreases in mature specimens available for reproduction. See IUCN (Bathyraja griseocauda) 2012, Exhibit 100 at 6.

Landings of at least some petitioned species have been increasing considerably due to international demand. See IUCN (Bathyraja griseocauda) 2012, Exhibit 100 at 5. Since at least some of these species are marketed for human consumption, it is likely that their exploitation will increase as human population continues to grow. See IUCN (Dasyatis margarita) 2012, Exhibit 101 at 3; "The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A)," supra. The fishing that impacts these species is often unregulated or under-regulated and oftentimes employs unsustainable practices such as targeting pregnant females at predictable aggregations. See IUCN (Okamejei pita) 2012, Exhibit 103 at 5 (completely unregulated fishing); IUCN (Rhinobatos cemiculus) 2012, Exhibit 106 at 3, 6 (fishing for pregnant females, finning embryos, and illegal fishing); IUCN (Rhinobatos horkelii) 2012, Exhibit 107 at 5 (fishers targeting species inside a refuge area and targeting aggregations where they catch 98% pregnant females); IUCN (Dasyatis margarita) 2012, Exhibit 101 at 3, 4 (intensive and unregulated fishing); IUCN (Rhinobatos rhinobatos) 2012, Exhibit 108 at 4 (unregulated fishing throughout the species' range). This is extremely problematic and is sure to lead to further declines, local extirpations, and complete extinctions.

Additionally, at least some of the petitioned species are subject to recreational overutilization from recreational fishing happening in their habitat. See IUCN (Electrolux addisoni) 2012, Exhibit 102 at 6; IUCN (Trygonorrhina melaleuca) 2012, Exhibit 109 at 3, 4; IUCN (Raja undulata) 2012, Exhibit 105 at 6. These facts make it clear that the petitioned rays and skates are being overutilized for commercial and recreational purposes and should be protected under the ESA.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

Nearly all of the petitioned species of rays and skates are completely lacking any specific conservation measures at all. See IUCN (Dasyatis margarita) 2012, Exhibit 101 at 4; IUCN (Electrolux addisoni) 2012, Exhibit 102 at 6; IUCN (Okamejei pita) 2012, Exhibit 103 at 5; IUCN (Pastinachus solocirostris) 2012, Exhibit 104 at 5; IUCN (Raja undulata) 2012, Exhibit 105 at 6; IUCN (Rhinobatos cemiculus) 2012, Exhibit 106 at 8 (functionally unprotected in Mediterranean and Sierra Leone); IUCN (Rhinobatos rhinobatos) 2012, Exhibit 108 at 8 ("There are no species specific measures currently in place."); IUCN (Trygonorrhina melaleuca) 2012, Exhibit 109 at 4. Those that are protected in some way are not protected adequately. As a result of these inadequate, or mostly completely absent, regulatory mechanisms, none of the petitioned rays and skates are characterized as having an increasing, or even a stable, population by the IUCN.[73] Such lax protection is inadequate for species facing such serious threats to their continued existence and ESA protection should be extended to all of the petitioned species of rays and skates to avoid their extinction.

CITES. CITES is an international agreement with 176 parties, including the United States, that aims to ensure that international trade in wild plants and animals does not threaten their existence. See CITES Undated 1, Exhibit 33 entire; CITES Undated 2, Exhibit 34 at 1. However, none of the petitioned species of rays and skates is protected under CITES. See, e.g., IUCN (Electrolux addisoni) 2012, Exhibit 102 at 6. While CITES listing is insufficient, it can help protect species that are subject to international trade. Since several of the petitioned species are subject to international trade, the absence of CITES listing is problematic for them.[74] While CITES listing represents a clear recognition by the international community that the listed species or subpopulation is threatened with extinction and must be protected, absence of such listing does not mean that the species or subpopulation is not threatened with extinction. A species may be denied listing for political and economic reasons or may not be considered at all (such consideration requires a party country to bring a proposal). Therefore, while CITES listing is a factor that should weigh towards finding the relevant species or subpopulation is "threatened" or "endangered" under the ESA, its absence should not be taken to show that it is not "threatened" or "endangered."

Limitations on Catch or Fishing Effort. Several fisheries limit catch or effort that can be expended to catch petitioned species of rays and skates. See, e.g., IUCN (Bathyraja griseocauda) 2012, Exhibit 100 at 7. However, these are often ignored, unmonitored, or based on insufficient stock status assessments. See, e.g., id. Furthermore, such limitations should be set at zero for populations that are experiencing extreme population declines and threats like the rays and skates in this petition.

MPAs. Two of the petitioned species are protected within the same marine reserves covering a portion of their range. See IUCN (Rhinobatos cemiculus) 2012, Exhibit 106 at 8; IUCN (Rhinobatos rhinobatos) 2012, Exhibit 108 at 8; see also "A. Corals: Corals Introduction: The Inadequacy of Existing Regulatory Mechanisms

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[73] See IUCN (Bathyraja griseocauda) 2012, Exhibit 100 at 4 (Decreasing);IUCN (Dasyatis margarita) 2012, Exhibit 101 at 4 (Decreasing); IUCN (Electrolux addisoni) 2012, Exhibit 102 at 5 (Unknown); IUCN (Okamejei pita) 2012, Exhibit 103 at 4 (Unknown); IUCN (Pastinachus solocirostris) 2012, Exhibit 104 at 4 (Unknown); IUCN (Raja undulata) 2012, Exhibit 105 at 5 (Decreasing); IUCN (Rhinobatos cemiculus) 2012, Exhibit 106 at 5 (Decreasing); IUCN (Rhinobatos horkelii) 2012, Exhibit 107 at 4 (Decreasing); IUCN (Rhinobatos rhinobatos) 2012, Exhibit 108 at 5 (Decreasing); IUCN (Trygonorrhina melaleuca) 2012, Exhibit 109 at 4 (Unknown).

[74] See, e.g., IUCN (Bathyraja griseocauda) 2012, Exhibit 100 at 5 ("Skate landings have been increasing considerably in Argentina due to international demand.").

(Criterion D): Marine Protected Areas ("MPAs")," supra (offering more information on MPAs and their limitations). The first area of protection for the species is the Banc d'Arguin in Mauritania where the species are protected as part of a ban on directly targeted elasmobranch fishing. See IUCN (Rhinobatos cemiculus) 2012, Exhibit 106 at 8; IUCN (Rhinobatos rhinobatos) 2012, Exhibit 108 at 8. However, fishing for other species, that likely results in bycatch of petitioned species, is still occurring. While protection in this area is helpful in that it offers fishing season and gear restrictions, it will not halt death of individuals. The second area of protection is also in common and covers MPAs in the Bijagos archipelago, the PNO marine reserve, and the PNMJVO marine reserve. See IUCN (Rhinobatos cemiculus) 2012, Exhibit 106 at 8; IUCN (Rhinobatos rhinobatos) 2012, Exhibit 108 at 8. This area has gear restrictions and only allows fishing for subsistence purposes (no commercial fishing is allowed). See IUCN (Rhinobatos cemiculus) 2012, Exhibit 106 at 8; IUCN (Rhinobatos rhinobatos) 2012, Exhibit 108 at 8. Therefore, bycatch and possibly even some directed fishing for the petitioned species may still occur in the area, but likely not on the scale present in most of the rest of the species' ranges.

While these protections are undoubtedly beneficial to the species to some degree, there is a broader problem with MPAs. All MPAs are problematic because they only protect the species in the limited area that is part of the MPA. Outside of the reserves the species are still subject to the same, mostly unregulated, fishing pressures that have been decimating their populations. Also, these MPAs can be limited by under-enforcement, thus offering limited or even nominal protection to the species therein. There is no information on the efficacy of these MPAs, so the actual level of protection the species are receiving therein in unclear. Furthermore, MPAs cannot protect against global threats such as anthropogenic climate change. Therefore, location within these MPAs is not sufficient, even for the fraction of the species' populations located therein, and ESA protection should be offered to the species for their further protection.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

K-Selected/K-Strategy Species. At least several of the petitioned species are also vulnerable to extinction in part because they are K-selected or K-strategy species (they posses qualities such as being large, have low productivity, reach reproductive maturity late in life, etc.). See IUCN (Bathyraja griseocauda) 2012, Exhibit 100 at 5 (reaching maturity only at 15 years of age and growing to 157 centimeters); IUCN (Dasyatis margarita) 2012, Exhibit 101 at 3, 4 (large, low fecundity ray); IUCN (Pastinachus solocirostris) 2012, Exhibit 104 at 4 (large species with only pregnant female observed carrying only one pup, likely indicating low fecundity); IUCN (Raja undulata) 2012, Exhibit 105 at 6 (large species, "delayed age at maturity, long generation time (14-15 years), low fecundity, and consequently slow population growth.") (citation omitted); see also Goble & Freyfogle 2010, Exhibit 64 at 1058-60.

> K-strategy species are more extinction prone than are r-strategy species. The very efficiency with which K-strategy species exploit their

> environment is a liability *during periods of rapid or chaotic change.* The larger body size of individuals of a K-strategy species - while giving an advantage in interspecific competition and in defense against predators and allowing individuals to exploit a larger area - means that there are fewer individuals . . . At the same time, lower reproduction rates make it more difficult both for the species to recover if its population becomes depressed and for it to adapt to a changed environment because fewer offspring contain less genetic variability. Thus, the very "fittedness" of K-strategy species to a particular environment - which is advantageous during periods of stability - becomes a serious handicap when the habitat changes more rapidly than genes can be substituted in a population - and in species that reproduce slowly, genes are substituted slowly.

Goble & Freyfogle 2010, Exhibit 64 at 1059-60 (emphasis in original). The aforementioned species are currently experiencing the type of rapid, chaotic change that makes their K-selected life history pattern a liability. This is because these species are facing a variety of threats including loss of habitat and being fished and removed from their remaining habitat at a rate greater than they can replenish their numbers.[75] As a result of these pressures, many of the petitioned species' physical attributes and reproductive adaptations have gone from being beneficial to creating increased risk of species extinction. This type of life history pattern means that the species do not replenish themselves as quickly as smaller, shorter-lived, r-selected species and are, therefore, more vulnerable when individuals are removed from their populations or the species' reproduction is otherwise disrupted. This difficulty is likely exacerbated by the fact that the largest rays and skates are both the ones most prized by fishers for the greatest economic return and those most likely to be sexually mature. Removing the few reproductively viable adults makes it impossible for younger rays and skates to replace the larger individuals because they are not yet sexually mature, thus making it very difficult for the population to replenish itself. Removing the only members of a species that are capable of reproduction means that there is a substantial risk that the population will rapidly collapse. This life history pattern represents another threat to the petitioned rays and skates that threatens their continued existence.

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of the petitioned species. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted).

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[75] See "The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range (Criterion A)," supra; "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra; see also, e.g., IUCN (Bathyraja griseocauda) 2012, Exhibit 100 at 3, 4 (indicating the species is endangered with a decreasing population); IUCN (Dasyatis margarita) 2012, Exhibit 101 at 3, 4 (indicating the species is endangered with a decreasing population); IUCN (Pastinachus solocirostris) 2012, Exhibit 104 at 4 (indicating the species is endangered); IUCN (Raja undulata) 2012, Exhibit 105 at 3, 5 (indicating the species is endangered with a decreasing population).

The combination of threats to the petitioned species and, where applicable, their habitat could cause a greater and faster reduction in the remaining populations 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." Id. at 453 (internal citations omitted).

Several of the petitioned species are already at risk as low-fecundity or K-selected species, rendering them more vulnerable to synergistic impacts of multiple threats.[76] "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." Id. at 455 (internal citations omitted).

Since all of the petitioned ray and skate species face a multitude of threats, it is likely that the synergistic effects of those threats will cause extinction pressure more severe than their additive impact alone. As such, the synergistic effects of the aforementioned threats represents yet another reason why these species should be extended ESA protections, especially for those species that are K-selected.

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INDIVIDUAL RAY AND SKATE SPECIES ACCOUNTS

(47) Scientific Name: *Bathyraja griseocauda*

Common Name: Graytail Skate

IUCN Status: Endangered **CITES Status**: N/A

Range: "This species [of skate] occurs in the Southwest Atlantic south of 37ºS on the slope[,] and south of 41ºS on the shelf[,] off Argentina and the Falkland/Malvinas Islands [near the] Atlantic Antarctic convergence." IUCN (Bathyraja griseocauda) 2012, Exhibit 100 at 4. "The species also occurs in the Southeast Pacific off Chile south of 41ºS." Id.

Habitat and Ecology: This benthic species is typically reported from depths of 82 to 940 meters in the Southwest Atlantic, and at depths of 140 to 600 meters off the Chilean coast. Id. at 4-5 (citing Menni & Stehmann 2000). This species has very low tolerance for changes in water temperature and water salinity levels. Id. at 5 (citing Figueroa et al. 1999). "During research trawls around the Falkland/Malvinas Islands, [Graytail Skates] were more abundant in deeper trawls (200 and 350 m[eters]) and formed only a small part of the catch in shallower trawls (150 m[eters])." Id. (citing Wakeford et al. 2004). "Unlike some other species [of skates], there is no evidence for large spatial or temporal movements and the species may complete its entire life cycle within Falkland Island waters." Id.

Known to be a slow growing, long-lived species, individuals mature at around 15 years of age, with an estimated size at maturity of around 120 centimeters total length in males. Id. (citing Agnew et al. 2000; Wakeford et al. 2004). "Small individuals feed opportunistically on benthic isopods and larger specimens are predominantly piscivorous[, the favored prey being the fish] *Patagonotothen ramsayi*." Id. Unlike some skates, this species is considered to be an "active predator." Id. (citing Brickle et al. 2003). "Like other skates, this species is oviparous." Id.

Population Status: The population size for this species is unknown. Id. at 4. However, declines have been detected around the Falklands. Id. (citing Agnew et al. 2000; Wakeford et al. 2004).

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Rays and Skates Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Rising ocean temperatures, coupled with the species' seeming inability to move to new areas, could mean that all of its current habitat will be unsuitable in the near future as anthropogenic climate change progresses and continues to heat the ocean. See IUCN (Bathyraja griseocauda) 2012, Exhibit 100 at 5; "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Climate Change," infra. This factor alone could lead to the extinction of the species and weighs in favor of protecting them under the ESA.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

The main threat to this species is overutilization through fishing. In Argentina, skate landings have been increasing considerably due to international demand. IUCN (Bathyraja griseocauda) 2012, Exhibit 100 at 5. "Prior to 1994, skate captures were less than 1,000 t[ons annually], however, since that year skate landings [have] increased considerably, reaching" more than 17,000 tons in 2003. Id. (citing Massa et al. 2004). The Graytail is a regular bycatch in the bottom trawl fisheries for bony fish, and has been captured during fishery-independent investigatory trawls for other species. Id. (citing García de la Rosa et al. 2000). This species is also taken as bycatch in the artisanal Patagonian toothfish longline fishery, which operates at depths of 300 to 2,500 meters between 20ºS and 49ºS. Id. (citing Lamilla 2003). Catches have been so high that there was a 15-59% decline in the biomass of the Graytail Skate captured between 45º and 55ºS just from 1998 to 1999. Id. (citing García de la Rosa et al. 2000). The species is also taken in a directed skate fishery targeting *Dipturus chilensis* off Argentina's coast. Id.

Further south, this species is taken in the multispecies skate fishery operating around the Falkland Islands, which has been operating since 1989. Id. at 6. "The [Falklands] fishery initially operated over two main areas, one located on the shelf edge to the north of the islands, and the other to the south of the Islands." Id. "In 1993 (the first year where observer data is available), this species was the dominant species of skate caught by finfish and ray-licensed vessels, especially in a ray "hot spot" to the south of the Islands, where it comprised around 70% of the catch." Id. (citing Agnew et al. 2000). By 1993, however, the proportion of the southern Falklands catch made up of Graytail skate had fallen to around 5%. Id. "The proportion of this species in catches north of the islands also fell, and [the Graytail Skate] was replaced as the dominant species in the catch" by other skate species. Id. In the south, total catches of this species fell from around 1,500 tons to around 100 tons between 1993 and 1995, while total catches in the northern areas fell from over 1,000 tons to around 250 tons between 1993 and 1997. Id. The mean disc width of captured Graytails also decreased from 52.18 centimeters in 1993 to 38.08 centimeters in 1997 indicating a decrease in older individuals and also capture of many immature individuals. See id.

"Following these declines in the early 1990s, the southern fishing area[] was closed to the ray fleet in 1996," while "a recent assessment of the northern ray population indicated that the [catch per unit of effort] of this species" declined by more than half between 1992 and 2001. Id. at 3, 6 (citing Wakeford et al. 2004). "There have been no studies to determine the abundance of [this species] in the southern area since the [skate] fishery closure;" however, it continues to be caught as bycatch by finfish trawlers that operate around the Falklands and within the closure area. Id. at 6 (citing Brickle et al. 2003; Wakeford et al. 2004). Vessels operating in this finfish fishery are prohibited from targeting skates, but some bycatch is allowed. Id. This means that skates, including *Bathyraja griseocauda*, to the south of the islands face continuing fishing pressure despite the ban on directed fishing. Id.

In Chile, "[t]his species is also taken in the directed skate fishery[,] which primarily targets *Dipturus chilensis*[,] but also lands other skates species. Landings comprise 85% *D. chilensis* and 10% *D. trachydermus* with the remaining 5% made up of *Bathyraja albomaculata*, *B. brachyurops*, *B. griseocauda* and *Rajella sadowskii*." Id. (citing Lamilla et al. 2001, 2002). "Overall biomass of the target species (*D. chilensis* and *D. trachydermus*) has declined by 51% since fishing began in 1979 and declines are thus also likely to have occurred for bycatch species." Id. (citing Quiroz 2005).

"*Bathyraja griseocauda* is also taken as bycatch in the artisanal Patagonian toothfish longline fishery which operates at depths of 300 to 2,500 m between Iquique (20°S) to Ladrillero Gulf (49°S)." Id. (citing Lamilla 2003).

These various fishing pressures show that the Graytail Skate continues to be threatened by commercial overutilization. This overutilization has caused, and appears to be continuing to cause, falling numbers of the species thereby threatening its continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are a number of cacth quotas in place for this species. Id. at 7. While catch quotas are necessary to ensure that species that have not yet become "endangered" are not harvested in unsustainable numbers, they are inappropriate measures for species that have already become "endangered." By listing a species as "endangered," IUCN has determined that the species is facing threats to its existence that create a "very high risk of extinction in the wild." IUCN Undated, Exhibit 38 at 17-20. If a species is facing a "very high risk of extinction in the wild," then the catch quota for that species should be set at zero. These types of half-measures are inappropriate to halt species extinctions, and this is why the more restrictive prohibitions represented by ESA protection are desperately needed for this species.

Argentina. "There are theoretically TACs [total allowable catches], minimum sizes and overall annual quotas for quite a number of elasmobranch species in Argentina, however, little attention is paid to these and there is no regular monitoring by authorities." Id. at 7. This offers the Graytail Skate only nominal protection and is clearly inadequate. As long as effective protections are lacking, numbers will continue to decline.

Falkland/Malvinas Islands. "The Falkland/Malvinas Islands multispecies skate fishery is managed by limiting fishing effort. The effort that each vessel is likely to exert is calculated (based on size, duration of license and past fishing history) and since 1994 only a limited number of licenses are granted to ensure that the total allowable effort (determined from assessments of stock status) is not exceeded. Stock status assessments are not, however, species-specific and a sustainable total allowable effort for the entire stock may not translate to sustainable levels of effort for individual species." Id. (citing Agnew et al. 1999; Agnew et al. 2000).

"Following declines in [catch per unit effort (CPUE)][77] in the early 1990s, in 1996, the southern area (below 52°S) was closed to [skate] fishing and the fishery is now restricted to the area north of the Islands. This closure is extended to 50°30S (between 56°30W and 58°W) during the second season of each year to exclude the skate fishing fleet from *Loligo gahi* fishing grounds." Id. (citing Agnew et al. 1999; Agnew et al. 2000).

"All licensed vessels are required to provide daily catch and effort details, including discards of commercial and non-commercial species to the Falkland Island Fisheries Department. There is, however, no requirement to report species-specific information. Scientific observers are deployed onboard vessels in order to quantify the catch composition by species and to obtain detailed biological data on individual species." Id. (citing Agnew et al. 1999; Agnew et al. 2000).

"Vessels fishing under general finfish licenses are prohibited from targeting [skates], although a small bycatch (below 10%) is allowed." Id. (citing Agnew et al. 1999; Agnew et al. 2000).

The focus of regulation on effort and not on stock status assessments and total catch means that fishers will work to become more efficient so as to increase their total catch, making this regulation insufficient in the long-term. This also means that unsustainable numbers of certain species may be targeted if a higher yield can be attained within the fishers' limited allowable efforts. The closure of the southern skate fishery is a good start, but it is not enough. Graytail skates and other skate species are still caught as bycatch by fishers legally targeting other species in the closure area and beyond. Therefore, even within this limited closure area, skates are still subject to significant threats. Furthermore, the skate fishery in the north has been allowed to continue to target skates and remove Graytails. Reporting on species-specific information is weak, which hampers assessment of Graytail stocks, and bycatch of Graytails and other skates is still allowed. Essentially, as long as landing of Graytail Skates and extensive fishing of other

[77] CPUE is an indirect measure of the abundance of a target species. Changes in the catch per unit effort are inferred to signify changes to the target species' true abundance. A decreasing CPUE indicates overexploitation, while an unchanging CPUE indicates sustainable harvesting.

species in Graytail closure areas is allowed, fishing quotas are focused on effort as opposed to sustainability of removals, and species-specific reporting is absent, the Graytail will not be adequately protected by these regulatory mechanisms.

Chile. "In Chile, since 2005, there has been an annual quota for *Dipturus* spp. caught south of 41°28S. Each year, there is also a seasonal fishery closure for the entire Chilean coast between December 1 and February 28 to protect the reproductive season [of *Dipturus* spp.] It is unknown whether this measure also protects the reproductive season of this *B. griseocauda*." Id. There are therefore no species-specific measures in place to protect the Graytail Skate and it is unclear whether the protections in place for other skate species incidentally benefit Graytails. There is thus no evidence of any helpful protection for Graytails at all apart from a general 3-month fishery closure. This is inadequate in the face of continuing declines.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Late Maturation. The fact that the Graytail Skate takes 15 years to reach maturity, coupled with evidence of drastically decreasing average size and numbers, indicates that mature individuals are being removed at a rate faster than they are being replenished. See id. at 3, 4, 5, 6. This is the hallmark of an unsustainable practice, and, therefore, the species' late maturation represents another threat to its continued existence.

Anthropogenic Climate Change. This species has very low tolerance for changes in water temperature and water salinity levels. Id. at 5 (citing Figueroa et al. 1999). Also, "[u]nlike some other species [of skates], there is no evidence for large spatial or temporal movements . . ." Id. This lack of mobility, coupled with extreme sensitivity to temperature changes poses a potentially catastrophic problem as climate change progresses and continues to warm the oceans. Faced with rising ocean temperatures and an inability to escape to more appropriate areas, the Graytail Skate could face a very large mortality event, or even extinction, from this impact alone.

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of the Graytail Skate. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted).

The combination of threats to the Graytail Skate 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." Id. at 453 (internal citations omitted).

The Graytail Skate is already at risk as part of 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." Id. at 455 (internal citations omitted). Therefore, the synergistic effects of multiple threats to this rare species may conspire to speed the Graytail Skate's current move towards extinction.

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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<u>(48) Scientific Name:</u> <u>*Dasyatis margarita*</u>

Common Name: ray

IUCN Status: Endangered **CITES Status**: N/A

Range: This species of demersal ray is endemic to the eastern-central and southeast Atlantic along the West African coast from Senegal to Congo. IUCN (Dasyatis margarita) 2012, Exhibit 101 at 3-4. "Records from outside this range (from Angola to Mauritania and the [Canary Islands]) may be based on [*Dasyatis*] *margaritella*, which has been confused with this species. As a result, this distribution of [*Dasyatis*] *margarita* may prove to be smaller than described here." <u>Id.</u> at 4 (citing Compagno & Roberts).

Habitat and Ecology: This tropical ray species was formerly reported as common in marine and estuarine habitats, "but records may have included misidentified specimens of [*Dasyatis*] *margeritella*." <u>Id.</u> (citing Compagno & Roberts 1984). The life history and biology of this species are largely unknown, other than that *Dasyatis margarita* is ovoviviparous, having 1-3 pups per litter, and a reported maximum size of 100 centimeters disc width. <u>Id.</u> (citing Stehmann 1981).

Population Status: Accurate population information is unavailable at this time, though recent declines in catches by local fishermen suggest an overall decline. <u>See</u> <u>id.</u> at 3, 4.

Population Trend: Decreasing. <u>Id.</u> at 4.

Known Threats/Listing Criteria

All of the threats and information discussed in "Rays and Skates Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Though the main threat to this species is fishing pressure[78], habitat modification and degradation from agricultural chemicals and light industry development are also negatively impacting *Dasyatis margarita* in some areas of its range.[79] This decreases available habitat for the species and represents a threat to its continued existence.

[78] <u>See</u> "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," infra

[79] <u>Id.</u>

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

The main threat to *Dasyatis margarita* is fishing pressure within its limited range, as inshore rays are particularly susceptible to a wide range of fishing gear. Id. This species is specifically targeted and marketed for human consumption. See id. at 3. "Fishing for [*Dasyatis*] *margarita* occurs in inshore waters [throughout] its distribution[] along the West African coast . . . where it is caught mainly by artisanal and small scale commercial fisheries using trammelnets, bottom trawls, and beach seines, but also by gillnets, fish traps, beach seines, and line fishing." Id. at 4 (citing Stehmann 1981). Since these threats operate throughout its range and the species is susceptible to all the aforementioned types of gear, this commercial overutilization of the species represents a significant threat to its continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

No specific conservation measures are currently in place for this species. Id. Such a complete lack of protections is inappropriate for an endangered species with a declining population that is facing a variety of threats to its continued existence. The species should therefore be protected under the ESA to remedy this inadequacy.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

K-Selected/K-Strategy Species. *Dasyatis margarita* is also at increased risk of extinction because it is a K-selected species. It is large with low fecundity, thus making it difficult to replace lost members. Id. at 3, 4. This inability to replace lost individuals puts the species at higher risk of collapse from fishing pressures than an r-selected species that reproduces very quickly.[80]

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of *Dasyatis margarita*. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted).

The combination of threats to *Dasyatis margarita* 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." Id. at 453 (internal citations omitted).

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[80] See "Rays and Skates Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): K-Selected/K-Strategy Species," supra.

Dasyatis margarita 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." Id. at 455 (internal citations omitted). Therefore, the synergistic effects of multiple threats to this rare species may conspire to speed *Dasyatis margarita*'s current move towards extinction.

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(49) Scientific Name: *Electrolux addisoni*

Common Name: Ornate Sleeper Ray

IUCN Status: Critically Endangered **CITES Status**: N/A

Range: This species of ray is restricted to "sandy patches of very limited inshore reef habitat off the Eastern Cape and KwaZulu-Natal coasts of South Africa," and is known only from five localities. IUCN (Electrolux addisoni) 2012, Exhibit 102 at 4 (citing Compagno & Heemstra 2007). These five localities are from dive sites off south-central KwaZulu-Natal and include (1) Coffee Bay, Eastern Cape; (2) Manaba Beach, the type locality near Margate, S. Africa; (3) Protea Banks, near Margate; (4) Aliwal Shoal; and (5) Tee Barge north of Durban off Virginia Beach (an artificial reef habitat). Id. The few sightings at each of these sites all occurred at a depth of 50 meters or less. Id. "Manaba Beach is the only place that [this species] has been seen" on more than one occasion. Id. Though the above localities stretch over 310 km of coastline, best estimates suggest that the actual range of this ray may be less than 10 km^2 and may even be much smaller. Id. "Although [*Electrolux addisoni*] may be more wide-ranging than presently known, offshore and inshore areas on the east coast of South Africa have been relatively well-sampled and this species" is thus likely a rarity. Id.

Habitat and Ecology: "The Ornate Sleeper Ray occurs in warm-temperate or subtropical waters along a very narrow continental shelf." Id. at 5. "The few sightings of this species were all at less than 50 meters depth." Id. This species is "[f]ound in subtidal environments in sandy and gravely patches on rocky reefs." Id. The Ornate Sleeper Ray is the largest known member of the family Narkidae, "with adult males measuring 50-52 [centimeters] total length, and is extremely conspicuous because of its spectacular coloration (which is hard to miss on light sandy patches), diurnal foraging activity and boldness when confronted by divers." Id. (citing Compagno & Heemstra 2007). Little is known of the biology of this species; juveniles have yet to be seen, with the only specimens collected to date being adult males. Id.

The Ornate Sleeper Ray "feeds on the substrate and vigorously thrusts its mouth into loose sand or gravel while walking actively on its spread pelvic fins." Id. Like other South African narkids, this species feeds on "infauna or meiofauna," living in the substratum. Id. at 5-6. When not feeding, it generally lies motionless on the substrate, but when approached will arch its back, curl its disk, and raise its tail in a display most likely meant to scare off predators. Id. at 5. The bold color pattern on its disk and the threat display most likely act as a defense against sharks that feed during the day, and indicates that the ray is well-armed with electric organs and should be avoided. Id. at 6.

"On the shallow, well-lit reefs where the Ornate Sleeper Ray has been found, its main potential predators would be large [] sharks." Id. Deepwater electric rays are known to successfully defend themselves from large sharks, and it is highly probable that for the inshore *Electrolux addisoni*, aposematic coloration and a threat display would likewise prevent shark attack if the visual warnings were reinforced by a shock. Id.

Population Status: This species is apparently very rare, though there is no trend data available for this species because there are so few confirmed records, and those few records have been made over a period stretching from 1984 to present. Id. at 4. This species is known only by a handful of sightings and photographic records made by recreational SCUBA divers, ichthyologists, and professional underwater photographers, as well as from two type specimens procured by spearfishing divers. Id. (citing Compagno & Heemstra 2007). As stated above, this ray has only been recorded at five distinct locations off the east coast of South Africa and only two specimens have ever been captured. Id.

Population Trend: Unknown. Id. at 5.

Known Threats/Listing Criteria

All of the threats and information discussed in "Rays and Skates Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

It is very possible that the species is threatened by pollution and habitat degradation in its very limited range. Id. at 6. This is because, "[i]t occurs on a heavily utilized and narrow strip of habitat with heavy and increasing human utilization including extensive and intensive recreational diving and sport and commercial fishing along with runaway coastal housing development, boating, commercial shipping, holiday-making, beach utilization, shark netting, and extensive pollution and habitat degradation of inshore environments." Id. These activities could likely render some, or its entire, habitat unsuitable in the near future, potentially eliminating this species entirely. This pollution and habitat degradation thus represents a very serious threat to the species' continued existence.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

While few specimens have been captured, even these limited removals represent a threat to a species that is so rare. See id. at 5. Furthermore, these captures have been the result of fatal removal by spearfishing. Id. Since these removals have been for scientific purposes, and this type of removal is damaging to the species' continued existence, *Electrolux addisoni* is threatened by overutilization for scientific purposes.

Also, since it is limited to such a small range, the ray could be at risk from harassment and disturbance by divers who want to see the rare creature. Id. at 6. This area is subject to "extensive and intensive recreational diving and sport and commercial fishing," thus increasing the likelihood that harassment is occurring or will occur. Id.

Electrolux addisoni is thus also threatened by overutilization for recreational and commercial purposes.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are currently no known conservation measures in place for this species. Id. This complete lack of protections for such a rare species is inappropriate and ESA protection should be extended to *Electrolux addisoni* to remedy this inadequacy.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Since the species occurs in a likely area of 10 km^2 or less, it is very vulnerable to localized stochastic events. See id. at 3, 4. This limited range means that the entire population could be wiped out in one catastrophic event or a series of smaller events. Such susceptibility to complete extinction throughout its range makes this species very vulnerable.

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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For More Information, See:

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Wallace, J.H. 1967. The batoid fishes of the east coast of southern Africa. Part III: Skates and electric rays. Oceanographc Research Institute Investatory Report No. 17.

(50) Scientific Name: *Okamejei pita*

Common Name: Pita Skate

IUCN Status: Critically Endangered **CITES Status**: N/A

Range: This species of skate is endemic to the western Indian Ocean. IUCN (Okamejei pita) 2012, Exhibit 103 at 4. "The only known confirmed specimen was recorded from the northernmost corner of the Persian/Arabian Gulf at Fao, Iraq," and it is thought that its "distribution is probably limited to mud bottoms along the Iraqi and part of the Iranian coast of the Gulf, possibly including Kuwaiti waters." Id. (citing Fricke & Al-Hassan 1995).

Habitat and Ecology: "The Pita Skate is known only from one female specimen (46 [centimeters] total length), collected in March 1992 by a trawler over a mud bottom, in water not deeper than 15 m[eters]." Id. (citing Fricke & Al-Hassan 1995). "The specimen did not contain any egg cases," though, "[l]ike other skates, this species is presumably oviparous." Id. at 4-5 (citing Dulvy & Reynolds 1997). No other information is available on this species' biology. Id. at 5.

Population Status: Although species-specific surveys have not been performed . . . there was certainly survey/fisheries work done in Iraqi waters prior to conflict in the 1980s." Id. at 4. Going back as far as 1944, there have been no records of this species save for the March 1992 specimen. Id. (citing Blegvad 1944). "Military conflict and tensions [in the region] since the 1980s has made further scientific collection within this species' known range extremely difficult and no specific information is available on population size, status, or trends. However, based on the available evidence of only one confirmed specimen, it is likely that this species is, at the least, uncommon." Id.

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Rays and Skates Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

The area of Pita Skate occurrence is subject to a variety of anthropogenic effects that negatively impact its habitat. Id. at 5. These threats include "habitat loss, degradation and deteriorating water quality, destructive fishing practices, hydrocarbon pollution, and radiological, chemical or biotic contamination." Id. (citing Al-Saadi & Arndt 1973; Hussain et al. 2001; Hussain et al. 1999; Douabul 1984; Abaychi & Al-Saad 1988; Al-Saad 1990; Al-Saad 1995; Al-Saad et al. 1995; Al-Saad et al. 1996; Al-Saad & Altimari

1993; DouAbul et al. 1987; Carroll 2005; Birdlife International 2006). Additionally, "[e]xtensive damming of the Tigris-Euphrates river system in Turkey and the drainage of the Iraqi marshes during the 1990s" and "[r]apid coastal development of previously pristine and uninhabited areas, such as Bubiyan Island in Kuwait, may also have [had negative] impacts" on the Pita Skate. Id. This development is complicated by the fact that, "[i]n the case of habitat destruction resulting from coastal development, the severity of impacts is high with low reversibility." Zamora-Arroyo et al. 2005, Exhibit 66 at 58. These various threats to the Pita Skate's limited habitat represent a significant threat to its continued existence.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

The main threat to this species is thought to be overfishing. IUCN (Okamejei pita) 2012, Exhibit 103 at 5. Levels of fishing-related mortality are unknown, but "overfishing and illegal fishing occurs in this region." Id. The main fishing methods used in the area in which the specimen was captured are "longline, driftnet, baited mesh cage trap, intertidal skate-net trap, and trawl. Id. (citing Jawad 2006). "For religious reasons[,] local Shia Muslims in southern Iraq do not consume elasmobranch fishes, and hence this species is likely discarded if captured." Id. However, discards of dead or dying individuals would still deplete the population.

"Fishing pressure is increasing within the area where this species was collected. Since 2003, Iraqi fisheries have been expanding southwards, particularly along the east coast of Bubiyan and Warba Islands[,] and are also apparently operating illegally in Kuwaiti" and Iranian waters. Id. (citing Morgan 2006). "These expanding trawl and gillnet fisheries are totally unregulated. As a result of this expansion, it is believed that both fishing effort and landings of marine fish" by the Iraqi fishery have increased significantly in the past seven to eight years. Id. Given this species' restricted range and already low population, it is highly likely that it is especially vulnerable to fishing pressure within its range. Id. Therefore, the species is likely threatened by overutilization for commercial purposes within its range as a result of bycatch in the expanding, unregulated fisheries there.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are no known conservation measures currently in place for this species. Id. Such a complete lack of protections for such a rare species is clearly inadequate and *Okamejei pita* should thus be provided protection under the ESA.

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(51) Scientific Name: *Pastinachus solocirostris*

Common Name: Roughnose Stingray

IUCN Status: Endangered **CITES Status**: N/A

Range: This species is endemic to the western-central Pacific and is known only from Malaysian Borneo and Indonesia. IUCN (Pastinachus solocirostris) 2012, Exhibit 104 at 4 (citing Last et al. 2005; White et al. 2006).

Habitat and Ecology: "This stingray occurs primarily in mangrove estuaries and turbid coastal marine habitats." Id. (citing Last et al. 2005). It most commonly occurs in very shallow water at less than 10 meters depth, but has been recorded as deep as 30 meters. Id. The only pregnant female observed contained only one pup, suggesting low fecundity. Id. Size at birth is approximately 22-23 centimeters disc width, but it attains a maximum size at maturity of at least 72 centimeters disc width. Id.

Population Status: The population size and status of this species is unknown. Id.

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Rays and Skates Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

"Habitat destruction and [chemical pollution] through aquaculture (specifically conversion of mangrove habitat into shrimp farms), mining and coastal development" are all major threats to this species. Id. "This species is known to be associated with mangrove habitat in very shallow water and is therefore considered highly vulnerable to destruction of this habitat. Extensive areas of mangrove forest have been lost in Indonesia and Malaysia through conversion of land for shrimp farms (Malaysia, East Java, Sulawesi and Sumatra), excessive logging, urban development (Malaysia), and, to a lesser extent, conversion of land to agriculture or salt pans (Java and Sulawesi)." Id. (citing FAO 2007). For example, "Indonesia lost about 1,300,000 hectares of mangroves from 1980-2005" and "Malaysia lost 110,000 hectares during the same period." Id. at 4-5 (citing FAO 2007). This represents a loss of more than 30% "of combined overall mangrove area in Indonesia and Malaysia" in just 25 years. Id. at 5. Such impacts are especially distressing given that, "[i]n the case of habitat destruction resulting from coastal development, the severity of impacts is high with low reversibility." Zamora-Arroyo et al. 2005, Exhibit 66 at 58. In addition to mangrove destruction, "extensive habitat degradation through destructive fishing practices and pollution has also negatively impacted this species' shallow water habitat." IUCN (Pastinachus solocirostris) 2012, Exhibit 104 at 45. These facts make it clear that the Roughnose Stingray is facing extensive threats to its habitat that are placing it at increased risk of extinction.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

The other major threat to this species is overfishing by local fisheries. Id. at 4. "Its restricted range and habitat have been heavily exploited during recent decades. This species is targeted, along with other rays, using bottom longlines in Indonesia." Id. at 3. "It is also caught occasionally by bottom trawl and demersal gillnet fisheries operating off Sumatra and Borneo." Id. at 4 (citing White et al. 2006). "All catches are retained and [utilized] for meat and probably also its skin." Id. (citing White et al. 2006). "The level of exploitation on its shallow water habitat is very high and it is considered to be at a very high level of threat throughout its range." Id. This shows that overutilization for commercial purposes is pervasive throughout the species' range, threatening its continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are no conservation measures currently in place for this species. Id. at 5. Such a complete lack of protection for a species facing these major threats is inappropriate and the species should be extended protection under the ESA to remedy this inadequacy.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Low Fecundity. This appears to be a low fecundity species. Id. at 4. The only recorded pregnant female had a mere one pup. Id. Such a small litter size makes it harder for a species to recover when individuals are removed from its population. Therefore, the Roughnose Stingray's likely low fecundity also makes it vulnerable to extinction.

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of the Roughnose Stingray. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted).

The combination of threats to the Roughnose Stingray 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." Id. at 453 (internal citations omitted).

the Roughnose Stingray is already at risk as a likely low-fecundity 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." Id. at 455 (internal citations omitted). Therefore, the synergistic effects of multiple threats to this species may conspire to speed the Roughnose Stingray's current move towards extinction.

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(52) Scientific Name: *Raja undulata*

Common Name: Undulate Ray

IUCN Status: Endangered **CITES Status**: N/A

Range: "This species has a patchy distribution in the eastern Atlantic, including the Mediterranean Sea, with discrete areas where it may be locally common," including southwest Ireland, the eastern English Channel, and southern Portugal." IUCN (Raja undulata) 2012, Exhibit 105 at 4. In the northeast and eastern central Atlantic, this species "occurs from southern Ireland and southwestern England to the Gulf of Guinea, including the Canary Islands." Id. (citing Coelho & Erzini 2006). In the Mediterranean Sea, the Undulate Ray occurs mostly in the west, especially in the "Ria Formosa coastal lagoon on the south coast of Portugal, an important nursery ground for many bony fishes." Id. (citing Coelho et al. 2002; Erzini et al. 2002). "Several smaller specimens of this species have been reported in this coastal lagoon[, suggesting] that this species also uses these sheltered areas as nursery grounds." Id. (citing Coelho et al. 2002).

Habitat and Ecology: "This skate occurs in shelf waters to about 200 m[eters] depth, on sandy and muddy substrates and appears to be more common in shallow waters." Id. at 5 (citing Stehmann & Bürkel 1984; Coelho & Erzini 2006). "Smaller specimens have been reported in coastal lagoons (specifically in the Ria Formosa coastal lagoon on the South coast of Portugal), which suggests that this species may use these sheltered habitats as nursery areas." Id. (citing Coelho et al. 2002). Estimated maximum size is 110 centimeters total length. Id.

"Like other skates, reproduction is oviparous." Id. Significant regional differences have been observed in size at first maturity ranging from 76.2 centimeters total length for females in the southern region to 83.8 centimeters total length for females in the western region and 73.6 centimeters total length for males in the southern region to 78.1 centimeters total length for males in the western region. Id. (citations omitted). Differences in reproductive habits have also been observed in different populations. Id. For example, an annual reproductive cycle has been observed in females, but differences occur between the different populations, whereby in southern Portugal this species breeds in winter, in western Portugal it breeds during both winter and spring. Id. (citing Coelho & Erzini 2006; Moura et al. 2007). "These [regional] differences [in reproduction] seem to be related to water temperature, with reproduction restricted to periods of colder water." Id. Females are 8.98 years of age on average at first maturity whereas males are 7.66 years old. Id.

Population Status: "Determining accurate stock trends in surveys is problematic [for this species] due to [its] patchy distribution." Id. at 4. "There appears to be a discrete population of *Raja undulata* in Tralee Bay," Ireland. Id. (citing ICES 2007). "Angling records from Tralee Bay [] indicate a peak in records of Undulate Ray in 1981-1982, with lower (but stable) catches since then." Id. (citing ICES 2007). "Undulate Ray have traditionally been observed in English beam trawl surveys in the eastern English Channel, but have been absent for the most recent [available] two years." Id. (citing ICES 2008). "This species is also common off southern Portugal, where it forms a separate population to that on the Portuguese west coast." Id. (citing Coelho & Erzini 2006; Moura et al. 2007). This species is uncommon in the Bay of Biscay and also in the Mediterranean, with only occasional records. Id. at 4-5 (citing Bertozzi et al. 2003; Baino et al. 2001).

Population Trend: Decreasing. Id. at 5.

Known Threats/Listing Criteria

All of the threats and information discussed in "Rays and Skates Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

The main threat to this species is commercial overutilization from fishing. See id. at 5-6. The Undulate Ray is a common bycatch of "trawl, trammel nets, and other demersal fisheries operating within its range. [It] has a patchy distribution and declines have been documented in areas where it was formerly considered locally abundant. Catch records are available from two charter-angling vessels in Tralee Bay (southwestern Ireland), where this species forms a discr[ete] population. These data show that catches of this species declined from a high of 80-100 [individuals annually] in 1981 to 20-30 [annually] in the mid 1990s (a decline of 60-70%)." Id. at 5. Though there was a slight population increase in the early 2000s, "catches now appear to be declining again, with less than 20 [individuals] recorded in 2005." Id. (citing ICES 2007). "*R. undulata* has traditionally been observed in English beam trawl surveys in the eastern English Channel, but has been absent for the most recent two years. ICES advice (2008) is now for no target fishing in the North Sea, English Channel and Celtic Seas." Id. at 5-6 (citing ICES 2008).

"*Raja undulata* is captured in large quantities as bycatch in the mixed species trammel net fishery that operates off the southern coast of Portugal." Id. at 6 (citing Coelho et al. 2002). "This species is retained and marketed for human consumption." Id. "Portuguese official fisheries statistics for landings of *Raja* spp. in the [southern region] have decreased 29.1% between 1988 and 2004." Id. (citing DGPA 1988-2004). This decrease has also been expressed as a decrease in catch per unit effort (CPUE)[81] from 1.91 specimens/1000 meters of net at 10-30 m depth to 0.03 specimens/1,000 meters of net at more than 90 m depth. Id. (citing Coelho et al. 2005). "*Raja undulata* is the most common skate species in this area and its size makes it more vulnerable to depletion than smaller skate species," suggesting that these declines may "under-reflect" decreases in the population of this species in Portuguese waters. Id. (citing Erzini et al. 2001; Coelho

[81] CPUE is an indirect measure of the abundance of a target species, which is in this instance calculated as rays caught per 1000 meters of fishing net. Changes in the catch per unit effort are inferred to signify changes to the target species' true abundance. A decreasing CPUE indicates overexploitation, while an unchanging CPUE indicates sustainable harvesting.

et al. 2005). This species is also a known bycatch of the Spanish demersal trawl fleet operating in the southern Bay of Biscay. Id. "Species-specific French landings data for the Celtic Seas report 12 t[ons] of *R. undulata* in 1995, 6 [tons] in 1996, 10 [tons] in 1997, after which landings fell to 2 t[ons] in 1998, 1 t[on] in 1999, to 0 t[ons] in 2000-2001." Id. (citing ICES 2007).

"This species' preference for shallow waters places it within the range of intensive artisanal coastal fisheries operating along the western coast of Africa." Id. (citing Walker et al. 2005). "Although no specific details are currently available on catches, this species is presumably a [utilized] bycatch of these, and demersal trawl[,] fisheries operating in this area." Id. "Exploitation of the continental shelf is also high in the Mediterranean Sea." Id. (citing Massuti & Moranta 2003). These fishing pressures clearly represent an ongoing threat to the species' continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are no species-specific conservation measures in place at this time. Id. Such a complete lack of protections is inappropriate for a species facing these threats and population declines. ESA protection should be extended to *Raja undulata* to remedy this inadequacy.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

K-Selected/K-Strategy Species. "Like many other larger skates, this species possesses life history characteristics that may increase [its] vulnerability to exploitation, reduce [its] rate of recovery and increase the risk of extinction: including delayed age at maturity, long generation time (14-15 years), low fecundity, and consequently slow population growth." Id. (citing Dulvy et al. 2000). These factors exacerbate the threats that *Raja undulata* is already facing by making its replacement of lost individuals more difficult, and thus make its extinction more likely.

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of *Raja undulata*. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted).

The combination of threats to *Raja undulata* 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." Id. at 453 (internal citations omitted).

Raja undulata is already at risk as a large, low-fecundity or K-selected species that experiences long generation time, delayed maturity, and slow population growth, 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." Id. at 455 (internal citations omitted). Therefore, the synergistic effects of multiple threats to this reduced population may conspire to speed *Raja undulata*'s current move towards extinction.

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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<u>(53) Scientific Name:</u> *<u>Rhinobatos cemiculus</u>*

Common Name: Blackchin Guitarfish

IUCN Status: Endangered **CITES Status**: N/A

Range: The Blackchin Guitarfish's range extends between 42ºN to 17ºS, and 19ºW to 36ºE, which goes from the northern coast of Portugal, down the West African coast and also includes the Mediterranean Sea. IUCN (Rhinobatos cemiculus) 2012, Exhibit 106 at 4. Its Atlantic range runs from northern Portugal south to Angola, and it is found throughout coastal Mediterranean waters, though it appears to be more prevalent in the southern and eastern regions. <u>Id.</u> (citing Capapé 1989).

Habitat and Ecology: "The Blackchin Guitarfish inhabits marine and brackish waters in subtropical areas. It is a demersal species, living over sandy or muddy substrates, with a depths range that spans from shallow waters to approximately 100 m[eters]. This fish tends to swim slowly over the bottom or partially buries itself under the substrate." <u>Id.</u> at 5. Maximum size varies, but total length can be as much as 192 centimeters for males and 230 centimeters for females. <u>Id.</u> "Analysis of [the Blackchin Guitarfish's] gut contents indicate[s] that the Blackchin's diet is composed [] primarily of prawn (two thirds), crab, and other crustacean[s] and fish." <u>Id.</u>

Population Status: This species was at one time regarded as common within the southern Mediterranean, particularly in the Gulf of Gabes on the east coast of Tunisia. <u>Id.</u> at 4 (citing Quignard & Capapé 1971). Preliminary surveys indicate that populations have since diminished substantially. <u>Id.</u> (citing Fowler et al. 2005). Several trawl surveys from the mid-70's through the early 80's in the species' African range found either few or no specimens. <u>Id.</u> (citing Litinov 1993).

Population Trend: Decreasing. <u>Id.</u> at 5.

Known Threats/Listing Criteria

All of the threats and information discussed in "Rays and Skates Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"In western Africa, the fins of the Blackchin Guitarfish are highly prized (they can fetch an estimated 100 Euro/[kilogram]), and as a result it is a major target species of artisanal fisheries operating along all coasts in the region. A reduction in the size of individuals and a strong decline in this species has been observed throughout it range in West Africa," and "[t]he tendency for reproductively active individuals of this species to aggregate around the coastline renders it especially vulnerable to targeted fisheries." <u>Id.</u>

at 6. This species is also caught as bycatch by the shrimp trawl fishery operating in shallow inshore waters. Id. This commercial exploitation has caused large decreases in catch and probable complete extirpations in some areas. In Senegal, for example, landings have decreased from 4,050 tons per year in 1998 to a mere 821 tons per year in 2005. Id. "Considering the lack of reporting in artisanal fish[eries in West Africa] and the number of foreign vessels fishing legally and illegally within this region," the actual fishing pressure on this species is likely to be higher still. Id. In the Balearic Islands it used to be considered a "typical resident," but now it has become extinct locally. Id. at 5. They also appear to be locally extirpated from the Alboran to the Aegean Sea. Id.

"In Guinea-Bissau, it is one of the main targets of specialized fishing teams." Id. at 6. There have been significant reductions in both the number of Blackchin Guitarfish caught and their size since this fishery began operating, though it has been closed in some areas. Id. at 6-7. Outside the closure areas, the reduction in size has continued. Id. at 7. This is an indication of catches of younger specimens. See id. Inside the closure area, the Blackchin Guitarfish is still caught as bycatch of teleost gillnet fisheries. Id. In Guinea-Conakry the season is now year-round for this species, with a large increase in catches occurring during the species' birthing and mating season. Id. Fishers land significant gravid [(pregnant)] females who are specifically targeted for the large size of their fins. Id. Finning of embryos has also been reported. Id. In Sierra Leone "*Rhinobatos cemiculus* is the most dominant batoid landed within artisanal fisheries," and "shark and ray[] bycatch landings make up an estimated 0.8 to 1.0% of the total reported catch." Id. (citing Seisay 2005). "It is likely that the actual number of sharks landed as bycatch by industrial fisheries is far greater, as this represents only the reported landings of legal fisheries. Although this data is not species specific, it gives an indication of the quantity of sharks landed in this country. Similar fisheries operate throughout the rest of the region. It is also caught as bycatch [in] industrial demersal trawl fisheries targeting cephalops and crustaceans and coastal teleosts." Id.

This data indicates that fishing pressure, both directed and incidental, is extreme on this species. This pressure has already led to declines in population, declines in size, and local extirpations in certain areas of exploitation. This fishing is done in an unsustainable and reckless manner. For example, fishing continues during mating and spawning times, specifically targets pregnant females for their fins, and kills embryos for their fins as well. Such operations appear to be widespread throughout the Blackchin Guitarfish's range and represent a significant threat of extinction to the species. Therefore, the Blackchin Guitarfish is subject to overutilization for commercial purposes.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

While the pressures facing the species are clear, the protections in place thus far are insufficient or, in some areas, non-existent.

Mediterranean. "The Mediterranean Action Plan for the conservation of chondrichthyan fishes [recognizes] the urgent need to assess the status of *Rhinobatos* species, as a species that may be at high risk of threat in the region." Id. at 8 (citing Anonymous 2003). However there are no active conservation measures in place.

West Africa.

Mauritania. "This species is protected as part of a ban on directly targeted elasmobranch fishing in the Banc d'Arguin, Mauritania, which was implemented in December 2003. In this national park, management measures specific to this species were also introduced. The fishery was closed from February to September, to avoid the parturition period [(period of giving birth)] and therefore the capture of pregnant females. After negotiations with local fishermen, gear restrictions were introduced (to stop fishing with bottom gillnets of 1 to 2 m[eters] height and 11 to 16 [centimeters] (one side) square mesh). Increased abundance ha[s] been observed in and around the bank, suggesting the protection was effective." Id. This protection is helpful, but only has effects inside the park. Outside of the park, unsustainable directed fishing practices continue to harm the species.[82] Furthermore, the species is also still caught as bycatch within the closure area. Finally, the level of enforcement in the MPA is unclear, and this will obviously affect the efficacy of any protections therein.[83]

Sierra Leone. "There are no species specific regulations for the management of shark and shark fisheries in the Sierra Leone. However, a licensing system for artisanal fishing canoes, both foreign and Sierra Leone owned is payable to the Ministry of Fisheries and Marine Resources and the Local Government Administration" IUCN (Rhinobatos cemiculus) 2012, Exhibit 106 at 8 (citing Seisay 2005). "A National Action Plan for the conservation and management of sharks is being proposed. Some of the recommended management measures include: area and seasonal closure to shark fisheries, effort limitation of the shark fishery and discarding of immature and/or juvenile shark and ray species." Id. So far there appear to be no direct protections for the species or limitations on catches; only rudimentary fishing license programs and a proposal for a general shark-fishing plan.

Guinea-Bissau. "There are marine protected areas inside the Bijagos archipelago (the Formosa Islands UROK marine reserve), the PNO marine reserve (Orango Islands) and the PNMJVO marine reserve (Joao Vieira and Poilao Islands). Within these areas, trawling and the use of nets is forbidden, the only gear type allowed is fishing with longlines. Furthermore, fishing is only allowed for subsistence purposes, commercial fishing is not permitted." Id. (citing Bucal 2006). Outside of these areas the species is still targeted without controls.[84] Protection within several MPAs, while a good step, is not enough for a species that remains threatened by fishing on a majority of its range. Furthermore, even within the MPAs, some fishing is still allowed. This means that the

[82] See "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra.
[83] See "A. Corals: Corals Introduction: The Inadequacy of Existing Regulatory Mechanisms (Criterion D): Marine Protected Areas ("MPAs")," supra.
[84] See "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra (discussing unsustainable practices).

Blackchin Guitarfish is likely still caught as bycatch. Finally, the level of enforcement in the MPA is unclear, and this will obviously affect the efficacy of any protections therein.[85]

In sum, the protections in place for the species are inadequate throughout its range. The threats to the species qualify it as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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[85] See "A. Corals: Corals Introduction: The Inadequacy of Existing Regulatory Mechanisms (Criterion D): Marine Protected Areas ("MPAs")," supra.

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(54) Scientific Name: *Rhinobatos horkelii*

Common Name: Brazilian Guitarfish

IUCN Status: Critically Endangered **CITES Status**: N/A

Range: This species is distributed along the Brazilian Coast and further south to Mar del Plata, Argentina. IUCN (Rhinobatos horkelii) 2012, Exhibit 107 at 4 (citing Bigelow & Schroeder 1953). Fishery statistics for this species show that most commercial catches occur in southern Brazil between the latitudes 28 to 34ºS, evidence that the species has its main distribution in southern Brazil and is scarce elsewhere. Id. (citing Vooren et al. 2005).

Habitat and Ecology: "This is a coastal species." Id. "In southern Brazil the adults migrate to coastal waters with depths of less than 20 m[eters] from November to March. At that time artisanal fisheries operate from the beaches, and the guitarfish catches are 98% pregnant females. Adult males reach the beach fishing grounds at the end of February. [Birth] and mating then take place in March. Soon after, the males and females return to deeper waters and disperse to depths of 40 to 150 m[eters] over the continental shelf. Newborn pups and juveniles remain in shallow waters throughout the year." Id. "Litter size is 4 to 12 pups," with the number of pups increasing with the size of the mother. Id. at 5. Pregnancy in this species occurs in two stages, the dormancy period and the period of embryonic development. Id. The first phase occurs from April to November while the females are in deeper, colder water. Id. "Ovulation occurs in April when the fertilized eggs are enclosed within a common shell (candle)" and "remain dormant in the uterus with no embryonic development" taking place. Id. The next phase of pregnancy requires higher summer temperatures in shallow waters and does not start until females return to shallow water in November. Id. "Embryonic development starts when the common embryonic shell breaks up in December and ends with birth in February." Id. "Embryos are found only from December to late February. Their size increases from 1 [centimeter total length] in December to 29 [centimeters total length] in February, when birth takes place." Id. "Full maturity is reached at nine years for females and six years for males," and females go on to live longer lives. Id.

Population Status and Trend: Decreasing. Id. at 4.

Known Threats/Listing Criteria

All of the threats and information discussed in "Rays and Skates Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

This species "was formerly abundant in southern Brazil, where in the 1980s it was the only economically important species of batoid caught in the area." Id. at 5. In southern Brazil, this species is fished by otter trawl, pair trawl, shrimp trawl, beach seine, and gillnet. Id. (citing Klippel et al. 2005). "Statistics on the annual catch and effort of the [southern Brazilian fisheries show that t]otal landings for this species increased from 842 t[ons] in 1975 to 1,804 t[ons] in 1984 and then declined continuously to 157 t[ons] in 2001. The average trawl [catch per unit effort (CPUE)][86] of [this species] in southern Brazil over the years 1993 to 1999 was 17% of that observed during the period 1975 to 1986, indicating a decline in abundance of [more than] 80% since 1986 in southern Brazil." Id. (citing Miranda & Vooren 2003; Vooren et al. 2005). Catches increased slightly after 2000, when trawl fleets from southern Brazil "exploited a refuge area" for a part of this species' population. Id. (citing Martins & Schwingel 2003; Vooren et al. 2005). "Following this, CPUE fell again by 31% from 2002 to 2003 and the overall population is still considered to be at critically low levels." Id. (citing Vooren et al. 2005). "Monitoring of beach seine catches and reports from fishers in 2004 confirmed that [this species] is now scarce in coastal waters, and in a trawl survey in February 2004 . . . only 23 individuals were caught, 17 of which were juveniles." Id. (citing Vooren et al. 2005). "Across the rest of this species' range, where it is scarce, inshore fishing pressure is generally high." Id. (citing Tamini et al. 2006).

Unsustainable fishing pressure has clearly greatly decreased the abundance of this species; so much so that fishers began targeting a refuge area to increase catches. Now CPUE has plummeted and the population is at critically low levels. Catches now are mostly juveniles with likely only smaller mature individuals being caught. Smaller mature individuals indicate a problematic trend since the number of pups is correlated with the size of the female. Id. Smaller, younger females therefore mean fewer pups per reproductive cycle per mature Brazilian Guitarfish. To make matters worse, Brazilian Guitarfish birthing aggregations are specifically targeted by artisanal fishers who catch 98% pregnant females during this time. Id. at 4. Targeting of these aggregations ensures that even the few pups that would be born to these small, barely mature females will not be able to help increase the population. Clearly this species is subject to commercial overutilization.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

Permits for directed fishing are no longer issued and bycatch must be thrown overboard, but these laws are still not effectively enforced. Id. at 6. Furthermore, throwing bycatch overboard is often ineffective as bycaught animals are often dead by the time they are brought to the surface. Therefore, even if adequately enforced, this regulation would often be ineffective at avoiding Brazilian Guitarfish mortalities.

[86] CPUE is an indirect measure of the abundance of a target species. Changes in the catch per unit effort are inferred to signify changes to the target species' true abundance. A decreasing CPUE indicates overexploitation, while an unchanging CPUE indicates sustainable harvesting.

There is also a prohibition on trawl fishing within three nautical miles from the coast of southern Brazil. Id. This prohibition is apparently being enforced satisfactorily, but represents protection from only one of the fishing threats targeting this species. See id. This is evidenced by the fact that "the species is still caught as bycatch in the legally permitted coastal gillnet fisheries and offshore trawl and gillnet fisheries." Id. Therefore, these measures, while beneficial, are not sufficient for a species facing this level of endangerment. ESA protections should be afforded to the species to stop its slide towards extinction. "Without protection against all fishing activities, this guitarfish may well become extinct in about ten years and measures are urgently required to protect it, particularly in areas of critical habitat." Id. at 4.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

The fact that females do not reach maturity until 9 years of age and that, even then, the number of pups born to each female is correlated to size, and therefore age, means that it takes a very long time for this species to begin reproducing at all, and even longer to begin doing so at a significant rate. See id. at 5. This is complicated by the fact that each female only produces 4-12 pups. Id. at 4, 5. Many of these pregnant females, however, actually end up giving birth to no pups at all. This is because the species appears at predictable annual mating and birthing aggregations that make them easy to target during these critical life history stages. Id. at 4. At these aggregations, the catch is 98% pregnant females, meaning that a huge proportion of the few females capable of birth are removed from the population annually. Id. Such life history factors further endanger the species' continued survival.

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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<u>(55) Scientific Name:</u> <u>*Rhinobatos rhinobatos*</u>

Common Name: Common Guitarfish / Violinfish

IUCN Status: Endangered **CITES Status**: N/A

Range: The Common Guitarfish's distribution extends from the southern Bay of Biscay southwards to Angola, including within the Mediterranean where it prefers the warmer waters of the southern and eastern regions. IUCN (Rhinobatos rhinobatos) 2012, Exhibit 108 at 4 (citing Fredj & Maurin 1987; Capapé 1989; Whitehead et al. 1984).

Habitat and Ecology: "The Common Guitarfish is a bottom dwelling species with an aplacental viviparous mode of reproduction (the maternal adult gives birth to live young which do not have a yolk sac placenta). It can be found over sandy, muddy, shell and occasionally micro-algal covered substrates." <u>Id.</u> at 5 (citing De Buen 1935; Whitehead et al. 1984). "It inhabits shallow waters in the intertidal zone" to depths of 180 meters. <u>Id.</u> The Common Guitarfish "tends to swim slowly along the sea bottom or partially buries itself under the substrate, feeding upon benthic invertebrates and fish." <u>Id.</u> (citing Patokina & Livinov 2005). "The age at maturity is not known for either sex, nor [is] the longevity of the species" <u>Id.</u> The females have between one and two litters per year, with a gestation period of four months, and between four and six pups per litter. <u>Id.</u>

Population Status: Unfortunately, the Common Guitarfish is becoming uncommon. "Due to widespread and unregulated fishing throughout [its] range[, this species'] population is expected to be declining. Little is known of the population sizes of [this species]. However, there has been a marked decline in the abundance of this guitarfish in the Northern regions of the Mediterranean, based on a combination of fishermen's knowledge and data from the Mediterranean International Trawl Survey (MEDITS). These experimental trawl surveys carried out in the North of the Mediterranean [] between 1994 and 1999 failed to catch [a single] Common Guitarfish, indicating that they have [been extirpated] from this area." <u>Id.</u> at 4-5 (citing Baino et al. 2001). One source confirms the Common Guitarfish is extinct in the northern Mediterranean. <u>Id.</u> at 5 (citing Relini & Piccinetti 1991). "Observations from the 1970s and 1980s indicate that the Common Guitarfish was prevalent within the south and eastern basins of [the] Mediterranean, however the demersal nature of this species and the localized decline within the northern Mediterranean indicate that there are low levels of interconnectivity between the geographical subpopulations. No information is available on the population size of this species along the West African coast." <u>Id.</u>

Population Trend: Decreasing. <u>Id.</u>

Known Threats/Listing Criteria

All of the threats and information discussed in "Rays and Skates Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

"[I]t is likely that habitat requirements[,] especially for young (nursery grounds)[, are] being influenced by humans causing habitat degradation in many [] areas." Id. at 6. Removal of nursery habitat could have devastating effects on young Common Guitarfish and therefore represents a serious threat to the species' continued survival.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"This species' biology and inshore habitat make it highly susceptible to population depletion. The distribution of this species is fairly wide but it [is] subjected to fishing pressures throughout most of its range, as its coastal habitat make this [species an] easy target for artisanal fisheries and it is likely to be caught as bycatch of commercial fisheries of all kinds." Id. at 5. "Based on anecdotal evidence, the Common Guitarfish [] was historically common throughout the Northern Mediterranean," but was conspicuously absent from the recent MEDITS research trawl, suggesting a local extinction in the northern Mediterranean. Id. at 6. However, the species is still present in some areas of the southern Mediterranean where fishing pressure was less severe. Id. Even in the areas where it is still present, most specimens are immature juveniles, indicating a population largely incapable of reproduction due to lack of mature adults. See id.

In the eastern Atlantic, this species is caught as a common bycatch of shrimp trawl fisheries operating in shallow inshore waters. Id. "They are also caught in artisanal bottom set net fisheries and dried for export to Ghana where [they are] used for human consumption." Id. There is also evidence of population declines in this region of the Common Guitarfish's range. Id. In Senegal, for example, the landings of all guitarfish species have "decreased dramatically." Id. "Landings peaked in 1997 at 4,218 t[ons annually] and have since gradually decreased to an estimated 821 t[ons] in 2005. In Guinea-Bissau, this species is one of the main targets of specialized shark fishing teams," and recent surveys indicate that populations of the Common Guitarfish have "diminished substantially." Id. (citing Fowler et al. 2005). Recent changes in mesh net size in the area will capture more juveniles and the species is caught as bycatch in other fisheries in many areas of its range. Id. at 6-7. In Sierra Leone there is an artisanal fishery exploiting the species with bottom set nets for drying and export to Ghana. Id. at 7. The species is also "[f]requently captured in Gambia." Id.

"Along the Mauritanian coast, however it is more abundant within the Banc d'Arguin national park where it is afforded some protection, and where in 2004 it composed 2% of the shark catch. [Of these landings, the species' f]lesh [is] retained and [its] fins [are] dried and exported to Ghana. Prior to the December 2003 Banc d'Arguin ban on elasmobranch targeted fisheries it was fished for its highly prized fins and caught with [specialized] nets. Today, it is still caught incidentally as bycatch in teleost gillnet fisheries. It is also bycatch of industrial demersal trawl fisheries targeting cephalops and crustaceans and coastal teleosts." Id. This shows that despite protections, the species is still threatened in this area.

It is clear on these facts that the Common Guitarfish has been heavily exploited throughout its range. This has resulted in decreased numbers and localized extirpations. Without further protections, the species will likely experience increased localized extirpations and then complete extinction.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are no species-specific conservation measures currently in place for the Common Guitarfish. Id. at 8. This is inappropriate for a species that has lost so much of its population and has been fished to extinction in large parts of its range. None of the areas discussed below have adequate protections in place for the species, and ESA protection should be extended to the Common Guitarfish to halt its move towards extinction.

Mediterranean. "The Mediterranean Action Plan for the conservation of chondrichthyan fishes [recognizes] the urgent need to assess the status of *Rhinobatos* species, as a species that may be at high risk of threat in the region." Id. (citing Anonymous 2003). This does not represent a concrete protection for the species, leaving it completely unprotected in an area where it has already been largely extirpated.

East Atlantic.

Mauritania. "This species is protected as part of a ban on directly targeted elasmobranch fishing in the Banc d'Arguin, Mauritania, which was implemented in December 2003. In this national park, management measures specific to *Rhinobatos cemiculus* were also introduced. The fishery was closed from February to September, to avoid the parturition [(birthing)] period and therefore the capture of pregnant females. After negotiations with local fishermen, gear restrictions were introduced (to stop fishing with bottom gillnets of 1 to 2 m[eters] height and 11 to 16 [centimeters] (one side) square mesh)." Id. While this is a positive step, it does not protect the species outside of the park and still threatens the species with bycatch outside of the fishery closure time. This protection is not sufficient.

Sierra Leone. "There are no species specific regulations for the management of [] shark fisheries in [] Sierra Leone. However, a licensing system for artisanal fishing canoes, both foreign and [domestic] is payable to the Ministry of Fisheries and Marine Resources and the Local Government Administration." Id. (citing Seisay 2005). "A National Action Plan for the conservation and management of sharks is being proposed. Highlights of the recommended management measures include: area and seasonal closure to shark fisheries; effort limitation of shark fishery; return of immature and/or juvenile shark and ray species." Id. This represents nearly no protection for the species. These measures are merely general licensing regulations and a "plan." The species requires some legitimate conservation measures to protect it from overfishing, and currently none exist in Sierra Leone.

Guinea-Bissau. "There are marine protected areas inside the Bijagos archipelago (the Formosa Islands UROK marine reserve), the PNO marine reserve (Orango Islands) and the PNMJVO marine reserve (Joao Vieira and Poilao Islands). Within these areas, trawling and the use of nets is forbidden, the only gear type allowed is fishing with longlines. Furthermore, fishing is only allowed for subsistence purposes, commercial fishing is disallowed." Id. (citing Bucal 2006). This only offers the species protection within the MPAs.[87] Furthermore, this protection is incomplete even within the MPAs and still subjects the species to at least some level of bycatch.

The many threats to this species qualify it as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(56) Scientific Name: *Trygonorrhina melaleuca*

Common Name: Magpie Fiddler Ray

IUCN Status: Endangered **CITES Status**: N/A

Range: This species is known only from St. Vincent's Gulf in Southern Australia. IUCN (Trygonorrhina melaleuca) 2012, Exhibit 109 at 3-4 (citing Last & Stevens 1994). "The species' extent of occurrence is estimated at <5,000 km^2." Id. at 3.

Habitat and Ecology: This species is "known only from a few specimens taken in shallow water in St. Vincent's Gulf, South Australia." Id. The largest of these specimens measured 90 centimeters. Id. at 4. "The species may be a mutant form of the Southern Fiddler Ray *Trygonorrhina fasciata*. However, until further systematic studies can be carried out, these two forms are considered as valid species." Id. at 3.

Population Status: This species is very rare. Id. at 4. It is only known from a few specimens taken from one area. Id.

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Rays and Skates Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

The area that the species occurs in is recreationally and commercially fished. Id. at 3. This species is "[s]usceptible to trawl, hook, and net fisheries operating in the area. Given apparent rarity in shallow water, any bycatch would be of concern." Id. at 4. The continuation of fishing in the area "impl[ies] a continuing decline in the number of mature individuals." Id. at 3. Therefore the species is likely subject to overutilization for commercial and recreational purposes.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are no conservation measures currently in place for this species. Id. at 4. Such a lack of protections is inappropriate for such a rare species subject to commercial and recreational exploitation. ESA protection should be afforded to the species to avoid its extinction.

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F. Sea Snakes

Sea Snakes Introduction

WildEarth Guardians is petitioning the Secretary to list 3 sea snake species from IUCN's lists of "endangered" and "critically endangered" species (Species Accounts 57-59) under the ESA as "threatened" or "endangered" species. The petitioned sea snake species face a variety of threats to their continued existence. Some of these common threats will be discussed in this introductory section ("Sea Snakes Introduction"). Sea Snakes Introduction is to be considered as incorporated by reference in each of the individual sea snake species accounts that follow ("Individual Sea Snake Species Accounts").

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

It appears as if the drastic declines, and possible extinction, of all three petitioned species of sea snakes are due to a common cause: anthropogenic climate change. See IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 6; IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 6; IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 6. As this threat progresses and causes further sea surface temperature increases, these impacts can be expected to intensify and place further pressure on these petitioned species. The threats to the species' habitat can be direct, by raising the temperature in the species' very limited areas of habitat to levels that are fatal, or indirect, by harming the coral reefs on which these species rely, causing massive damage to this fragile ecosystem. See IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 6; IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 6; IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 6. While the upper lethal limit these species can withstand is unknown, the 36°C upper lethal limit for the sea snake *Pelamis platurus* has been used to show the plausibility of the direct threat to habitat explanation for the mass mortalities experienced by these species in recent years. See IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 6 (citing Graham et al. 1971); IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 6 (citing Graham et al. 1971); IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 6 (citing Graham et al. 1971). Clearly if the species' only habitat is too hot for them to survive, then this means the habitat has been modified out of suitability and the species functionally have no remaining habitat.

The indirect threats to the species' habitat are from harms to the corals that create the reefs these species live on. The threats to corals, and in turn these species' coral reef habitat, from anthropogenic climate change are varied.[88] However, "UN scientists are predicting that coral reefs around the world, can disappear by the end of the century" due to climate change. Freeport News 2012, Exhibit 26 at 1. This would make coral reefs the first entire ecosystem to have been destroyed by humans. Id. "In general, the major threat to corals is global [anthropogenic] climate change, in particular, temperature extremes

[88] See generally "A. Corals: Corals Introduction," supra.

leading to bleaching and increased susceptibility to disease, increased severity of ENSO events[89] and storms, and ocean acidification." See, e.g., IUCN (Acropora suharsonoi) 2012, Exhibit 2 at 5. When this habitat is destroyed, the petitioned species will have nowhere to go since very deep waters, prohibiting dispersal, separate their limited areas of habitat. IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 5; IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 5; IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 4. This habitat loss is already occurring. Severe bleaching events, which occurred on the relevant reefs in 1998 and particularly 2003, are the other possible reason for the species' recent declines. See IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 6; IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 6; IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 6. When these bleaching events occur, the species' only available habitat is destroyed. Unfortunately, these bleaching events are likely to increase in frequency and intensity as climate change progresses.[90] Therefore, the petitioned species of sea snakes are all experiencing severe present and threatened destruction of their small area of habitat.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

The protections offered to the petitioned species of sea snakes are inadequate given their precipitous declines. As a result of these inadequate regulatory mechanisms, none of the petitioned sea snakes are characterized as having an increasing, or even a stable, population by the IUCN, they are all decreasing.[91] Such lax protection is inadequate for species facing such serious threats to their continued existence and ESA protection should be extended to all of the petitioned species of sea snakes to avoid their extinction.

The Ashmore Reef Nature Reserve. "Ashmore Reef[, representing a portion of the species' habitat,] has been a nature reserve since 1983 and has had various levels of monitoring against illegal fishing since that time. Management plans that focused on protection of marine life did not come into effect until 1990, with a second management plan coming into effect in 2002, and since 1998 protection has been actively enforced."[92] "However, these management plans have not specifically addressed threat abatement or recovery of any sea snake species," and "there are no data to indicate how, or to what

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[89] El Niño-Southern Oscillation, or ENSO, is a "quasi-periodic shift in the distribution of heat across the tropical Pacific." Earth Gauge Undated, Exhibit 47 at 1. The *Southern Oscillation* refers to "the periodic shift in atmospheric pressure differences between Tahiti (in the southeastern Pacific) and Darwin Australia (near Indonesia)." Id. El Niño causes the *Southern Oscillation* to essentially stop functioning causing warm waters to cover all or most of the tropical Pacific. Id. at 2. While the cold phase, La Niña, corresponds to abnormally cool eastern tropical Pacific temperatures. Id.

[90] See "A. Corals: Corals Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Bleaching," supra.

[91] See IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 5 (Decreasing); IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 5 (Decreasing); IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 5 (Decreasing).

[92] IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 6 (citing Australian National Parks and Wildlife Service 1989); Commonwealth of Australia 2002); IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 6 (citing Australian National Parks and Wildlife Service 1989); IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 6 (citing Australian National Parks and Wildlife Service 1989; Commonwealth of Australia 2002).

extent, these measures are providing threat abatement [for these species]."[93] Therefore, it is unclear what level of protection the species are getting even from targeted threats in this marine reserve.

Furthermore, while designation of nature reserves is a very positive thing from a conservation standpoint, it has not been, and likely cannot be, sufficient for these species. The extreme decline in abundance, and possible extinction, of the petitioned species occurred sometime after the first management plan was in effect and being actively enforced in 1998, and possibly even after the second management plan came into effect in 2002.[94] Though, the fact that these management plans did not address threat abatement or recovery of these species certainly has not helped them (and as such represents one weakness in the existing regulatory mechanisms), the main reason that protection in this nature reserve has not been effective at maintaining the petitioned species' numbers is that anthropogenic climate change is a global threat. These reserves cannot prevent anthropogenic climate change from warming the sea surface; and, when the oceans do warm, the effects on corals can be catastrophic. These effects include extensive coral reef bleaching (such as that experienced in this very nature reserve in 1998 and especially in 2003) and increases in coral diseases, amongst other impacts, that can wipe out huge swaths of reef and render them vastly less productive ecosystems.[95] It is also possible that global warming caused the temperature on the reef flat to exceed the species' upper lethal limit, an effect that location in a nature reserve cannot avoid.[96] Since location in this nature reserve has failed to protect these species, and is inadequate to protect against the threats to their reef habitat stemming from climate change, this protection is inadequate. Furthermore, it appears that only Ashmore Reef is protected as a nature reserve, thus leaving the species completely unprotected throughout the rest of their ranges.[97]

CITES. CITES is an international agreement with 176 parties, including the United States, that aims to ensure that international trade in wild plants and animals does not threaten their existence. See CITES Undated 1, Exhibit 33 entire; CITES Undated 2, Exhibit 34 at 1. However, no sea snakes are protected under CITES. See, e.g., IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 6 ("No sea snake species is currently listed by CITES . . ."). While CITES listing is insufficient, it can help protect species that are subject to international trade. Since the petitioned species may be subject to international trade presently or in the future, the absence of CITES listing is problematic for them. While CITES listing is not sufficient, the fact that it is lacking here is yet another weakness in the regulatory mechanisms in place protecting these species. Also, while

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[93] IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 6; IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 6; IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 6.

[94] See IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 6; IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 6; IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 6.

[95] See "The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A)," supra; see also "A. Corals: Corals Introduction," supra.

[96] See IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 6 (citing Graham et al. 1971); IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 6 (citing Graham et al. 1971); IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 6 (citing Graham et al. 1971).

[97] See IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 6; IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 6; IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 6.

CITES listing represents a clear recognition by the international community that the listed species or is threatened with extinction and must be protected, absence of such listing does not mean that the species or subpopulation is not threatened with extinction. A species may be denied listing for political and economic reasons or may not be considered at all (such consideration requires a party country to bring a proposal). Therefore, while CITES listing is a factor that should weigh towards finding the relevant species is "threatened" or "endangered" under the ESA, its absence should not be taken to show the species is not "threatened" or "endangered."

Lack of Specific Conservation Measures in Australia. Despite their clear endangerment, "there are no specific conservation or management plans for any sea snake species in Australia." IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 4. All of the petitioned species have their entire range in coral reefs occurring in Australian waters. See IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 4; IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 3; IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 4. Therefore, the lack of any specific conservation and management plans is very problematic for the species and represents a vast deficiency in their protection under current regulatory mechanisms. To make up for these weaknesses, the species should be protected under the ESA.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

All of the petitioned species have extremely limited areas of occupancy. IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 4 ("it ha[s] an area of occupancy estimated to be less than 10 km^2."); IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 4 ("it has an area of occupancy estimated to be less than 10 km^2."); IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 4 ("it has an area of occupancy estimated to be less than 500 km^2."). This leaves the populations extremely vulnerable to localized stochastic events that could suddenly impact the entirety of their habitat. This problem is exacerbated by the fact that populations of these species are extremely fragmented with dispersal being rare or impossible as a result of deep water barriers between areas of suitable habitat. See IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 5; IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 5; IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 4. This lack of movement between populations makes re-colonization of areas where the species have been extirpated unlikely and prohibits individuals leaving areas of habitat that have become unsuitable due to stochastic events or the progression of global climate change. As such, these factors make these species of sea snakes even more vulnerable to extinction and provide further support for their listing under the ESA.

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INDIVIDUAL SEA SNAKE SPECIES ACCOUNTS

(57) Scientific Name: *Aipysurus apraefrontalis*

Common Name: Sahul Reef Snake / Short-Nosed Sea Snake

IUCN Status: Critically Endangered **CITES Status**: N/A

Range: This species is endemic to Australia and has a very small range. IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 4. It is found only on Ashmore Reef and Hibernia Reef off the north coast of Australia. Id. (citing Smith 1926; Minton & Heatwole 1975; Cogger 2000). "It has never been seen from Scott Reef or other reefs in the Ashmore Reef region. This species has very occasionally been recorded from other locations in northwest Australian waters; however, these rare records from outside Ashmore and Hibernia reefs are thought to be of vagrant individuals and not part of the range of breeding populations of this species." Id. (citing Guinea 2007). "This species' range [runs along only] 70 km of shoreline, and[,] given its very shallow depth range of 10 m[eters], it ha[s] an area of occupancy estimated to be less than 10 km^2." Id.

Habitat and Ecology: The Sahul Reef Snake "is found on the reef flat and the reef edge," and "is usually found associated with coral reefs and prefers sandy substrata with sparse coral." Id. at 5 (citing Minton & Heatwole 1975). "[D]uring the daylight hours [it rests] beneath small coral overhangs or coral heads in 1-2 m[eters] of water," and feeds on fish, especially eels. Id. (citing Smith 1926; McCosker 1975).

Population "dispersal for this species is very restricted [due to] deep-water barriers. Based on similar species, this species has a generation [time] of approximately five years, based on longevity of approximately 8-10 years, and age of first maturity of 4-5 years." Id.

Population Status: This species has undergone serious declines in recent years. Id. at 5. *Aipysurus apraefrontalis* occurs in "two subpopulations – Ashmore Reef and Hibernia Reef. Current population sizes [at each location] are unknown. It is likely that there is very little movement between these subpopulations" as "[g]enetic studies of a far more widely distributed congener, *Aipysurus laevis*, indicates restricted gene flow between Ashmore, Hibernia and Cartier reefs." Id. at 4 (citing Lukoschek et al. 2007; Lukoschek et al. 2008). "*A. laevis* occurs in a much wider range of habitat types (including deeper water) than *A. apraefrontalis*, thus it is likely that dispersal is more restricted in *A. apraefrontalis* than for *A. laevis*." Id. at 4-5.

"In 1926, Malcolm Smith obtained [around] 100 sea snakes from Ashmore Reef, which were collected for him by Malay fishers, presumably at random. Of these 100 sea snakes, seven were *A. apraefrontalis*, suggesting that this species comprised [roughly] 7% of the population. These were the first records of [this species]." Id. at 5 (citing Smith 1926). There have been serious declines in *A. apraefrontalis* based on surveys done in

1998. Id. "There are no specific current or previous abundance estimates; however, [this species] comprised [roughly 6%] of sea snakes seen on the reef flat [at] high tide [on] Ashmore Reef in 1994." Id. (citing Guinea & Whiting 2005). "The mean density of all sea snakes on the reef flat at high tide was 228 individuals [per square kilometer] giving a total abundance estimate of sea snakes on the reef flat of [approximately] 39,675." Id. (citing Guinea & Whiting 2005). "Given that 6.02% were *A. apraefrontalis*, this suggests that this species abundance was 2,388 individuals." Id. Though this estimate is provisional, "it suggests that the population size [of *A. apraefrontalis*] on Ashmore Reef in the 1990s was substantial, potentially in the vicinity of 1,600 to 3,200 individuals. In addition, [this species] was the third most commonly seen sea snake on the reef flat at low tide in the 1990s and comprised [roughly] 14% of individuals" seen at low tide." Id. (citing Guinea & Whiting 2005).

Despite extensive surveys since 2000, no individuals of this species have been recorded on either Ashmore or Hibernia reefs, suggesting a decline of at least 90% since 1998. Id. (citing Guinea 2006; Guinea 2007). "The reasons for the local extinctions[, or near extinctions,] of these populations are [currently] unknown. A possible threat could be unusually high water temperatures leading to severe coral bleaching and coral reef habitat degradation" throughout its limited range. Id. (citing Francis 2006).

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sea Snakes Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

The causes for observed declines in *A. apraefrontalis* are not clear. Id. at 6. "Nonetheless, something is clearly impacting this species and it is most likely that current and future threats relate to degradation or modification of shallow-water coral reef habitats from bleaching events due to increased sea surface temperatures. However, compared to other areas, the Ashmore Reef was not badly affected by the 1998 bleaching event, although it suffered severe bleaching in 2003." Id. (citing Kaspartov et al. 2006). "In addition, increased water temperatures on the reef flat may exceed the upper lethal limit for *A. apraefrontalis*, which has been reported to be 36°C for the sea snake *Pelamis platurus*." Id. (citing Graham et al. 1971). Thus, it appears likely that climate change is a threat to this species. See id.

Corals and the reefs that they build face a variety of threats caused and/or exacerbated by climate change.[98] These threats to corals are expected to increase in severity as sea surface temperatures continue to warm. See generally id. As a species who

[98] See generally "A. Corals: Corals Introduction," supra.

relies on coral reefs and seems to have been potentially brought to, or possibly even past, the brink of extinction by climate change's impacts to its coral reef habitat, this represents an increasing threat to *A. apraefrontalis*. See generally id.; see also IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 4-6.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

"Ashmore Reef has been a nature reserve since 1983 and has had various levels of monitoring against illegal fishing since that time. Management plans that focused on protection of marine life did not come into effect until 1990, with a second management plan coming into effect in 2002, and since 1998 protection has been actively enforced." IUCN (Aipysurus apraefrontalis) 2012, Exhibit 110 at 6 (citing Australian National Parks and Wildlife Service 1989; Commonwealth of Australia 2002). "However, these management plans have not specifically addressed threat abatement or recovery of any sea snake species," and "there are no data to indicate how, or to what extent, these measures are providing threat abatement [for this species]." Id.

To begin with, designation of nature reserves is a very positive thing from a conservation standpoint. Unfortunately, location in a designated nature reserve has not been effective for this species. The extreme decline in abundance, and possible extinction, of *Aipysurus apraefrontalis* on Ashmore Reef occurred sometime after the first management plan was in effect and being actively enforced in 1998, and possibly even after the second management plan came into effect in 2002. See id. This may not even be an issue of the management plans not addressing threat abatement or recovery of the species. Though that certainly does not help, and represents one weakness of the current regulatory mechanisms, the likely main culprit of this decline is much larger. The reason that protection in this nature reserve has not been effective at maintaining *Aipysurus apraefrontalis*'s numbers is that it is threatened by a global threat. These reserves cannot stop the world, including the oceans, from warming due to anthropogenic greenhouse gas emissions; and, when the oceans do warm, the effects on corals can be catastrophic. These effects include extensive coral reef bleaching (such as that experienced in this very nature reserve in 1998 and especially in 2003) and increases in coral diseases that can wipe out huge swaths of reef and render them vastly less productive ecosystems.[99] It is also possible that global warming caused the temperature on the reef flat to exceed the species' upper lethal limit, an effect that location in a nature reserve cannot avoid. Since location in this nature reserve has failed to protect the species, and is inadequate to protect against the threats to its reef habitat stemming from climate change, this protection is inadequate. Furthermore, it does not appear that Hibernia Reef is a nature reserve or is subject to any protection at all, leaving the species completely unprotected in the rest of its range. Therefore, ESA protection should be extended to the species to bolster the existing regulatory mechanisms and help prevent the species' extinction.

[99] See generally "A. Corals: Corals Introduction," supra.

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(58) Scientific Name: *Aipysurus foliosquama*

Common Name: Leaf-Scaled Sea Snake

IUCN Status: Critically Endangered **CITES Status**: N/A

Range: This species of sea snake is restricted to a very small range and is found only on Ashmore Reef and Hibernia Reef off the north coast of Australia. IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 3 (citing Smith 1926; Minton & Heatwole 1975; Cogger 2000). "It has never been seen on Scott Reef or other reefs in the Ashmore Reef region. This species also has very occasionally been recorded from other locations in northwest Australian waters," but "these rare records from outside Ashmore and Hibernia reefs are thought to be of vagrant individuals and not part of the range of breeding populations of this species." Id. at 3-4 (citing Shuntov 1872; Cogger 2000). "This species' range [stretches along] approximately 70 km of shoreline, and given its very shallow depth range of 10 m[eters], it has an area of occupancy estimated to be less than 10 km^2." Id. at 4.

Habitat and Ecology: "This species occurs primarily on the reef flat or in the shallow waters of the outer reef edge, usually no more than 10 m[eters] depth." Id. at 5 (citing Minton & Heatwole 1975). This species "is a predator [of] small coral reef fishes, which it finds by poking its head into crevices and hollows of coral reefs and then catches by strike predation." Id. (citing McCosker 1975). "This species is usually solitary but sometimes found in groups at coral outcrops with other sea snakes." Id. (citing Guinea & Whiting 2005).

"This species has restricted [population] dispersal due to deep water barriers," and as a result, its "[p]opulations are severely fragmented." Id. Its two known locations are only 50 km apart, but are separated by waters 200 meters deep. Id. Therefore, "[t]here is no dispersal between the two localities." Id. Based on other similar sea snakes, this species most likely has a generation length of approximately 5 years, based on longevity of 8-10 years and age of first maturity of 2 years. Id.

Population Status: *A. foliosquama* occurs as two distinct subpopulations – one at Ashmore Reef, the other at Hibernia Reef. Id. at 4. "Current population sizes are unknown," and "[i]t is likely that there is very little movement between these subpopulations. Genetic studies of a far more widely distributed congener, *Aipysurus laevis*, indicates restricted gene flow between Ashmore, Hibernia, and Cartier reefs." Id. (citing Lukoschek et al. 2007b, 2008). "*A. laevis* occurs in a much wider range of habitat types (including deeper water) than *A. foliosquama*, [and] thus it is likely that dispersal is more restricted for *A. foliosquama* than for *A. laevis*." Id.

"In 1926, Malcolm Smith obtained [approximately] 100 sea snakes from Ashmore Reef, which were collected for him by Malay fishers, presumably at random. Of these 100 sea snakes, 17 were *A. foliosquama*, suggesting that is made up [roughly] 17% of the population. These were the first records of *A. foliosquama*, which had not been previously described." Id. at 5 (citing Smith 1926). "*A. foliosquama* comprised 10% of 367 sea snakes (37 individuals) caught at Ashmore Reef and 9% of 11 sea snakes (one individual) caught at Hibernia Reef between Dec 31st 1972 and January 13th 1973." Id. (citing Minton & Heatwole 1975). "It was not seen or captured at Cartier or Scott Reef during these surveys." Id. (citing Minton & Heatwole 1975).

"There are no current or previous abundance estimates, however, *A. foliosquama* comprised 16.87% of sea snakes seen on the reef flat at Ashmore Reefs in 1994." Id. at 4 (citing Guinea & Whiting 2005). "The mean density of all sea snakes on the reef flat was 228 individuals [per square kilometer,] giving a total abundance estimate of [all sea snakes] on the [Ashmore reef flat] of approximately 39,675." Id. (citing Guinea & Whiting 2005). "Given that 16.87% of these were *A. foliosquama*, this suggests that the abundance of [this species] was 6,694 individuals." Id. While this estimate is provisional, it nonetheless suggests that the *A. foliosquama* population "on Ashmore Reef in the 1990s was large, potentially in the vicinity of 4,000 to 9,000 individuals. Moreover, standardized catch rates of [this species] at the inner mooring of Ashmore Reef [] in 1994, 1996, and 1998 were five, three, and [seventeen] per hour respectively, and comprised between 4.5% and 29% of all snakes sighted at the inner mooring." Id. at 4-5 (citing Guinea 2006; Guinea 2007; Guinea & Whiting 2005). Also, this species "comprised [roughly] 50% of sea snakes seen on the reef flat at low tide in the 1990s." Id. at 5 (citing Guinea & Whiting 2005).

However, there have been serious declines recorded in the *A. foliosquama* populations since surveys conducted in 1998. Id. (citing Guinea 2006, 2007). "Indeed, no single individual of this species has been seen over the past nine years despite extensive surveys of Ashmore and Hibernia Reefs." Id. (Guinea 2006, 2007). "As such, there are no [current] estimates of its population size, however, there appears to have been a decline of at least 90% since 1998. The reasons for the possibly local extinctions of these populations are unknown," but "[a] possible threat could be unusually high water temperatures leading to severe coral bleaching and coral reef habitat degradation throughout the area." Id. (citing Francis 2006). "This species has not been sighted at any other location." Id.

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sea Snakes Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

The causes for observed declines in *A. foliosquama* are not clear. Id. at 5-6. "Nonetheless, something is clearly impacting this species and it is most likely that current and future threats relate to degradation or modification of shallow-water coral reef habitats from bleaching events due to increased sea surface temperatures. However, compared to other areas, the Ashmore Reef was not badly affected by the 1998 bleaching event, although it suffered severe bleaching in 2003." Id. at 6 (citing Kaspartov et al. 2006). "In addition, increased water temperatures on the reef flat may exceed the upper lethal limit for *A. foliosquama*, which has been reported to be 36°C for the sea snake *Pelamis platurus*." Id. (citing Graham et al. 1971). Thus, it appears likely that climate change is a threat to this species. See id.

Corals and the reefs that they build face a variety of threats caused and/or exacerbated by climate change.[100] These threats to corals are expected to increase in severity as sea surface temperatures continue to warm. See generally id. As a species who relies on coral reefs and seems to have been potentially brought to, or possibly even past, the brink of extinction by climate change's impacts to its coral reef habitat, this represents an increasing threat to *A. foliosquama*. See generally id.; see also IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 3-6. This threat could destroy all of the snake's suitable habitat, which would surely cause its extinction, and, therefore, represents an extreme threat to its continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

"Ashmore Reef has been a nature reserve since 1983 and has had various levels of monitoring against illegal fishing since that time. Management plans that focused on protection of marine life did not come into effect until 1990, with a second management plan coming into effect in 2002, and since 1998 protection has been actively enforced." IUCN (Aipysurus foliosquama) 2012, Exhibit 111 at 6 (citing Australian National Parks and Wildlife Service 1989; Commonwealth of Australia 2002). "However, these management plans have not specifically addressed threat abatement or recovery of any sea snake species," and "there are no data to indicate how, or to what extent, these measures are providing threat abatement [for this species]." Id.

To begin with, designation of nature reserves is a very positive thing from a conservation standpoint. Unfortunately, location in a designated nature reserve has not been effective for this species. The extreme decline in abundance, and possible extinction, of *A. foliosquama* on Ashmore Reef occurred sometime after the first management plan was in effect and being actively enforced in 1998, and possibly even after the second management plan came into effect in 2002. See id. This may not even be an issue of the management plans not addressing threat abatement or recovery of the species. Though that certainly does not help, and represents one weakness of the current regulatory mechanisms, the likely main culprit of this decline is much larger. The reason that protection in this nature reserve has not been effective at maintaining *A. foliosquama*'s numbers is that it is threatened by a global threat. These reserves cannot stop the world, including the oceans, from warming due to anthropogenic greenhouse gas emissions; and, when the oceans do warm, the effects on corals can be catastrophic. These effects include extensive coral reef bleaching (such as that experienced in this very

[100] See generally "A. Corals: Corals Introduction," supra.

nature reserve in 1998 and especially in 2003) and increases in coral diseases that can wipe out huge swaths of reef and render them vastly less productive ecosystems.[101] It is also possible that global warming caused the temperature on the reef flat to exceed the species' upper lethal limit, an effect that location in a nature reserve cannot avoid. Since location in this nature reserve has failed to protect the species, and is inadequate to protect against the dangers to its reef habitat stemming from climate change, this protection is inadequate. Furthermore, it does not appear that Hibernia Reef is a nature reserve or is subject to any protection at all, leaving the species completely unprotected in the rest of its range. ESA protection should be extended to the species to supplement the current regulatory mechanisms and prevent the species' extinction.

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[101] See generally "A. Corals: Corals Introduction," supra.

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<u>(59) Scientific Name:</u> *<u>Aipysurus fuscus</u>*

Common Name: Dusky Sea Snake / Timor Reef Snake

IUCN Status: Endangered **CITES Status**: N/A

Range: This species is restricted to a small geographic range off the northern coast of Australia, and is only found on Ashmore, Cartier, Hibernia, Scott, and Seringapatan Reefs in the Timor Sea between northwestern Australia and Timor. IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 4 (citing Heatwole 1999; Cogger 2000). "Given its shallow depth range, it has an area of occupancy estimated to be less than 500 km^2." <u>Id.</u>

Habitat and Ecology: *Aipysurus fuscus* "occurs in a range of reef habitats and primarily shallow waters, although it is found in water depths up to 25 or 30 m[eters]." <u>Id.</u> at 5 (citing Minton & Heatwole 1975). "It feeds mostly on small reef fishes," especially wrasses and gobies, as well as eels and fish eggs. <u>Id.</u> (citing Voris 1972; McCosker 1975; Rasmussen 2001).

Population Status: This species is split up into no more than five subpopulations; Ashmore, Hibernia, Cartier, Scott, and Seringapatan reefs. <u>Id.</u> at 4. "Current population sizes are unknown," and "[i]t is likely that there is very little movement between these subpopulations." <u>Id.</u> Genetic studies of a far more widely distributed congener and sister species, *Aipysurus laevis*, indicates restricted gene flow between Ashmore, Hibernia, and Cartier reefs." <u>Id.</u> (citing Lukoschek et al. 2007b, 2008). "*A. laevis* occurs in a much wider range of habitat types (including deeper water) than [this species], thus it is likely that dispersal is more restricted for [this species] than *A. laevis*." <u>Id.</u>

"Since 1998, records of sea snakes from Ashmore Reef, Australia have shown rapid decline." <u>Id.</u> (citing Francis 2006). "*A. fuscus* comprised between 3-22% of the population at Ashmore Reef in 1994." <u>Id.</u> (citing Guinea & Whiting 2005). "In 2002, 29 individuals of this species were recorded in over three weeks of intensive surveying at Ashmore Reef and three individuals were recorded on Scott Reef in one day. In 1972 it comprised 10% of records of sea snake at Ashmore Reef and 13% of sea snakes recorded from Scott Reef." <u>Id.</u> (citing Minton & Heatwole 1975). "It comprised [around] 20% of a sample of sea snakes collected from Ashmore Reef in the 1920s." <u>Id.</u> (citing Smith 1926).

While "[s]ightings of this species at Ashmore Reef have been variable over the years . . . there seems to have been an overall decline in sightings since 1998. Standardized sighting rates at the inner mooring at Ashmore Reef" fell from 14 per hour in 1998 to no sightings at all in 2005. <u>Id.</u> (citing Francis 2006; Guinea 2006; Guinea 2007). Though this species was still recorded sporadically in other parts of Ashmore and Hibernia reefs in 2005, "it was not recorded from any reef in 2007." <u>Id.</u> (citing Guinea 2006; Guinea 2007). "As such, there are no estimates of its current population size, however, there appears to have been a decline of at least 70% since 1998. The reasons for the [possible] local extinctions of these populations are unknown. A possible threat could be unusually high water temperatures leading to severe coral bleaching and coral reef habitat degradation throughout" this species' range. <u>Id.</u> (citing Francis 2006). "The declines in abundance of this species on the Timor Sea reefs coincide with overall declines in all sea snakes on these reefs." Id. (citing Francis 2006; Guinea 2006; Guinea 2007).

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sea Snakes Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

The causes for observed declines in *A. fuscus* are not clear. Id. at 5-6. "Nonetheless, something is clearly impacting this species and it is most likely that current and future threats relate to degradation or modification of shallow-water coral reef habitats from bleaching events due to increased sea surface temperatures. However, compared to other areas, the Ashmore Reef was not badly affected by the 1998 bleaching event, although it suffered severe bleaching in 2003." Id. at 6 (citing Kaspartov et al. 2006). "In addition, increased water temperatures on the reef flat may exceed the upper lethal limit for *A. fuscus*, which has been reported to be 36°C for the sea snake *Pelamis platurus*." Id. (citing Graham et al. 1971). Thus, it appears likely that climate change is a threat to this species. See id.

Corals and the reefs that they build face a variety of threats caused and/or exacerbated by climate change.[102] These threats to corals are expected to increase in severity as sea surface temperatures continue to warm. See generally id. As a species who relies on coral reefs and seems to have been potentially brought to, or possibly even past, the brink of extinction by climate change's impacts to its coral reef habitat, this represents an increasing threat to *A. fuscus*. See generally id.; see also IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 3-6. Furthermore, if the temperature on the reef flat exceeds the species' upper lethal limit, all specimens could be simultaneously wiped out in a very short amount of time. If this has not already happened, then the likelihood of it happening in the future will only increase as sea surface temperatures continue to warm. Therefore, climate change is an extreme threat to this species' continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

"Ashmore Reef has been a nature reserve since 1983 and has had various levels of monitoring against illegal fishing since that time. Management plans that focused on protection of marine life did not come into effect until 1990, with a second management plan coming into effect in 2002, and since 1998 protection has been actively enforced." IUCN (Aipysurus fuscus) 2012, Exhibit 112 at 6 (citing Australian National Parks and

[102] See generally "A. Corals: Corals Introduction," supra.

Wildlife Service 1989; Commonwealth of Australia 2002). "However, these management plans have not specifically addressed threat abatement or recovery of any sea snake species," and "there are no data to indicate how, or to what extent, these measures are providing threat abatement [for this species]." Id.

To begin with, designation of nature reserves is a very positive thing from a conservation standpoint. Unfortunately, location in a designated nature reserve has not been effective for this species. The extreme decline in abundance, and possible extinction, of *A. fuscus* on Ashmore Reef occurred sometime after the first management plan was in effect and being actively enforced in 1998, and possibly even after the second management plan came into effect in 2002. See id. This may not even be an issue of the management plans not addressing threat abatement or recovery of the species. Though that certainly does not help, and represents one weakness of the current regulatory mechanisms, the likely main culprit of this decline is much larger. The reason that protection in this nature reserve has not been effective at maintaining *A. fuscus*' numbers is that it is threatened by a global threat. These reserves cannot stop the world, including the oceans, from warming due to anthropogenic greenhouse gas emissions; and, when the oceans do warm, the effects on corals can be catastrophic. These effects include extensive coral reef bleaching (such as that experienced in this very nature reserve in 1998 and especially in 2003) and increases in coral diseases that can wipe out vast swaths of reef and render them vastly less productive ecosystems.[103] Since location in this nature reserve has failed to protect the species, and is inadequate to protect against the dangers to its reef habitat stemming from climate change, this protection is inadequate. Furthermore, it does not appear that the other reefs in the species' range are nature reserves or are subject to any protection at all, leaving the species completely unprotected in the rest of its range. Therefore, the existing regulatory mechanisms are clearly inadequate and ESA protection should be extended to the species to prevent its extinction.

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[103] See generally "A. Corals: Corals Introduction," supra.

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G. SHARKS

SHARKS INTRODUCTION

WildEarth Guardians is petitioning the Secretary to list 19 shark species and 3 subpopulations from IUCN's lists of "endangered" and "critically endangered" species (Species/Subpopulation Accounts 60-81) under the ESA as "threatened" or "endangered" species and DPSs respectively. The petitioned shark species and subpopulations face a variety of threats to their continued existence. This section will begin with a consideration of various common threats to these shark species and then will examine each petitioned species and subpopulation and the threats they face individually. The "Sharks Introduction" section is to be considered as incorporated by reference in all of the individual shark species and subpopulation accounts that follow.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Trawling. Trawling activities throughout many of these species' and subpopulations' ranges is a serious threat due to unsustainable bycatch or directed catch (See Factor B); it also a threat to habitat.

> Recent research suggests that intensive bottom-trawling may reduce demersal fish productivity by reducing the complexity of the benthic substrate or even gross destruction of hard bottom habitats. Apart from topographic changes resulting from the physical impact of demersal trawls and dredges, epiflora and epifauna are dislodged and uprooted. Such disruptions are likely to reduce the availability of suitable habitat for predators and prey.

IUCN/SSG Status Survey Part 2, Exhibit 139 at 6 (internal citation omitted); see also Zamora-Arroyo et al. 2005, Exhibit 66 at 59. Benthic trawling causes high impacts with low reversibility. It results in "disruption of the physical substrate and its benthos, incidental catch and mortality of nontarget fish and marine mammals, exposed species susceptible to predation, and changes in benthic community composition." Zamora-Arroyo et al. 2005, Exhibit 66 at 59. Bottom trawling decreases the biodiversity of the trawled area and negatively alters the habitat. See Johnson 2002, Exhibit 155 at 8-19. Scientists recommend that trawling efforts should be decreased, gears should be developed that are less damaging for habitats and fauna, and areas should be designated as closed to fishing because of species and habitats that cannot be protected otherwise. Id. at 53-54.

Trawling efforts have increased both in intensity and efficiency in several of the petitioned shark species' ranges over the past 50 years and occur in many others. See, e.g., IUCN (Squatina squatina) 2012, Exhibit 133 at 6; IUCN (Squatina aculeata) 2012, Exhibit 127 at 6. This has coincided with a dramatic decline in the species' abundance and their extirpation from certain areas. See, e.g., IUCN (Squatina

squatina) 2012, Exhibit 133 at 4, 5; IUCN (Squatina aculeata) 2012, Exhibit 127 at 6. While this is almost certainly due in large part to captures of the species, trawling's negative effects on the sharks' habitat should not be discounted. While some sharks may enjoy the muddy bottoms created by increased trawling efforts, they will ultimately suffer from decreased biodiversity of prey caused by trawling's destruction of the sea floor. See Johnson 2002, Exhibit 155 at 8-19. This impact can be expected to grow as human population increases, particularly on the coasts, causing an increased demand for fish.

Human Population Growth. While general human population has a substantial negative effect on shark populations due to increased fishing pressure, those human populations that are located near the coasts have an even stronger negative impact. This is reflected in the observation that "contemporary sharks occur mostly where human population density is low." Ward-Paige et al. 2010, Exhibit 172 at 6. This is very problematic because NMFS' own recent Status Review Report estimates that the human population by 2045-2050 will be around 9 billion, and cited one source putting that total at an even higher 10.6 billion. Status Review Report, Exhibit 40 at 20 (citations omitted). Currently, worldwide, approximately 2.5 billion people live within just **100 km** of the coastline. See WRI 2011, Exhibit 41 at 21. By 2020, an astonishing 75% of the expanded human population is expected to live within just **60 km** of the coastline. Knip et al. 2010, Exhibit 42 at 2 (citation omitted). This increasing concentration of people near the coasts means that the negative effect of the general population increase will be magnified greatly.

Impacts from population growth do not occur evenly. Increased economic growth in coastal cities is a major cause of ocean habitat destruction. With growth comes an increase in consumption and development. This is reflected in an increase in construction projects, some of which occur on reef communities; dredging of harbors and shipping channels; dumping of waste, run-off pollution and increased sedimentation; deforestation; and increased tourism. As a result of these factors, the coasts around virtually all urban areas are "beset by a pattern of pollution and over-development." Hinrichsen Undated, Exhibit 43 at 2. "Coastal urban areas dump increasing loads of toxic wastes into the sea. In fact, waters around many coastal cities have turned into virtual cesspools, so thick with pollution that virtually no marine life can survive." Id. at 4.

This urban pollution is contributing to increasing "dead zones," amongst other things. These dead zones are areas where dissolved oxygen content is so low that no marine life, apart from microorganisms, can survive. A 2007 study identified 200 of these dead zones, which represents an increase of 51 such zones found just four years earlier. Id. at 5. Worse yet, these dead zones are not only becoming more numerous, they are also greatly expanding "due mainly to high nutrient pollution levels brought in by rivers and streams and washed off coastal land." Id.

Furthermore, climate change is expected to magnify these coastal pollution problems. For example, "[d]ue to water circulation and oceanic volume changes, estuarine and coastal systems are predicted to experience . . . increased eutrophication, hypoxia, and anoxia." Roessig et al. 2004, Exhibit 29 at 258 (citations omitted). "More intense rains wash more fertilizer and sewage into coastal waters, and this runoff triggers algal blooms and consequent poisoning of fish and humans." Id. at 269 (citation omitted).

Coral reefs have already been exhibiting significant levels of deterioration due to anthropogenic impacts, and scientists believe that upwards of 70% of tropical and semi-tropical coral reefs may be lost within the next 40 years. Hinrichsen undated, Exhibit 43 at 2. Damage to coral reef habitat is already having profound impacts on shark populations. A recent University of Miami study found that reef shark numbers around populated islands, those where anthropogenic effects would obviously be strongest, had dropped by more than 90% compared to those at the most pristine reefs. Nadon 2012, Exhibit 173 at 1. The researchers found that "[t]he pattern - of very low reef shark numbers near inhabited islands - was remarkably consistent, irrespective of ocean conditions or region." Id. at 2. In short, as human population, especially human population located near coasts and coral reefs, continues to increase, sharks, especially those that depend on fragile coastal ecosystems, will continue to lose habitat. Several of the petitioned shark species and subpopulations are already facing negative impacts to their habitat from this human population growth and many more likely will as the human population continues to explode and become increasingly concentrated on the coasts.[104]

Loss of Coral Reef Habitat. Climate change will not only affect shark habitat by exacerbating the effects of human-caused pollution, it will negatively impact shark habitat directly as well. "Global climate change is impacting and will likely increasingly impact marine and estuarine fish and fisheries." Roessig et al. 2004, Exhibit 29 at 269. "Extremes in environmental factors, such as elevated water temperature, low dissolved oxygen or salinity, and pH, [all impacts predicted with anthropogenic climate change,] can have deleterious effects on fishes." See id. at 257 (citations omitted). As global climate change progresses, these environmental factors will continue to deteriorate, thus rendering more and more habitat unsuitable for the petitioned species and subpopulations of sharks.

Currently, the exact consequences of climate change for the oceans are not well understood, but the "hypothesis that coral reef communities are among the first to show signs of adverse climate change-related effects has been widely stated in the literature." Id. at 263, 265 (citations omitted). Coral reefs form important shark habitat, and their continued, imminent destruction will have deleterious consequences for the petitioned species and subpopulations that rely on them. See, e.g., IUCN (Haploblepharus kistnasamyi) 2012, Exhibit 119 at 4. "Corals are, quite obviously, central to coral reef ecosystems." Hoegh-Guldberg 2006, Exhibit 25 at 3. "To date, the study of potential effects of global climate change and inter-annual variation on coral reef communities have focused almost entirely on hermatypic (reef-building) corals, including 'bleaching' events." Roessig et al. 2004, Exhibit 29 at 263 (citations omitted). "Coral bleaching

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[104] See "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): Inshore Range," infra; "The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A): Trawling," supra.

occurs when the photosynthetic symbionts of corals (zooxanthellae) become increasingly vulnerable to damage by light at higher than normal temperatures. The resulting damage leads to the expulsion of these important organisms from the coral host. Corals tend to die in great numbers immediately following coral bleaching events, which may stretch across thousands of square kilometers of ocean." Hoegh-Guldberg 2006, Exhibit 25 at Executive Summary. These bleaching events have been increasing both in terms of intensity and extent due to worldwide anthropogenic climate increases and will continue to cause severe damage to coral reefs. Id.

However, bleaching caused directly by temperature increase is not the only threat to coral reefs exacerbated by climate change. Certain coral diseases, harmful bacteria, and fungi may also damage this important shark habitat.

> Three coral pathogens (*Aspergillus sydowii, Vibrio shiloi*, and Black Band Disease) grow well at temperatures close to or exceeding probable host optima, suggesting that their population sizes would increase in warmer waters. Certain bacteria (e.g., *V. shiloi*) cause bleaching of certain coral species (e.g., *Oculina patagonica*), while fungi grow optimally at temperatures that coincide with thermal stress and bleaching in corals. This may lead to a co-occurrence of bleaching and infection... [T]he leftover dead coral surfaces can become colonized by macroalage, which support the proliferation of toxic dinoflagellates."

Roessig et al. 2004, Exhibit 29 at 269 (internal citations omitted). Mass blooms of such dinoflagellates can cause destructive effects including toxic red tides. Latz Laboratory undated, Exhibit 30 at 2. Therefore, increased ocean temperatures mean a plethora of increased threats to corals, the reef ecosystems that depend on them, and the sharks, including petitioned species and subpopulations, that depend on those ecosystems.

"Ultimately the only clear solution to this threat will be a concerted and successful global effort to reduce atmospheric greenhouse gas emissions and to stabilize atmospheric concentrations [of those gases] somewhere around or below current levels." Burke et al. 2011, Exhibit 41 at 31. So far, the U.S. has not been part of this solution. The U.S. Fish and Wildlife Service acknowledges this shortcoming in its "warranted but precluded" finding for the meltwater lednian stonefly, which is primarily threatened by climate change:

> The United States is only now beginning to address global climate change through the regulatory process (e.g., Clean Air Act). We have no information on what regulations may eventually be adopted, and when implemented, if they would address the changes in meltwater lednian stonefly habitat that are likely to occur in the foreseeable future. Consequently, we conclude that existing regulatory mechanisms are not adequate to address the threat of habitat loss and modification resulting from the environmental changes due to climate change to the meltwater lednian stonefly in the foreseeable future.

76 Fed. Reg. 18,684 (April 5, 2011), Exhibit 45 at 18,694. With global temperatures already rising, no imminent solution to global climate change, and the negative effects on shark habitat that the lack of such a solution entails, there is both present and threatened destruction, modification, and curtailment of petitioned sharks' habitat and range due to climate change.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

The petitioned species and subpopulations of sharks face a variety of threats due to their overutilization for commercial purposes. They are killed in directed fisheries and caught as bycatch, a fate that often leaves them dead, injured, or with their critical life stages disrupted.[105] Experts have identified the substantial increases in fishing pressure throughout the world as the "single greatest threat to all sharks." Baum et al. 2005, Exhibit 158 at 29. A 2009 CITES document created by the Animals Committee and discussing current dangers facing shark populations explains why bycatch and discards are increasingly serious threats to sharks:

> According to FAO [], **bycatch** is 'the part of a catch of a fishing unit taken incidentally in addition to the target species towards which fishing effort is directed. Some or all of it may be returned to the sea as discards, *usually dead or dying*'. In turn, **discard** is defined as 'to release or return fish to the sea, *dead or alive*, whether or not such fish are brought fully on board a fishing vessel'. *Discards represent a significant proportion of global marine catches* . . .
>
> Sharks are caught as bycatch in many commercial fisheries and by most fishing methods. For fishermen who are not targeting sharks, lost revenue from shark predation on hooked targeted species can amount to several thousand U.S. dollars in a single set in some fisheries. *But the growing value of shark parts and products, combined with declining stocks of traditional target species has turned them into an increasingly important component of the economic and food value of fisheries, thus shifting from a largely unwanted, discarded bycatch, to a by-product or joint catch, or even the main fishing target.* However, the contribution of bycatch and discards to overall shark mortality is still very important. And several species of sharks taken as bycatch and subject to trade are

[105] See, e.g., IUCN (Isogomphodon oxyrhynchus) 2012, Exhibit 123 at 5 (discussing targeted shark fishery in the species' range); IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 8 (discussing a single bay in England that is responsible for as many as 40 bycaught Basking Sharks per year); IUCN (Squatina argentina) 2012, Exhibit 128 at 5 (discussing fact that *S. argentina* is "one of the most retained bycatch species" in the relevant fishery); IUCN (Carcharias taurus (Southwest Atlantic Subpopulation)) 2012, Exhibit 115 at 6 ("Out of 175 sharks observed, 153 suffered serious injuries of the internal organs caused by hooks.") (citation omitted); IUCN (Squatina guggenheim) 2012, Exhibit 130 at 5 (pregnant females "of *S. guggenheim* have been observed to abort embryos easily upon capture, further reducing the reproductive capacity" of this species) (citation omitted).

> of particular concern owing to their rarity or dependence on threatened or degraded habitats.[106]
>
> . . .
>
> It is difficult to determine the numbers of sharks being captured as bycatch and/or discarded from fishing operations worldwide. Most countries do not require reporting of shark bycatch in logbooks, so few bycatch data are incorporated into FAO statistics. And although observer [programs] provide the best available information, coverage on the high seas is minimal.

CITES 2009, Exhibit 140 at 53-54 (internal citations omitted, emphasis added). These statements show that bycatch is causing significant mortality of sharks, especially as they move from a discard species, where at least some specimens would likely survive capture, to a utilized bycatch, meaning certain death for those specimens that are caught. This problem will only intensify as the market for shark products continues to boom; traditionally fished stocks continue to decline due to overutilization; and human populations, and their associated need for food, continue to grow.

Expansion of the Market for Shark Products. The market for shark products is not new, but it has seen serious increases in recent years. The CITES Animals Committee explains the current and historical targeting of sharks for commercial purposes as follows:

> Sharks have been sought for centuries for their meat, skins, liver oil, fins and teeth, and more recently for emerging uses such as cartilage skeletons for medical products and ecotourism. Many coastal shark fisheries [utilize] the whole carcass and yield a wide range of products. Although their rich liver oil has been and continues to be a reason to fish for sharks and some recreational shark fishing occurs, most of today's shark fisheries are driven by commercial demand for their meat and fins.

Id. at 44 (internal citation omitted). With the main drivers of shark exploitation, and consequently of their endangerment, being commercial demand for their meat and fins, it makes sense to look at these practices more closely. See id. Shark "finning" is the practice of cutting off a shark's fins and discarding the rest at sea. Pew 2011, Exhibit 159 at 18. The shark fin trade is responsible for killing up to 73 million sharks annually. Id. at 6. Shark fins are one of the world's most valuable food items, reaching prices as high as $700 per kilogram and generating $400 to $550 million a year in global trade. Morgan

[106] This applies to all of the petitioned species and subpopulations of sharks as they are all listed as either "endangered" or "critically endangered" by the IUCN and many of them also rely on threatened habitats. See, e.g., IUCN (Carcharhinus borneensis) 2012, Exhibit 113 at 3 (IUCN listing the species as endangered); IUCN (Centrophorus harrissoni) 2012, Exhibit 116 at 3 (IUCN listing the species as "critically endangered"); see also "The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A)," supra.

2010, Exhibit 190 at 4 (citation omitted). The CITES Animals Committee explains the uses of these shark fins as follows:

> Even though shark meat can reach very high market prices, the most valuable part of a shark is usually its fins. These are the main ingredient of shark fin soup, a traditional Chinese delicacy which is becoming increasingly popular. Sets of shark fins can sell for more than US$700 per kilogram, and the global shark fin trade is estimated to be increasing by 5% per year.
> . . .
> Fins are a by-product of several target fisheries, directed to obtain shark meat for human consumption, particularly, and those for deep sea sharks (oil and meat fisheries). On the other hand, meat is a by-product of some shark fisheries that are primarily driven by the high value of fins in international trade. As the yield of other fisheries (mainly teleosts and invertebrates) decrease, the demand for shark meat continues to increase and meat products become more important drivers for shark fisheries.

CITES 2009, Exhibit 140 at 46 (internal citations omitted). In terms of shark meat, the CITES Animal Committee notes that:

> Smaller species like [] smooth-hounds (Family Triakidae)[107] are particularly appreciated, as they contain smaller concentrations of urea and mercury than other species and are also easier to process. They do not usually require soaking, and the fish are finned, gutted and landed as whole carcasses with the skin intact. The backs are used in Europe and Australia while fresh whole carcasses are sold in South America where they are marketed as *cazón*. This product is exported for sale as fillets, steaks or portions, and is also used in the fish-and-chips trade.

Id. at 44 (internal citations omitted). These markets are clearly creating a significant incentive for fishers to target sharks and to utilize those that are caught incidentally.

The increase in the demand for shark products is already apparent in the growth trends recognized for these products. For instance, "[a]ccording to FAO statistics [], reported production of fresh, frozen and cured shark meat and fillets more than doubled from approximately [31,500 tons] in 1985 to over [73,000 tons] in 2000[, valued at over $152 million]." Id. at 59. As this market has been expanding, the United States has emerged as a leading exporter of shark products. In fact, the CITES Animals Committee recognized the United States as one of the top ten exporting countries for shark products in 2003. Id. With the United States being such a significant player in the shark products market, U.S. protection of the petitioned species and subpopulations of sharks could have substantial positive effects on their

[107] This includes the petitioned species *Triakis acutipinna* and *Hemitriakis leucoperiptera*. See ITIS Undated A, Exhibit 161 at 1; ITIS Undated B, Exhibit 162 at 1.

recovery. The petitioned species' and subpopulations' endangerment from exploitation for the shark products market is negatively impacting their continued existence.

Decreases in Traditionally Fished Fish Stocks. Increases in targeting of sharks and utilization of shark bycatch are related to depletion of stocks in more traditionally utilized fish species. Id. at 46. Since these depletions will only worsen as fishing pressure increases to supply growing human populations with food, capture and retention of sharks to satisfy these market demands is sure to increase as well. Many fish species have been, and continue to be, overexploited by commercial fisheries. To date there has been insufficient regulation of this exploitative industry, and this lack of regulation has caused unsustainable practices leading to population declines and extinctions amongst species.

> Around the world, fish populations are decreasing as demand for fish is increasing. Within the first 15 years of industrialized fishery operation, fish populations have been decreased by 80 percent on average. For example, in the Gulf of Thailand, 60 percent of large finfish, sharks and skate were lost within the first five years of commercial trawl fishing.
>
> The decline of large mature fish has led to an increase in the intensity of fishing and to an increase in the number of juveniles and non food fish caught (e.g., bycatch).

ESI Undated, Exhibit 81 at 1. With this increased fishing pressure we can expect increased targeting of species, including sharks, that were not traditionally sought out by fishers; increased intensity of fishing pressure to exploit existing stocks, leading to increased bycatch of sharks (which will often be utilized or discarded, dead or dying); and decreased prey species availability, negatively impacting sharks. Therefore, decreases in traditionally fished stocks represent a serious threat to the petitioned species and subpopulations of sharks.

Human Population Growth. The negative impacts associated with human overutilization of sharks for commercial purposes will increase as the human population and demand for protein increases. See ESI Undated, Exhibit 81 at 1 (discussing growing demand for fish causing increased fishing pressure and species declines). This is very problematic because NMFS' own recent Status Review Report estimates that there will be roughly 9 billion people by 2045-2050, and cited one source putting that total at an even larger 10.6 billion. Status Review Report, Exhibit 40 at 20 (citations omitted). With the significant pressures that the current human population is already placing on the petitioned species and subpopulations of sharks, the enormous growth projected by NMFS will certainly have serious consequences for the remaining shark populations. Therefore, human population growth represents a serious threat to the petitioned species and subpopulations of sharks.

With these impacts to the petitioned species and subpopulations of sharks in mind, it is clear that overutilization for commercial purposes is a serious threat to their continued existence.

Disease or Predation (Criterion C):

The addition of mercury, persistent organic compounds, heavy metals, and other pollutants to the oceans causes resultant physical effects on the bodies of the petitioned species and subpopulations of sharks that can be categorized as a disease. In discussing the effects of these pollutants on White Sharks, one study found that "[a]ll life-history stages may be vulnerable to high body burdens of anthropogenic toxins; how these may impact the population is not known." Domeier 2012, Exhibit 163 at 219-20. Effects can be assumed to be similar in the petitioned species and subpopulations of sharks as well because they are also apex predators facing serious bioaccumulation of these compounds. Mercury and organochlorine contaminants have specifically been singled out as pollutants that may cause behavioral alterations, emaciation, cerebral lesions, and impaired sexual development that may already be affecting the survival of sharks. Mull et al. 2012, Exhibit 164 at 73.

Mercury. Mercury is often released into the environment from industrial emissions, including those from coal-fired powerplants and other sources. Presence of mercury in sharks is problematic because of the host of neurological and other problems that result in studied species. On average, mercury accumulates to levels a million times higher in the bodies of predatory fish than in the atmosphere. Geiger 2011, Exhibit 165 at 7. In addition to high trophic position, this high level of accumulation is due in part to slow growth-rates and longevity. See, e.g., Lyle 1984, Exhibit 166 at 447. One study showed that levels of mercury increase exponentially with size. Id. at 445. Since some of these species and subpopulations are very large and slow-growing, they are particularly susceptible to mercury accumulation. See id. at 443; see also, e.g., FLMNH Undated, Exhibit 167 at 4 (basking shark is "extremely slow-growing" and "can reach lengths up to 40 feet").

Studies of shark mercury contents have found levels that vastly exceed standards for mercury in seafood. See Lyle 1984, Exhibit 166 at 441. Since some of the petitioned species are ovoviviparous and viviparous, female sharks directly transfer nutrients, and consequently mercury, through the placenta to ova and embryos. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 5; IUCN/SSG Status Survey Part 1, Exhibit 138 at 143 (*Isogomphodon oxyrhynchus*); IUCN (Lamiopsis temmincki) 2012, Exhibit 124 at 4; IUCN (Squatina aculeata) 2012, Exhibit 127 at 5; IUCN (Squatina guggenheim) 2012, Exhibit 130 at 5; IUCN (Squatina oculata) 2012, Exhibit 131 at 6; IUCN (Squatina punctata) 2012, Exhibit 132 at 5; IUCN (Squatina squatina) 2012, Exhibit 133 at 6. This means that these species are already experiencing mercury poisoning before they are even born. One study found embryo mercury concentrations to be as high as 0.82 mg/kg, far exceeding the 0.5 mg/kg standard for seafood, even though the shark was still only in the embryonic stage. Lyle 1986, Exhibit 168 at 318-19. These studies were from 1984 and 1986 respectively, so, with increased levels of mercury in the oceans and atmosphere, the mercury concentrations in petitioned species and subpopulations are surely even higher now than they were then.

These mercury accumulation problems are exacerbated for some of the petitioned species and subpopulations because of their habitat. The rate at which fish accumulate mercury from surrounding waters increases with rising water temperatures. Id. at 318. Since some of these petitioned species and subpopulations are found in warm temperate and tropical waters around the world, they accumulate mercury more quickly than sharks living in cooler waters. See, e.g., IUCN (Isogomphodon oxyrhynchus) 2012, Exhibit 123 at 4 ("[t]he whole area where the Daggernose Shark occurs is characterized by a humid, tropical climate . . . "); IUCN (Squatina aculeata) 2012, Exhibit 127 at 5 (the Sawback Angelshark "is an offshore angel shark of the outer continental shelf and [the] uppermost slope of the warm-temperate and tropical eastern Atlantic."). This problem will become more serious for both warm and cold water sharks as both more mercury is released into the oceans through runoff and atmospheric deposition and as ocean temperatures continue to increase due to anthropogenic climate change.

The balance of mercury and selenium in the tissues of great white sharks (*Carcharodon carchaias*) tested in the Southern California Bight 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. Mull et al. 2012, Exhibit 164 at 73. The authors of that study concluded that the high levels of heavy metals and organic contaminants may cause the sharks to suffer lower survival or future reproductive impairment. Id. Due to the commonalities between great whites and many of the petitioned species and subpopulations (including factors such as large size, longevity, and high trophic position), the threats to the petitioned species and subpopulations should be assumed to be at least the same as those experienced by the great whites from this study. The effects on at least some of the petitioned species and subpopulations are likely greater since they live in much warmer waters than the great white, thus allowing them to take up mercury more rapidly. See Lyle 1986, Exhibit 168 at 318. This difference has played out in the observed mercury concentrations from species living in warmer waters when compared to great whites. For instance, where the great whites from the 2012 study had average mercury concentrations in their blood of only 3.01mg/kg, the aforementioned 1984 study observed great hammerheads, who lived in much warmer waters, with mercury concentrations of 4.33 mg/kg even though the great hammerhead observations were taken nearly 30 years earlier when mercury concentrations in the ocean were over 30% lower. See Mull et al. 2012, Exhibit 164 at 59; Lyle 1984, Exhibit 166 at 443; Cone 2009, Exhibit 169 at 1. This shows both how warm water affects mercury uptake and serves as a warning of how serious current mercury levels likely are for warm water shark species.

One of the largest contributors to oceanic mercury is industrial emissions, including coal-fired powerplants. Cone 2009, Exhibit 169 at 1. Burning of fossil fuels is the single biggest source of mercury pollution in the world. MSNBC 2009, Exhibit 170 at 1. With the need for energy growing, mercury levels in the ocean have risen about 30% over the last 20 years. Cone 2009, Exhibit 169 at 1. A study conducted by scientists from

Harvard University and the U.S. Geological Survey predicts that the amount of mercury found in the Pacific Ocean will reach double 1995 levels by 2050 under current emission rates. Id. This trend suggests that the biological effects of mercury on the petitioned species and subpopulations of sharks will only increase.

PCBs. "PCBs constitute a class of 209 compounds with differential biological activity and toxicity as a result of differences in the number and position of chlorine atoms. The so-called dioxin-like PCBs . . . exert a wide range of toxic responses particularly focused on the endocrine system, while the ortho-substituted congeners of PCBs, with two or more ortho-chlorines . . . seem able to produce neurotoxic effects." Storelli et al. 2003, Exhibit 171 at 1035 (citations omitted). PCBs accumulate in the fat of sharks and are present in high concentrations in sharks throughout the world. A recent study found PCB levels in smooth hammerheads (*Sphyrna zygaena*) to be very high, especially in the sharks' liver tissue. See id. at 1037. The profile of PCBs in the sharks' bodies exhibited a higher proportion of more chlorinated PCBs in both muscle and liver tissues. Id. This concentration of more chlorinated PCBs poses significant neurological dangers for sharks, as PCBs with two or more ortho-chlorines are the ones thought to produce neurotoxic effects. Id. at 1035. Therefore, the PCBs present in the highest quantities in sharks are also those most likely to cause neurological problems for them. The damage caused by these neurotoxic PCBs is compounded by the fact that recent laboratory animal studies suggest that mercury neurotoxicity can be exacerbated by the presence of PCBs. Id. at 1035, 1037 (citations omitted). Therefore, since both neurotoxins are present in large quantities in sharks, the risks to the petitioned species and subpopulations are greater than the additive impact of each neurotoxin separately. The study concluded by noting that "the presence of PCBs and methylmercury, coupled with their synergistic activity, may make these organisms susceptible to long-term toxic effects." Id. at 1037.

Arsenic. High levels of arsenic were present in the bodies of the sharks from the aforementioned study. Id. at 1036-37. Scientists have noted that this arsenic presence deserves particular attention because "it has recently been shown that, among organoarsenic compounds, dimethylarsinic acid has carcinogenic potential." Id. (citations omitted). Therefore, not only are these sharks at significant risk of serious neurotoxic effects from the pollutants such as mercury and PCBs that have entered their bodies, they also are at an increased risk of cancer due to the extremely high levels of arsenic in their systems.

These varied threats from the addition of mercury, persistent organic compounds, heavy metals, and other pollutants to the oceans are causing, and will continue to cause, resultant physical effects on the bodies of the petitioned species and subpopulations of sharks that can be categorized as a disease. The negative impacts stemming from this anthropogenic pollutant deposition represents a severe threat to the petitioned species' and subpopulations' continued survival, and, therefore, represents another reason to list them under the ESA.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There is a complete lack of conservation measures in place for more than a third of the petitioned shark species. See IUCN (Carcharhinus borneensis) 2012, Exhibit 113 at 4; IUCN (Carcharhinus hemiodon) 2012, Exhibit 114 at 4; IUCN (Haploblepharus kistnasamyi) 2012, Exhibit 119 at 5; IUCN (Hemitriakis leucoperiptera) 2012, Exhibit 120 at 4; IUCN (Holohalaelurus favus) 2012, Exhibit 121 at 5; IUCN (Holohalaelurus punctatus) 2012, Exhibit 122 at 5; IUCN (Isogomphodon oxyrhynchus) 2012, Exhibit 123 at 5-6; IUCN (Lamiopsis temmincki) 2012, Exhibit 124 at 4. Also, while at least some level of protection exists for the other species and subpopulations of sharks in this Petition, the protections in place are inadequate. This is in part evidenced by the fact that none of the species or subpopulations is characterized as having an increasing, or even stable, population trend.[108] The IUCN has designated all of the petitioned species and subpopulations as either "endangered" or "critically endangered." For species facing population declines and threats sufficient for them to be categorized as "endangered" or "critically endangered," weak or absent conservation measures are extremely inappropriate. ESA protections should be afforded to these species and subpopulations to prevent their extinction.

CITES. CITES is an international agreement with 176 parties, including the United States, that aims to ensure that international trade in wild plants and animals does not threaten their existence. See CITES Undated 1, Exhibit 33 entire; CITES Undated 2, Exhibit 34 at 1. Unfortunately, to date the petitioned species and subpopulations of sharks have been largely ignored by CITES with only one species, representing two petitioned subpopulations, being listed therein. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 8. Despite the limitations inherent in CITES listings, the listings do at least offer some protection when the species are the subject of trade. See "A. Corals: Corals Introduction: The Inadequacy of Existing Regulatory Mechanisms (Criterion D): CITES," supra for discussion of CITES' function and limitations. As discussed in "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra, sharks face severe commercial threats that could likely be ameliorated by trade restrictions on the petitioned species and subpopulations. Even

[108] IUCN (Carcharhinus borneensis) 2012, Exhibit 113 at 4 (Unknown); IUCN (Carcharhinus hemiodon) 2012, Exhibit 114 at 4 (Unknown); IUCN (Carcharias taurus (Southwest Atlantic Subpopulation)) 2012, Exhibit 115 at 4 (Decreasing); IUCN (Centrophorus harrissoni) 2012, Exhibit 116 at 4 (Decreasing); IUCN (Cetorhinus maximus (North Pacific Subpopulation)) 2012, Exhibit 117 at 4 (Decreasing); IUCN (Cetorhinus maximus (Northeast Atlantic Subpopulation)) 2012, Exhibit 118 at 4 (Decreasing); IUCN (Haploblepharus kistnasamyi) 2012, Exhibit 119 at 4 (Unknown); IUCN (Hemitriakis leucoperiptera) 2012, Exhibit 120 at 4 (Unknown); IUCN (Holohalaelurus favus) 2012, Exhibit 121 at 5 (Decreasing); IUCN (Holohalaelurus punctatus) 2012, Exhibit 122 at 5 (Decreasing); IUCN (Isogomphodon oxyrhynchus) 2012, Exhibit 123 at 4 (Decreasing); IUCN (Lamiopsis temmincki) 2012, Exhibit 124 at 4 (Decreasing); IUCN (Mustelus fasciatus) 2012, Exhibit 125 at 4 (Decreasing); IUCN (Mustelus schmitti) 2012, Exhibit 126 at 4 (Decreasing); IUCN (Squatina aculeata) 2012, Exhibit 127 at 5 (Decreasing); IUCN (Squatina argentina) 2012, Exhibit 128 at 5 (Decreasing); IUCN (Squatina formosa) 2012, Exhibit 129 at 4 (Unknown); IUCN (Squatina guggenheim) 2012, Exhibit 130 at 5 (Decreasing); IUCN (Squatina oculata) 2012, Exhibit 131 at 5 (Decreasing); IUCN (Squatina punctata) 2012, Exhibit 132 at 4 (Decreasing); IUCN (Squatina squatina) 2012, Exhibit 133 at 5 (Decreasing); IUCN (Triakis acutipinna) 2012, Exhibit 134 at 4 (Decreasing).

though listing under CITES is not sufficient to protect species and subpopulations facing threats and population declines like those experienced by the petitioned species and subpopulations of sharks herein, it is helpful.[109] Unfortunately, almost all of the petitioned species and subpopulations do not even have this limited protection standing between them and extinction.

While CITES listing represents a clear recognition by the international community that the listed species or subpopulation is threatened with extinction and must be protected, absence of such listing does not mean that the species or subpopulation is not threatened with extinction. A species may be denied listing for political and economic reasons or may not be considered at all (such consideration requires a party country to bring a proposal). Therefore, while CITES listing is a factor that should weigh towards finding the relevant species or subpopulation is "threatened" or "endangered" under the ESA, its absence should not be taken to show that it is not "threatened" or "endangered."

Furthermore, while some countries have instituted finning bans, finning bans do not protect sharks from harvest. Finning bans can be seen more accurately as anti-cruelty regulations. These bans require landing the entire shark carcass instead of cutting its fins off and throwing the rest of the shark back into the ocean, dead or dying. In terms of conserving the sharks' numbers, it does not matter how the sharks are landed, either as a whole carcass or as fins only. With either method the shark is lethally removed from the population and the species' numbers will suffer the same decline. Therefore, while finning bans clearly have merit in terms of avoiding cruelty, they do little to conserve the number of sharks remaining in the ocean.

While there are some other measures offering some of these petitioned species and subpopulations varying levels of protection, these often only cover part of the sharks' range and/or only address some of the threats that they face. These sharks need more substantial and overarching protection to halt their progression towards extinction, and should be afforded protection under the ESA.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

K-Selected/K-Strategy Species. Most species in the chondrichthyan family, which includes all of the petitioned species and subpopulations of sharks, are K-selected or K-strategy species. This means they exhibit naturally slow population growth rates. The IUCN's Shark Specialist Group published a report entitled "Review of Migratory Chondrichthyan Fishes" in 2007. The report explains the increased threat to K-selected chondrichthyan fishes, like those petitioned, as follows:

[109] See "Individual Shark Species/Subpopulation Accounts: (64) *Cetorhinus maximus* (North Pacific Subpopulation): The Inadequacy of Existing Regulatory Mechanisms (Criterion D)," infra; "Individual Shark Species/Subpopulation Accounts: (65) *Cetorhinus maximus* (Northeast Atlantic Subpopulation): The Inadequacy of Existing Regulatory Mechanisms (Criterion D)," supra.

> The chondrichthyan fishes are generally K-selected; that is most species are [characterized] by all or many of the following characteristics: low fecundity, large precocious young, slow growth, late maturity, long life and high survival at all age classes. They therefore have a low reproductive potential and a low capacity for population increase. This makes most chondrichthyans (with the exception of the most abundant and fecund species), poor candidates for sustainable fisheries exploitation. The majority of threats to these species arise from mortality in fisheries that take unsustainable numbers as part of the target catch, or as a [utilized] or discarded bycatch.

IUCN 2007, Exhibit 142 at 4; Goble & Freyfogle 2010, Exhibit 64 at 1059 (including large body size as a K-selected trait); <u>see also, e.g.</u>, IUCN (Carcharias taurus (Southwest Atlantic Subpopulation), Exhibit 115 at 5 (this species has a very slow reproductive rate due, at least in part, to embryonic oviphagy, intra-uterine cannibalism, and production of only one or two pups per little every second year); IUCN (Centrophorus harrissoni) 2012, Exhibit 116 at 4 (low fecundity, longevity, and probable late age at first maturity); IUCN (Isogomphodon oxyrhynchus) 2012, Exhibit 123 at 3, 5 (low fecundity with a two-year birth circle and one year gestation period); IUCN (Squatina argentina) 2012, Exhibit 128 at 4 (breeding cycle of female lasts at least two years); IUCN (Squatina formosa) 2012, Exhibit 129 at 5 (likely low reproductive potential, triennial reproductive cycle, and low fecundity); IUCN (Squatina guggenheim) 2012, Exhibit 130 at 4 (breeding cycle for females is triennial, only 3-9 embryos per litter, sexual maturity at 4 to 5 years, and longevity of 12 years); IUCN (Squatina punctata) 2012, Exhibit 132 at 4 (breeding cycle of the female lasts at least two years, produces maximum of 3-8 young); IUCN (Squatina squatina) 2012, Exhibit 133 at 6 (maximum sizes of up to 244 cm, gestation 8-10 months); IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 3, 5 (this applies to both the northeast Atlantic and north Pacific subpopulations - very large, a 2-4 year interval between litters, maturity between 16 and 20 years for females); IUCN/SSG Status Survey Part 1, Exhibit 138 at 143 (Daggernose Shark – low fecundity, likely two-year birth cycle, may reach up to 244 centimeters in length). Since these species and subpopulations are neither the most abundant (they are all "endangered" or "critically endangered") nor the most fecund of the chondrichthyan fishes, they are particularly vulnerable when individuals are removed from the population or their habitat changes. <u>See</u> IUCN 2007, Exhibit 142 at 4.

> K-strategy species are more extinction prone than are r-strategy species. The very efficiency with which K-strategy species exploit their environment is a liability *during periods of rapid or chaotic change. . . .* [L]ower reproduction rates make it more difficult both for the species to recover if its population becomes depressed and for it to adapt to a changed environment because fewer offspring contain less genetic variability. Thus, the very "fittedness" of K-strategy species to a particular environment - which is advantageous during periods of stability - becomes a serious handicap when the habitat changes more rapidly than

> genes can be substituted in a population - and in species that reproduce slowly, genes are substituted slowly.

Goble & Freyfogle 2010, Exhibit 64 at 1059-60 (emphasis in original). The petitioned species and subpopulations of sharks are currently experiencing the type of rapid, chaotic change that makes their K-selected life history patterns a liability. This is because these sharks are faced with a variety of threats including loss of habitat and being fished and removed from their remaining habitat at a rate greater than they can replenish their numbers.[110] As a result of these pressures, the petitioned species' and subpopulations' reproductive adaptations have gone from being beneficial to creating increased risk of extinction. This type of life history pattern means that the species and subpopulations do not replenish themselves as quickly as smaller, shorter-lived, r-selected species and are more vulnerable when individuals are removed from the population or reproduction is otherwise disrupted.

Low Rate of Exchange Between Populations. Some of the petitioned species have a low rate of exchange between their various constituent subpopulations making them prone to local depletion and making re-colonization extremely difficult or impossible. See IUCN (Squatina aculeata) 2012, Exhibit 127 at 6; IUCN (Squatina argentina) 2012, Exhibit 128 at 5; IUCN (Squatina formosa) 2012, Exhibit 129 at 5; IUCN (Squatina guggenheim) 2012, Exhibit 130 at 5; IUCN (Squatina oculata) 2012, Exhibit 131 at 5; IUCN (Squatina punctata) 2012, Exhibit 132 at 5; GFCM 2010, Exhibit 154 at 33 (Squatina squatina). Therefore, the species are inherently unable to rebound when subjected to loss of individuals and local populations. Because such losses have been occurring, this represents another serious threat to these sharks' continued existence.[111]

Inshore Range. Several of the petitioned shark species are threatened due, at least in part, to their inshore range. Not only does such a range put the species at increased risk of capture from fishing operations operating from coastal locations, but it also causes increased risk of certain types of habitat degradation and destruction. See IUCN (Haploblepharus kistnasamyi) 2012, Exhibit 119 at 4-5 (coastal area affected by rapid heavy industry expansion and increased tourism-based land development); IUCN (Hemitriakis leucoperiptera) 2012, Exhibit 120 at 4 (dynamite and cyanide fishing damaging nearshore reef habitat); IUCN (Lamiopsis temmincki) 2012, Exhibit 124 at 4 (mangrove destruction, pollution from river outflow); IUCN/SSG Status Survey Part 2, Exhibit 139 at 5 (development and other human activities causing pollution outflow from rivers in Daggernose Shark habitat); FAO 2007, Exhibit 144 at 31, 44 (loss of mangroves in Daggernose Shark habitat); IUCN (Squatina oculata) 2012, Exhibit 131 at 6 (habitat degradation, in part, from tourism). It is clear that a variety of human activities are impacting these petitioned sharks that rely on nearshore habitats and that many of these

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[110] See "The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range (Criterion A)" supra; "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)" supra.
[111] See "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra.

impacts are likely, if not sure, to continue. Therefore, these species' reliance on an inshore range is increasing the likelihood that they will go extinct.

Restricted Range. A number of the petitioned species have very restricted ranges. See IUCN (Haploblepharus kistnasamyi) 2012, Exhibit 119 at 4 ("extent of occurrence is estimated at less than 100 km^2"); IUCN (Hemitriakis leucoperiptera) 2012, Exhibit 120 at 3 ("from an extremely restricted range"); IUCN (Holohalaelurus favus) 2012, Exhibit 121 at 3 (restricted range); IUCN (Isogomphodon oxyrhynchus) 2012, Exhibit 123 at 3 (restricted distribution); IUCN (Mustelus fasciatus) 2012, Exhibit 125 at 3 (endemic to a restricted area); IUCN (Triakis acutipinna) 2012, Exhibit 134 at 3 ("extent of occurrence is considerably less than 5,000 km^2…"). These species restricted ranges leaves them very vulnerable to localized pressures and stochastic events. For instance, a large oil spill, pollution event, or natural disaster could potentially impact a species' entire range and, if severe enough, could wipe them out entirely in a very short period of time. Long-term, localized pollution and other persistant pressures could also render the species' entire ranges uninhabitable over a longer period of time, even if those pressures had largely local effects. Such vulnerability increases extinction likelihood for those petitioned shark species.

Human Population Growth. Because fishing, both targeted and incidental, remains the key threat to the continued existence of many of the petitioned species and subpopulations, human population growth will only intensify this threat.[112] Coastal human populations have a substantial negative effect on sharks from a pollution standpoint and human populations along the coasts are increasing rapidly.[113] This increased human population on the coasts will increase the pollutant load currently experienced by coastal species and subpopulations beyond its already unsustainable levels. The inevitable increase in these impacts caused by human population growth and its increasing concentration on the coasts shows that this growth represents a significant, and growing, threat to the petitioned species and susbpopulations of sharks.

Anthropogenic Climate Change. The negative coastal pollution effects discussed above will be exacerbated by climate change, resulting in even more problems for the petitioned sharks. See Roessig et al. 2004, Exhibit 29 at 258, 269; "The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range (Criterion A): Human Population Growth," supra. Anthropogenic climate change will also raise ocean temperatures and cause the petitioned sharks to absorb more mercury than they would in cooler waters, thus subjecting them to even more severe medical problems associated with having high levels of mercury in their bodies. See Lyle 1986, Exhibit 168 at 318; "Disease or Predation (Criterion C): Mercury," supra. This increase in absorption efficiency will act in concert with the increasing concentrations of mercury in the oceans that are expected as energy needs continue to grow, more coal is burned, and more mercury is thus released. See Cone 2009, Exhibit 169 at 1. Therefore, climate change

[112] See "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra.

[113] See "The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A)," supra.

represents a significant threat to the continued existence of the petitioned species and subpopulations of sharks.

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of the petitioned species and subpopulations of sharks. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted).

The combination of threats to the petitioned species and subpopulations and, where applicable, their habitat could cause a greater and faster reduction in the remaining populations 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." Id. at 453 (internal citations omitted).

Most, if not all, of the petitioned species and subpopulations are already at risk as members of low-fecundity or K-selected species, rendering them more vulnerable to synergistic impacts of multiple threats.[114] "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." Id. at 455 (internal citations omitted).

Since all of the petitioned shark species and subpopulations face a multitude of threats, it is likely that the synergistic effects of those threats will cause extinction pressure more severe than their additive impact alone, especially since all of the petitioned species and subpopulations are members of K-selected/K-strategy species. These threats qualify the species and subpopulations as "threatened" or "endangered" under the ESA and they should be listed. This protection is necessary to help avoid their extinction.

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Individual Shark Species/Subpopulation Accounts

(60) Scientific Name: *Carcharhinus borneensis*

Common Name: Borneo Shark

IUCN Status: Endangered **CITES Status**: N/A

Range: The Borneo Shark is endemic to the west Indo-Pacific region, with all recent specimens coming exclusively from Sarawak, Malaysia on Borneo. See IUCN (Carcharhinus borneensis) 2012, Exhibit 113 at 3-4; White et al. 2010, Exhibit 135 at 25-26. Possible records also exist from Java and the Philippines but these cannot yet be confirmed. See IUCN (Carcharhinus borneensis) 2012, Exhibit 113 at 4 (citing Garrick 1982; Compagno 1984; Compagno 1988); White et al. 2010, Exhibit 135 at 25-26 (citations omitted).

Historic Range: Prior to 1937, one individual from this species was recorded from fisheries in China, hinting at a possibly wider historical distribution than currently observed. See IUCN (Carcharhinus borneensis) 2012, Exhibit 113 at 3-4; White et al. 2010, Exhibit 135 at 26.

Habitat and Ecology: "This is a small, rare inshore coastal shark." IUCN (Carcharhinus borneensis) 2012, Exhibit 113 at 4. "Virtually all details of its biology and life history parameters are unknown. The maximum size for this species is estimated to be around 70 [centimeters]." Id.

Population Status: This shark is extremely rare. Id. Prior to 1937, this shark was recorded only five times, with four confirmed specimens collected near Borneo and the fifth specimen collected in China. Id. This species was not recorded again until 2004, when researchers from the Malaysian University at Sabah, in northwest Borneo, discovered several new individuals during a survey of the Sarawak fishery. White et al. 2010, Exhibit 135 at 17-18. This species has not been recorded elsewhere despite thorough surveys across the rest of its possible range. Id. at 26. Actual population numbers are currently unavailable. IUCN (Carcharhinus borneensis) 2012, Exhibit 113 at 4.

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

Carcharhinus borneensis is very rare. Id. It is found in an area that has been and continues to be heavily exploited by artisanal and commercial fishing practices, and it is highly likely that this fishing activity has detrimentally affected this species. Id. Therefore, commercial overutilization is likely.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

"No conservation measures are in place for this species." Id. A complete lack of protections for this extremely rare, and until-recently-thought-extinct, shark is inappropriate, and ESA protections should be extended to protect the species.

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(61) Scientific Name: *Carcharhinus hemiodon*

Common Name: Pondicherry Shark

IUCN Status: Critically Endangered **CITES Status**: N/A

Range: "This Indo-West-Pacific species has only been recorded from a small number of widely-separated sites (most of them in India) and is represented by fewer than twenty specimens in museum collections, most of which were captured before 1900. IUCN (Carcharhinus hemiodon) 2012, Exhibit 114 at 4. "The last record [of this species] was in 1979 in India; it has not been seen [anywhere since], despite detailed surveys in Borneo, Philippines, and Indonesia." Id.

Habitat and Ecology: This species occurs (or occurred) "inshore on continental and insular shelves. No information [is] available on the biology or life history parameters of this rarely recorded and poorly known inshore shark." Id.

Population Status: "Considered to be extremely rare globally (possibly even extinct)." Id.

Population Trend: Unknown; possibly extinct. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

This very rare shark "occurs (or occurred) in inshore localities and habitats subject to large, expanding, and unregulated artisanal and commercial fisheries". Id. If it still exists, "it is probably caught and utilized as bycatch of other fisheries, although market surveys have failed to locate it. Its populations are thought to have been severely depleted as a result of this exploitation." Id. Therefore, It appears that this species is threatened by commercial overutilization due to these fishing pressures in its only known habitat.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are no conservation measures currently in place for this species. Id. Such a complete lack of conservation measures for such a rare species is inappropriate and ESA protection should be extended to protect the species.

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(62) Scientific Name: *Carcharias taurus* (Southwest Atlantic Subpopulation)

Common Name: Sandtiger Shark

IUCN Status: Critically Endangered **CITES Status**: N/A

Range: As a whole, "*Carcharias taurus* has a broad but disjunct distribution in littoral and sub-littoral waters, primarily in subtropical to warm temperate regions around the main continental landmasses, except in the eastern and central Pacific." IUCN (Carcharias taurus (Southwest Atlantic Subpopulation)) 2012, Exhibit 115 at 4 (citing Compagno 1984; Compagno 2001; Gilmore et al. 1983). The Southwestern Atlantic Subpopulation of *C. taurus* ranges from Rio de Janeiro, Brazil to San Matias Gulf, Argentina. Id. (citing Menni 1986; Soto 2001).

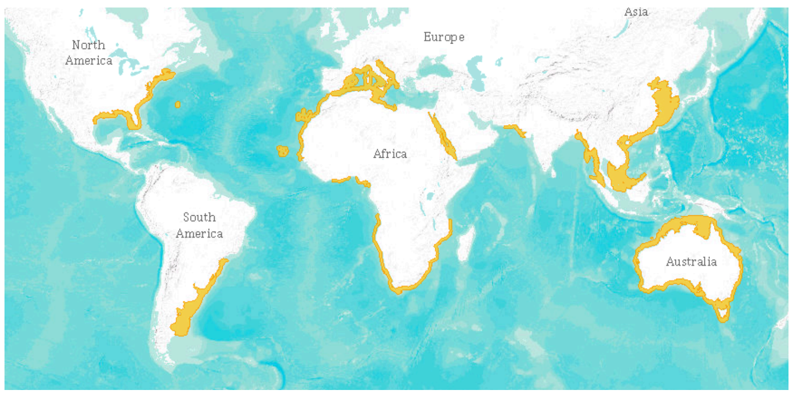

Figure 9: Range of *C. taurus*
Source: http://maps.iucnredlist.org/map.html?id=3854

Habitat and Ecology: "*Carcharias taurus* generally occurs in warm-temperate and subtropical waters, ranging from the surf zone and shallow bays to approximately 200 m[eters] depth on the outer continental shelf. The species is most [commonly] found on or near the bottom in reef areas[,] but may occasionally occur in midwater or at the surface." Id. at 4-5 (citing Compagno 1984). This species engages in embryonic oviphagy and intra-uterine cannibalism, and thus a maximum of two large pups are born per litter every second year. Id. at 5 (citing Gilmore et al. 1983; Goldman 2002; Goldman et al. 2005). "As a result, annual rates of population increase are very low, greatly reducing [the Sandtiger's] ability" to maintain its population in the face of fishing pressures. Id. These factors mean that this is a K-slected/K-strategy species.

Maximum size attained is a total length of 300 to 320 centimeters for females and 220 to 270 centimeters for males, with age and size at maturity varying regionally. Id. (citing Compagno 2001). In the Southwest Atlantic Subpopulation, age and size of maturity in females is reported at 7.7 years and 218-235 centimeters, and 4.5 years and 193 centimeters for males. Id. (citing Lucifora 2003). "Longevity [in the Southwestern Atlantic Subpopulation] is estimated at 18.3 years in females and 12.8 years in males." Id.

Population Status: "Morphometric and meristic analysis indicate that the Southwest Atlantic subpopulation [of *C. taurus*] is a probable 'closed group' with common characteristics, but not a distinct species." Id. at 4 (citing Sadowsky 1970; Compagno 2001). "Although there is no information on the population size of *C. taurus* in the Southwest Atlantic, past and present fishing pressures have led to significant declines in catches [from this population]." Id.

Population Trend: Decreasing. Id.

Qualifications as a DPS

NMFS and FWS have jointly published a policy document defining the statutory requirements for finding a DPS. 61 Fed. Reg. 4,722. This joint policy employs a three-part analysis to determine the status of a possible DPS as endangered or threatened under the ESA: (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. at 4,725.

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 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.

Id.

The Southwest Atlantic Subpopulation of Sandtiger Sharks meets both of these requirements.

1. Markedly Separate From Other Populations

The Southwest Atlantic Subpopulation of Sandtiger Sharks is physically separated from all other populations of these sharks as they typically stay in shallow waters and rarely even venture into waters that are 200 meters deep. See IUCN (Carcharias taurus (Southwest Atlantic Subpopulation)) 2012, Exhibit 115 at 4-5 (citing Compagno 1984); see also IUCN (Carcharias taurus (Southwest Atlantic Subpopulation)) 2012, Exhibit 115 at 4 ("It is not known from deepwater…"). Furthermore, "[m]orphometric and meristic analysis indicate that the Southwest Atlantic subpopulation [of *C. taurus*] is a probable 'closed group' with common characteristics, but not a distinct species." Id. at 4 (citing Sadowsky 1970; Compagno 2001). "Age and size at maturity varies regionally," and this subpopulation has its own unique maturation age and size of 7.7 years and 218 to 235 centimeters total length for females and 4.5 years and 193 centimeters total length for males. Id. at 5. This subpopulation is behaviorally unique: it is more migratory than other *C. taurus* subpopulations, though not enough so that it mixes with the other subpopulations. See id. at 4 (citing Sadowsky 1970; Compagno 2001); Compagno 2001, Exhibit 177 at 60. Furthermore, unlike the eastern Australian Subpopulation, this subpopulation does not experience sexual segregation and separate migration of the sexes. Id. Finally, this subpopulation has dentition differing from all other subpopulations. See Sadowsky 1970, Exhibit 178 at 42. Since this subpopulation is markedly separate from other subpopulations, it meets the "*discreteness*" requirement for listing as a DPS.

2. Significant Differences in Regulatory Mechanisms:

Regulatory mechanisms protecting the Southwest Atlantic Subpopulation of Sandtiger Sharks are less effective than those elsewhere in its range. See "The Inadequacy of Existing Regulatory Mechanisms (Criterion D)," infra; IUCN (Carcharius Taurus (GENERAL)) 2012, Exhibit 179 at 6-7. For instance in Australia, "[c]apture of this species was banned voluntarily by game fishermen . . . in 1979." IUCN (Carcharius taurus (GENERAL)) 2012, Exhibit 179 at 6 (citing Pepperell 1992). While voluntary measures are often ineffective, this voluntary ban has been bolstered by "protection of *C. taurus* as a "Vulnerable" species in all Commonwealth waters and throughout Australia's Exclusive Economic Zone (EEZ) (i.e., out to two hundred nautical miles offshore)" since 1997. Id. at 7. "A National Recovery Plan for [*C. taurus*] in Australia was adopted for implementation by the Minister for Environment and Heritage [in] June 2002" and a "draft Recovery Plan for [*C. taurus*] has been developed for New South Wales." IUCN (Carcharius taurus (East coast of Australia Subpopulation)) 2012, Exhibit 180 at 6. "Management measures have been developed for the critical habitat site identified at Pimpernel Rock in northern" New South Wales. Id. "Also[,] in 1997, *C. taurus* received full protection on the Atlantic and Gulf coasts of the USA, under the Atlantic Fishery Management Plan." IUCN (Carcharius Taurus (GENERAL)) 2012, Exhibit 179 at 7.

The only existing protections for the Southwest Atlantic Subpopulation are comparatively weak. This species "has been listed as a species threatened with over-exploitation on Annex II of the Brazilian federal law of Threatened and Overexploited Aquatic Species since 2004" and is protected by the "prohibition of trawl fishing within three nautical miles from the coast of southern Brazil." See IUCN (Carcharias taurus (Southwest Atlantic Subpopulation)) 2012, Exhibit 115 at 6 (citing Vooren & Klippel 2005). However, catches of the species still occur in "the legally permitted coastal gillnet fisheries and offshore trawl and gillnet fisheries." Id. This continues despite threats to the Southwest Atlantic Sandtiger Sharks from commercial overutilization and extremely low reproductive rates.[115] The subpopulation needs to be protected from all of the threats to its continued existence with regulatory mechanisms matching, or likely even exceeding, those protecting other subpopulations, as it appears that it cannot sustain many more losses before collapse. The inadequacy of regulatory mechanisms in the Southwest Atlantic qualifies the subpopulation under the "*discreteness*" critera and makes it even more urgent that it receive ESA protections.

Significance. 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 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 DPS in an ecological setting unusual or unique for the taxon;
2. Evidence that loss of the DPS would result in a significant gap in the range of a taxon;
3. Evidence that the DPS 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 DPS differs markedly from other populations of the species in its genetic characteristics.

61 Fed. Reg. at 4,725.

The Southwest Atlantic Subpopulation of Sandtiger Sharks is significant to the species because loss of the subpopulation "would result in a significant gap in the range of the taxon." Id. Due to the apparent lack of genetic connectivity between the Southwest Atlantic Subpopulation and other subpopulations as evidenced by their differing behavioral and physical characteristics and the enormous distance between this subpopulation and any other subpopulation of the species, it appears highly unlikely that Sandtiger Sharks from other populations would be able to fill the gap if this subpopulation were extirpated. See IUCN (Carcharias taurus (Southwest Atlantic Subpopulation)) 2012, Exhibit 115 at 6; see also Figure 9, supra. Also, Southwest Atlantic Subpopulation of Sandtiger Sharks differs from other subpopulations in its genetic characteristics (as evidenced in part by their differing dentition and differing age and size at maturity). See IUCN (Carcharias taurus (Southwest Atlantic Subpopulation)) 2012, Exhibit 115 at 4-5; Sadowsky 1970 at 42; "Discreteness: 1. Markedly Separate From Other Populations," supra. In addition to physical characteristics, there are also a number of differing behavioral characteristics that differentiate this subpopulation from other subpopulations of the species. Compagno 2001 at 60; IUCN (Carcharias taurus (Southwest Atlantic Subpopulation)) 2012, Exhibit 115 at 4; "Discreteness: 1. Markedly Separate From Other Populations," supra. The best available scientific information

[115] See "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," infra; "Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E)," infra.

indicates that the subpopulation differs markedly in its genetic characteristics from other subpopulations.

The Southwest Atlantic Subpopulation of Sandtiger Sharks satisfies both the "*discreteness*" and "*significance*" requirements. Although these guidelines are not regulations and serve only as policy guidance for the agencies (61 Fed. Reg. at 4,723), they have been upheld as a reasonable interpretation of ambiguous statutory language. Maine v. Norton, 257 F. Supp. 2d 357 (D. Me. 2003). Accordingly, if the responsible agency determines a potential DPS of vertebrate fish or wildlife is both "*discrete*" and "*significant*," it will then evaluate the population segment's conservation status under the ESA as though the DPS were in fact a species and it is eligible for listing. The Southwest Atlantic Subpopulation of Sandtiger Sharks are vertebrates that meet the "*discreteness*" and "*significance*" requirements set forth above, and therefore should be considered for listing based on the listing criteria described below.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual subpopulation account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

The main threat facing this subpopulation is overuse due to fishing practices, both from direct targeting and as bycatch. See id. at 5-6. "Because this species typically inhabits shallow inshore areas, it is rarely, if ever[,] caught by large-scale industrial fisheries operating on the high seas. However, its near-shore distribution makes is susceptible to small-scale multi-species and artisanal fisheries as well as recreational fishermen, spear-fishers and shark control programs. As a by-catch in other fisheries[,] it is often reported as an unidentified shark or not reported at all and as such the extent of the impact that these fisheries have had on *C. taurus* is unknown for most of its geographic range. Consequently this species could be at a high risk of unrecognized depletion in many countries." Id. at 5.

"The Sandtiger is not subjected to directed[/targeted] fishing in South America, but nevertheless does have commercial value (including the jaws) as a non[-]target catch in benthic trawling and gillnet fisheries and is harvested throughout its [Southwest Atlantic] regional range by commercial, artisanal, and recreational (mainly in Argentina) fishing." Id. (citing Chiaramonte 1998; Nion 1999; Lucifora et al. 2002). "Coastal species are the most important commercial elasmobranchs in the Southwest Atlantic and coastal fishing pressure is intense in this region." Id. (citing Bonfil et al. 2005). "The exposure of its coastal habitat to fisheries and its vulnerable life-history characteristics provide little capacity for recovery." Id.

Captures of Sandtigers from Central-North Rio Grande do Sul, the southern-most state of Brazil, have declined dramatically throughout the 1980s and 1990s from an initial catch per unit effort (CPUE)[116] of 11.7 sharks per 1000 meters of net to 0.3 sharks per 1000 meters of net by the early 2000s, representing a decline of approximately 97%. Id. (citing Soto 2001). During the 1980s, *C. taurus* were considered abundant off the coast of Rio Grande do Sul and were commonly caught in aggregations by gillnet fisheries. Id. (citing Vooren et al. 2005). However, there were no Sandtigers recorded for the same fishery during the summer of 2003, and only 11 individuals total were recorded at another fishery in Passo de Torres, Santa Catarina, Brazil (just north of Rio Grande do Sul) during the fall and spring of 2005. Id. Spear fishermen also systematically wiped out large aggregations of Sandtigers in Santa Catarina in the 1970s and 1980s. Id. at 6. This species is now considered rare in Brazilian fisheries, with fishing pressure remaining intense within its coastal habitat. Id. at 5-6. The scarcity of neonates is of special concern given the incredibly slow reproductive rate of Sandtigers. Id. at 5 (citing Vooren et al. 2005).

"In Uruguay, this species has been taken for over 50 years by the artisanal fleet." Id. at 6. Reaching a peak in the mid 1980s, Sandtiger captures have thereafter suffered a marked decline, with catches decreasing from 784 kg per fishing-day in 1985 to a mere 32 kg per fishing-day in 2001 with only occasional captures reported since. Id.

Furthermore, immediate mortality is not the only impact these sharks are facing from the fisheries. One source estimates that anglers caught 889 sharks during the summers 1999 through 2001 in Anegada Bay, Argentina. Id. (citing Lucifora 2003). "Out of 175 sharks observed, 153 suffered serious injuries of the internal organs caused by hooks." Id. (citing Lucifora 2003). Another source reported "extensive damage to shark catches in gillnets by marine mammals (sea lions bite out the belly of entangled sharks and eat the liver)." Id. (citing Crespo & Corcuera 1990). Therefore, since coastal fishing pressure is intense and continuing within this species' coastal habitat in the Southwest Atlantic, these fisheries continue to pose a grave threat to the long-term survival of this subpopulation of *Carcharias taurus*. Id. at 5-6.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

"This species has been listed as a species threatened with over-exploitation on Annex II of the Brazilian federal law of Threatened and Overexploited Aquatic Species since 2004." Id. at 6 (citing Vooren & Klippel 2005). "Also the prohibition of trawl fishing within three nautical miles from the coast of southern Brazil is now being enforced satisfactorily. However, the species is still caught as bycatch in the legally permitted coastal gillnet fisheries and offshore trawl and gillnet fisheries." Id. "A management plan is being considered for development for this species in the Bahía San Blas Reserve (Anegada Bay, Argentina)." Id.

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[116] CPUE is an indirect measure of the abundance of a target species, which is in this instance calculated as sharks caught per 1000 meters of fishing net. Changes in the catch per unit effort are inferred to signify changes to the target species' true abundance. A decreasing CPUE indicates overexploitation, while an unchanging CPUE indicates sustainable harvesting.

While these measures are positive first steps, they are not sufficient to protect this imperiled subpopulation and have not been effective against the massive overutilization that has occurred since at least the 1950s.[117] Regardless of the Brazilian listing and the prohibition on trawling, this subpopulation's inshore habitat leaves it vulnerable to small-scale multi-species and artisanal fisheries as well as recreational fishermen, spear-fishers and shark control programs. See id. It is also retained due to its value when caught as bycatch. See id. Since fishing pressure has remained high, and the species has significant difficulty replacing lost individuals, these fishing threats need to be halted with stronger measures. See id. Also, while the species may possibly be protected in the future in the Bahía San Blas Reserve, these considerations are currently doing nothing for the subpopulation. Furthermore, even if implemented, the Reserve protections would only assist the subpopulation in a small area of its range. Therefore, existing regulatory mechanisms are inadequate to protect this subpopulation from continued high risk of extinction and the subpopulation should be protected under the ESA.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

As stated above, this species has a very slow reproductive rate due, at least in part, to embryonic oviphagy, intra-uterine cannibalism, and production of only one or two pups per little every second year. Id. at 5. This gives it "one of the lowest reproductive rates known among chondrichthyans." Id. at 3. This severely reduces the Sandtiger's ability to recover in the face of intense overutilization like that seen in the Southwest Atlantic region.[118]

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of this subpopulation. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted). Therefore, the combination of threats to this subpopulation could cause a greater and faster reduction in the remaining population than might be expected from simply the additive impacts of the threats.

This subpopulation is already at risk as its members are part of 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-

[117] See "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra.
[118] Id. at 5-6; see also "G. Sharks: Sharks Introduction: Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E): K-Selected/K-Strategy Species," supra.

bodied, long-generation and low-fecundity species particularly predisposed to anthropogenic threats given their lower replacement rates." Id. at 455 (internal citations omitted).

These threats qualify the subpopulation as a "threatened" or "endangered" DPS under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(63) Scientific Name: *Centrophorus harrissoni*

Common Name: Dumb Gulper Shark / Harrison's Dogfish / Harrison's Deepsea Dogfish

IUCN Status: Critically Endangered **CITES Status**: N/A

Range: This shark occurs sporadically in the Western Central and Southwest Pacific off eastern Australia and on seamounts and ridges to the north of New Zealand. IUCN (Centrophorus harrissoni) 2012, Exhibit 116 at 4.

Habitat and Ecology: "Demersal on the upper to middle continental slope, mainly in depths of 220 to 790 m[eters], although catches have been made as deep as 1,050 m[eters]." Id. (citing Last & Stevens 1994; Daley et al. 2002). "The diet of this species consists of teleost fishes[], cephalopods, and crustaceans." Id. (citing Daley et al. 2002). "The low fecundity (1 to 2 pups maximum every 1 to 2 years), high longevity . . . and probable late age at first maturity of this species prevent it from quick recovery after sustained fishing of its populations in the last 20 to 30 years." Id. (citing Graham et al. 2001; Daley et al. 2002).

Population Status: "The population size (although suspected to be small) . . . is unknown." Id.

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

The main threat to this species is overfishing stemming from market demand for its flesh, especially the fins, and liver oil. See id. (citing Daley et al. 2002). Demersal trawling and drop-lining along the continental slope within its range led to "[d]ocumented declines of over 99%" between 1976 and 1997 in the waters between Sydney and the Eden-Gabo Island Area. Id. (citing Graham et al. 1997; Graham et al. 2001; Andrew et al. 1997). "Catches in the above[-]mentioned areas [within this species' preferred depth range] declined from a mean of 28.8 [kilograms per hour] in 1976[] to a mean of 0.1 [kilograms per hour] in []1997," representing a total of only eight individuals. Id. (citing Daley et al. 2002). Overutilization for commercial purposes has nearly wiped this species out and continues to be a threat to its existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There have recently been some limits placed on allowable catch of *C. harrissoni* and a requirement that livers be landed with the carcass and not removed at sea. Id. at 4-5. These protections are not sufficient. The species has faced drastic declines and the catch limit should be set at zero. No carcasses should be allowed to be landed and no livers should be allowed to be kept. There needs to be a clear prohibition on continued exploitation of this species and these half measures are not appropriate in this circumstance. While catch quotas are necessary to ensure that species that have not yet become "endangered" are not harvested in unsustainable numbers, they are inappropriate measures for species that have already become "endangered," or in this instance "critically endangered." By listing a species as "critically endangered," IUCN is saying that the species is facing threats to its existence that create an "extremely high risk of extinction in the wild." IUCN Undated, Exhibit 38 at 14-17. If a species is facing an "extremely high risk of extinction in the wild," then the catch quota for that species should be set at zero. These types of half measures are inappropriate to halt species extinctions, and this is why the more restrictive prohibitions represented by ESA protection are desperately needed for this species. *Centrophorus harrissoni* has also been nominated for protection as an endangered species on the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. IUCN (Centrophorus harrissoni) 2012, Exhibit 116 at 5. However, unless and until the species is listed, this provides it no protection whatsoever. These regulatory mechanisms are clearly inadequate and the species should be protected under the ESA.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

K-Selected/K-Strategy Species. The species' low fecundity, longevity, and probable late age at first maturity put it at increased risk of extinction and make it much harder to overcome threats to its existence. Id. at 4. These life factors mean that *Centrophorus harrissoni* is a K-selected or K-strategy species. See Goble & Freyfogle 2010, Exhibit 64 at 1058-60.

> K-strategy species are more extinction prone than are r-strategy species. The very efficiency with which K-strategy species exploit their environment is a liability *during periods of rapid or chaotic change.* The larger body size of individuals of a K-strategy species - while giving an advantage in interspecific competition and in defense against predators and allowing individuals to exploit a larger area - means that there are fewer individuals . . . At the same time, lower reproduction rates make it more difficult both for the species to recover if its population becomes depressed and for it to adapt to a changed environment because fewer offspring contain less genetic variability. Thus, the very "fittedness" of K-strategy species to a particular environment - which is advantageous during periods of stability - becomes a serious handicap when the habitat

> changes more rapidly than genes can be substituted in a population - and in species that reproduce slowly, genes are substituted slowly.

Id. at 1059-60 (emphasis in original).

Harrison's Dogfish are currently experiencing the type of rapid, chaotic change that makes their K-selected life history pattern a liability. This is because they are being fished and removed from their habitat at a rate greater than they can replenish their numbers.[119] As a result of these pressures, many of the *Centrophorus harrissoni*'s physical attributes and reproductive adaptations have gone from being beneficial to creating increased risk of species extinction for this species. For instance, species recruitment is hindered by the fact that they live longer than most shark species, reach sexual maturity late in life, and have low fecundity. See IUCN (Centrophorus harrissoni) 2012, Exhibit 116 at 4. This type of life history pattern means that the species does not replenish itself as quickly as smaller, shorter-lived, r-selected species and is, therefore, more vulnerable when individuals are removed from the population or species reproduction is otherwise disrupted. This difficulty is exacerbated by the fact that the largest Harrison's Dogfish are both the ones most likely targeted by fishers for the greatest economic return and those most likely to be sexually mature. Removing the only members of a species that are capable of reproduction means that there is a substantial risk that the population will rapidly collapse.

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of Harrison's Dogfish. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted). Therefore, the combination of threats to this species could cause a greater and faster reduction in the remaining population than might be expected from simply the additive impacts of the threats.

Harrison's Dogfish 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." Id. at 455 (internal citations omitted).

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

[119] See "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra.

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(64) Scientific Name: *Cetorhinus maximus* (North Pacific Subpopulation)

Common Name: Basking Shark

IUCN Status: Endangered **CITES Status**: Appendix II; with reservations in Indonesia, Iceland, Japan, Korea, and Norway

Range: In the North Pacific, the Basking Shark "occurs around Japan and off the Chinese coast, and from California north to British Columbia." IUCN (Cetorhinus maximus (North Pacific Subpopulation)) 2012, Exhibit 117 at 4. "The different morphological characteristics of Basking Sharks in the Pacific and the north and south Atlantic oceans are not thought to indicate separate species, but are geographically isolated subpopulations." Id. (citing Compagno 1984).

Habitat and Ecology: "The Basking Shark [] is a very large, filter-feeding cold-water pelagic species that is migratory and widely distributed, but only regularly seen in a few favored coastal locations and probably never abundant." Id. at 3. "This shark is named from its habit of 'basking' on the surface in good weather conditions, usually singly or in small groups, although it also carries out extensive vertical migrations between the surface and deep water on the continental shelf and shelf-edge." IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 5 (citing Sims et al. 2003). "Basking Sharks are often associated with surface aggregations of zooplankton, particularly along tidal and shelf-break fronts, where they feed on small fish, fish eggs and zooplankton by swimming open-mouthed with gill rakers erect and extended across the gaps between the gill arches to form a sieve." Id. (citing Kunzlik 1988; Earll & Turner 1993; Sims et al. 1997; Sims et al. 2003; Sims & Quayle 1998; Speedie 1998; Stendall 1933; Matthews & Parker 1950; Van Deinse & Adriani 1953). "Few sharks are recorded from coastal and surface waters in winter, indicating a migration into warmer regions or deep water." Id. (citing Squire 1990; Baduini 1995).

"The reproductive biology of Basking Sharks is considered to be similar to that of other lamnoid sharks." Id. (citing Kunzlik 1988). The Basking Shark exhibits ovoviviparity, where embryos hatch within the uterus, and likely ovophagy, in which the mother continues to produce infertile eggs on which the embryos can then feed. Id. The gestation period has been estimated at anywhere from 12 to 36 months, and it is thought that there is a resting period of at least one year between pregnancies, and thus a 2-4 year interval between litters. Id. (citing Parker & Stott 1965; Pauly 1978; Pauly 2002; Compagno 1984a). Maturity appears to occur between 12 and 16 years for males and 16 and 20 years for females. Id. at 6 (citing Compagno 1984a). Maximum age is also uncertain. Id.

Population Status and Trend: Decreasing. IUCN (Cetorhinus maximus (North Pacific Subpopulation)) 2012, Exhibit 117 at 4.

Qualifications as a DPS

NMFS and FWS have jointly published a policy document defining the statutory requirements for finding a DPS. 61 Fed. Reg. 4,722. This joint policy employs a three-part analysis to determine the status of a possible DPS as endangered or threatened under the ESA: (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. at 4,725.

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 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.

Id.

The North Pacific Subpopulation of Basking Sharks meets both of these requirements.

1. Markedly Separate From Other Populations.

Basking Sharks are an elusive species and not much is known about them. See, e.g., IUCN (Cetorhinus maximus (North Pacific Subpopulation)) 2012, Exhibit 117 at 3. However, what is known about the different populations indicates that "[t]he different morphological characteristics of Basking Sharks in the Pacific and the north and south Atlantic oceans are not thought to indicate separate species, but are geographically isolated subpopulations." Id. at 4 (citing Compagno 1984). Therefore, due to the fact that this subpopulation is markedly separate from other populations, it meets the "*discreteness*" requirement for listing as a DPS.

2. Significant Differences in Regulatory Mechanisms.

While CITES protection does exist for the species as a whole, it does not protect this subpopulation.[120] This is because "Japan and Norway, the world's two main trading nations [in Basking Sharks], took reservations on this listing," which means that the

[120] See The Inadequacy of Existing Regulatory Mechanisms (Criterion D): CITES," infra.

requirements will not apply to them. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 8. As a result, Japan, which fishes this subpopulation and trades in its products, can continue to hunt, kill, and trade members of the subpopulation without violating CITES (Republic of Korea, which also is in the subpopulation's range, also took a reservation). In contrast, CITES does offer some protection to the South Atlantic Subpopulation, for example; no countries in the South Atlantic Subpopulation's range took reservations to the CITES listing and, therefore, all member countries are bound. See CITES Undated 6, Exhibit 181 at 4 (citing reservations to this CITES listing from Iceland, Indonesia, Japan, Norway, and Republic of Korea).

Further national and regional protections also exist for other subpopulations that are not available to this subpopulation. "The Basking Shark is strictly protected under wildlife legislation within 12 nautical miles of the Isle of Man and Guernsey (United Kingdom dependent territories) and in British waters. It is protected in US Federal waters (including the Gulf of Mexico and Caribbean Sea) by a National Marine Fisheries Service rule for Atlantic shark fisheries, which prohibits directed commercial fishing, landing and sale of the species and in Florida State waters. The basking shark is one of several species partially protected through New Zealand's Fisheries Act (1983). Commercial target fishing [in New Zealand] has been banned since 1991 . . . " IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 8. The species also is protected in Malta. Id. This subpopulation's range does not overlap with any of these areas, and, therefore, these protections are of no help to it. As a result, significant differences exist in the regulatory mechanisms that exist to protect this subpopulation as compared to those that exist to protect the other subpopulations. Therefore this subpopulation qualifies under the "*discreteness*" requirement for listing as a DPS.

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 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 DPS in an ecological setting unusual or unique for the taxon;
2. Evidence that loss of the DPS would result in a significant gap in the range of a taxon;
3. Evidence that the DPS 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 DPS differs markedly from other populations of the species in its genetic characteristics.

61 Fed. Reg. at 4,725.

The North Pacific Subpopulation of Basking Sharks is significant to the species because loss of the subpopulation "would result in a significant gap in the range of the taxon." Id. The various subpopulations appear to be geographically isolated from one another, which means that re-colonization would be unlikely in the event of this subpopulation's extirpation. See IUCN (Cetorhinus maximus (North Pacific Subpopulation)) 2012, Exhibit 117 at 4. Also, the North Pacific Subpopulation differs markedly from other subpopulations in its genetic characteristics as evidenced by differing morphological characteristics. Id. (citing Compagno 1984) ("[t]he different morphological characteristics of Basking Sharks in the Pacific and the north and south Atlantic oceans are not thought to indicate separate species, but are geographically isolated subpopulations."). Therefore, due to the fact that this subpopulation is markedly separate in its genetic characteristics from other populations, it meets the "*discreteness*" requirement for listing as a DPS. While there is scarce discussion of these differences, this is almost certainly due to the fact that there are so few individuals to test and so little is known about the species as a result. The best available scientific information thus provides that the subpopulation differs markedly in its genetic characteristics from other subpopulations and that extirpation of the subpopulation would result in a significant gap (representing its entire North Pacific habitat) in the range of the taxon.

The North Pacific Subpopulation of Basking Sharks satisfies both the "*discreteness*" and "*significance*" requirements. Although these guidelines are not regulations and serve only as policy guidance for the agencies (61 Fed. Reg. at 4,723), they have been upheld as a reasonable interpretation of ambiguous statutory language. Maine v. Norton, 257 F. Supp. 2d 357 (D. Me. 2003). Accordingly, if the responsible agency determines a potential DPS 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 DPS were in fact a species and it is eligible for listing. The North Pacific Subpopulation of Basking Sharks are vertebrates that meet the "*discreteness*" and "*significance*" requirements set forth above, and therefore should be considered for listing based on the listing criteria described below.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual subpopulation account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

Historically, "[t]he Basking Shark had been exploited for several centuries to supply liver oil for lighting and industrial use, skin for leather and flesh for food or fishmeal. Modern fisheries yield liver oil, fins, meat, and cartilage." IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 6 (citing Rose 1996). "The large liver [in this species] represents 17-25% of total weight and contains a high proportion of squalene oil." Id. (citing Buranudeen & Rishards-Rajadurai 1986). "The very large fins fetch extremely high prices in international trade to East Asia." Id. (citing Fleming & Papageorgiou 1996; Lum 1996; Fairfax 1998; Anon. 2002c). "Most Basking Shark fisheries appear to have collapsed after initial high yields," indicating that this shark is "extremely vulnerable to overfishing . . . " Id. (citing Compagno 1984a). These collapsed stocks are slow to rebuild themselves and they are struggling to do so over 60 years later in some cases. See id. at 6-7.

In the North Pacific, "[a]n intensive targeted Japanese Basking Shark fishery, utilizing liver oil, shark fin[s,] and meat, took place" in the 1960s and 1970s. Id. at 7. "An estimated 1,200 sharks were harpooned from 1967-78, peaking in 1972 when more than 60 sharks were sold at market in one day." Id. Catches then declined throughout the 1970s until only six total were caught in 1978 and the fishery closed a few years later. Id. Despite the closure, to this day only one or two Basking Sharks are seen each year off the coast of Japan. Id. "Basking sharks are [also] sometimes landed and sold after becoming entangled in set nets or pot lines, or caught in trawls, but bycatch (whether landed or discarded) is rarely reported." Id. These fisheries have decimated Basking Shark numbers and they have not been able to recover despite the general cessation of fisheries. They are seemingly still caught as bycatch and the high value of their fins ensures that unreported, illegal catches will continue. Therefore, commercial overutilization continues to threaten the subpopulation's continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

Currently, existing regulatory mechanisms are insufficient to protect this subpopulation of the Basking Shark. Internationally, the Basking Shark has been listed on Appendix II of CITES since 2003, with Norway and Japan (amongst other countries) taking reservations to the listing. Id. at 8. "This [listing] requires international trade to be monitored and derived from sustainably managed fisheries." Id. at 8. CITES is an international agreement with 176 parties that aims to ensure that international trade in wild plants and animals does not threaten their existence. See CITES Undated 1, Exhibit 33 entire; CITES Undated 2, Exhibit 34 at 1. However, CITES listing has thus far proven to be insufficient.

CITES only applies to **international trade** in endangered species. See CITES Undated 2, Exhibit 34 at 1. CITES' focus is too narrow to protect Basking Sharks from the other threats that they face, such as bycatch. The CITES listing itself offers insufficient protection to the Basking Shark as it simply requires that exporting countries demonstrate that the exported Basking Shark carcasses came from sustainable populations. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 8. This is problematic because there is currently no clear standard for these so-called "non-detriment findings," which are used to determine whether killings of covered species would threaten sustainable populations. See CITES Undated 5, Exhibit 137 at 1. Even if there were some way to determine what a sustainable population means, it would be difficult to demonstrate a sustainable Basking Shark fishery because of the elusive nature of the species. See generally IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136.

There is also relatively little that can be done to enforce CITES requirements, particularly when there is an illegal market for Basking Shark products. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 8. Part of the problem is that Appendix II only requires a permit for exports of species listed therein. Therefore, it does not require a country to demonstrate domestically consumed Basking Sharks came from sustainable populations. See CITES Undated 3, Exhibit 35 at 1-2. Furthermore, the fact that only an export permit, and not an import permit, is required for international trade means there is one less level of scrutiny for those smuggling Basking Shark products internationally. See id. Thus, fishers from one country could kill Basking Sharks in international waters and take the carcasses directly to any importing country. If they were to do so without returning to their country of origin they would completely avoid any permitting procedure under Appendix II of CITES. NMFS acknowledged the unsatisfactory effect of even the more restrictive Appendix I listings in its determination for the listing of the Largetooth Sawfish under the ESA, when it stated that illegal foreign trade of the species continued "in spite of the CITES listing and national laws, due to lack of enforcement." See 76 Fed. Reg. 40822 (July 12, 2011), Exhibit 36 at 40832; NOAA Undated at 3, Exhibit 37.

Furthermore, CITES, while very inclusive, does not cover every nation. See CITES Undated 1, Exhibit 33 entire. "Japan and Norway, the world's two main trading nations [in Basking Sharks], took reservations on this listing," which means that the requirements will not apply to them or any nonparties. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 8. As a result, Japan, which fishes this subpopulation and trades in its products, can continue to hunt, kill, and trade members of the subpopulation without violating CITES (the Republic of Korea, which also is in the subpopulation's range, also took a reservation). In contrast, CITES does offer some protection to the South Atlantic Subpopulation, for example; no countries in the South Atlantic Subpopulation's range took reservations to the CITES listing and, therefore, all member countries are bound. See CITES Undated 6, Exhibit 181 at 4 (citing reservations to this CITES listing from Iceland, Indonesia, Japan, Norway, and Republic of Korea). This lack of universal applicability undercuts the effectiveness of the measure by allowing covered species to be transferred from or through a non-party country, or party country that has taken reservations, thus avoiding the export restrictions on Appendix II species. See CITES Undated 3, Exhibit 35 at 3.

CITES' narrow focus and the ease of CITES circumvention demonstrate the inadequacy of CITES listing in the protection of Basking Sharks. While CITES listing is important, it is not sufficient, and the Basking Shark should be offered the further protections of ESA listing.

It is clear that existing regulatory mechanisms are not sufficient to protect this subpopulation, especially considering the fact that the species is so fragile and slow to recover from losses of individuals. This subpopulation should be listed as a DPS and protected under the ESA to stop its extirpation.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

K-Selected/K-Strategy Species. The species' low fecundity, longevity, devotion of significant energy to reproduction, long gestation period, rest period between pregnancies, and probable late age at first maturity put it at increased risk of extinction and make it much harder to overcome threats to its existence. Id. at 5-6. These life history factors indicate that the Basking Shark is a K-selected or K-strategy species. See Goble & Freyfogle 2010, Exhibit 64 at 1058-60.

> K-strategy species are more extinction prone than are r-strategy species. The very efficiency with which K-strategy species exploit their environment is a liability *during periods of rapid or chaotic change.* The larger body size of individuals of a K-strategy species - while giving an advantage in interspecific competition and in defense against predators and allowing individuals to exploit a larger area - means that there are fewer individuals . . . At the same time, lower reproduction rates make it more difficult both for the species to recover if its population becomes depressed and for it to adapt to a changed environment because fewer offspring contain less genetic variability. Thus, the very "fittedness" of K-strategy species to a particular environment - which is advantageous during periods of stability - becomes a serious handicap when the habitat changes more rapidly than genes can be substituted in a population - and in species that reproduce slowly, genes are substituted slowly.

Id. at 1059-60 (emphasis in original).

The North Pacific Subpopulation of Basking Sharks are currently experiencing the type of rapid, chaotic change that makes their K-selected life history pattern a liability. They are being fished and removed from their habitat at a faster rate than they can replenish their numbers.[121] As a result of these pressures, many of the Basking Shark's physical attributes and reproductive adaptations have gone from being beneficial to creating increased risk of species extinction. For instance, species recruitment is hindered by the fact that they exhibit low fecundity, high longevity, devotion of significant energy to reproducing, long gestation periods, long rest periods between pregnancies, and probable late age at first maturity. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 5-6. This type of life history pattern means that the species does not replenish itself as quickly as smaller, shorter-lived, r-selected species and is, therefore, more vulnerable when individuals are removed from the population or species reproduction is otherwise disrupted. This difficulty is exacerbated as the largest Basking Sharks are both the ones most likely targeted by fishers for the greatest economic return on their large fins **and** those most likely to be sexually mature. Removing the only members of a species that are capable of reproduction means that there is a substantial risk that the population will rapidly collapse.

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[121] See "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra.

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of this subpopulation of Basking Sharks. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted). Therefore, the combination of threats to this subpopulation could cause a greater and faster reduction in the remaining population than might be expected from simply the additive impacts of the threats.

Basking Sharks are already at risk as a low-fecundity or K-selected species, rendering them 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." Id. at 455 (internal citations omitted). As a result of these threats, the North Pacific Subpopulation of Basking Sharks should be protected under the ESA to prevent its extinction.

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(65) Scientific Name: *Cetorhinus maximus* (Northeast Atlantic Subpopulation)

Common Name: Basking Shark

IUCN Status: Endangered **CITES Status**: Appendix II; with reservations in Indonesia, Iceland, Japan, Korea, and Norway

Range: "Basking Sharks occur in temperate and boreal oceans. In the North Atlantic, the species occurs from the transition between Atlantic and Arctic waters (including the Gulf of Maine, south and west of Iceland, and off the North Cape of Norway and Russia) to the Mediterranean, and occasionally as far south as Senegal and Florida. The different morphological characteristics of Basking Sharks in the Pacific and north and south Atlantic oceans are not thought to indicate separate species, but geographically isolated [sub]populations." IUCN (Cetorhinus maximus (Northeast Atlantic Subpopulation)) 2012, Exhibit 118 at 4 (citing Compagno 1984).

Habitat and Ecology: "The Basking Shark is a very large, filter-feeding cold-water pelagic species that is migratory and widely distributed, but only regularly seen in a few favored coastal locations and probably never abundant." IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 3. "This shark is named from its habit of 'basking' on the surface in good weather conditions, usually singly or in small groups, although it also carries out extensive vertical migrations between the surface and deep water on the continental shelf and shelf-edge." Id. at 5 (citing Sims et al. 2003). "Basking Sharks are often associated with surface aggregations of zooplankton, particularly along tidal and shelf-break fronts, where they feed on small fish, fish eggs and zooplankton by swimming open-mouthed with gill rakers erect and extended across the gaps between the gill arches to form a sieve." Id. (citing Kunzlik 1988; Earll & Turner 1993; Sims et al. 1997; Sims et al. 2003; Sims & Quayle 1998; Speedie 1998; Stendall 1933; Matthews & Parker 1950; Van Deinse & Adriani 1953). "Few sharks are recorded from coastal and surface waters in winter, indicating a migration into warmer regions or deep water." Id. (citing Squire 1990; Baduini 1995).

"The reproductive biology of Basking Sharks is considered to be similar to that of other lamnoid sharks." Id. (citing Kunzlik 1988). The Basking Shark exhibits ovoviviparity, where embryos hatch within the uterus, and likely ovophagy, in which the mother continues to produce infertile eggs on which the embryos can then feed. Id. The gestation period has been estimated at anywhere from 12 to 36 months, and it is thought that there is a resting period of at least one year between pregnancies, and thus a 2-4 year interval between litters. Id. (citing Parker & Stott 1965; Pauly 1978; Pauly 2002; Compagno 1984a). Maturity appears to occur between 12 and 16 years for males and 16 and 20 years for females. Id. at 6 (citing Compagno 1984a). Maximum age is also uncertain. Id.

Population Status and Trend: Decreasing. IUCN (Cetorhinus maximus (Northeast Atlantic Subpopulation)) 2012, Exhibit 118 at 4.

Qualifications as a DPS

NMFS and FWS have jointly published a policy document defining the statutory requirements for finding a DPS. 61 Fed. Reg. 4,722. This joint policy employs a three-part analysis to determine the status of a possible DPS as endangered or threatened under the ESA: (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. at 4,725.

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 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.

Id.

The Northeast Atlantic Subpopulation of Basking Sharks meets both of these requirements.

1. Markedly Separate From Other Populations.

Basking Sharks are an elusive species and not much is known about them. See, e.g., IUCN (Cetorhinus maximus (Northeast Atlantic Subpopulation)) 2012, Exhibit 118 at 3. However, what is known about the different populations indicates that "[t]he different morphological characteristics of Basking Sharks in the Pacific and the north and south Atlantic oceans are not thought to indicate separate species, but geographically isolated populations." Id. at 4 (citing Compagno 1984). Therefore, this subpopulation is markedly separate from other populations and meets the "*discreteness*" requirement for listing as a DPS.

2. Significant Differences in Regulatory Mechanisms.

While CITES protection does exist for the species as a whole, it does not protect this subpopulation.[122] This is because "Japan and Norway, the world's two main trading

[122] See The Inadequacy of Existing Regulatory Mechanisms (Criterion D): CITES," infra.

nations [in Basking Sharks], took reservations on this listing," which means that the requirements will not apply to them. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 8. As a result, Norway, which has historically fished this subpopulation and traded in its products, can continue to hunt, kill, and trade members of the subpopulation without violating CITES (Iceland, which also is in the subpopulation's range, also took a reservation). In contrast, CITES does offer some protection to the South Atlantic Subpopulation, for example; no countries in the South Atlantic Subpopulation's range took reservations to the CITES listing and, therefore, all member countries are bound. See CITES Undated 6, Exhibit 181 at 4 (citing reservations to this CITES listing from Iceland, Indonesia, Japan, Norway, and Republic of Korea). There are also some extraneous international measures applicable to the EU protecting Basking Sharks, but they do not protect sufficiently against bycatch and illegal sales, which certainly are still occurring. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 8 ("[e]very year . . . we get reports of basking sharks being caught, landed and put on sale illegally in the EU. So, small scale bycatch and [utilization] is definitely ongoing even in areas where the species is strictly protected"). Finally, there are a number of national protections, but they lack the requisite scope to protect the population and therefore will, at best, be of limited efficacy.[123] Furthermore, the Northwest Atlantic Subpopulation is protected in all U.S. waters, including the Gulf of Mexico and Caribbean Sea, which covers most of that subpopulation's coastal range. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 8. Whereas the Northeast Atlantic Subpopulation has only been protected in the waters of the U.K. and Malta. Id. As a result, significant differences exist in the regulatory mechanisms that exist to protect this subpopulation as compared to those that exist to protect the other subpopulations. Therefore this subpopulation qualifies under the "*discreteness*" requirement for listing as a DPS.

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 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 DPS in an ecological setting unusual or unique for the taxon;
2. Evidence that loss of the DPS would result in a significant gap in the range of a taxon;
3. Evidence that the DPS 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 DPS differs markedly from other populations of the species in its genetic characteristics.

61 Fed. Reg. at 4,725.

[123] See "The Inadequacy of Existing Regulatory Mechanisms (Criterion D)," infra.

The Northeast Atlantic Subpopulation of Basking Sharks is significant to the species because loss of the subpopulation "would result in a significant gap in the range of the taxon." Id. The various subpopulations appear to be geographically isolated from one another, which means that re-colonization would be unlikely in the event of this subpopulation's extirpation. See IUCN (Cetorhinus maximus (Northeast Atlantic Subpopulation)) 2012, Exhibit 118 at 4. Also, the Northeast Atlantic Subpopulation differs markedly from other subpopulations in its genetic characteristics as evidenced by differing morphological characteristics. Id. (citing Compagno 1984) ("[t]he different morphological characteristics of Basking Sharks in the Pacific and the north and south Atlantic oceans are not thought to indicate separate species, but geographically isolated populations."). Therefore, due to the fact that this subpopulation is markedly separate in its genetic characteristics from other populations, it meets the "*discreteness*" requirement for listing as a DPS. While there is scarce discussion of these differences, this is almost certainly due to the fact that there are so few individuals to test and so little is known about the species as a result. The best available scientific information thus provides that the subpopulation differs markedly in its genetic characteristics from other subpopulations and that extirpation of the subpopulation would result in a significant gap (representing its entire Northeast Atlantic habitat) in the range of the taxon.

The Northeast Atlantic Subpopulation of Basking Sharks satisfies both the "*discreteness*" and "*significance*" requirements. Although these guidelines are not regulations and serve only as policy guidance for the agencies (61 Fed. Reg. at 4,723), they have been upheld as a reasonable interpretation of ambiguous statutory language. Maine v. Norton, 257 F. Supp. 2d 357 (D. Me. 2003). Accordingly, if the responsible agency determines a potential DPS 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 DPS were in fact a species and it is eligible for listing. The Northeast Atlantic Subpopulation of Basking Sharks are vertebrates that meet the "*discreteness*" and "*significance*" requirements set forth above, and therefore should be considered for listing based on the listing criteria described below.

Known Threats/Listing Criteria:

All of the threats and information discussed in "Sharks Introduction," supra, are to be considered as incorporated by reference in this individual subpopulation account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

Historically, "[t]he Basking Shark had been exploited for several centuries to supply liver oil for lighting and industrial use, skin for leather and flesh for food or fishmeal. Modern fisheries yield liver oil, fins, meat, and cartilage." IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 6 (citing Rose 1996). "The large liver [in this species] represents 17-25% of total weight and contains a high proportion of squalene oil." Id. (citing Buranudeen & Rishards-Rajadurai 1986). "The very large fins fetch extremely high prices in international trade to East Asia." Id. (citing Fleming & Papageorgiou 1996; Lum 1996; Fairfax 1998; Anon. 2002c). "Most Basking Shark fisheries appear to have collapsed after initial high yields," indicating that this shark is "extremely vulnerable to overfishing . . . " Id. (citing Compagno 1984a). These collapsed stocks are slow to rebuild themselves and they are struggling to do so over 60 years later in some cases. See id. at 6-7.

In the northeast Atlantic a Basking Shark fishery "started at Achill Island, western Ireland in 1947, using set nets to entangle sharks. It peaked in the early 1950s, when 1000-1808 [Basking S]harks were taken each year." Id. at 6. However, by the "early 1970s, only 29-85 [Basking S]harks were taken annually, a decline of over 90% in 20-25 years. Re-capitalization of the fishery in 1973 failed to increase yields locally and it closed in 1975, despite high oil prices." Id. The sharp decline and collapse of this fishery has been attributed to the overfishing of the local stock, and there are still very few observations of Basking Sharks along the whole west and northwest coast of Ireland. Id. The Achill Island fishery appears to have depleted the population to such an extent that it has still not recovered some forty years later, with fishers reporting seeing a mere 10 Basking Sharks annually. Id. at 6-7.

The main fishing pressure on the northeast Atlantic Basking Shark population was the Norwegian fleet, active every year from April to September. Id. at 7. Basking Shark catches for this fishery ranged from a low of more than 1,000 to a high of more than 4,000 per year from 1959-1980. Id. (citing Kunzlik 1988; ICES data in Anon. 2002c). "The majority of fins landed by Norway have been exported to Japan." Id. (citing Anon. 2002c). "Since the precise location from which the Basking Sharks were taken is only identified by ICES sea area, it is difficult to detect and evaluate trends in catches, effort, and hence population, but declines appear to be related to population trends and driven by fisheries and trade demand." Id. (citing Anon. 2002c). It appears that Norway closed its fishery for Basking Sharks in 2006 or 2007. Id. at 8. However, "[t]hey are presumably still landing bycatch." Id. Every year there are also reports from the EU of Basking Sharks "being caught, landed and put on sale illegally []. So, small scale bycatch and [utilization] is definitely ongoing even in areas where the species is strictly protected." Id.

Basking Sharks from this northeast Atlantic Subpopulation are also caught as bycatch in several other European fisheries with as many as 40 per year from a single bay in south-west England. Id. Therefore, it is clear that both intentional, directed efforts and bycatch have historically been responsible for vast depletions in the numbers of Basking Sharks in this northeast Atlantic Subpopulation and that those factors continue to impact the species' numbers in the area. Fishing pressures remain, and, since the species has so much trouble replacing lost individuals, these continuing catches represent commercial overutilization of the species threatening its continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

Currently existing regulatory mechanisms are insufficient to protect this subpopulation of the Basking Shark. For instance, while "[t]he Basking Shark is strictly protected under wildlife legislation within 12 nautical miles of the Isle of Man and Guernsey (United Kingdom dependent territories) and in British waters," it is still subject to extensive bycatch with more than 40 per year caught in a single English Bay. Id. at 7, 8.

Internationally, the Basking Shark has been listed on Appendix II of CITES since 2003, with Norway and Japan, amongst other countries, taking reservations to the listing. Id. at 8. "This [listing] requires international trade to be monitored and derived from sustainably managed fisheries." Id. at 8. CITES is an international agreement with 176 parties that aims to ensure that international trade in wild plants and animals does not threaten their existence. See CITES Undated 1, Exhibit 33 entire; CITES Undated 2, Exhibit 34 at 1. However, CITES listing has thus far proven to be insufficient.

CITES only applies to **international trade** in endangered species. See CITES Undated 2, Exhibit 34 at 1. CITES' focus is too narrow to protect them from the other threats that they face, such as bycatch. The CITES listing simply requires that exporting countries demonstrate that the exported Basking Shark carcasses came from sustainable populations. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 8. This is problematic because there is currently no clear standard for these so-called "non-detriment findings," which are used to determine whether killings of covered species would threaten sustainable populations. See CITES Undated 5, Exhibit 137 at 1. Even if there were some way to determine what a sustainable population means, it would be difficult to demonstrate a sustainable Basking Shark fishery because of the elusive nature of the species. See generally IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136.

There is also relatively little that can be done to enforce CITES requirements, particularly when there is an illegal market for Basking Shark products. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 8. Part of the problem is that Appendix II only requires a permit for exports of species listed therein. Therefore, it does not require a country to demonstrate domestically consumed Basking Sharks came from sustainable populations. See CITES Undated 3, Exhibit 35 at 1-2. Furthermore, the fact that only an export permit, and not an import permit, is required for international trade means there is one less level of scrutiny for those smuggling Basking Shark products internationally. See id. Thus, fishers from one country could kill Basking Sharks in international waters and take the carcasses directly to any importing country. If they were to do so without returning to their country of origin they would completely avoid any permitting procedure under Appendix II of CITES. NMFS acknowledged the unsatisfactory effect of even the more restrictive Appendix I listings in its determination for the listing of the Largetooth Sawfish under the ESA, when it stated that illegal foreign trade of the species continued "in spite of the CITES listing and national laws, due to lack of enforcement." See 76 Fed. Reg. 40822 (July 12, 2011), Exhibit 36 at 40832; NOAA Undated at 3, Exhibit 37.

Furthermore, CITES, while very inclusive, does not cover every nation. See CITES Undated 1, Exhibit 33 entire. "Japan and Norway, the world's two main trading nations [in Basking Sharks], took reservations on this listing," which means that the requirements will not apply to them or other nonparty countries. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 8. As a result, Norway, which has historically fished this subpopulation and traded in its products, can continue to hunt, kill, and trade members of the subpopulation without violating CITES (Iceland, which also is in the subpopulation's range, also took a reservation). See CITES Undated 6, Exhibit 181 at 4 (citing reservations to this CITES listing from Iceland, Indonesia, Japan, Norway, and Republic of Korea). In contrast, CITES does offer some protection to the South Atlantic Subpopulation, for example; no countries in the South Atlantic Subpopulation's range took reservations to the CITES listing and, therefore, all member countries are bound. See CITES Undated 6, Exhibit 181 at 4 (citing reservations to this CITES listing from Iceland, Indonesia, Japan, Norway, and Republic of Korea). This lack of universal applicability undercuts the effectiveness of the measure by allowing covered species to be transferred from or through a non-party country, or party country that has taken reservations, thus avoiding the export restrictions on Appendix II species. See CITES Undated 3, Exhibit 35 at 3. In this case, Norway, which is largely responsible for massive depletions of this subpopulation, has taken reservations and therefore will have completely bypassed CITES regulation in this instance. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 6, 8; see also CITES Undated 6, Exhibit 181 at 4 (Iceland, also in this subpopulation's range, has also taken a reservation to the listing).

CITES' narrow focus and the ease of CITES circumvention demonstrate the inadequacy of CITES listing in the protection of Basking Sharks. While CITES listing is important, it is not sufficient, and this subpopulation of Basking Sharks should be offered the further protections of ESA listing.

Furthermore, the Northeast Atlantic Subpopulation has only been nationally protected in the waters of the U.K. and Malta. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 8. Even these national measures seemingly do not protect sufficiently against bycatch and illegal sales, which certainly are still occurring. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 8 ("[e]very year . . . we get reports of basking sharks being caught, landed and put on sale illegally in the EU. So, small scale bycatch and [utilization] is definitely ongoing even in areas where the species is strictly protected"). Therefore, it is clear that existing regulations are not sufficient to protect this subpopulation, especially considering the fact that the species is so fragile and slow to recover from losses of individuals.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

K-Selected/K-Strategy Species. The species' low fecundity, longevity, devotion of significant energy to reproduction, long gestation period, rest period between pregnancies and probable late age at first maturity put it at increased risk of extinction and make it much harder to overcome threats to its existence. Id. at 5-6. These life history factors indicate that the Basking Shark is a K-selected or K-strategy species. See Goble & Freyfogle 2010, Exhibit 64 at 1058-60.

> K-strategy species are more extinction prone than are r-strategy species. The very efficiency with which K-strategy species exploit their environment is a liability *during periods of rapid or chaotic change.* The larger body size of individuals of a K-strategy species - while giving an advantage in interspecific competition and in defense against predators and allowing individuals to exploit a larger area - means that there are fewer individuals . . . At the same time, lower reproduction rates make it more difficult both for the species to recover if its population becomes depressed and for it to adapt to a changed environment because fewer offspring contain less genetic variability. Thus, the very "fittedness" of K-strategy species to a particular environment - which is advantageous during periods of stability - becomes a serious handicap when the habitat changes more rapidly than genes can be substituted in a population - and in species that reproduce slowly, genes are substituted slowly.

Id. at 1059-60 (emphasis in original).

Basking Sharks in the Northeast Atlantic are currently experiencing the type of rapid, chaotic change that makes their K-selected life history pattern a liability. They are being fished from their habitat at a faster rate than they can replenish their numbers.[124] As a result of these pressures, many of the Basking Shark's physical attributes and reproductive adaptations have gone from being beneficial to creating increased risk of the subpopulation's extinction. For instance, species recruitment is hindered by the fact that they exhibit low fecundity, high longevity, devotion of significant energy to reproducing, long gestation periods, long rest periods between pregnancies, and probable late age at first maturity. See IUCN (Cetorhinus maximus) 2012 (GENERAL), Exhibit 136 at 5-6. This type of life history pattern means that the species does not replenish itself as quickly as smaller, shorter-lived, r-selected species and is, therefore, more vulnerable when individuals are removed from the population or species reproduction is otherwise disrupted. This difficulty is exacerbated as the largest Basking Sharks are both the ones most likely targeted by fishers for the greatest economic return on their large fins **and** those most likely to be sexually mature. Removing the only members of a population that are capable of reproduction means that there is a substantial risk that the population will rapidly collapse.

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of this subpopulation of Basking Sharks. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted). Therefore, the combination of threats to this species could cause a greater and faster reduction in the remaining subpopulation than might be expected from simply the additive impacts of the threats.

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[124] See "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra.

Basking Sharks are already at risk as a low-fecundity or K-selected species, rendering them 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." Id. at 455 (internal citations omitted).

These threats qualify the subpopulation as a "threatened" or "endangered" DPS under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(66) Scientific Name: *Haploblepharus kistnasamyi*

Common Name: Shark

IUCN Status: Critically Endangered **CITES Status**: N/A

Range: "*Haploblepharus kistnasamyi* occurs in the Western Indian Ocean." IUCN (Haploblepharus kistnasamyi) 2012, Exhibit 119 at 4. It is a rare species endemic to South Africa, with a very restricted range. Id. Adults have been recorded only from the fishery in Durban, KwaZulu-Natal, South Africa, and it has not been found elsewhere despite extensive surveys. Id. Based on this, the species' extent of occurrence is estimated at less then 100 km^2. Id. at 3, 4. Individuals tentatively assigned as juveniles of this species have been recorded in Mossel Bay on the southern tip of South Africa, but the juvenile records still require verification. Id. at 4 (citing Human & Compagno 2006; Human 2006).

Habitat and Ecology: The only known specimens have all occurred inshore, usually close to the coastline. Id. "Its preferred habitat therefore appears to be rocky and coral reefs, and sandy habitats, with a depth range from intertidal to 30 m[eters] depth." Id. (citing Human & Compagno 2006; Human 2006). The life history of *Haploblepharus kistnasamyi* is virtually unknown. Id.

Population Status: "The population size of this rare shark is unknown, but apparently it is small as it is known only from three adults." Id. "This species is probably represented by a single population." Id. (citing Human & Compagno 2006; Human 2006).

Population Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

"With its restricted, inshore range and apparently very small population size, the main threat to *H. kistnasamyi* is habitat degradation." Id. (citing Human & Compagno 2006; Human 2006). "Intensive habitat modification and destruction is known to be occurring within its known range, particularly around [the city of] Durban, which has a rapidly expanding heavy industry sector, and is also expanding its tourist industry. This expansion includes increased industrial waste output and pollution, and land development for tourist resorts and attraction[s]." Id. at 4-5. Since the area around Durban represents essentially the core of this species' very limited habitat, and the entire population appears to live in this single area, degradation of its only habitat represents an extreme threat to *H. kistnasamyi*'s continued existence.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"The area around Durban is also under intensive fishing pressure from a number of fishing industries, most notably, the prawn fishing industry." Id. at 5. Intensive fishing pressure in its only habitat represents a significant threat of death from bycatch. Since this species is seemingly very rare, it is unlikely that it can withstand even minimal removal of individuals. Therefore, this bycatch threat represents overutilization of the species for commercial purposes.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

"No conservation measures are currently in place for *H. kistnasamyi*." Id. This complete lack of conservation measures is inappropriate for a species that is so rare and that is facing a number of serious threats in its very small area of habitat. ESA protections should be extended to *H. kistnasamyi* in order to protect it from the threats to its continued existence.

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Wallace, J.H., Kok, H.M., Buxton, C.D. and Bennett, B. 1984. Inshore small-mesh trawling survey of the Cape south coast. Part 1. Introduction, methods stations and catches. *South African Journal of Zoology* 19(3): 154-164.

(67) Scientific Name: *Hemitriakis leucoperiptera*

Common Name: Whitefin Topeshark

IUCN Status: Endangered **CITES Status**: N/A

Range: This species occurs in the Northwest Pacific around the Philippines. IUCN (Hemitriakis leucoperiptera) 2012, Exhibit 120 at 3.

Habitat and Ecology: "Most details of [this species'] ecology and life history parameters are unknown" because "this species is only known from two free-swimming individuals." Id. at 4. "The only gravid [(pregnant)] female reported was 96 cm total length and had 12 fetuses." Id.

Population Status and Trend: Unknown. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

This species may be suffering from habitat loss and deterioration due to dynamite and cyanide fishing, which has occurred over much of the reef habitat in its area of occurrence. Id. These fishing practices damage portions of reef habitat rendering it unsuitable to most former inhabitants. Since these practices are occurring in the species' range, they are likely destroying its habitat. Such habitat destruction is likely causing significant harms to this rare species.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"This species is probably taken as utilized bycatch by local fisheries in the Philippines. The holotype was taken in a fish trap. No statistics are available for fishery catches and there have been no confirmed records of this species for over 50 years. However, past and continuing population reduction is probable, due to the heavy inshore fishing occurring throughout its limited area of distribution." Id. Since the species appears to be very rare and also appears to be facing ongoing fishing pressure as utilized bycatch, this commercial activity represents overutilization of *Hemitriakis leucoperiptera* threatening its continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are currently no conservation measures in place for this species. Id. Such a complete lack of protections for such a rare species in inappropriate and ESA protections should be extended to the species to prevent its extinction.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Conservation of this species is further complicated because there are apparently two Philippine *Hemitriakis* sharks that have been confused for this species. Id. (citing Compagno 1970; Compagno 1984b; Compagno 1988; Compagno in prep. b). This makes information on which to proceed with conservation measures difficult to obtain and trust.

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

References:

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For More Information, See:

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<u>(68) Scientific Name:</u> <u>*Holohalaelurus favus*</u>

Common Name: Honeycomb Izak / Natal Izak

IUCN Status: Endangered **CITES Status**: N/A

Range: *Holohalaelurus favus* is a species of shark occurring in the Western Indian Ocean, off the coast of South Africa and Mozambique. IUCN (Holohalaelurus favus) 2012, Exhibit 121 at 3. A recent assessment of this species' range showed that *H. favus* is restricted to five degrees of latitude along the east African coast, from Durban, KwaZulu-Natal, South Africa (north of 30ºS), north to southern Mozambique (south of 25º). <u>Id.</u> at 4 (citing Human 2006).

Habitat and Ecology: "Very little data is available on the habitat and ecology of this shark. It is found on the upper to mid slope at depths of 200-1000 m[eters]. Maximum size for [this species] is 51.5 [centimeters] total length." <u>Id.</u> at 5. Males are mature at 51.5 centimeters total length, and females are mature at 42.3 centimeters total length. <u>Id.</u> "It is probable that this shark develops one egg-case per uterus at a time, as do other members of this genus." <u>Id.</u> (citing Human 2006).

Population Status: This species is thought to most likely exist as a single population. <u>Id.</u> at 4. "The population size is unknown, although it is presumed to have suffered a substantial decline in recent years." <u>Id.</u>

Historically, the Honeycomb Izak was regularly recorded from fishing trawls within its geographic range, and available data shows that this shark was fairly common in the late 1960s and early 1970s. <u>Id.</u> However, since the mid-1970s no specimens have been collected, despite recent biodiversity research cruises in 2002, 2003, and 2007, and biodiversity trawl surveys in the Honeycomb's known range as part of the Coelacanth (*Latimeria chalumnae*) project in progress. <u>Id.</u> (citing Human 2006). "The cause for this apparent decline is not known. Catch rates for this species were stable during the late 1960s to the early 1970s, followed by an abrupt" drop-off in catches. <u>Id.</u> "[T]herefore, the decline does not appear to be related to fishing pressure," although this is as yet uncertain. <u>Id.</u>

Population Trend: Decreasing. <u>Id.</u> at 5.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

No conservation measures are currently in place for this species. Id. Such a complete lack of conservation measures is inappropriate for a species that appears to be so rare and that appears to have lost so much of its population. Therefore, ESA protection should be extended to the species in order to prevent its extinction.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

"An intensive crustacean trawl fishery exists off of Durban and extends northward into southern Mozambique." Id. "It is not known whether the reduced numbers of this species are due to fishing pressures, habitat loss, pollution, or an as yet unidentified threat." Id. (citing Human 2006). However, declines are occurring and have been considerable, thus qualifying the species for listing under the ESA and necessitating further research and protection of the species to prevent its extinction.

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(69) Scientific Name: *Holohalaelurus punctatus*

Common Name: Whitespotted Izak / African Spotted Catshark

IUCN Status: Endangered **CITES Status**: N/A

Range: This shark is endemic to the southwestern Indian Ocean, from northeast South Africa, southern Mozambique, and Madagascar. IUCN (Holohalaelurus punctatus) 2012, Exhibit 122 at 3-4 (citing Human 2003; Human 2006; Séret 1987).

Habitat and Ecology: This species' known depth range is 220-420 meters. Id. at 5. Life history for this species is largely unknown. Id. "Males appear to obtain greater maximum length compared to females, a trait common to *Holohalaelurus* sharks." Id. Maximum-recorded size for this species is 34 centimeters total length. Id. Females appear to carry a single egg-case in each uterus. Id. (citing Bass et al. 1975). "Juveniles are unknown for this species and Bass et al. (1975) speculate that they may occur in deeper waters." Id.

Population Status: There appear to be two populations of *Holohalaelurs punctatus*, "one occurring off the coast of South Africa and Mozambique, and the other off Madagascar." Id. at 4. Historically, this species was "common in commercial and research bottom trawls made . . . in its range, off the KwaZulu-Natal (South Africa) and southern Mozambique coasts. Id. (citing Bass et al. 1975; Bass 1986; Human 2006). "Examination of species data . . . indicates this shark was common to abundant in the late 1960s and early 1970s." Id. However, "only a single specimen has been collected from this area since 1972, despite recent biodiversity trawl surveys in that region as part of the coelacanth (*Latimeria chalumnae*) project in progress." Id. (citing Human 2006).

"The Whitespotted Izak also occurs off Madagascar where its population status is unknown[,] although its depth range possibly places it beyond the capabilities of local fisheries, thus providing a possible refuge for this species. It is not known if the Madagascar population is separate from the population off southern Mozambique and northeastern South Africa, but it is likely that the deep waters of the Mozambique channel present a migration barrier" to the species. Id. at 4.

Population Trend: Decreasing. Id. at 5.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are currently no conservation measures in place for this species. Id. Such a complete lack of protections is inappropriate for a species that appears to be so rare and that has suffered such large declines in its numbers. ESA protection should be afforded to the species to avoid its extinction.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

"An intensive crustacean trawl fishery operates off of Durban[, South Africa], and extends northward into southern Mozambique." Id. "*Holohalaelurus* sharks from the KwaZulu-Natal and southern Mozambique region are still present in commercial fisheries landings, but apparently only rarely, and species identification is not being recorded. It is not known whether the reduced population numbers are due to fisheries pressure, habitat loss, pollution, or an as yet unidentified threat." Id. (citing Human 2006). Despite these uncertainties, it is clear that there have been drastic reductions in this species' numbers that appear to be ongoing. Therefore, it qualifies for listing under the ESA.

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(70) Scientific Name: *Isogomphodon oxyrhynchus*

Common Name: Daggernose Shark

IUCN Status: Critically Endangered **CITES Status:** N/A

Range: "This geographically restricted species occurs in the Western Atlantic: Trinidad, Guyana, Suriname, French Guiana, northern Brazil to about 3°S and possibly central Brazil and Venezuela. IUCN/SSG Status Survey Part 1, Exhibit 138 at 143 (citing Compagno in prep. b). However, "it is unlikely that the species occurs off the Brazilian central coast, since no catch records have been made by artisanal fisheries and the species is unknown to fishermen in this area." Id.

"The species frequents low-lying and deeply indented coasts with a large number of rivers, islands and estuaries dominated by mangroves. Off northern Brazil it is caught in depths of 4–40 m[eters], and is commonest in water of high turbidity inshore on shallow banks, and declines in abundance in clearer water." Id. (citing Stride et al. 1992). "It is possible that this species is barred or restricted south-east of northern Brazil by unsuitable habitat with clear waters, no mangroves and a narrow continental shelf. The Daggernose is not known to venture up rivers." Id. (citing Compagno in prep. b).

"In a survey in northern Brazil from November 1983 to February 1985, off the western coast of Maranhão State, Brazil [] using floating gillnets, this species represented about 10% of the elasmobranch catch. No catches were recorded during the rainy months (December to May). This and a later survey, suggest that the species moves to shallower waters in bays during the dry season (June to November), returning to the deeper waters of coastal banks in the rainy months." Id. (citing Stride et al. 1992).

"The sexes are partially separated by depth, and females tend to live in somewhat deeper waters than males, and are less likely to be caught than males by near-shore gillnet fisheries." Id. (citing Compagno, in prep. b). "Off northern Brazil, females appear to outnumber males by 1:0.8." Id.

Habitat and Ecology: "An unmistakable requiem shark, the Daggernose has an extremely long, flattened, acutely pointed, triangular snout and minute eyes. The first dorsal fin has its origin over the very large, paddle-shaped pectoral fins. The narrow, erect teeth are small and without cusplets, the upper teeth are serrated and there are over 45 rows of teeth in both jaws. The [color] is grey or yellow-grey above and white below, without any prominent markings. This shark bears a superficial resemblance to rhinochimaerids, the goblin shark *Mitsukurina* or certain undescribed species of the *scyliorhinid* genus *Apristurus*, all with similar long snouts." Id. (citing Compagno in prep. b).

"The daggernose shark is viviparous[125], with a yolk-sac placenta. Fecundity is low, with the number of young recorded as 3–8 per litter, with no correlation between female and litter size. [The g]estation period is thought to be about a year, with birth occurring at the start of the rainy period. This species may have a two-year birth cycle, with a year's development of ovarian follicles followed by fertilisation and a year's gestation." Id. (citing Compagno in prep. b). "Birth takes place at the end of the dry season (in December) when salinity falls." Id.

"The daggernose shark feeds on small, schooling fishes including herring, anchovies, catfish and croakers, for which its long jaws and small, spike-like teeth are very well suited. Its elongated snout and small eyes seem to be possible adaptations for the murky inshore waters it frequents, analogous to the elongated snouts of many deepwater rhynchobathic sharks and chimaeroids (which generally have large eyes), and the small eyes of river sharks *Glyphis* spp., which occur in sediment-filled deltas of large tropical rivers and in turbid fresh water far up the rivers." Id. (citing Compagno in prep. b).

"Maximum total length said to be about 200–244 [centimeters], although this has not been verified above 152 [centimeters] and reports of larger specimens could be due to confusion with other larger carcharhinid[s] such as *Carcharhinus brevipinna*. Size at birth is about 38–43 [centimeters]; males are smaller than females and mature between 90 and 110 [centimeters], are adult over 110 [centimeters] and reach 125 [centimeters]; females mature between 105 and 112 [centimeters] and reach 145 [centimeters]. Maximum weight recorded is about 13 [kilograms]." Id. "Maturity is reached at five years for males and seven years for females." Id. at 144.

"The whole area where the Daggernose Shark occurs is characterized by a humid, tropical climate, coasts covered by extensive mangrove systems, wide continental shelves, intense draining by numerous rivers (including the Amazon), muddy bottoms and highly turbid waters." IUCN (Isogomphodon oxyrhynchus) 2012, Exhibit 123 at 4. "This species is found mainly in a deeply indented coastline with a large number of rivers, islands, estuaries and some beaches." Id. Depth of occurrence is shallow, reaching to 40 meters. Id. (citing Lessa 1986; Lessa & Menni 1994).

"The elasmobranch fish fauna in the area is made up of two dominant-resident species, *Carcharhinus porosus* and *Sphyrna tiburo* and 11 other common species. The daggernose shark spends most of its life cycle within the same area and no long distance movements have been recorded, however some local seasonal movements possibly occur." Id. (citing Lessa & Menni 1994).

Population Status: The IUCN assessed the Daggernose Shark as "critically endangered." Id. at 3. The IUCN further reports that:

[125] The word "viviparous" means the Daggernose Shark brings forth living young rather than eggs, like most mammals and some reptiles and fishes.

> Recent demographic analyses suggest that the population has been decreasing at 18.4% per year with very large declines (>90%) resulting over the past 10 years. Although data are currently lacking for Venezuela, Trinidad, Guyana, Suriname and French Guiana, it is highly likely that similar declines have also occurred there given that the species is taken primarily in artisanal fisheries. Such fishing pressure is intense across its range, will continue to increase into the future and its restricted movements may limit re-[colonization of] depleted areas. These factors, together with limited distribution, life history traits and dramatic population declines result in the Daggernose Shark being considered a Critically Endangered species for which urgent conservation and management action is required.

Id. (internal citations omitted).

Population Trend: Decreasing. Id. at 4.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Human Population Growth. The Daggernose Shark is found in coastal habitat with intense drainage from numerous rivers in north Latin America. Furthermore, the nations whose coasts make up this range (Trinidad, Guyana, Suriname, French Guiana, Brazil and Venezuela) are all developing countries. Therefore, there are intense pressures on Daggernose Shark habitat resulting from rapid development on the coasts. According to the IUCN/SSG Report, human pressures on inshore sources of fresh water cause problems for sharks because these waters eventually wash into their habitat.

> Land clearing and destructive land-use practices in a river catchment can degrade chondrichthyan habitat within the river, the estuary and offshore.
> . . .
> Coastal habitat is being destroyed and degraded at an alarming rate. Human activity threatens coastal and estuarine habitats through development, chemical and nutrient pollution, and freshwater diversion from incoming rivers. Dumping of plastic and other garbage is known to entangle and choke a wide variety of marine life.

IUCN/SSG Status Survey Part 2, Exhibit 139 at 5.

The shallow coastal nursery areas where Daggernose Shark females go to give birth are particularly vulnerable. "Many of these areas are likely to be at high risk through loss or change of habitat from coastal development, pollution, aquaculture industries and the spread of exotic organisms." Id. Such coastal development is problematice because, "[i]n the case of habitat destruction resulting from coastal development, the severity of impacts is high with low reversibility." Zamora-Arroyo et al. 2005, Exhibit 66 at 58.

Population density on the coasts multiplies the negative affects on the Daggernose Shark's coastal habitat. A 2010 UNEP report entitled "State of Biodiversity in Latin America and the Caribbean" concludes:

> A large percentage of the region's population and its development activities are concentrated in the coastal area. This concentration of population and activities has resulted in increased pressure on these ecosystems, which are being severely degraded . . . The eastern Atlantic coast of South America, the western coast of Central America, and the Caribbean are the worst affected shorelines in the region.

UNEP 2010, Exhibit 143 at 3. Since the Daggernose Shark's entire habitat is located on the northern portion of South America's eastern Atlantic coast and extends to the southwest corner of the Caribbean Sea, negative effects from this coastal population growth can be expected to be severe for the species' habitat. See IUCN (Isogomphodon oxyrhynchus) 2012, Exhibit 123 at 4.

According to the database published by UNEP, population density along the coastal line in Latin America is higher than inland areas. The Daggernose Shark's habitat coincides with a number of these areas with higher coastal population density.

Figure 10: Latin America and Caribbean Human Population Distribution as of 2000
Source: http://na.unep.net/siouxfalls/globalpop/lac/lacpopd00.gif

In the above figure, which comes from UNEP, the more orange an area is, the more densely populated it is. The areas encompassing the coast of Trinidad, the Brazilian coast, and the northern Venezuela coast are areas of daggernose shark habitat that also have very high coastal population density. Also, NMFS recognizes that human population is continuing to grow. NMFS' own recent Status Review Report estimates that the total human population will be around 9 billion by 2045-2050, and cited one source putting that total at an even larger 10.6 billion. Status Review Report, Exhibit 40 at 20 (citations omitted). This population growth will increase pressures on coastal species. Id. at 19 ("Increased human population and consumption of natural resources are also root causes for increases in fishing (particularly of herbivores) at many locations around the globe, for massive inputs of nutrients (eutrophication), toxic pollutants, and sediments into many coastal waters, and for the spread of invasive species.").

While human population growth in general has a substantial negative effect on ocean habitat populations, those human populations that are located near the coasts have an even stronger negative impact. See id. at 19. This is very problematic because, worldwide, approximately 2.5 billion people already live within just **100 km** of the coastline. See WRI 2011, Exhibit 41 at 21. By 2020, an astonishing 75% of the expanded human population is expected to live within just **60 km** of the coastline. Knip et al. 2010, Exhibit 42 at 2 (citation omitted). This increasing concentration of people near the coasts means that the negative effect of the general population increase will be compounded.

Impacts from population growth do not occur evenly. Increased economic growth in coastal cities is a major cause of ocean habitat destruction. With growth comes an increase in consumption and development. This is reflected in an increase in construction projects, some of which occur on reef communities; dredging of harbors and shipping channels; dumping of waste, run-off pollution and increased sedimentation; deforestation; and increased tourism. As a result of these factors, the coasts around virtually all urban areas are "beset by a pattern of pollution and over-development." Hinrichsen Undated, Exhibit 43 at 2. "Coastal urban areas dump increasing loads of toxic wastes into the sea. In fact, waters around many coastal cities have turned into virtual cesspools, so thick with pollution that virtually no marine life can survive." Id. at 4.

This urban pollution is contributing to increasing "dead zones," amongst other things. These dead zones are areas where dissolved oxygen content is so low that no marine life, apart from microorganisms, can live. A 2007 study identified 200 of these dead zones, which represents an increase of 51 such zones found just four years earlier. Id. at 5. Worse yet, these dead zones are not only becoming more numerous, they are also greatly expanding "due mainly to high nutrient pollution levels brought in by rivers and streams and washed off coastal land." Id. This represents a significant threat to the Daggernose Shark since it specifically inhabits coastal areas characterized by "intense draining by numerous rivers (including the Amazon)." IUCN (Isogomphodon oxyrhynchus) 2012, Exhibit 123 at 4.

To make matter worse for the Daggernose Shark, climate change is expected to further magnify these coastal pollution problems. For example, "[d]ue to water circulation and oceanic volume changes, estuarine and coastal systems are predicted to experience . . . increased eutrophication, hypoxia, and anoxia." Roessig et al. 2004, Exhibit 29 at 258 (citations omitted). "More intense rains wash more fertilizer and sewage into coastal waters, and this runoff triggers algal blooms and consequent poisoning of fish and humans." Id. at 269 (citation omitted).

As human populations continue to grow and require more resources, humans will continually exhibit further pressures on the oceans, including the Daggernose Shark and its habitat, and significantly reduce the likelihood of their continued existence.

Fisheries. Fisheries in this area are a significant industry for the coastal countries in the Daggernose Shark's range and these fisheries also have negative effects on the species' habitat.

> Recent research suggests that intensive bottom-trawling may reduce demersal fish productivity by reducing the complexity of the benthic substrate or even gross destruction of hard bottom habitats. Apart from topographic changes resulting from the physical impact of demersal trawls and dredges, epiflora and epifauna are dislodged and uprooted. Such disruptions are likely to reduce the availability of suitable habitat for predators and prey.

IUCN/SSG Status Survey Part 2, Exhibit 139 at 6 (internal citation omitted). This impact can be expected to grow as human population increases, particularly on the coasts, and brings with it an increased demand for protein. See Status Review Report, Exhibit 40 at 19 ("Increased human population and consumption of natural resources are also root causes for increases in fishing (particularly of herbivores) at many locations around the globe . . .").

Mangroves. The Daggernose Shark occurs on coasts that are covered by extensive mangrove systems. Therefore, the destruction of mangroves is also a threat to the species. In 2007, the FAO published a report called "the world's mangroves 1980-2005." The report indicates that in the period from 1980 to 2005 Trinidad, Guyana, Suriname, Brazil and Venezuela (all important areas of Daggernose Shark mangrove habitat) experienced declines in mangroves. See FAO 2007, Exhibit 144 at 31, 44; IUCN (Isogomphodon oxyrhynchus) 2012, Exhibit 123 at 4. The report says:

> Awareness of the importance of these coastal ecosystems is growing, but limited understanding of their services and benefits and lack of harmonization and implementation of existing laws still represent threats to mangroves. These forests continue to be under serious threat also from increasing urban and industrial pollution [], the flow of pesticides to coastal zones (e.g. Suriname) and oil spills (particularly in [Venezuela]). The planning and construction of dams or changes in

river flows upstream are also current threats. These decrease the freshwater input, consequently increasing salinity and reducing nutrients and sediments transported to the coast.

FAO 2007, Exhibit 144 at 47.

Moreover, climate change is also a threat to the mangroves, primarily as a result of their vulnerability to sea-level rise. Gilman et al. 2007, Exhibit 145 at 1. Other threats to mangroves from climate change include increases in extreme high water events, storms, precipitation, temperature, atmospheric CO_2 concentration and ocean circulation patterns. Id. Because mangroves in its range are important components of Daggernose Shark habitat, threats to mangroves represent serious threats to the species' continued existence.

All of the problems discussed above represent significant threats to the Daggernose Shark's habitat. As a result, the Daggernose Shark's continued existence is threatened by both present and threatened destruction, modification, and curtailment of its habitat and range.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"The Daggernose Shark is caught incidentally in artisanal floating gillnets targeting both Spanish mackerel *Scomberomorus brasiliensis* and King Weakfish *Cynoscium acoupa* inside or near estuary mouths." IUCN (Isogomphodon oxyrhynchus) 2012, Exhibit 123 at 5. This occurs "mainly during the dry season, representing about 10% of the catch in the State of Maranhao, Brazil." Id. (citing Lessa 1986; Lessa *et al*. 1999). "Stride et al. (1992) recorded a [catch per unit effort (CPUE)][126] of 71 [kilograms/kilometer/hour] for the Daggernose Shark, however, fishing efforts for target bony fish have increased in recent years due to the increase of the price of byproducts, mainly swim bladders. Observations have indicated that a commercial fishery targeting sharks is also presently taking place in this area. Recent demographic analyses suggest that the population has been decreasing at 18.4% per year and very large population declines (>90%) have been observed over the past 10 years." Id. (citing Santana & Lessa 2002). "This species does not compensate [well] for the high natural and fishing mortality due to its limited biological characteristics, including [slow] intrinsic population growth rate. The high mortality rates for such a biologically limited species are resulting in it not being able to support sustained fishing pressure." Id. (citing Lessa et al. 2000; Santana & Lessa 2002). "This entire situation indicates a high risk of extinction for this species particularly given that it is [endemic] with a restricted range, and that fishing pressure is still increasing." Id. "Data are [currently] lacking for the other countries in its range, but because the species is taken primarily in artisanal fisheries, which are intense throughout its range[,] there is no reason to believe that [] similar decline[s have] not occurred there

[126] CPUE is an indirect measure of the abundance of a target species. Changes in the catch per unit effort are inferred to signify changes to the target species' true abundance. A decreasing CPUE indicates overexploitation, while an unchanging CPUE indicates sustainable harvesting.

as well." Id. Therefore, it appears that the Daggernose Shark is facing pressure from both bycatch and directed fishing efforts, likely throughout its range, and these pressures are leading to significant declines in the species' abundance.

A 2009 CITES document discussing current dangers facing shark populations explains why bycatch and discards are increasingly serious threats to sharks:

> According to FAO (2007c), **bycatch** is 'the part of a catch of a fishing unit taken incidentally in addition to the target species towards which fishing effort is directed. Some or all of it may be returned to the sea as discards, *usually dead or dying*'. In turn, **discard** is defined as 'to release or return fish to the sea, *dead or alive*, whether or not such fish are brought fully on board a fishing vessel'. Discards represent a significant proportion of global marine catches . . .
>
> Sharks are caught as bycatch in many commercial fisheries and by most fishing methods. For fishermen who are not targeting sharks, lost revenue from shark predation on hooked targeted species can amount to several thousand U.S. Dollars in a single set in some fisheries. *But the growing value of shark parts and products, combined with declining stocks of traditional target species has turned them into an increasingly important component of the economic and food value of fisheries, thus shifting from a largely unwanted, discarded bycatch, to a by-product or joint catch, or even the main fishing target.* However, the contribution of bycatch and discards to overall shark mortality is still very important. *And several species of sharks taken as bycatch and subject to trade[, like the Daggernose Shark,] are of particular concern owing to their rarity or dependence on threatened or degraded habitats.*
> . . .
> Beyond bycatch and discards, it is important to note that no allowance has been made for the numbers of sharks and other fish killed through interactions with fishing gear that do not result in their capture. These unobserved mortalities may be caused by the impact of trawl gear on the bottom, escapement or drop-out from nets, ghost fishing by lost or drift nets and similar gear inefficiencies. In either case, these can become relevant mortality causes that can have a detrimental effect on wild populations of sharks and other fish species.
>
> It is difficult to determine the numbers of sharks being captured as bycatch and/or discarded from fishing operations worldwide. Most countries do not require reporting of shark bycatch in logbooks, so few bycatch data are incorporated into FAO statistics. And although observer programmes provide the best available information, coverage on the high seas is minimal.

CITES 2009, Exhibit 140 at 55-56 (internal citations omitted, emphasis added).

Though the Daggernose Shark's fins have a relatively low price as compared to other shark fins its meat is still sold as food. IUCN (Isogomphodon oxyrhynchus) 2012, Exhibit 123 at 5. The uses of shark meat and fins are generally as follows:

> **Meat.** Several countries are consumer and traders of shark meat.
> . . .
> Smaller species like spiny dogfish *Squalus acanthias*[,] smooth-hounds (Family Triakidae)[, and Daggernose Sharks] are particularly appreciated, as they contain smaller concentrations of urea and mercury than other species and are also easier to process. They do not usually require soaking, and the fish are finned, gutted and landed as whole carcasses with the skin intact. The backs are used in Europe and Australia while fresh whole carcasses are sold in South America where they are marketed as *cazón*. This product is exported for sale as fillets, steaks or portions, and is also used in the fish-and-chips trade.

CITES 2009, Exhibit 140 at 44. The use of shark meat has seen drastic rises recently with consumption more than doubling between 1985 and 2000, going from 31,500 tons to over 73,000 tons valued at over $152 million. Id. at 59. It is likely that this trend will continue and the Daggernose will be increasingly targeted for its meat. Also, although less-valued for its fins, it is still exploited for the fin market as well. CITES explains the nature of this threat as follows:

> These are the main ingredient [in] shark fin soup, a traditional Chinese delicacy [that] is becoming increasingly popular. Sets of shark fins can sell for more than [$700] per kilogram, and the global shark fin trade is estimated to be increasing by 5% per year.
> . . .
> Fins are a by-product of several target fisheries, directed to obtain shark meat for human consumption[, such as that for the Daggernose Shark], and those for deep sea sharks (oil and meat fisheries) . . . *As the yield of other fisheries (mainly teleosts and invertebrates) decrease, the demand for shark meat continues to increase and meat products become more important drivers for shark fisheries.*

Id. at 46 (emphasis added, internal citation omitted).

As the emphasized portion of the above quote indicates, the threat embodied by international trade will likely only continue to grow. "Based on import and export data reported to FAO, exports of shark products [already] doubled between 1990 and 2003," totaling 86,500 tons in 2003 alone valued at $249 million. Id. at 59.

In Latin America, the Daggernose Shark's range, the prevalence of shark meat and fins is also increasing. In fact, Brazil was recognized as the number 19 shark-catching country in 2003, particularly distressing for the Daggernose since key portions of its habitat are in Brazilian waters. Id. at 52, Table 3. FAO also promulgated a report entitled "Shark Utilization, Marketing and Trade," which explains the shark exploitation situation in Latin America as follows:

> **Meat.** In Latin America domestic consumption of shark meat is significant in Argentina, Uruguay, Brazil and Peru . . . Steaks are often sold under the names of more expensive fish such as tuna . . . Elasmobranch production by Latin American countries was [4,500 tons] in 1997, according to FAO statistics.
>
> Exports of elasmobranchs amounted to [4,200 tons], worth US$6.9 million. They have increased significantly since the mid-1980s . . . In 1997 imports were [1,840 tons], worth [$2.1 million], representing a substantial increase as compared to the [354 tons], valued at [$355,000] in 1996. Uruguay was by far the main importer, accounting for 70.7% of total imports, followed by Brazil and Venezuela[, both countries representing important Daggernose Shark range].
>
> Brazil is the main market for shark products in Latin America . . . In 1997 Brazil imported [280 tons], valued at [$352,000] and exported [37 tons], worth [$38,000].

FAO 1999, Exhibit 141 § 6.1.3.5. Since shark consumption appears to be on the rise in Latin America, and this region also represents the Daggernose Shark's entire range, it is likely that targeted exploitation of the species is also on the rise. In terms of exploitation for fins, "Brazil and Uruguay are the only Latin American countries that report production of shark fins to FAO." Id. § 6.2.8.5. Fin sales peaked in 1993 at 477 tons, worth $3.8 million. Id. In the Daggernose's range, exporters of shark fins include Brazil, Guyana, and Suriname with "most Latin American countries export[ing] shark fins to Asian countries such as Hong Kong, Singapore and [the] Taiwan Province of China." Id. "Requiem sharks[, like the Daggernose,] are the main shark species caught in this area with nearly [11,400 tons caught] in 1997, of which [7,600 tons] were from Venezuela[, an important area of the Daggernose Shark's range,] and [3,800 tons] from Mexico." Id. § 3.3.8.

There is a severe lack of specific information about the shark trade for any of the countries in the Daggernose Shark's range (except Brazil). However, the above information makes it clear that the demand for shark products has increased both in the international market and in the Daggernose's range, and the countries in the Daggernose Shark's range are responding by increasing catch and export.

In sum, the facts make it clear that the Daggernose Shark is threatened with extinction by overutilization for commercial purposes throughout its range.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

This species is unprotected throughout its range. IUCN (Isogomphodon oxyrhynchus) 2012, Exhibit 123 at 5-6. This complete lack of protection is inappropriate for a species facing these serious threats to its continued existence. It should be protected under the ESA to avoid its extinction.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

K-Selected/K-Strategy Species. Most species in the chondrichthyan family, including the Daggernose Shark, are K-selected or K-strategy species meaning, essentially, that they exhibit naturally slow population growth rates. The Daggernose Shark is K-Selected because it exhibits low fecundity with a two-year birth circle and one-year gestation period. IUCN (Isogomphodon oxyrhynchus) 2012, Exhibit 123 at 3, 5. "This species does not compensate for the high natural and fishing mortality due to its limited biological characteristics, including [slow] intrinsic population growth rate. The high mortality rates for such a biologically limited species are resulting in it not being able to support sustained fishing pressure." Id. at 5 (citing Lessa et al. 2000, Santana & Lessa 2002). "This entire situation indicates a high risk of extinction for this species particularly given that it is an endemic species with a restricted range, and that fishing pressure is still increasing." Id. IUCN/SSG published a report called "Review of Migratory Chondrichthyan Fishes" in 2007. The report explains the increased threat to K-selected chondrichthyan fishes, like the Daggernose, as follows:

> The chondrichthyan fishes are generally K-selected; that is most species are [characterized] by all or many of the following characteristics: low fecundity, large precocious young, slow growth, late maturity, long life and high survival at all age classes. They therefore have a low reproductive potential and a low capacity for population increase. This makes most chondrichthyans (with the exception of the most abundant and fecund species), poor candidates for sustainable fisheries exploitation. The majority of threats to these species arise from mortality in fisheries that take unsustainable numbers as part of the target catch, or as a [utilized] or discarded bycatch.

IUCN 2007, Exhibit 142 at 4. The vulnerability of these species is thus increased when individuals are removed from the population or its habitat changes.

> K-strategy species are more extinction prone than are r-strategy species. The very efficiency with which K-strategy species exploit their environment is a liability *during periods of rapid or chaotic change.* . . . [L]ower reproduction rates make it more difficult both for the species to recover if its population becomes depressed and for it to adapt to a changed environment because fewer offspring contain less genetic variability. Thus, the very "fittedness" of K-strategy species to a

> particular environment - which is advantageous during periods of stability - becomes a serious handicap when the habitat changes more rapidly than genes can be substituted in a population - and in species that reproduce slowly, genes are substituted slowly.

Goble & Freyfogle 2010, Exhibit 64 at 1059-60 (emphasis in original).

Daggernose Sharks are currently experiencing the type of rapid, chaotic change that makes their K-selected life history pattern a liability. This is because Daggernose Sharks are not only losing habitat, but they are also being fished and removed from their remaining habitat at a rate greater than they can replenish their numbers.[127] As a result of these pressures, the Daggernose Shark's reproductive adaptations have gone from being beneficial to creating increased risk of species extinction. This type of life history pattern means that the species does not replenish itself as quickly as smaller, shorter-lived, r-selected species and is, therefore, more vulnerable when individuals are removed from the population or species reproduction is otherwise disrupted. Steps must be taken to protect the Daggernose Shark from this risk of extinction.

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of Daggernose Sharks. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted).

The combination of threats to the Daggernose 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." Id. at 453 (internal citations omitted).

The Daggernose 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." Id. at 455 (internal citations omitted). Therefore, the synergistic

[127] See "The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range (Criterion A)," supra; "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra.

effects of multiple threats may combine to cause the Daggernose Shark's extinction more quickly than might otherwise be expected.

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(71) Scientific Name: *Lamiopsis temmincki*

Common Name: Broadfin Shark

IUCN Status: Endangered **CITES Status**: N/A

Range: This shark is known from the Indian Ocean and Western Pacific, including a sporadic distribution off India, Pakistan, Myanmar, Indonesia, Sarawak, and China. IUCN (Lamiopsis temmincki) 2012, Exhibit 124 at 3-4 (citing Compagno in prep).

Habitat and Ecology: "Found inshore on the continental shelf (mostly close inshore)," the Broadfin Shark is "a viviparous species giving birth to four to eight pups per litter after an eight-month gestation period." Id. at 4.

Population Status: "Rare throughout most of its range, but [was] once known to be common off [the] west coast of India." Id. (citing Compagno et al. 2005). Currently, it is only observed in low numbers in heavily fished areas throughout its range, indicating probable population depletion. Id. at 3.

Population Trend: Decreasing. Id. at 4.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

The Broadfin Shark is "[p]robably threatened by habitat removal and destruction (e.g., inshore mangrove areas) which is prolific throughout much of its range." Id. Its habitat is likely further degraded by pollution from river outflow since it occurs primarily inshore. Id. Reduction of habitat for this species thus represents a significant threat to its continued existence.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

This species is "[t]aken regularly (but in low numbers) by local fishermen in India[], Pakistan[], Sarawak and Kalimantan" using "bottom and floating gillnets and with line gear." Id. The meat of the animals is used for human consumption, while the fins are dried for fin trade and the livers are used for vitamin oil. Id. (citing Compagno in prep.). "This species is fairly similar to *Glyphis* species [of sharks], which are suspected to have undergone serious declines as a result of heavy fishing pressure. Given its rarity, very heavy and unregulated fishing pressure throughout its entire range, and evidence to suggest that significant declines have already occurred off India, the Broadfin is" severely threatened with extinction due to commercial overutilization. Id. at 3-4.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

It does not appear that there are currently any conservation measures in place to protect this species. See generally id. at 4. Such a complete lack of conservation measures is inappropriate for a species facing such serious threats to its continued existence. ESA protection should be given to the species to prevent its extinction.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of the Broadfin Shark. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted). Therefore, the combination of threats to this species could cause a greater and faster reduction in the remaining population than might be expected from simply the additive impacts of the threats.

The Broadfin Shark is already at risk as a 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." Id. at 455 (internal citations omitted). As a result of this combination of threats, *Lamiopsis temmincki* may face more extinction pressure than the additive effect of threats combined.

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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<u>(72) Scientific Name:</u> <u>*Mustelus fasciatus*</u>

Common Name: Striped Dogfish

IUCN Status: Critically Endangered **CITES Status**: N/A

Range: This shark is endemic to the Southwest Atlantic and occurs at low densities over a restricted area (only 1,500 km of coastline). IUCN (Mustelus fasciatus) 2012, Exhibit 125 at 4. "In Brazil the species occurs only in the extreme south, between latitudes of approximately 29ºS and 34ºS. [Its] range extends southward to around 35°30S in Argentina. Nursery area and birth of young occur only on the coast of Rio Grande do Sul State, Brazil, at latitudes from approximately 29 to 34°S and into northern Uruguay, which is a considerable portion of the species' distribution." <u>Id.</u> (citing Soto 2001).

Habitat and Ecology: "In southern Brazil, the species occurs all year round over smooth bottom[s] of the inner continental shelf at depths down to 250 m[eters]. <u>Id.</u> It is considered a non-migratory, permanent resident of the area despite the fact that females carry out a seasonal inshore-offshore migration to give birth. <u>Id.</u> Gravid females stay at depths greater than 20 meters during most of the year but migrate to shallow inshore waters to give birth in the spring. <u>Id.</u> Neonates and small juveniles stay in these waters, which constitute the nursery area of the species. <u>Id.</u> (citing Vooren 1997; Vasconcellos & Vooren 1991; Soto 2001). Available evidence indicates that this species has a yearly reproductive cycle with a gestation period of 11 to 12 months. <u>Id.</u> (citing Soto 2001).

Population Status/Trend: Decreasing. <u>Id.</u>

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"Intensive demersal fisheries exist over the entire area of distribution of this species, already naturally low in density (as evidenced from catches [on average] of one to ten specimens per one-hour trawl in 1980 when the species was still relatively unexploited)." <u>Id.</u> "In southern Brazil, fishing is intense in the habitat of this demersal shark." <u>Id.</u> at 5 (citing Miranda & Vooren 1999). "The major threat to this species is intensive fishing by pair trawl, shrimp trawl, gillnet, and beach seine in the coastal nursery area of the species[]. The species is caught as by-catch in the shrimp fishery and in the multi-species fishery aimed mostly at an assembly of sciaenid fish, flounders, mullets, angelsharks, and guitarfish." <u>Id.</u> (citing Haimovici & Mendonça 1996). "The fishery in the nursery area catches gravid females during their inshore migration in spring and the small juveniles all year round. In gillnets set of the beach during summer, neonates used to be caught in large numbers (10-100 per set) in the 1980s but were caught only sporadically and in much smaller numbers in 2003. The coastal fishery is driving this species towards extinction through recruitment overfishing." Id.

"In Uruguay, where [this species] is not targeted but taken as bycatch in industrial and artisanal fisheries, species-specific data are not available." Id. Estimated capture in Uruguayan waters for the period 2000-2002 was 900 tons per year. Id. This overexploitation led to an observed decrease in biomass in the coastal region of the Bonaerensean District of northern Argentina and Uruguay, as measured by trawl surveys, of 96% between 1994 and 1999. Id. This species is thus clearly being threatened by overutilization for commercial purposes and this threat qualifies the species as "threatened" or "endangered" under the ESA. It should be listed.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

"In Brazil, trawl fishing at distances less than three nautical miles from shore [] is forbidden by law but enforcement of this law meets with practical difficulties, and trawling in the nursery area of this species proceeds without legal restrictions. Gillnetting in the nursery area proceeds without legal restrictions" and "[d]ue to the multi-species nature of the fisheries [in much of its range], regulation measures aimed at a particular species are a difficult proposition." Id. These protections are clearly not enough to protect the species from both targeted and bycatch mortality. ESA protections should be afforded to the Striped Dogfish to help avoid its extinction.

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<u>(73) Scientific Name:</u> <u>*Mustelus schmitti*</u>

Common Name: Narrownose Smoothhound

IUCN Status: Endangered **CITES Status**: N/A

Range: This shark is "[e]ndemic to the Southwest Atlantic, from southwest Brazil to the coast of central Argentina, between latitudes 22ºS (Rio de Janeiro) and 48ºS (Patagonia)." IUCN (Mustelus schmitti) 2012, Exhibit 126 at 4 (citing Figueiredo 1977; Chiaramonte & Pettovello 1998).

Habitat and Ecology: "In south[ern] Brazil, the species occurs mostly at depths of 10 to 140 m[eters], at bottom temperatures of 12 to 20ºC . . . " <u>Id.</u> (citing Vooren 1997; Haimovici et al. 1996). The waters off southern Brazil comprise this species' wintering grounds; "[w]inter migrants include juveniles, adult males, and gravid adult females. [These w]inter migrants arrive in [Brazilian waters in] large numbers in April and stay until November, then presumably migrate southward to Uruguay and/or Argentina. A small population was known to give birth in south Brazil in November and remain during January and February, but this population appears to have been extirpated." <u>Id.</u> at 4-5 (citing Vooren 1997). Other small populations with their own inshore-offshore migration patterns are thought to exist throughout this species' range. <u>Id.</u> at 4. This species feeds mostly on crabs. <u>Id.</u> at 5 (citing Capitoli et al. 2005). "In Argentina, the species occurs from coastal waters to 120 m[eters], at temperatures of 5.5 to 11.0ºC. <u>Id.</u> (citing Menni 1985).

Population Status: "Pupping occurs inshore in spring throughout this range [of this species] from south[ern] Brazil to Patagonia . . ." <u>Id.</u> at 4 (citing Cousseau 1982; Cousseau 1986; Chiaramonte & Pettovello 1998). "This is evidence of the existence of several populations of the species. One large population migrates to south[ern] Brazil in autumn and leaves [] in spring, presumably in a southward migration with an [as yet] unknown route. A locally breeding, smaller population existed in south[ern] Brazil [year-round, but is thought to] have been extirpated by the [local] fishery. Important nursery areas exist in Argentina off Buenos Aires in Cabo San Antonioand El Rincón. <u>Id.</u> (citing Cousseau 1986). Two other nursery areas occur in north and south Patagonia. <u>Id.</u> (citing Van der Molen et al. 1998; Chiaramonte & Pettovello 2000).

Population Trend: Decreasing. <u>Id.</u>

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

This species is "subject to intensive fishing in its entire area of distribution, including its nursery grounds. From the observed decline in abundance under intensive fishing, it is concluded that in Brazil the fishery causes recruitment overfishing. In winter, the species is fished in south Brazil as a component of a mixed-species fishery and also by directed fishing. Bottom trawl fishery [catch per unit effort (CPUE) data from southern Brazil is] evidence that since intensive fishing [began] in 1985 [], the abundance of the winter migrant population of the species has decreased by 85% by 1997, and the fishery continues [to operate] without restraint." Id. at 5 (citing Miranda & Vooren 2003). Also, in southern Brazil, a small local population reproduced in spring but then remained during the summer. Id. "Neonates used to be commonly caught by beach seine and bottom trawl[ers] in the 1980s." Id. However, "a recent summer shore fishery survey (2003)" in the area failed to produce a single specimen of this once common species. Id. Therefore, this local population "seems to have disappeared," which is "attributed to fishing in its inshore pupping and nursery areas." Id.

"In Argentina, this species has been an important fishery resource since 1988, and market demand [for it has] increased over the last eight years." Id. (citing Chiaramonte 1988). "Intensive fishing in coastal nursery areas threatens recruitment while fishing for adults is increasing. In the main fishing area off Buenos Aires [] and Uruguay [], biomass [for this species] has decreased by 22%, while national landings in Argentina decreased by 30% between 1998 and 2002. Id. While "[f]isheries statistics may underestimate the actual volume landed, [] reductions in landings are an indication that the resource cannot withstand the current level of exploitation. The most recent data (2003) indicate a continuing decline in the stock [of this species]." Id. at 5-6.

"In industrial and artisanal fisheries in Uruguay this species is not targeted but taken as bycatch. Together with *M. fasciatus*, estimated capture for the period 2000-2002 was 900 [tons] per year (*M. schmitti* was the main species taken)." Id. at 6. Therefore, overutilization for commercial purposes appears to be occurring throughout the species' range and threatening its continued existence. This threat qualifies the species as "threatened" or "endangered" under the ESA and it should be listed.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

The only current conservation measure in place for this species is the Maximum Permitted Catch established by the Argentine fisheries authority. Id. However, this has failed to prevent further and continuing population declines in this species throughout its range. Id. While catch quotas are necessary to ensure that species that have not yet become "endangered" are not harvested in unsustainable numbers, they are inappropriate measures for species that have already become "endangered." By listing a species as "endangered," IUCN is saying that the species is facing threats to its existence that create a "very high risk of extinction in the wild." IUCN Undated, Exhibit 38 at 17-20. If a species is facing a "very high risk of extinction in the wild," then the catch quota for that species should be set at zero. These types of half measures are inappropriate to halt species extinctions, and this is why the more restrictive prohibitions represented by ESA protection are desperately needed for this species.

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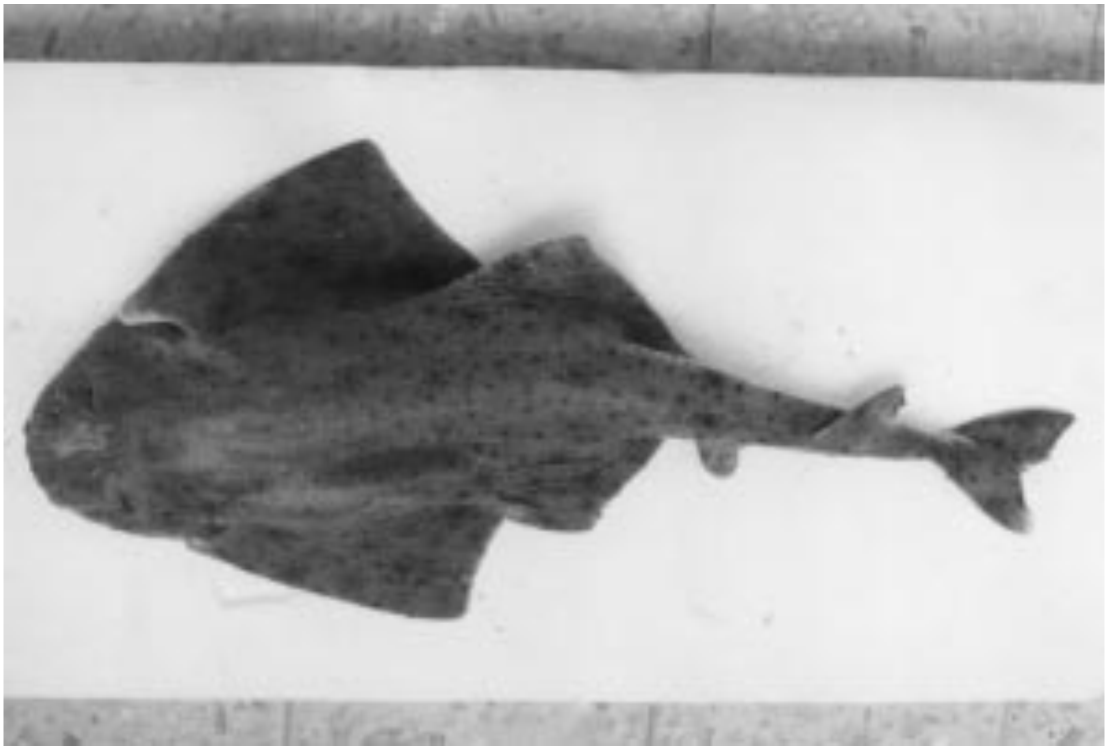
<u>(74) Scientific Name:</u> *<u>Squatina aculeata</u>*

Common Name: Sawback Angelshark

IUCN Status: Critically Endangered **CITES Status:** N/A



Source: Basusta 2002, Exhibit 148 at 1178.

Range: The Sawback Angelshark is known to live in the "coastal and outer continental shelf sediment habitat in the Mediterranean Sea and eastern Atlantic." IUCN (Squatina aculeata) 2012, Exhibit 127 at 3. The Sawback Angelshark's range in the eastern Atlantic is Morocco and the Western Sahara coasts, Mauritania, Senegal, Guinea to Nigeria, Gabon to southern Angola, and Namibia. <u>Id.</u> at 4. The Sawback Angelshark's Mediterranean range consists of the western and central basins, the Ionian Sea, and the Egyptian coast. <u>Id.</u> The Sawback Angelshark's occurrence in the Adriatic has not been reported. <u>Id.</u> The Sawback Angelshark is native to Algeria, Angola, France, Gabon, Guinea, Italy, Mauritania, Morocco, Namibia, Niger, Senegal, Spain, Tunisia, and Western Sahara. <u>Id.</u> However, it is now extremely uncommon throughout most of its range. <u>Id.</u>

Habitat and Ecology: "The biology of [the Sawback Angelshark] is sketchily known. The estimated average length of this shark at maturity is 124 [centimeters]. Maximum sizes are estimated at around 188 [centimeters]. Its size at birth, longevity, age at maturity, rate of population increase and mortality are unknown. It is ovoviviparous, but the reproductive age, gestation time, reproductive periodicity, fecundity and the rate of population increase are also all unknown." <u>Id.</u> at 5 (citing Compagno in prep). The species is named for their pectoral fins that resemble wings. MarineBio Undated, Exhibit 146 at 1.

The Sawback Angelshark "is an offshore angel shark of the outer continental shelf and [the] uppermost slope of the warm-temperate and tropical eastern Atlantic. It lives on or near the seabed at depths of 30 to 500 [meters]." IUCN (Squatina aculeata) 2012, Exhibit 127 at 5. It prefers sand or muddy bottoms. Id. at 5, 6; MarineBio Undated, Exhibit 146 at 1. They spend much of their time buried and lying motionless, "sometimes for as long as several weeks, until prey comes within striking range." MarineBio Undated, Exhibit 146 at 1-2.

The Sawback Angelshark's "[d]iet in the Mediterranean includes small sharks, herring [], jacks [], picarels [], flatfish [,] sole [], cuttlefish [], and crustaceans including shrimp, manis shrimp, and crabs []." IUCN (Squatina aculeata) 2012, Exhibit 127 at 5-6.

The shark's coloration is "a dull grey to a light brown on [the] back that [is sparsely] scattered with small irregular white spots and also with regular small dark brownish spots." EOL Undated, Exhibit 147 at 11. The shark "[o]btains dark blotches on [its] head, back, the fin bases and tail." Id. The body has "large thorns atop its head in a row down its back." Id. It also has a concave space between its eyes and heavily fringed nasal barbels with anterior nasal flaps. Id.

Population Status: The Sawback Angelshark was once "a common and important demersal predator" across large areas of "coastal and outer continental shelf habitat in the Mediterranean Sea and eastern Atlantic. Most of this region is now subject to intense demersal fisheries, and the [Sawback Angelshark] is highly vulnerable from birth onwards to bycatch, in the benthic trawls, set nets and bottom longlines operating through[out] most of its range and habitat." IUCN (Squatina aculeata) 2012, Exhibit 127 at 3. Because of this, the Sawback Angelshark's abundance has "declined dramatically over the past 50 years to the point where it has been extirpated from large areas of the northern Mediterranean and parts of the West African coasts. It is now extremely uncommon throughout most of the remainder of its range." Id. at 3-4. However, Russian surveys in the 1970s and 1980s along the West African coast reported that the species was common at that time. Id. at 4. However, "Portuguese landings data from the fleet operating off Morocco and Mauritania, aggregated for *S. aculeata*, *S. oculata* and *S. squatina* combined indicates a 95% decline in CPUE[128] from 1990 to 1998 . . ." Id. "The available data from this region indicate that there are very few recent records, and none since 2002." Id.

The Mediterranean Sea. Identifying Sawback Angelshark declines is frustrated by the fact that Sawback Angelsharks can be difficult to identify to species, and many fishers' records are only to the genus. Id. at 3. However, a dramatic decline in the number of angelsharks caught by tuna traps operating in Baratti (the Northern Tyrrhenian Sea)

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[128] CPUE is an indirect measure of the abundance of a target species. Changes in the catch per unit effort are inferred to signify changes to the target species' true abundance. A decreasing CPUE indicates overexploitation, while an unchanging CPUE indicates sustainable harvesting.

was reported between the years of 1898 and 1922. Id. at 4 (citing Vacchi et al. 2002). From 1898 to 1905, catches of the genus *Squatina* averaged 134 specimens per year, but from 1914-1922, catches averaged only 15 per year. Id. This decline is thought to coincide with the beginning of trawling activity in the area, to which Sawback angelsharks are very susceptible. See id. at 3, 4.

Squatina sharks were historically documented in checklists off the Balearic Islands. Id. (citing Barceló y Combis 1868; Fage 1907). Declines have been reported from studies in the region where this species, once common, may now be absent. Id. at 4-5. "Captures of *Squatina* spp. were relatively frequent until the 1970s, becoming increasingly sporadic during the 1980s in coastal artisanal fisheries (trammel nets and gillnets), trawls and bottom longline fisheries." Id. at 4. Records from a lobster gillnet fishery in the Balearics "show that it was common to capture angel sharks on a daily basis until the mid 1980's (presumably of *S. aculeata* or *S. oculata*, judging by the depth and substratum where this fishery operates). But since the mid 1990s," there have been no reports of *Squatina* spp. in the area. Id. at 4-5. A recent study reported that there were no captures of *Squatina* spp. "from four bottom trawl fishing surveys (131 hauls, at a depth range of 46-1,800 [meters]) carried out between 1996 and 2001 around the Balearic Islands." Id. at 5 (citing Massutí & Moranta 2003). "In addition, the likely low interaction with stocks from other areas further affects the already low recovery capacity of isolated populations such as those around the Balearics." Id.

Another survey performed between 1985 and 1998 did not report a single capture of Sawback Angelshark from 9,281 hauls during 22 trawl surveys in the northern Mediterranean. Id. (citing Relini et al. 2000). In a broad, international, bottom trawl survey of the north Mediterranean coastline from 1995-1999, spanning from West Morocco to the Aegean Sea at depths of 10-800 meters, Sawback Angelsharks "appeared in only one of a total of 9,095 tows." Id. (citing Baino et al. 2001). "Indeed, it appears that angel sharks are now absent from most of the northern Mediterranean coastline." Id.

There have been reports of Sawback Angelsharks in Turkish waters, including a specimen that was caught in a trawl on May 15, 1997 in Iskenderun Bay at about 120-200 m depth. Basusta 2002, Exhibit 148 at 1177; see also IUCN (Squatina aculeata) 2012, Exhibit 127 at 5 (citing Bilecenoglu et al. 2002). However, the species is considered very rare in eastern parts of the Mediterranean and not at all present in the Black Sea. IUCN (Squatina aculeata) 2012, Exhibit 127 at 5 (citing Serena 2005).

The Eastern Atlantic Ocean. There is not much species-specific data from the West African coasts. Id. However, Sawback Angelsharks were "previously reported as common in Russian surveys in this region during the 1970s and 1980s. Artisanal Senegalese fishermen also remember [Sawback Angelsharks] as common and frequently caught by lines and gillnet 30 years ago." Id. However, it seems the species has been depleted so much that it has almost completely disappeared; according to both artisanal fishermen and observers of the industrial demersal trawl fleets, catches are now very rare. Id.

"In Sierra Leone, [Sawback Angelsharks] were periodically caught by demersal trawlers in the 1980s," but today are caught very infrequently. Id. at 7. One specimen was caught in Guinea (year unknown), and one individual was caught in Gambia in 1998. Id. In Senegal, 13 individuals were caught from 1970 to 1998 and none have been observed in recent surveys since that time. Id. "In Mauritania[,] four were caught between 1988 and 1989, and none have been caught since." Id.

Consistent with all of the above surveys and data, the IUCN concludes the population trend of Sawback Angelshark is decreasing. Wherever there are good records, the Sawback Angelshark has declined. The decline is due to fishing, destruction of its habitat, and a lack of regulatory mechanisms in place to prevent the species from being fished to extinction. While data may be missing from some parts of its range, both fishing and a lack of regulatory mechanisms are present in these parts as well, making it reasonable to conclude the same decline is happening in the parts of the species' range without good records.

Population Trend: Decreasing. Id. at 5.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

Bottom trawling seems to have been occurring in the Sawback Angelshark's range since sometime around 1898-1905. Id. at 4. Bottom trawling is a form of fishing that alters the bottom of the seabed; it negatively alters habitat and decreases biodiversity. Johnson 2002, Exhibit 149 at 7. The Sawback Angelshark uses muddy or sandy bottoms in order to sneak up on its prey, but these substrates are disturbed when bottom trawling occurs, damaging this vital habitat. See id.; IUCN (Squatina aculeata) 2012, Exhibit 127 at 5, 6. Decreases in biodiversity caused by bottom trawling can also translate into less prey for the species to survive on, which in turn causes the habitat subject to these pressures to be far less suitable. Bottom trawling efforts in the Sawback Angelshark's range have increased in both intensity and efficiency over the last 50 years and, therefore, the negative effects on the species' habitat have also increased. See IUCN (Squatina aculeata) 2012, Exhibit 127 at 6. These pressures are expected to continue at this high level, or even increase, in the future, causing further degradation of Sawback Angelshark habitat. Id. at 4. "Human disturbance by habitat degradation and tourism are also possible threats to its preferred sandy nearshore habitat." Id. at 6. Therefore, this degradation of the species' habitat represents a significant threat to its continued existence.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

The Sawback Angelshark's decline in population is primarily due to bycatch from commercial and recreational fishing. "Angel sharks are highly susceptible to bycatch in trawls as they lie on the bottom. Benthic trawl effort has increased in both intensity and efficiency on the shelf and slope area Mediterranean over the last 50 years." Id. As a result of these pressures, "*Squatina aculeata* has virtually disappeared from most of its former Mediterranean range . . ." Id. This is due to the fact that the Sawback Angelshark is "highly vulnerable from birth onwards to bycatch in the benthic trawls, set nets and bottom longlines operating through most of its range and habitat." Id. at 3. In fact, the initial precipitous decline in the species' Northern Tyrrhenian Sea habitat observed in the early 20th century was likely caused by the start of trawling in the area. Id. at 6.

There is evidence that the species used to be targeted in the Balearic Islands through the use of a special net called an 'escatera.' Id. The species used to be common in this area, but now may have been completely extirpated. Id. Fishers in the area have reported that all species of *Squatina* have "diminished drastically" over the last 20 years. Id. The species may also be threatened by an intensive lobster gillnet fishery operating around the Island of Menorca. Id.

"The species is also bycaught in trammel nets and bottom longlines throughout its range." Id. This seems to have led to a "dramatic decline in most of its range of distribution" and probable local extirpations. Id. Declines from a Portuguese fishery operating off Morocco and Mauritania indicate declines of over 95% in both catch per unit effort (CPUE)[129] and total landings in the eight-year period going from 1990-1998. Id. While the Sawback Angelshark is likely too rare in all of its range to support a directed fishery, at least some of the incidental catch is utilized for human consumption. See EOL Undated 2, Exhibit 147 at 5. Its liver oil is also used and its hides are turned into leather. Id.

As stated above, benthic trawl efforts have increased in intensity and efficiency in the Mediterranean over the past 50 years. See IUCN (Squatina aculeata) 2012, Exhibit 127 at 6. Along the coasts of West Africa, the species is taken as bycatch of industrial trawls and gillnet fisheries, to the point where today the species is extremely uncommon. Id. at 4. "Industrial and artisanal fishing pressure is intense and often unregulated in this region and it is suspected that this will continue at the current level or increase in the future." Id. Therefore, the threats the Sawback Angelshark is facing from this commercial overutilization are likely to continue to cause further declines and local extinctions unless it is adequately protected.

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[129] CPUE is an indirect measure of the abundance of a target species. Changes in the catch per unit effort are inferred to signify changes to the target species' true abundance. A decreasing CPUE indicates overexploitation, while an unchanging CPUE indicates sustainable harvesting.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

Industrial and artisanal commercial fishing is intense, and often unregulated, throughout the Sawback Angelshark's range. Id.

The Mediterranean Sea. "The genus *Squatina* is protected within six Balearic Island marine reserves, where fishing for these species is forbidden and accidental captures must be released." Id. at 7. However, the Balearic Islands are just a tiny part of the Sawback Angelshark's range, and, as stated previously, there have been no reports of Sawback Angelshark in the Balearic Islands since the mid 1990s, indicating that perhaps it is too late for conservation there. Id. at 5. Furthermore, discarded bycatch species are often dead or dying upon discard, thus potentially limiting the efficacy of any releases that would occur.

In January 2012, Spain published Order AAA/75/2012, "announcing the inclusion of nine shark and ray species in its List of Wild Species under Special Protection." Roy 2012, Exhibit 150 at 1. The Sawback Angelshark is on the list, which "prohibits the capture, injury, trade, import and export of the[] species, and requires periodic evaluations of their conservation status." Id. However, the Sawback Angelshark is likely not intentionally fished; it is, at least primarily, caught as bycatch. This makes species-specific protection much less effective, because even if a country says the Sawback Angelshark cannot be killed intentionally, fishers targeting other species will still kill it incidentally. Spanish waters also only account for a small portion of the species' habitat. Therefore, this measure is not sufficient to stop the commercial overutilization of the species.

The Eastern Atlantic Ocean. Outside of Spanish waters, which are a small fraction of the Sawback Angelshark's eastern Atlantic range, there are no other known conservation measures for the species in the Atlantic. See IUCN (Squatina aculeata) 2012, Exhibit 127 at 7.

This lack of adequate regulatory mechanisms in existence to protect the species makes ESA protection approppropriate, and the Sawback Angelshark should be protected under the ESA to avoid its extinction.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Low Rate of Exchange. "A low rate of exchange between *Squatina* populations makes them prone to local depletion and means that [re-colonization] will be extremely low." Id. at 6. Therefore, the species is inherently unable to rebound when subjected to loss of individuals and local populations.

Synergistic Effects. The synergistic effects of aforementioned threats could conspire to cause the extinction of Sawback Angelsharks. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction." Brook et al. 2008, Exhibit 46 at 457 (internal citations omitted). Therefore, the combination of threats to this species could cause a greater and faster reduction in the remaining population of this rare species than might be expected from simply the additive impacts of the 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." Id. at 455 (internal citations omitted). The Sawback Angelshark is a K-selected species and, therefore, is at a greater extinction risk.

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(75) Scientific Name: *Squatina argentina*

Common Name: Argentine Angel Shark / Longfin Angel Shark

IUCN Status: Endangered **CITES Status**: N/A

Range: This species "is endemic to the Southwest Atlantic" occurring from 32ºS, near Rio Grande do Sul, Brazil, south through Uruguay to 43ºS near Patagonia, Argentina. IUCN (Squatina argentina) 2012, Exhibit 128 at 4. "Nursery areas [for this] species have not been found in southern Brazil and may exist further south off Uruguay and/or Argentina." Id.

Habitat and Ecology: "*Squatina argentina* is a bottom-dwelling shark of smooth sandy and muddy grounds on the outer shelf and upper slope[,] at depths of 120 to 320 m[eters.]" Id. at 5 (citing Vooren & Silva 1991; Vooren 1997). Maximum size is 138 centimeters total length and size at maturity is roughly 120 centimeters total length for both sexes. Id. (citing Silva 1996). Fecundity for this species "is 7 to 11 embryos per litter, with most females carrying 9 or 10 young." Id. (citing Vooren & Silva 1991). "The breeding cycle of female lasts at least two years." Id.

Population Status: "*Squatina argentina* appears to be the [least] abundant of the three angel shark species captured by fisheries off Rio Grande do Sul," Brazil. Id. (citing Perez & Warhlich 2005). There is evidence that the species has experienced "significant declines" at least in Brazil where it is estimated that only 15% of the species still exists. Id. at 4. This is due to overfishing of the species. Id. "In Uruguay and Argentina[, the remainder of the species' range,] the species is uncommon in commercial landings," though the declines from these areas are less clear. Id.

Population Trend: Decreasing. Id. at 5.

Known Threats/Listing Criteria:

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"The nocturnal habits of angel sharks render them vulnerable to bottom gillnets, and increases in captures during the 1990s are attributed to the introduction of this gear on the shelf and slope off southern Brazil at that time. Gillnets were reported as six times more effective at catching angel sharks than trawling alone." Id. (Vooren & Klippel 2005). "A low rate of dispersal between angel shark populations makes them especially prone to local depletion and means that [re-colonization is] extremely low." Id.

Fishery statistics for angel sharks in southern Brazil do not differentiate and refer to landings of *Squatina guggenheim*, *Squatina oculata*, and *Squatina argentina* as a combined total. Id. However, as previously noted, *Squatina argentina* is the least abundant of these three in the catch. Id. (citing Perea & warhlich 2005). With this in mind, annual catches of all angel sharks by the Brazilian fishery decreased by about 85% from 1984 to 2002. Id. (citing Miranda & Vooren 2003; CEPERG 2003; GEP/CTTMar 2003). However, fishing for the species still continues. For example, in the monkfish trawl and gillnet fisheries, *Squatina oculata* and *Squatina argentina* continue to be significant bycatch, and a targeted angel shark gillnet fishery along the outer shelf still catches large amounts of angel sharks, including *S. argentina*. Id. (citing Miranda & Vooren 2003).

While specific fisheries statistics are somewhat difficult to ascertain in Brazil due to the lack of differentiation between the three angel shark species in their reporting terms, research trawl surveys of the outer shelf in 1987 and 2002 "confirmed that in southern Brazil the abundance of *S. argentina* has decreased to 15% of its original level[, which] is attributed primarily to recruitment overfishing due to the bottom gillnet fishery." Id. (citing Vooren & Lamónaca 2002; Vooren & Klippel 2005). At least one study has also noted that *S. argentina* is "one of the most retained bycatch species in the gillnet monkfish fishery, with bycatch estimated at 1.052 per 100 nets in 2001 (total 8,698 individuals)," which is an unsustainable level for the species. Id. (citing Perez & Warhlich 2005).

"At present, there is no evidence of the existence of abundant populations of the species outside southern Brazil. In Uruguay and Argentina[, this] species is uncommon in commercial landings . . ." Id. at 6. "In Argentina, angel shark landings have shown a negative trend since a peak in 1998 . . ." Id. (citing Massa et al. 2004). "In Uruguay, there is little direct fishing for angel sharks, but they are taken as bycatch in industrial and artisanal fisheries. The estimated capture [of angel sharks] has been 300 to 400 [metric tons] per year since 1997. There are no statistics by species [for Uruguayan waters], but the largest captures probably correspond to *S. guggenheim* and *S. argentina*." Id. While most available information on this species comes from Brazil, "trawl and other demersal fisheries operate over the species' [entire] area of occurrence," exerting immense, unsustainable, pressure on this species. Id. at 5-6. Therefore, the species has been, and continues to be, threatened by overutilization for commercial purposes.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

Little regulation exists to protect this species. Id. This is the case especially in Brazil, where "there is no control of the shelf angel shark fishery, and[,] although trawling in inshore waters is prohibited, enforcement of this regulation is difficult." Id. The monkfish fishery in Brazil, which takes many specimens of this species as retained bycatch, has also been limited, but these protections are not tailored to protect *S. argentina* and likely will fail to do so. Id. at 5, 6. There is also a maximum permitted catch in Argentina, but it is set at a very high 4,000 metric tons, which represents 10-13 times the estimated amount caught in all of Uruguay every year. Id. (citing Massa et al.

2003). Furthermore, while catch quotas are necessary to ensure that species that have not yet become "endangered" are not harvested in unsustainable numbers, they are inappropriate measures for species that have already become "endangered." By listing a species as "endangered," IUCN is saying that the species is facing threats to its existence that create a "very high risk of extinction in the wild." IUCN Undated, Exhibit 38 at 17-20. If a species is facing a "very high risk of extinction in the wild," then the catch quota for that species should be set at zero. These types of half measures are inappropriate to halt species extinctions, and this is why the more restrictive prohibitions represented by ESA protection are needed for this species.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

"The species' low reproductive potential (litter size of 7 to 11 and female breeding cycle at least biennial) . . . [and] low rate of dispersal between angel shark populations makes them especially prone to local depletion and means that [re-colonization] will be extremely low." See IUCN (Squatina argentina) 2012, Exhibit 128 at 4, 5. These characteristics of the species make it even more vulnerable to the extensive fishing pressures and other losses it faces throughout its range.

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(76) Scientific Name: *Squatina formosa*

Common Name: Taiwan Angelshark

IUCN Status: Endangered **CITES Status**: N/A

Range: This species of Angelshark is found in the northwest Pacific Ocean in the East China Sea. IUCN (Squatina formosa) 2012, Exhibit 129 at 4 (citing Compagno et al. 2005a; Walsh & Ebert 2007). It is found primarily in the continental waters surrounding northern Taiwan and the East Taiwan Straight. Id. (citing Shuyuan 1994).

Habitat and Ecology: "A little known species, [*Squatina formosa* is usually] caught at or near the bottom on the continental shelf, usually at depths of 100-300 [meters], although it is [thought to also] occur in shallower" water. Id. "Other angel sharks are known to bury themselves in sediment and ambush their prey." Id. Though detailed life history for this species remains unknown, it "is thought to be slow growing and late maturing like other species of angel shark." Id. Maximum recorded size is 150 centimeters total length. Id.

Population Status: "No details are [currently] available on the population of this species. Individuals are found in local fish markets in Taiwan," but catch records for this species have never been recorded. Id. Another reason so little data exist for this species is that it is hard to distinguish it from other northwest Pacific angel sharks. Id.

"Where population data are available for other angel sharks, declines greater than 80% have been observed in less than three generations," within areas where angel sharks are either targeted or taken as bycatch. Id. *Squatina formosa* is subject to such pressures throughout its entire range and is thus almost certain to be experiencing these extreme declines. See id. at 5.

Population Trend: Unknown. Id. at 4.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"Taiwan's main fisheries operate throughout the entire known range of this species," where "[i]t is caught in bottom trawl fisheries, which operate between 50 and 300 [meters]." Id. at 5. This species is utilized for its meat and by-products and is found in local fish markets, "but it is unknown whether this species is truly targeted by fishing operations" or if it is just a retained bycatch. Id.

"The East China Sea is intensively exploited, with several stocks declining due to overfishing and pollution." Id. (citing NOAA 2004). "Heavy fishing mortality has resulted in a shift from an older, traditional fishery based on high-value demersal species to faster-growing, smaller, and lower-value species such as shrimp and cephalopods." Id. (citing NOAA 2004). "Fishing pressure from trawl vessels[, like those used to fish shrimp,] is intense off China, despite bans on bottom trawling in certain areas." Id. This is largely due to the fact that China possesses the largest fleet of fishing vessels and fishers in the world, with "trawlers accounting for 47.6% of catches in 2004." Id. (citing FAO 2007).

Though little data exist for this species, "[o]ther angel shark populations [] have proved particularly vulnerable to fishing pressure due to their low reproductive potential, vulnerability to trawl and gillnet fishing gear, and low potential for [re-colonization] (due to their sedentary habit)." Id. (citing Gaida 1997; ICES 2004; Morey et al. 2006; Vooren & Klippel 2005). Several species of angel sharks "have a triennial reproductive cycle, with a little size of only two to eight pups. This extended breeding cycle means that they have a very low intrinsic rate of population growth. Consequently, these sharks are generally highly vulnerable to extirpation through bycatch in fisheries that are managed to sustain production of other, more productive" species, like those fisheries maintained in *Squatina formosa*'s entire range. Id. (citing Musick et al. 2000).

Intense fishing pressure throughout its range, to which it is particularly vulnerable, and an extended reproductive cycle greatly reduce this species' chances of long-term survival. Therefore, it is almost certainly subject to overutilization for commercial purposes.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

There are currently no conservation measures in place to protect this species. Id. There are some areas where trawling is banned or restricted, but there is no information on whether those areas intersect *Squatina formosa*'s range, the timings involved, or the effectiveness of enforcement of these restrictions. Id. As such, these restrictions represent no certain protection for the species whatsoever. Such a complete lack of protection for a species facing such significant threats to its continued existence is inappropriate. ESA protection should be extended to the species to halt its progress towards extinction.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

Again, *Squatina formosa*'s likely low reproductive potential, vulnerability to trawl and gillnet fishing gear due to its habitat requirements, low potential for re-colonization, triennial reproductive cycle, and low fecundity make it much more susceptible to extinction when the species faces sustained pressure leading to losses of individuals, as is happening now.[130] Therefore, the threats to the species qualify it as "threatened" or "endangered" under the ESA and it should be listed.

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[130] See id.; see also Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B), supra.

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(77) Scientific Name: ***Squatina guggenheim***

Common Name: Spiny Angel Shark / Hidden Angelshark

IUCN Status: Endangered **CITES Status**: N/A

Range: This species of shark "is endemic to the Southwest Atlantic from Rio de Janeiro, Brazil (24ºS) through Uruguay to northern Patagonia, Argentina (43ºS)." IUCN (Squatina guggenheim) 2012, Exhibit 130 at 4. "Gravid females migrate in spring to shallow inshore nursery grounds to give birth." Id. (citing Silva 1996).

Habitat and Ecology: "*Squatina guggenheim* is a relatively small, shelf bottom-dwelling shark. In Brazil the species occurs mostly at depths of 10 to 80 m[eters, preferring] bottom temperatures of 10 to 22ºC. Id. at 5 (citing Vooren & Silva 1991). In Argentinean waters, this species has been recorded as deep as 150 meters. Id. (citing Cousseau 1973; Gosztonyi 1981; Menni et al. 1981). Maximum size is 92 cm total length. Id. (citing Silva 1996). Reproduction occurs via aplacental yolksac viviparous reproduction utilizing the female's one functional ovary. Id. The breeding cycle for a female is triennial with 3-9 embryos per litter, giving this species a slow reproductive rate. Id. (citing Vooren & Klippel 2005; Compagno in prep.). Pregnant *S. guggenheim* females migrate to shallow coastal waters in the spring to give birth (small juveniles occur in these shallow coastal waters all year round). Id. (citing Vooren & Silva 1991; Vooren & Klippel 2005). "The age at sexual maturity was calculated as 4 to 5 years and longevity 12 years." Id.

Population Status: "Although the species lives in a geographical continuum of [around] 20 degrees of latitude, [its] range is probably composed of local populations each with its own inshore-offshore migration pattern within their local temperature regime." Id. Available data show that these local populations are vulnerable to extirpation due to fishing pressure. Id. "Shallow inshore regions are important as [birthing and] nursery grounds throughout the geographical range of the species," and therefore fishing in these areas likely represents an even greater threat than elsewhere. Id. at 4, 5.

Population Trend: Decreasing. Id. at 5.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"The nocturnal habits of angel sharks render them vulnerable to bottom gillnets, and the increases in captures during the 1990s are attributed to the introduction of this gear on the [continental] shelf and slope off southern Brazil at that time. Gillnets were reported as six times more effective at catching angel sharks than trawling alone." Id. (citing Vooren & Klippal 2005).

Pregnant females "of *S. guggenheim* have been observed to abort embryos easily upon capture, further reducing the reproductive capacity" of this species even if the caught specimen is released alive. Id. (citing Vooren & Klippal 2005). "A low rate of dispersal between populations also makes [this species] especially prone to local depletion and means that [re-colonization] will be extremely low. Furthermore, pupping and nursery areas in Brazil occur in shallow inshore waters at depths of [less than 30 meters]." Id. at 4, 5. "Intensive fishing by gillnet[s] and trawl[s] in these nursery areas results in additional pressure on gravid females and juveniles of the species." Id. at 5 (citing Silva 1996; Vooren & Klippel 2005). "Additionally, an angel shark bottom gillnet fishery on the outer shelf commenced [in Brazil] around 1990[,] and at present large amounts of angel sharks[, including *S. guggenheim*,] are caught this way." Id. at 6 (citing Miranda & Vooren 2003). "Research trawl surveys of the outer shelf in the years 1986/87 and 2001/02 confirmed that in southern Brazil the abundance of *S. guggenheim* has decreased to 15% of its original level and this is attributed to recruitment overfishing primarily due to the bottom gillnet fishery." Id. (citing Vooren & Lamónaca 2002; Vooren & Klippel 2005). This is backed up by the fact that catch per unit effort (CPUE)[131] "by otter trawl and pair trawl on the continental shelf decreased by about 85% from 1984 to 2002. Id. (citing Miranda & Vooren 2003; CEPERG 2003; GEP/CTTMar 2003; Vooren & Klippel 2005).

In Argentina, angel shark catches, both targeted and as bycatch, amounted to as much as 4,167 metric tons in 1991, and 4,281 metric tons in 1996. Id. Available data indicate that these Argentine "[c]atches consist almost entirely of *S. guggenheim*." Id. However, landings of this species in Argentine waters had dropped to less than 2,000 metric tons in 2002, rising again in 2003 to 3,550 metric tons. Id. (citing Massa et al. 2004). Studies have suggested that this overall negative trend in landings during the period 1998-2003 corresponds with a 58% decline in catch per unit effort (CPUE) of angel shark in the coastal bottom trawl fleet. Id. (citing Vooren & Klippel 2005). This likely indicates a very large decline in the species' prevalence over the same period.

"In Uruguay, there is little direct fishing for angel sharks [like *S. guggenheim*], but they are taken as bycatch in industrial and artisanal fisheries. The estimated capture [in Uruguayan waters] has been 300 to 400 [metric tons] per year since 1997." Id. Though Uruguayan records of angel shark landings are not categorized by species, the largest proportion of captures likely corresponds to *S. guggenheim* and *S. argentina*. Id. Therefore, continuing fishing pressure represents a threat to the species' continued existence due to commercial overutilization.

[131] CPUE is an indirect measure of the abundance of a target species. Changes in the catch per unit effort are inferred to signify changes to the target species' true abundance. A decreasing CPUE indicates overexploitation, while an unchanging CPUE indicates sustainable harvesting.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

This species suffers from a lack of protective regulations. This is especially true "[i]n Brazil [where] there is no control of the shelf angel shark fishery, and[,] although trawling in inshore waters is prohibited, enforcement of this regulation is difficult." Id. There is also a maximum permitted catch for all species of angel sharks in Argentina, but at 4,000 metric tons it is massive and dwarfs the 300 to 400 metric tons of angel sharks taken yearly in Uruguay. Id. Furthermore, while catch quotas are necessary to ensure that species that have not yet become "endangered" are not harvested in unsustainable numbers, they are inappropriate measures for species that have already become "endangered." By listing a species as "endangered," IUCN is saying that the species is facing threats to its existence that create a "very high risk of extinction in the wild." IUCN Undated, Exhibit 38 at 17-20. If a species is facing a "very high risk of extinction in the wild," then the catch quota for that species should be set at zero. These types of half measures are inappropriate to halt species extinctions.

There are almost no protective measures in place for this species, and what is there is insufficiently stringent and insufficiently targeted towards restoring this species' numbers. This paucity of protection in the form of existing regulatory mechanisms is inadequate and should be supplemented by protection under the ESA.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

This species' low reproductive rate, tendency to abort on capture, splintered population, and vulnerability to gillnet fishing techniques, together with continuing high exploitation throughout its range leave *Squatina guggenheim* highly vulnerable to local extirpation and possibly extinction. See id. at 4-6. These factors render the threats to the species all the more significant and further qualify the species as "threatened" or "endangered" under the ESA.

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<u>(78) Scientific Name:</u> *<u>Squatina oculata</u>*

Common Name: Smoothback Angel Shark /Monkfish

IUCN Status: Critically Endangered **CITES Status**: N/A

Range: This species of shark used to occur throughout the Mediterranean, but is now most frequent in the south in areas like the coast of Tunisia. IUCN (Squatina oculata) 2012, Exhibit 131 at 4 (citing Bradaï 2000). Its Mediterranean range extends from Libya in the west to Turkey in the East. <u>Id.</u> (citing Fischer et al. 1987; Fredj & Maurin 1987; Lamboeuf et al. 1995; Golani 1996; Bilecenoglu et al. 2002). In the Atlantic, this species has been reported from the Iberian Peninsula in the north, to as far south as Sâo Tomé and Principe off the West African coast. <u>Id.</u>

Habitat and Ecology: "A warm-temperate and tropical angelshark of the eastern Atlantic [and Mediterranean] continental shelves and upper slopes from [less than] 20 m[eters] to [as deep as] 500 m[eters, going] deeper in the tropics than in temperate seas. Surveys off the West African coast indicate that the species may form aggregations in December." <u>Id.</u> at 5-6 (citing Litvinov 1993).

This species is ovoviviparous, giving birth in February-April to 3 to 8 pups. <u>Id.</u> at 6 (citing Capapé et al. 1990). Age at maturity, longevity, and reproductive age are all still unknown, as are the gestation time, reproductive periodicity, reproductive rate, and natural mortality. <u>Id.</u> It eats small fish, squid, octopus, and crustaceans including mud shrimp and crabs. <u>Id.</u> (citing Compagno in prep.).

Population Status: "This species is known to be caught off Tunisia and is possibly a component of catches [from] other countries throughout the Mediterranean," including those countries that simply report all species of angel sharks caught as one generic group, such as Albania, France, Malta, and Turkey. <u>Id.</u> at 4 (citing Compagno in prep.). The earliest available data for species of this genus show a quick decline in numbers from an average of 134 per year in the early 1900s, down to a mere 15 per year on average for the years 1914-1922. <u>Id.</u> at 5 (citing Vacchi et al. 2002). This early decline corresponds with the beginning of trawling activity within this species' range. <u>Id.</u>

Off the Balearic Islands, catches for species of this genus have been documented since the early 1900s, and the data shows that "[c]aptures of *Squatina* spp. were relatively frequent until the 1970s, becoming increasingly sporadic during the 1980s in coastal artisanal fisheries [], trawls and bottom long-line fisheries." <u>Id.</u> For example, records from a Balearic lobster gillnet fishery show that it was common to capture angel sharks, presumably mostly *S. oculata* judging by the depth and substratum where this fishery operates, on a daily basis until the mid 1980s. <u>Id.</u> However, since the mid 1990s no catches of angelsharks have been reported in the area. <u>Id.</u> A recent survey "reported no captures of [this species] from four bottom trawl fishing surveys [] carried out between 1996 and 2001 around the Balearic Islands." <u>Id.</u> (citing Massutí & Moranta 2003). Similarly, recent surveys of other areas of the northern Mediterranean likewise failed to capture a single specimen of *S. oculata* even though they completed a total of 9,095 tows. Id. (citing Baino et al. 2001). "Indeed, it appears that angel sharks [as a whole] are now absent from most of the northern Mediterranean coastline." Id. Though more abundant in the southern Mediterranean, recent surveys off the Tunisian coast in the Gulf of Gabès show that this species is nevertheless very rare in this region of the Mediterranean as well. Id. (citing Quignard & Ben Othaman 1978; Bradai 2000).

"Data from Southern Portugal also suggest the scarcity of this species in the area, where no specimen of [this] genus [] was recorded" from recent biological surveys. Id. (citing Coelho et al. 2005). "[T]he genus *Squatina* is [sometimes] reported in Portuguese fishery statistics, showing a clear decline in the last 20 years." Id.

"There are little species specific data from the West African coasts, however, this species was previously reported as common in Russian surveys in this region during the 1970s and 1980s. Artisanal Senegalese fishermen also remember this species as common and frequently caught by lines and gillnet 30 years ago; however it is appears to have been strongly depleted to the point where it has almost disappeared, now occurring very rarely. Catches are now very rare according to both artisanal fishermen and observers of the industrial demersal trawl fleets." Id.

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range (Criterion A):

"Human disturbance by habitat degradation and tourism are [] possible threats to [*Squatina oculata*'s] preferred sandy nearshore habitat." Id. at 6. Therefore the species is likely facing habitat degradation due to these pressures.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"Angel sharks are highly susceptible to bycatch in trawls as they lie on the bottom" of the ocean, and "[b]enthic trawl effort has increased in both intensity and efficiency on the shelf and slope [of the] Mediterranean over the last 50 years." Id. This means that the pressures already experienced by the species have likewise been increasing. "The species is also bycaught in trammel nets and bottom longlines throughout its range." Id. "The habitat of the species over the outer continental shelf and uppermost slope (20-500 m depth) is subject to intense demersal fisheries, especially off the northern coasts of the Mediterranean." Id. There is evidence for "dramatic declines" in this species from historic data from the Northern Tyrrhenian Sea, with more recent surveys showing zero specimens in the northern Mediterranean. Id. (citing Vacchi et al. 2002). "A low rate of exchange between *Squatina* populations [also] makes them prone to local depletion and means that [re-colonization] will be extremely low." Id.

Elsewhere in the Mediterranean, early reports showed *S. oculata* as a common species along the southern and eastern Iberian coasts, but since the early 1900s this species has "virtually disappeared from most of its former range in the Mediterranean." Id. For example, during the late 1990s, two major trawl surveys were carried out in the Mediterranean and out of a combined total of 18,376 tows, *S. oculata* was not caught in any. Id. at 7 (citing Baino et al. 2001; Relini et al. 2000). "Due to increasing fishing effort and capacity throughout the Mediterranean during the last few decades, the absence of the species in any recently recorded catches and its likely limiting life history characteristics, this species" has a very low chance of long-term survival in the Mediterranean. Id. It is quite possibly already locally extinct in the northern Mediterranean. Id.

"Along the West African coasts, there are no directed fisheries for this species, but it is taken as bycatch [by] major international industrial demersal trawl fisheries and inshore bottom set gillnets. Portuguese landings data from the fleet operating off Morocco and Mauritania, aggregated for [three species of angel shark including *S. oculata*,] indicates a 95% decline in" catch per unit effort (CPUE)[132] over the eight year period beginning in 1990. Id. Portuguese landings of angelsharks increased to a peak of 35 metric tons in 1990, and when the fishery was closed in 1998 the total landings had fallen precipitously to a mere 1.7 tons, representing a 95% decline in just eight years. Id. *S. oculata* was also "previously reported as common in Russian surveys [of] this region during the 1970s and 1980s. Artisanal Senegalese fishermen also remember this species as common and frequently caught by lines and gillnets 30 years ago; however it [] appears to have been [heavily] depleted to the point where it has almost disappeared, now occurring very rarely." Id.

"In Sierra Leone, [species of this genus including *S. oculata*] were periodically caught by demersal trawlers in the 1980s, but are now caught very infrequently." Id. As further evidence of this species' decline, only five individuals (weighing a total of only 7 kg) were caught in Guinea between 1986 and 2002 and none were caught in Mauritania. Id. In Senegal, a total of 51 individuals were caught from 1971 to 2000, and none have been recorded in recent surveys. Id. Similarly, in Gambia six individuals were caught from 1986 to 2000, and none have been caught since. Id. These shocking declines and potential local extirpations evidence the threat that ongoing commercial overutilization of the species is having throughout its range.

[132] CPUE is an indirect measure of the abundance of a target species. Changes in the catch per unit effort are inferred to signify changes to the target species' true abundance. A decreasing CPUE indicates overexploitation, while an unchanging CPUE indicates sustainable harvesting.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

Species of this genus are protected within six marine reserves around the Balearic Island, but no members of the species have even been reported from these islands since the mid 1990s. Id. at 5, 6. The inclusion in this marine reserve seems like it may be "too little too late" as the species has quite possibly been entirely extirpated there now. "There are no known specific conservation measures for this species throughout the rest of its range." Id. at 6-7. Since the species is likely extinct throughout the Balearics, this means the species is functionally unprotected throughout its existing range. Such a complete lack of protections is insufficient for a species facing such serious threats to its continued existence, especially when its extinction, or near extinction, has already been observed throughout a significant portion of its historic range in recent years. Therefore, ESA protection should be afforded to the species to prevent its ongoing progress towards worldwide extinction.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

The isolated populations of this species have low interactions with stocks from other areas. Id. at 5. This means that natural re-colonization of overfished areas is extremely unlikely.

These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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(79) Scientific Name: *Squatina punctata*

Common Name: Angular Angelshark

IUCN Status: Endangered **CITES Status**: N/A

Range: *Squatina punctata* is endemic to the Southwest Atlantic, occurring from 24ºS, roughly in line with Rio de Janeiro, Brazil, south through Uruguay to 43ºS off northern Patagonia, Argentina. IUCN (Squatina punctata) 2012, Exhibit 132 at 4.

Habitat and Ecology: "*Squatina punctata* is a relatively small, bottom-dwelling shark. Id. at 5. In Brazilian waters, this "species occurs mostly at depths of 10 to 80 m[eters] at bottom temperatures of 10º to 22ºC. Id. (citing Compagno in prep.). In Argentine waters, this species has been reported as deep as 150 meters. Id. (citing Cousseau 1973). Maximum size for this species is around 90 cm total length. Id. (citing Compagno in prep.; Silva 1996). "The breeding cycle of the female lasts at least two years." Id. Reproduction occurs via the species' one functional ovary. Id. The embryos are nourished viviparously by an aplacental yolksac. Id. "Reproduction begins in both males and females at about 70 to 80" centimeters total length. Id. (citing Cousseau 1973; Vooren & Silva 1991; Compagno in prep). This species migrates in the spring to shallow coastal waters where gravid females give birth and small juveniles occur year round. Id. (citing Vooren & Silva 1991).

Population Status: "Although this species lives in a geographical continuum of about 20 degrees of latitude, [its population range is most likely] composed of local populations each with its own inshore-offshore migration pattern within their local temperature regime." Id. at 4. Because they do not normally mix, these local populations can easily be extirpated by fishing activities. Id. at 4, 5. "Shallow inshore regions are important as nursery grounds throughout the geographical range of the species." Id. at 4.

Population Trend: Decreasing. Id.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"The nocturnal habits of angel sharks render them vulnerable to bottom gillnets, and increases in captures during the 1990s are attributed to the introduction of this gear on the shelf and slope off southern Brazil at that time." Id. at 5 (citing Vooren & Klippel 2005). "Gillnets [a]re reported as six times more effective at catching angel sharks than trawling alone." Id. (citing Vooren & Klippel 2005).

"Gravid angel shark females have been observed to abort embryos easily upon capture, further reducing the reproductive capacity [of this species]." Id. (citing Vooren & Klippel 2005). "A low rate of dispersal between populations also makes them especially prone to local depletion and means that [re-colonization is] extremely low. Furthermore, pupping and nursery areas in Brazil occur in shallow inshore waters at depths of [less than] 30 m[eters], and intensive fishing by gillnets and trawling in these areas results in additional pressure on females and juveniles." Id. (citing Silva 1996; Vooren & Klippel 2005).

Though landing statistics of angel sharks in southern Brazil refer to all *Squatina* species combined, available data show that angel shark populations declined by about 85% from 1984 to 2002. Id. (citing Miranda & Vooren 2003; CEPERG 2003; Vooren & Klippel 2005). This sharp decline is attributed to recruitment overfishing primarily due to increased intensity of the bottom gillnet fishery. Id. (citing Vooren & Lamónaca 2002; Vooren & Klippel 2005). *S. punctata* is very rare throughout the rest of its range off Argentina and Uruguay, but it is taken as bycatch in other fisheries and is likely sometimes directly targeted. Id. at 5-6. Available data show that there was an almost 58% decline in angel shark catch per unit effort (CPUE)[133] in Argentine waters between 1998 and 2003, though statistics by species are unavailable. Id. at 6 (citing Massa & Hozbor 2003; Massa et al. 2004; Vooren & Klippel 2005). Therefore, the already rare angel sharks in this region are being subject to even further losses and this commercial overutilization is threatening their continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

This species suffers from a lack of protective regulations. This is especially true "[i]n Brazil [where] there is no control of the shelf angel shark fishery, and[,] although trawling in inshore waters is prohibited, enforcement of this regulation is difficult." Id. There is also a maximum permitted catch for all species of angel sharks in Argentina, but at 4,000 metric tons it is massive and dwarfs the 300 to 400 metric tons of angel sharks taken yearly in Uruguay. Id. While catch quotas are necessary to ensure that species that have not yet become "endangered" are not harvested in unsustainable numbers, they are inappropriate measures for species that have already become "endangered." By listing a species as "endangered," IUCN is saying that the species is facing threats to its existence that create a "very high risk of extinction in the wild." IUCN Undated, Exhibit 38 at 17-20. If a species is facing a "very high risk of extinction in the wild," then the catch quota for that species should be set at zero. These types of half measures are inappropriate to halt species extinctions.

There are almost no protective measures in place for this species, and what is there is insufficiently stringent and insufficiently targeted towards restoring this species' numbers. This paucity of protection shows the inadequacy of existing regulatory

[133] CPUE is an indirect measure of the abundance of a target species. Changes in the catch per unit effort are inferred to signify changes to the target species' true abundance. A decreasing CPUE indicates overexploitation, while an unchanging CPUE indicates sustainable harvesting.

mechanisms and the necessity that they be supplemented by protecting the species under the ESA.

Other Natural or Manmade Factors Affecting its Continued Existence (Criterion E):

This species' habitat depth requirement, which exposes it to intense fishing pressures throughout its range, combined with a splintered population make this species particularly susceptible to local extirpation and possible degradation past the point of recovery. IUCN (Squatina punctata) 2012, Exhibit 132 at 4-6. Also, the fact that the females' breeding cycle lasts at least two years, and, if successful, results in a maximum of 3-8 young means that the species will have great trouble replacing lost individuals. Id. at 5. Finally, "[a] low rate of dispersal between populations also makes them especially prone to local depletion and means that [re-colonization] will be extremely low." Id. These natural factors result in increased threats to the species that are likely contributing to its move towards extinction. These threats qualify the species as "threatened" or "endangered" under the ESA and it should be listed.

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<u>(80) Scientific Name:</u> <u>*Squatina squatina*</u>

Common Name: Angel Shark

IUCN Status: Critically Endangered **CITES Status:** N/A

Range: *Squatina squatina*'s original range was "from Scandinavia to North-western Africa (Mauritania and the Canary Islands), including the Mediterranean and Black Seas." GFCM 2010, Exhibit 154 at 30. Its current distribution has been "reduced from this historic range, as a result of severe population depletion, local extirpations, and some contraction in range." <u>Id.</u> "[F]or example it is now considered to be extinct in the North Sea and is no longer encountered in most areas of the northern Mediterranean." <u>Id</u>.

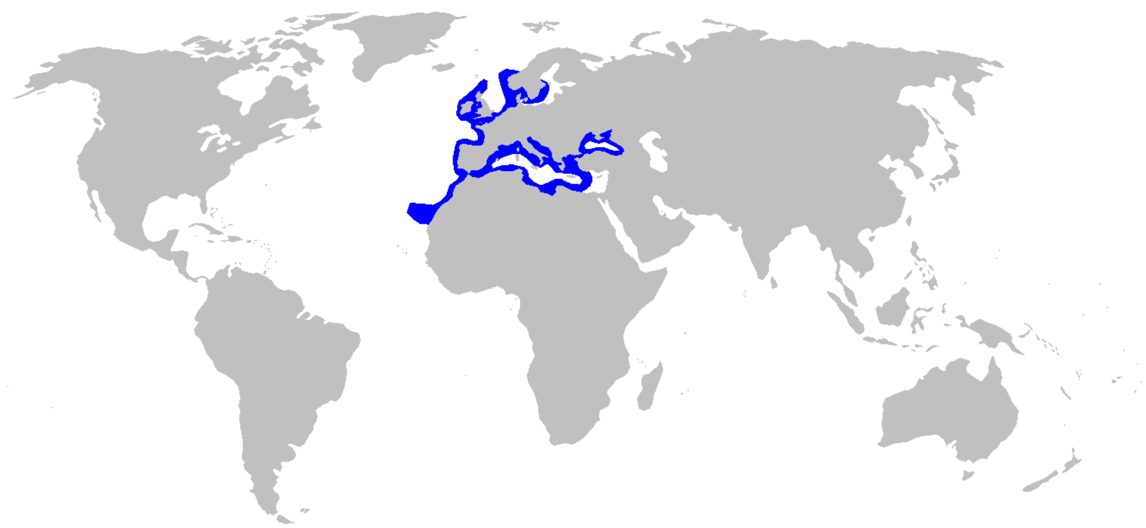

Figure 11: Historic Distribution of the Angel Shark
Source: GFCM 2010, Exhibit 154 at 30.

Squatina squatina now lives on the ocean floor of the coastal and outer continental shelf sediment habitats of the Northeast Atlantic, Mediterranean Sea, and Black Seas. Populations of the species have declined dramatically in the past 50 years, especially, as mentioned above, in the North Sea where it has been declared extinct and large areas of the Northern Mediterranean where it has been extirpated. <u>Id.</u>

Habitat and Ecology: *Squatina squatina* is a "temperate-water bottom-dwelling angel shark," occurring "on or near the bottom from close inshore to at least 150 m[eters] depth." FAO Undated, Exhibit 153 at 2. It "prefers mud or sandy bottom[s], where it lies buried with hardly more than its eyes protruding. It is nocturnal and can be found swimming strongly up off the bottom, but is torpid in the daytime and rests on the bottom. In the northern parts of its range the angelshark is seasonally migratory, and makes northwards incursions during the summer." <u>Id.</u> "It may penetrate estuaries and brackish water." IUCN (Squatina squatina) 2012, Exhibit 133 at 6.

Squatina squatina is "[a]n angelshark with a broad trunk, simple, conical nasal barbel[l]s and smooth or weakly fringed anterior nasal flaps, dermal flaps on sides of head with an angular lobe, very high broad pectoral fins, and no ocelli on [its] body." Compagno 1984, Exhibit 151 at 150. The very high and wide pectoral fins have broadly rounded rear tips. Id. at 151. Small spines may be present on the midline from the head to the first dorsal fin and between the dorsal fin bases. Id. They can also be found on the snout and above the eyes. Id.

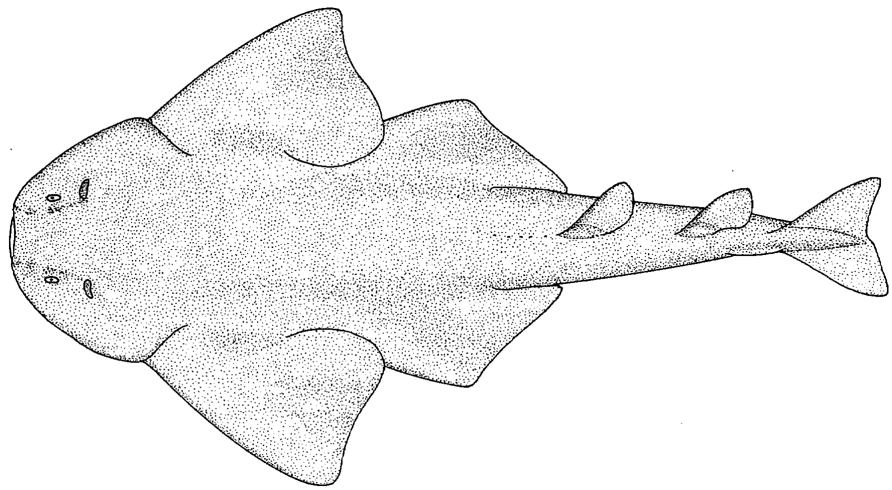

Figure 12: Sketch of Angel Shark
Source: Compagno 1984, Exhibit 151 at 150.

"Females reach maturity at 128 to 169 [centimeters], and males at 80 to 132 [centimeters], with maximum sizes of 183 [centimeters] and possibly up to 244 [centimeters], with estimates of less than 240 [centimeters] in the Mediterranean Sea." IUCN (Squatina squatina) 2012, Exhibit 133 at 6 (citing Compagno 1984, in prep.; Lipej et al. 2004; Tortonese 1956). "Age at maturity and longevity are unknown. This shark is ovoviviparous, with both ovaries functional. It has moderate-sized litters of 7 to 25 young which vary according to the size of the female." Id. (citing Tortonese 1956; Bini 1967; Capapé et al. 1990; Compagno in prep). "Gestation period is 8 to 10 months, [with young] born in December to February in the Mediterranean but apparently later in northern parts of its range (July in England)." Id. (citing Capapé et al. 1990; Compagno in prep.).

"The angelshark feeds primarily on bony fishes, especially flatfishes but also other demersal fishes and skates, crustaceans and [mollusks]." Id. (citing Ellis et al. 1996). "It occasionally swallows odd items, including eelgrass and seabirds (a cormorant was once recorded)." Id. (citing Compagno in prep.).

Population Status: "*S. squatina* was reported to be common or at least frequently or regularly recorded in many areas of the Mediterranean and Black Sea during the 19th century and early 20th century." GFCM 2010, Exhibit 154 at 30-31. "Steep population declines have, however, now been reported from several parts of [*S. squatina*'s] range, including the North Sea, the French coast, and large areas of the Mediterranean Sea. During the early 1900s, an average of one specimen was taken during every ten hours of trawl survey, but in recent years the species has virtually vanished. The population is clearly becoming increasingly fragmented and records are now extremely infrequent. It has now disappeared from much of its former range in the Northeast Atlantic and Mediterranean." Id. at 31.

During the MEDiterranean International Trawl Survey program ("MEDITS") (1985–1999), "a broad scale survey of the north Mediterranean coastline from west Morocco to the Aegean Sea [(located to the east of Greece)] in depths of 10 to 800 m[eters], *S. squatina* appeared in only two of a total of 9,095 tows, at a depth range of 50 to 100 m[eters], resulting in an estimated standing biomass of 14 t[ons] throughout the survey area, which equates to 1,400 individuals assuming an average individual weight of 10 kg." IUCN (Squatina squatina) 2012, Exhibit 133 at 5 (citing Baino et al. 2001). "*Squatina squatina* was reported from trawl surveys carried out in the Adriatic Sea [(located to the east of Italy)] in 1948, but MEDITS trawls in 1998 indicated this species may now be absent from this area." Id. (citing Jukic-Peladic et al. 2001). "Indeed, evidence points to [Angel Sharks] being absent nowadays from most of the northern Mediterranean coastline." Id.

In the Italian National Project (National Group for Demersal Resource Evaluation - GRUND) survey (1982-1999), "captures of *S. squatina* were reported in only 0.41% of 9,281 hauls." Id. (citing Relini et al. 2000). "Declines have also been reported from studies off the Balearic Islands where this species, previously relatively frequent, may now be absent. Off the Balearic Islands *Squatina squatina* was historically documented in checklists." Id. (citing Delaroche 1809; Ramis 1814; Barceló I Combis 1868; Fage 1907; De Buen 1935). "Captures of *S. squatina* spp. were relatively frequent until the 1970's, becoming increasingly sporadic during the 1980's in coastal artisanal fisheries (trammel nets and gillnets), lobster tanglenets, trawls and bottom longline fisheries. Since the mid 1990's no reports of *Squatina* spp. have been reported in the area." Id. a recent report stated "no captures of *Squatina* spp. from four bottom trawl fishing surveys (131 hauls, at a depth range of 46 to 1,800 m[eters]) carried out between 1996 and 2001 around the Balearic Islands. In addition, the likely low interaction with stocks from other areas further affects the already low recovery capacity of isolated populations such as those around the Balearics." Id. (citing Massutí & Moranta 2003).

From all areas where data on *Squatina squatina* populations exist, it is clear that its numbers are crashing. For locations where there is not data, the threats are still present, and the population decreases are likely similar. There is no reason to think that it might be more abundant in un-surveyed areas.

Population Trend: Decreasing. Id.

Identified Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Trawling and coastal development continues to destroy *Squatina squatina*'s habitat. Such impacts are particularly problematic because, "[i]n the case of habitat destruction resulting from coastal development, the severity of impacts is high with low reversibility." Zamora-Arroyo et al. 2005, Exhibit 66 at 58. Furthermore, benthic trawling also causes high impacts with low reversibility. Id. at 59. It results in "disruption of the physical substrate and its benthos, incidental catch and mortality of nontarget fish and marine mammals, exposed species susceptible to predation, and changes in benthic community composition." Id. *Squatina squatina* is overfished and caught as bycatch in trawling operations. Regulatory mechanisms do not exist in much of the shark's range, and those that do exist are inadequate because they do not address the issue of bycatch or protect habitat. The Angel Shark population is already fragmented, causing little exchange between existing populations, increasing its chances of extinction and limiting the chances of recovery.

The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range (Criterion A):

It is likely that the early decline of Angel Shark numbers in the Northern Tyrrhenian Sea (located to the west of Italy) between 1898 and 1922 was caused the beginning of trawling in the area. IUCN (Squatina squatina) 2012, Exhibit 133 at 6 (citing Vacchi et al. 2002). Bottom trawling decreases the biodiversity of the area that has been trawled and negatively alters the habitat. See Johnson 2002, Exhibit 155 at 8-19. Scientists recommend that trawling efforts should be decreased, gears should be developed that are less damaging for habitats and fauna, and areas should be designated as closed to fishing because of species and habitats that cannot be protected otherwise. Id. at 53-54. Trawling efforts have increased both in intensity and efficiency in *Squatina squatina*'s range over the past 50 years. IUCN (Squatina squatina) 2012, Exhibit 133 at 6. This has coincided with a dramatic decline in the species' abundance, its extinction in the North Sea, its extirpation from large areas of the northern Mediterranean, and population decreases from at least portions of the southern Mediterranean as well. Id. at 4, 5 (citing Bradai 2000; ICES ACFM 2005). While the shark may enjoy the muddy bottoms created by increased trawling efforts, it will ultimately suffer from decreased biodiversity of prey caused by trawling's destruction of the sea floor. See Johnson 2002, Exhibit 155 at 8-19.

Human population growth may pose a serious risk to the *Squatina squatina*. NMFS' own recent Status Review Report put the total number of people by 2045-2050 at around 9 billion, and cited one source putting that total at an even larger 10.6 billion. Status Review Report, Exhibit 40 at 20 (citations omitted). The population of North Africa is exploding. From 1950 to 2000, the population of the Middle East and North Africa increased from 100 million to 380 million people, a ratio of 3.7 times (more than any other region on Earth). Roudi 2001, Exhibit 157 at 1. Europe, by comparison, only grew by a ratio of 1.3. Id. These statistics are important because, while the population of Europe did not grow as quickly, the population of *Squatina squatina* present in European waters is already decimated. Where populations of *Squatina squatina* may persist, North Africa, human population growth is expanding rapidly. Higher populations will result in more fishing and trawling to satisfy the dietary and monetary needs of more people thus increasing habitat damage. Impacts on *Squatina squatina* habitat from pollution and development will also likely increase as more and more people populate coastal areas. As the IUCN has noted "[h]uman disturbance [of *Squatina squatina*] by habitat degradation and tourism are also possible threats to its preferred sandy nearshore habitat." IUCN (Squatina squatina) 2012, Exhibit 133 at 6. Therefore, *Squatina squatina* faces significant threats to its habitat, which threaten its continued existence.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"This large stocky angel shark was formerly a common and important demersal predator over large areas of its coastal and outer continental shelf sediment habitat in the Northeast Atlantic, Mediterranean and Black Seas. Most of this region is now subject to intense demersal fisheries, and the species is highly vulnerable from birth onwards to bycatch in the benthic trawls, set nets and bottom longlines operating through most of its range and habitat." Id. at 4. As a result of these activities, *Squatina squatina* has been extirpated from large areas of its range (including reported extirpation in the Baltic Sea, the Black Sea, and the northern Mediterranean). See, e.g., OSPAR 2010, Exhibit 156 at 7. This is mostly due to its susceptibility to being caught in bottom trawls, a method of fishing that has increased in both intensity and efficiency in *Squatina squatina*'s range over the last 50 years. IUCN (Squatina squatina) 2012, Exhibit 133 at 6. This increase in fishing pressure has coincided with dramatic declines in the species' prevalence. Id. at 4, 5, 6. Trawling's continued prevalence represents an ongoing threat to the species and has historically been blamed for the drastic declines in the species' prevalence in the Northern Tyrrhenian Sea. Id. at 6.

"The species is also bycaught in trammel nets and bottom longlines throughout its range." Id. This represent yet another commercial overutilization of the species. "A low rate of exchange between *Squatina* populations may make[] them especially prone to local depletion and means that [re-colonization] will be extremely low." Id. Despite these threats to the species, a number of Mediterranean countries continue to catch angelsharks, including *Squatina squatina*. These countries include Tunisia, Albania, Turkey, Malta, and France. Id. The species is also caught in the Northeast Atlantic as a non-quota species and there is evidence of severe declines in catches between the 1980s and 1990s. Id. at 6-7. It has now become "extremely uncommon throughout most of the remainder of its range," signifying that declines both as to area and density have been enormous. See id. at 4. As a result of these fishing pressures, it is clear that the species is threatened by overutilization for commercial purposes.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

The Angel shark is listed as a prohibited species by the European Union. The Council of the European Union 2011, Exhibit 152 at 7, 12. However, the prohibition only prohibits EU and third country vessels from fishing for, retaining on board, transporting, or landing the species. Id. It does not address the most important threats to *Squatina squatina*—bycatch and habitat destruction.[134] Also, since the species seems to have been largely extirpated from northern Mediterranean, Baltic Sea, and Black Sea waters (which covers the shorelines of most countries in the EU), this regulation will be insufficient to protect what are likely the only remaining viable populations in the southern Mediterranean and Northwest Africa, which are not part of the EU.

"The genus *Squatina* is [also] protected within three Balearic Islands marine reserves, where fishing for these species is forbidden." IUCN (Squatina squatina) 2012, Exhibit 133 at 7. However, after precipitous declines since the 1980s, no specimens of the genus *Squatina* have been reported from this area since the mid-1990s. IUCN (Squatina oculata) 2012, Exhibit 131 at 5 ("since the mid 1990s no reports of *Squatina* spp. have been reported in the area"). Therefore, this protection is likely nominal as the species has probably been extirpated from the area. This likely extirpation indicates this regulation is not effective to protect the species, and furthermore illustrates the dangers of losing this species in the few areas where it is still likely to exist in viable populations.

The species is also protected by the UK Wildlife and Countryside Act, but this protection only extends to 3 nautical miles from English coastal baselines. IUCN (Squatina squatina) 2012, Exhibit 133 at 7. This may protect individuals that inhabiting this narrow band off the coasts of England, but will not protect the species elsewhere. See id. The species is also protected listed on Annex III of the Barcelona Convention and was proposed "for listing on the OSPAR Priority List of Threatened and Endangered Species, and although the proposal was deemed appropriate by the Study Group on Elasmobranch Fishes (ICES, 2002), the nomination was not accepted." See id. at 7. Despite this international recognition of the necessity of protecting this species it has thus far been inadequately protected.

Despite the serious threats to the species, a number of Mediterranean countries continue to catch angelsharks, including *Squatina squatina*. Id. at 6. These countries include Tunisia, Albania, Turkey, Malta, and France. Id. The species is also caught in the Northeast Atlantic as a non-quota species and there is evidence of severe declines in catches between the 1980s and 1990s. Id. at 6-7. It has now become "extremely uncommon throughout most of the remainder of its range," signifying that declines in both area and density have been enormous. See id. at 4. Clearly, existing regulations have not been effective at preventing the species' decline. Regulations are needed that protect

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[134] See id.; see also "The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range (Criterion A)," supra; "Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B)," supra.

Squatina squatina in all areas where it still exists. ESA protection should be afforded to the species to prevent its continued progress towards extinction.

Other Natural or Manmade Factors Affecting Its Continued Existence (Criterion E):

The *Squatina squatina* population is highly fragmented, with extirpation reported in many parts of its range, including the Baltic Sea, Black Sea, North Sea, and Northern Mediterranean Sea. OSPAR 2010, Exhibit 156 at 7. The low interaction with stocks from other areas further affects the already low recovery capacity of isolated populations such as those around the Balearic Islands. GFCM 2010, Exhibit 154 at 33. A similar species of the same genus, occurring off California, (*Squatina californica*) was found to have a relatively low intrinsic rebound potential. FAO Undated, Exhibit 153 at 3. Low population numbers, low interaction with stocks from other areas, and low rebound potential leave *Squatina squatina* even more susceptible to extinction. These threats combined qualify the species as "threatened" or "endangered" under the ESA and it should be listed. This protection is necessary to help avoid its extinction.

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<u>(81) Scientific Name:</u> <u>*Triakis acutipinna*</u>

Common Name: Sharpfin Houndshark / Tollo

IUCN Status: Endangered **CITES Status**: N/A

Range: This shark is found only in the Southeast Pacific in the tropical, continental waters off Manabí Province in Ecuador. IUCN (Triakis acutipinna) 2012, Exhibit 134 at 4. The first record of this species came from Isla de La Plata 40 years ago, and it has since been recorded in rare landings of the coastal gillnet fishery in Daniel López, Ecuador 21 nautical miles from Isla de La Plata. <u>Id.</u> at 3. "[T]he Sharpfin Houndshark's estimated extent of occurrence is considerably less than 5,000 km² . . . " <u>Id.</u>

Habitat and Ecology: "The habitat and ecology of *Triakis acutipinna* is virtually unknown." <u>Id.</u> at 4. Documented specimens are a single 102 cm adult female and a 90 cm adult male, both caught inshore. <u>Id.</u> "All life-history parameters are unknown." <u>Id.</u>

Population Status: "The population size is considered to be less than 2,500 individuals on the basis of very few records within a restricted area (with no evidence for genetically or geographically distinct populations), and a continuing decline in the number of mature individuals is suspected on the basis of continued unregulated exploitation throughout its known range." <u>Id.</u> at 3.

Population Trend: Decreasing. <u>Id.</u> at 4.

Known Threats/Listing Criteria

All of the threats and information discussed in "Sharks Introduction," supra, and "Petition Introduction," supra, are to be considered as incorporated by reference in this individual species account.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B):

"Throughout Ecuador, several (mainly artisanal) fisheries land various species of carcharhinoid sharks (including houndsharks) as bycatch. In some cases, small-scale fishing communities have specifically targeted sharks, however target fisheries for sharks were prohibited in 2004 (see [The Inadequacy of Existing Regulatory Mechanisms (Criterion D), infra]). Catch statistics are limited, with inadequate monitoring of fishing activities and landings." <u>Id.</u> One source estimates "that in the early 1980s small-scale fishers landed some 1,800-2,000 t[ons] of sharks per year." <u>Id.</u> (citing Bostock & Herdson 1985). "Later catch estimates from only a subset of landing ports amounted to ~4,000 t[ons]/year for 1993-1995." <u>Id.</u> Another source "noticed a reduction in shark landings in small-scale coastal fisheries in more recent years when compared with those of the early 1980s." <u>Id.</u> (citing Martínez 1999).

"The sharpfin houndshark is [occasionally] landed in coastal monofilament gillnet artisanal fisheries in the fishing port of Daniel López in Manabí, Ecuador." Id. "It is unknown if the species is taken in other inshore artisanal fisheries." Id. While little is known about catch statistics, 90-day decisions under the ESA are to proceed on the best available scientific and commercial information. This information indicates that species of this genus are landed, and perhaps even targeted. It is thus likely that fishing pressures have caused a decline in the numbers of this already very rare shark and are a threat to its continued existence.

The Inadequacy of Existing Regulatory Mechanisms (Criterion D):

"There is little effective management of inshore fishing activities in Continental Ecuador." Id. at 5. "Decree 2130 banned target[ed shark] fisheries and fin trade in 2004, but implementation and enforcement was insufficient and fins continued to be exported illegally. Subsequently, Decree 486 permitted trade in fins from bycatch, mandated the full [utilization] of all shark meat, and required monitoring of all bycatch and a licensing system for the trade of fins."[135] Allowing exports of shark fins just ensures that the sharpfin houndshark will continue to be a utilized bycatch species. Requiring that the meat be used discourages waste, but does nothing to ensure the species is not removed from the water and killed, especially since it appears that its meat may have higher market value than most other species. Also, since "[t]here is little effective management of inshore fishing activities" throughout the species' range, it is unclear if even this protection and the ban on targeted fisheries will have any effect on actual practices of fishers in this area. IUCN (Triakis acutipinna) 2012, Exhibit 134 at 5. As such, these regulatory mechanisms are inadequate and "given the rarity of this species, along with its occurrence in exploited inshore waters, it likely requires more immediate conservation actions, i.e. full protection [under the ESA]." See id.

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For More Information, See:

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[135] Id.; see also "Sharks Introduction: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Criterion B): Expansion of the Market for Shark Products," supra (discussing how the meat from this family of sharks is particularly appealing and sought after, thus likely influencing targeting and retention of bycatch for sale, reducing the effectiveness, in conservation terms, of the requirement that the shark's meat be utilized, and increasing fishing pressure on the species).

CONCLUSION

The seventy-five species and six subpopulations contained in this Petition merit listing as "endangered" or "threatened" species and distinct population segments respectively under the Endangered Species Act. These species and subpopulations are depleted or in decline and continue to face a variety overwhelming threats to their continued existence. Listing these species and subpopulations under the Endangered Species Act would provide essential protection for them by protecting their populations in United States waters in the Atlantic, Pacific, and United States Territorial waters elsewhere; prohibiting the import or export of products derived from them into the United States; and providing financial, technical and law enforcement assistance for international conservation efforts. Current protections are inadequate to protect these species and subpopulations and protection under the Endangered Species Act could be very helpful in avoiding their extinctions. The loss of these species and subpopulations would represent enormous losses of biodiversity and would cause a negative ripple effect through many other species that are directly and indirectly dependant on them for habitat creation, food, maintenance of healthy populations, and other functions.

REQUESTED DESIGNATION

WildEarth Guardians hereby petitions the National Marine Fisheries Service within the National Oceanic and Atmospheric Administration to list the species and subpopulations included in this Petition as "endangered" or "threatened" species and Distinct Population Segments (DPS) respectively pursuant to the Endangered Species Act and to list any DPS of a petitioned species that the National Marine Fisheries Service may find as well.[136] This listing action is warranted, given that the species and

[136] The petitioned species and subpopulations are as follows: *Acropora roseni*; *Acropora suharsonoi*; *Aipysurus apraefrontalis*; *Aipysurus foliosquama*; *Aipysurus fuscus*; *Alveopora excelsa*; *Alveopora minuta*; *Arctocephalus galapagoensis*; *Argyrosomus hololepidotus*; *Azurina eupalama*; *Bathyraja griseocauda*; *Cantharellus noumeae*; *Carcharhinus borneensis*; *Carcharhinus hemiodon*; *Carcharias taurus* (Southwest Atlantic Subpopulation); *Centrophorus harrissoni*; *Cephalorhynchus hectori*; *Cetorhinus maximus* (North Pacific Subpopulation); *Cetorhinus maximus* (Northeast Atlantic Subpopulation); *Chaetodontoplus vanderloosi*; *Colpichthys hubbsi*; *Ctenella chagius*; *Dasyatis margarita*; *Electrolux addisoni*; *Enneapterygius namarrgon*; *Eptatretus octatrema*; *Halichoeres socialis*; *Haploblepharus kistnasamyi*; *Hemitriakis leucoperiptera*; *Holohalaelurus favus*; *Holohalaelurus punctatus*; *Hydnophora bonsai*; *Isogomphodon oxyrhynchus*; *Isopora togianensis*; *Lamiopsis temmincki*; *Latimeria chalumnae*; *Lithophyllon ranjithi*; *Lobophyllia serratus*; *Millepora boschmai*; *Millepora striata*; *Montipora setosa*; *Mustelus fasciatus*; *Mustelus schmitti*; *Mycteroperca fusca*; *Mycteroperca jordani*; *Myxine paucidens*; *Okamejei pita*; *Paraclinus magdalenae*; *Paraclinus walkeri*; *Paralabrax albomaculatus*; *Paramyxine taiwanae*; *Parasimplastrea sheppardi*; *Pastinachus solocirostris*; *Pectinia maxima*; *Phocoena phocoena* (Baltic Sea Subpopulation); *Pocillopora fungiformis*; *Porites desilveri*; *Porites eridani*; *Porites ornata*; *Pterapogon kauderni*; *Raja undulata*; *Rhinobatos cemiculus*; *Rhinobatos rhinobatos*; *Rhinobatos horkelii*; *Rhizopsammia wellingtoni*; *Scarus trispinosus*; *Siderastrea glynni*; *Sousa chinensis* (eastern Taiwan Strait Subpopulation); *Squatina aculeate*; *Squatina argentina*; *Squatina formosa*; *Squatina guggenheim*; *Squatina oculata*; *Squatina punctata*; *Squatina squatina*; *Stylophora madagascarensis*; *Tomicodon abuelorum*;

subpopulations face a variety of threats that, when all species are considered, include all five Endangered Species Act listing criteria. Listing for the DPSs discussed is also warranted, as all of the petitioned subpopulations meet both the “discreteness” and “significance” criteria and are extremely imperiled. WildEarth Guardians also requests that critical habitat be designated for these species and subpopulations concurrent with final Endangered Species Act listing. Critical habitat should protect the areas under United States jurisdiction most important to the species’ and subpopulations’ survival, such as breeding grounds and coastal areas.

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