PETITION TO LIST THE
Humphead Wrasse (*Cheilinus undulatus*)
UNDER THE ENDANGERED SPECIES ACT

Drawing of the humphead wrasse (*Cheilinus undulatus*). Source: Gillett 2010 at 1.

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

Petitioner:

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WILDEARTH GUARDIANS
A FORCE FOR NATURE

INTRODUCTION

The humphead wrasse is one of the largest reef fishes in the world, growing up to 6 feet long and weighing up to 420 pounds. Its range spans the entire Indo-Pacific region, from the Middle East to Africa to Southeast Asia and the Pacific. It is naturally uncommon wherever it exists and its biological characteristics (long life, late sexual maturation, hermaphroditism, sedentary lifestyle, etc.) make it particularly vulnerable to even minimal fishing pressures. This species is imperiled throughout all or a significant portion of its range due to overfishing, destruction of coral reef habitat, inadequate regulatory measures or an absence of regulatory protection, and effects from climate change.

Considering the numerous threats to this species, WildEarth Guardians (Guardians) requests that the U.S. Secretary of Commerce (Secretary) list the humphead wrasse as "threatened" or "endangered" under the Endangered Species Act (ESA). Moreover, given the rapid loss of its coral reef habitat, Guardians also requests that the Secretary designate critical habitat for the wrasse in U.S. waters concurrent with final ESA listing. Over 99 percent of species listed under the ESA still persist.[1] The ESA is the humphead wrasse's best protection against extinction.

PETITIONER

WildEarth Guardians is a nonprofit environmental advocacy organization that works to protect endangered species and biodiversity, in part, by securing ESA protection for imperiled species. The organization has more than 18,000 members and supporters throughout the United States and around the world. WildEarth Guardians has an active endangered species program that works to protect imperiled terrestrial and marine species and their habitat throughout the United States and beyond.

ENDANGERED SPECIES ACT AND IMPLEMENTING REGULATIONS

The Endangered Species Act of 1973 protects plants and animals that are listed by the federal government as "endangered" or "threatened" (16 U.S.C. § 1531 *et seq*.). Any interested person may submit a written petition to the Secretary of Commerce requesting him or her to list a species as "endangered" or "threatened" under the ESA (50 C.F.R. § 424.14(a)). An "endangered species" is "any species that is in danger of extinction throughout all or a significant portion of its range" (16 U.S.C. § 1532(6)). A "threatened species" is defined as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (16 U.S.C § 1532(20)). "Species" includes subspecies and distinct population segments of vertebrate taxa (16 U.S.C § 1532(16)).

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

A. The present or threatened destruction, modification, or curtailment of habitat or range;

[1] Compare the number of U.S. species currently listed under the ESA (1387) with the species that have been delisted due to extinction (10). *See* ecos.fws.gov/tess_public/pub/boxScore.jsp; ecos.fws.gov/tess_public/DelistingReport.do [viewed February 2012].

B. Overutilization for commercial, recreational, scientific, or educational purposes;
C. Disease or predation;
D. The inadequacy of existing regulatory mechanisms; or
E. Other natural or manmade factors affecting its continued existence.

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

Within 90 days of receiving this petition, the Secretary "shall make a finding as to whether the petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted" (*Id*. at § 1533(b)(3)(A)). "Substantial information" is further defined as "that amount of information that would lead a reasonable person to believe that the measure proposed in the petition may be warranted" (50 C.F.R. § 424.14(b)(1)). As discussed in greater detail below, the humphead wrasse is already listed as an Appendix II species under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), meaning that it may be threatened with extinction in the near future unless trade is controlled (*see* CITES, Art. II, subd. 2(a); *see also* 16 U.S.C. § 1533(b)(1)(B)(i), "the Secretary shall give consideration to species which have been designated as requiring protection from unrestricted commerce … pursuant to any international agreement"). In addition, the International Union for Conservation of Nature (IUCN) has listed the humphead wrasse as "endangered" (Russell 2004). The CITES listing and the IUCN's assessment support listing the humphead wrasse under the ESA.

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

CLASSIFICATION AND NOMENCLATURE

Common name. *Cheilinus undulatus* Rüppell, 1835, is known by the common names "Giant Wrasse," "Humphead," "Humphead Wrasse," "Maori Wrasse," "Napoleon Wrasse," "Truck Wrasse," and "Undulate Wrasse" (Russell 2004 at 1; Sadovy *et al.* 2004 at 328). This petition refers to the species as "humphead wrasse" or "wrasse."

Taxonomy. The petitioned species is *Cheilinus undulatus*. The complete taxonomic classification for the species is shown in Table 1.

Table 1. Taxonomy of *Cheilinus undulatus* (Source: Russell 2004 at 1).

Kingdom	Animalia
Phylum	Chordata
Class	Actinopterygii
Order	Perciformes
Family	Labridae
Genus	*Cheilinus*
Species	*undulatus*

SPECIES DESCRIPTION

The humphead wrasse is one of the world's largest reef fishes and is the largest member of the *Labridae* family (wrasses). It can grow up to 6 feet (2 meters) in length, weigh up to 420 pounds (190 kilograms) (Sadovy *et al.* 2004 at 328), and live for 25-32 years (Id. at 341). Females rarely exceed 3 feet, and they weigh less and live longer than males (Id.). The species undergoes significant changes in shape and color as it grows (Figure 1). Small juveniles are black and white with large dark spots that produce a series of dark bands. As they grow, their color changes to pale green and forms a vertically elongated spot on each scale, which tend to form vertical bars on the fish. Two black lines extend posteriorly from each eye through all stages of color change. The larger adults are green, blue, or blue-green with wavy yellow lines near the head and a spindle-shaped dark bar on each scale; scales can exceed 10 centimeters in diameter (Id. at 335). Large adults have distinctive traits: a large, bulbous bump on the forehead (from which it gets its name) and thick, fleshy lips (Figure 2) (Donaldson and Sadovy 2001).

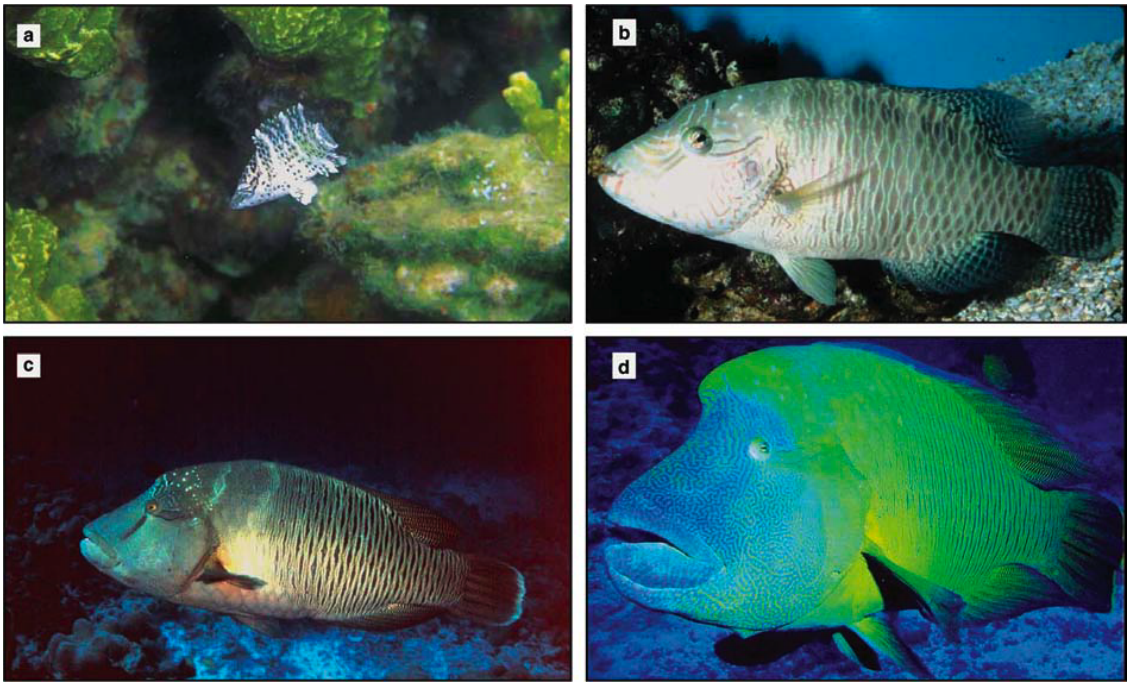

Figure 1. Stages of development in Humphead Wrasse. Source: Sadovy *et al.* 2004 at 338.

Figure 2. Adult Humphead Wrasse. Source: NOAA 2009 at 1 (photo by John E. Randall).

GEOGRAPHIC RANGE

The humphead wrasse is widely distributed, but nowhere common (NOAA 2009 at 3). Its range (Figure 3) encompasses almost the entire Indo-Pacific region, stretching from Egypt, down the eastern coast of Africa to Madagascar; up to Sri Lanka; all of Southeast Asia; northern Australia and the Great Barrier Reef; and up to the southern islands of Japan. It has been recorded from the following locations: Israel, Egypt, Somalia, Sudan, Eritrea, Saudi Arabia, Tanzania, Djibouti, Mozambique, Madagascar, Seychelles, southern India, Sri Lanka, Myanmar, the Maldives, Christmas Island, Indonesia, the Philippines, Melanesia, Polynesia, northern Australia, the Ryukyu Islands of Japan, the Marshall Islands, Fiji, New Caledonia, China, Hong Kong, Thailand, Vietnam, Taiwan, Cambodia, Comoros, Cook Islands, Kenya, Kiribati, Malaysia, Federated States of Micronesia, Palau, Papua New Guinea, Samoa, Singapore, Solomon Islands, Tonga, and Tuvalu. Within U.S. waters,[2] it occurs in American Samoa, Guam, the Line Islands, and the Northern Mariana Islands[3] (Sadovy *et al.* 2004 at 330; Russell 2004 at 2).

[2] Though two sightings of humphead wrasse have recently been reported in Hawaii, NOAA has determined these are most likely strays (NOAA 2009 at 2).

[3] The range of the humphead wrasse overlaps significantly with the bumphead parrotfish, *Bolbometopon muricatum*, which is currently under consideration for listing under the ESA (NOAA 2010a).

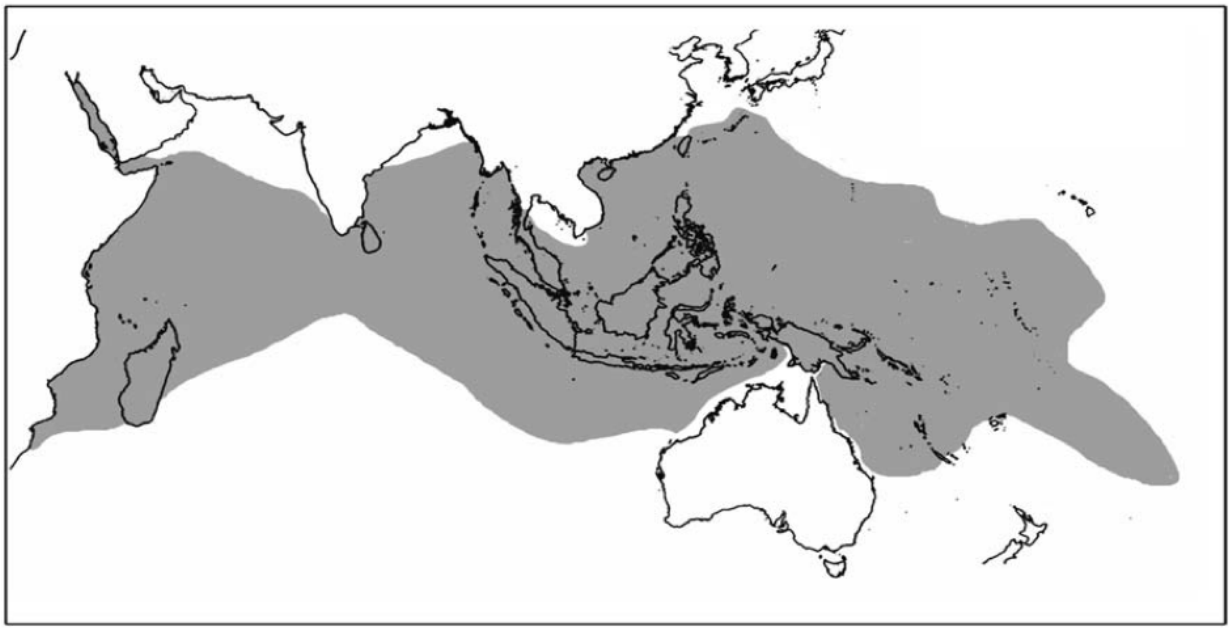

Figure 3. Range of the humphead wrasse. Source: Sadovy *et al.* 2004 at 330. Most of the wrasses' range is within the Indian Ocean, Southeast Asia, and Pacific Coral Reef regions, as defined by Burke *et al.* 2011 at 16, Map 2.1.

HABITAT REQUIREMENTS

The humphead wrasse uses coral reefs, seagrass, lagoons, and channel slopes, ranging in depths from 3-330 feet (1-100 meters), throughout its range and in all developmental stages. Juveniles typically live inshore in denser coral reefs, while adults live farther away from shore in deeper, more open water at the edges of reefs, in channels, reef passes, channel slopes, and lagoon reef slopes, often taking cover in caves or rocky areas (Donaldson and Sadovy 2001). Adults are typically solitary, living alone or in pairs, and also sedentary in that the same individuals may be seen in the same reef for extended periods of time (Sadovy *et al.* 2004 at 331). Habitat is directly correlated with population density and fish size: wrasse density (fish/10,000 m^2) increases with more hard cover from reefs (such as barrier reefs), and fish length decreases in habitats with more hard cover (i.e., the smallest fish are generally found in areas with high coral cover) (Figure 4) (Sadovy *et al.* 2004 at 333-334).

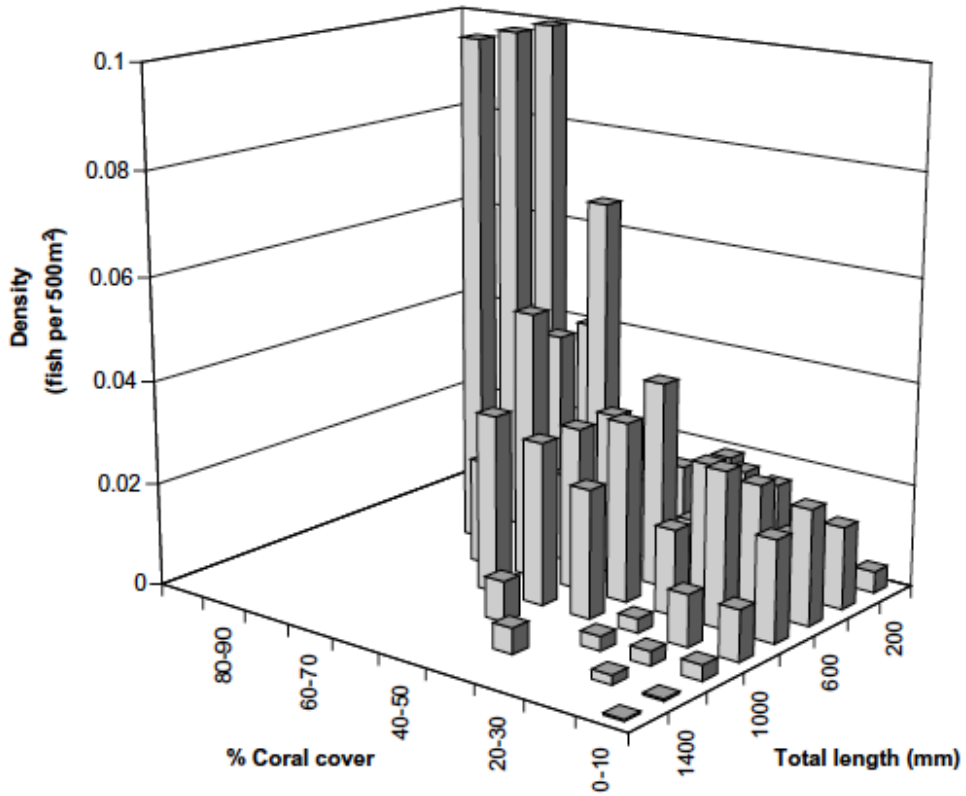

Figure 4. Relationship between coral cover, and wrasse density and fish size in New Caledonia and Tuamotu Archipelago. Source: Sadovy *et al.* 2004 at 334.

LIFE HISTORY

Reproduction. Females reach sexual maturity at approximately five years and 35-50 cm; males reach sexual maturity several years later (Colin 2010 at 1004). Spawning occurs for at least several months out of the year, and may occur year round (Sadovy *et al.* 2004 at 341; Colin 2010 at 987; Russell 2004 at 3). They form daily spawning aggregations and likely do not migrate far to their spawning sites, consistent with their sedentary behavior (Sadovy *et al.* 2004 at 341; Colin 2010 at 1002; Russell 2004 at 3; *see also* Donaldson 1995 at 312, 317).

> Accounts of reproductive activity in the field reveal that, depending on location, this species spawns… in small or large groupings, that spawning coincides with certain phases of the tidal cycle, and that groups of spawning fish can form daily, at a range of different reef types. Spawning areas and aggregated adults have been noted regularly along specific sections of reef, sometimes associated with no obvious topographical features, sometimes close to the shelf edge on outer reefs, or adjacent to exposed reef passes near fairly steep drop-offs, or on mid-shelf (unspecified) reefs. (Russell 2004 at 3, internal citations omitted)

"Many spawning aggregations, both resident and transient, are known to persist at the exact same location for decades" (Colin 2010 at 1005).

The social system of spawning is lek-like, with fish clustering in specific areas of the

> aggregation site, but also able to move the short distances, at most 50 m, between sites. Given the flexibility of fish to apparently move between clusters, the social structure within a cluster was believed to be temporary and variable. There was no strong male–male aggression, as no direct contact, biting or close encounters were seen. There did appear to be a definite dominance hierarchy, as smaller fish at a cluster site immediately retreated if approached by a larger male when aggregation was occurring. Smaller males were believed to achieve some spawning, as many females appeared ready to spawn nearly simultaneously, but dominant males were not able to spawn immediately with all of them. Once initiated, spawning generally occurs for <1 h… Males generally spawn numerous times in rapid succession during the aggregation, but it is probable that females spawn only once a day since no multiple spawning by females were seen and they leave the area quickly after spawning. (Id. at 1004)

The humphead wrasse is a protogynous hermaphrodite; at about fifteen years of age, individuals may change sex from female to male (Russell 2004 at 3), a pattern that renders the species vulnerable to size-selective fishing (Sadovy *et al.* 2004 at 358). Due to its long life, late sexual maturation, aggregation spawning, and sex change, this species is particularly susceptible to disturbances and fishing pressures (Id.).

Diet. The humphead wrasse feeds upon mollusks, crustaceans, echinoids (e.g., sea urchins), brittle stars, and starfish (Randall *et al.* 1978 at 237). It is a predator of a number of toxic marine species, including the crown of thorns starfish, boxfishes, and sea hares (Sadovy *et al.* 2004 at 335, 338). Due to its diet, which includes some poisonous prey, the humphead wrasse may be ciguatoxic (toxic to humans) in some areas (Randall *et al.* 1978 at 235; Donaldson and Sadovy 2001; Sadovy *et al.* 2004 at 338).

Ecology. The wrasses' predation on crown of thorns starfish is beneficial to coral reefs. Crown of thorns starfish feed on coral. When large outbreaks of crown of thorns occurs, they can devastate entire reefs, reducing hard coral reef cover to 1 percent in some instances (Harriott *et al.* 2003 at 2). Because the crown of thorns is, as its name implies, covered in long venomous spines, it has very few predators. With the decline of the humphead wrasse and other predators, as well as anthropogenic effects on water quality, crown of thorns starfish outbreaks have increased, causing devastation to Indo-Pacific coral reefs and further destruction of the humphead wrasse's habitat (Id. at 4).

POPULATION STATUS AND TRENDS

Population assessment of large, wide-ranging tropical reef fishes, like the humphead wrasse, is very difficult (Gillett 2010 at 23). Accordingly, there is no population or abundance index, globally or nationally, for this species (Id.). However, several studies of the humphead wrasse show clear density declines as fishing pressure intensifies. Wrasse density patterns are generally 10-20 fish per 10,000 m^2 when there is little to no fishing pressure. Density drops to 0-5 fish per 10,000 m^2 when fishing intensifies (Figure 5) (Id.; Sadovy *et al.* 2004 at 335-336). The United Nations Food and Agriculture Organization has recently concluded that the humphead wrasse cannot withstand anything other than light fishing pressure (Gillett 2010 at 24).

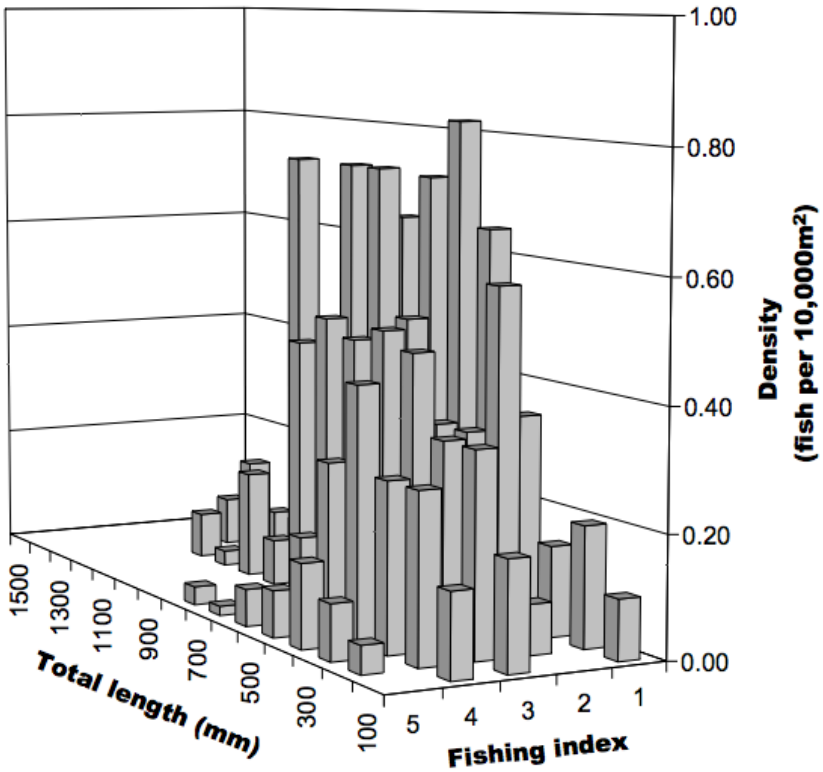

Figure 5. Density and body sizes (in mm total length) of *Cheilinus undulatus* in New Caledonia and Tuamotu Archipelago, based on 17 areas surveyed between 1987 and 1995 using underwater visual census surveys and standardized methodology in relation to a crude measure of fishing index (index of 1: low to 5: high). Source: Sadovy *et al.* 2004 at 335.

Naturally uncommon to rare, humphead wrasse have declined dramatically due to their vulnerability to fishing. Wherever the species is taken, density declines to 25 percent or less of peak densities with no fishing (Russell 2004 at 1; Sadovy *et al.* 2004 at 258). The total global catch, as of 2004, is only approximately 100-400 metric tons (mt) annually, but severe declines are noted in all places for which data is available on the species. (Sadovy *et al.* 2004 at 352, Russell 2004 at 1). The National Oceanic and Atmospheric Administration (NOAA) recently set annual catch limits for the humphead wrasse in American Samoa, Guam, and the Marianas Archipelago at a combined total of 5,712 pounds (NOAA 2012, *entire*). Assuming an average weight of 200 lbs, which is less than half the adult maximum weight, this would equate to potentially 28-29 individual humphead wrasse caught in U.S. waters.

Humphead wrasse populations have markedly declined in a number of places where the species occurs. For example, the species has almost disappeared in some areas of Fiji and is extirpated from waters around one island due to fishing (Russell 2004 at 7). A survey of Fijian waters conducted in 1995-1996, which covered 126,000 m^2 and required 150 diver hours, found no humphead wrasse (Id. at 8-9). Overall, Fiji has seen an approximate 80 percent decline in annual catch (Id. at 13). In Malaysia, humphead wrasse populations have decreased by 99.91 percent since 1974 (Id. at 9). In Indonesia, a 2001 survey conducted by The Nature Conservancy spanning 80 dive hours and 67 sites discovered only five individuals (Id.). Palau has seen a 10-fold decline in its annual catch (Id. at 12) and Australia has recorded a 50 percent decline in

catch rates per boat per year in 1998 as compared to 1991 (Id. at 11).[4] The speicies was once abundant and is now suffering severe declines throughout the Southeast Asian region, particularly Malaysia, Indonesia, and the Philippines (Sadovy *et al* 2004 at 358).

NOAA identified species rarity among the reasons for listing the humphead wrasse as a "species of concern" in the South Pacific and U.S. territories:

> Once an economically important species in Guam, it is now rarely seen on reefs there, and is infrequently reported on inshore survey catch results… Surveys conducted on extensive research cruises by the NOAA Pacific Islands Fisheries Science Center's Coral Reef Ecosystem Division in 2002, 2004, and 2006, found humphead wrasse to be present, but uncommon, around all islands of America Samoa… and large individuals to be rare. The species was observed to be uncommon to rare… at Howland and Baker Islands, in the U.S. Phoenix Islands, and at Jarvis Island, Palmyra Atoll, and Kingman Reef [and]… in the Marianas Archipelago. (NOAA 2009 at 3)

IDENTIFIED THREATS TO THE PETITIONED SPECIES: CRITERIA FOR LISTING

Listing the humphead wrasse as "threatened" or "endangered" is both warranted and necessary to conserve and recover the species. At least four of the five ESA listing factors are contributing to the decline of the humphead wrasse (16 U.S.C. §1533(a)(1)) (in bold):

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

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

Coral reef destruction. The humphead wrasse spends much, if not all, of its life cycle in coral reef habitat. Coral reefs all over the world, especially in the Indo-Pacific, suffer from significant destruction, most of which is caused by humans (Bryant *et al.* 1998 at 11-16, 20; Figure 6). The majority of the wrasses' distribution falls within the Indian Ocean, Southeast Asia, Pacific, Australia, and Middle East Coral Reef regions as defined by Burke *et al.* (2011 at 16, Map 2.1). "In the Pacific and Indian oceans, many reefs formerly classified as low threat are now threatened, largely reflecting increased overfishing pressure. In the Middle East, Southeast Asia, and the Atlantic over the past ten years, extensive areas of reefs have been pushed from medium threat into higher threat categories through a combination of local threats" (Burke *et al.* 2011 at 4; Figure 7). Large areas of coral reef habitat throughout humphead wrasse range are now at risk: 76 percent of reefs in the Middle East; 82 percent in the Indian Ocean; 95 percent in Southeast

[4] The humphead wrasse may no longer be commercially caught or exported in Australia (Sadovy *et al.* 2004 at 355).

Asia; 40 percent in Australia; and 65 percent in the Pacific (Burke *et al.* 2011 at 42, Table 4.1-Integrated Local + thermal stress threatened (medium or higher)).

> By the 2030s… estimates predict that more than 90 percent of the world's reefs will be threatened by local human activities, warming, and acidification, with nearly 60 percent facing high, very high, or critical threat levels. Thirty percent of reefs will shift from low threat to medium or higher threat specifically due to climate or ocean chemistry changes. An additional 45 percent of reefs that were already impacted by local threats will shift to a higher threat level by the 2030s due to climate or ocean chemistry changes. (Burke *et al.* 2011 at 45)

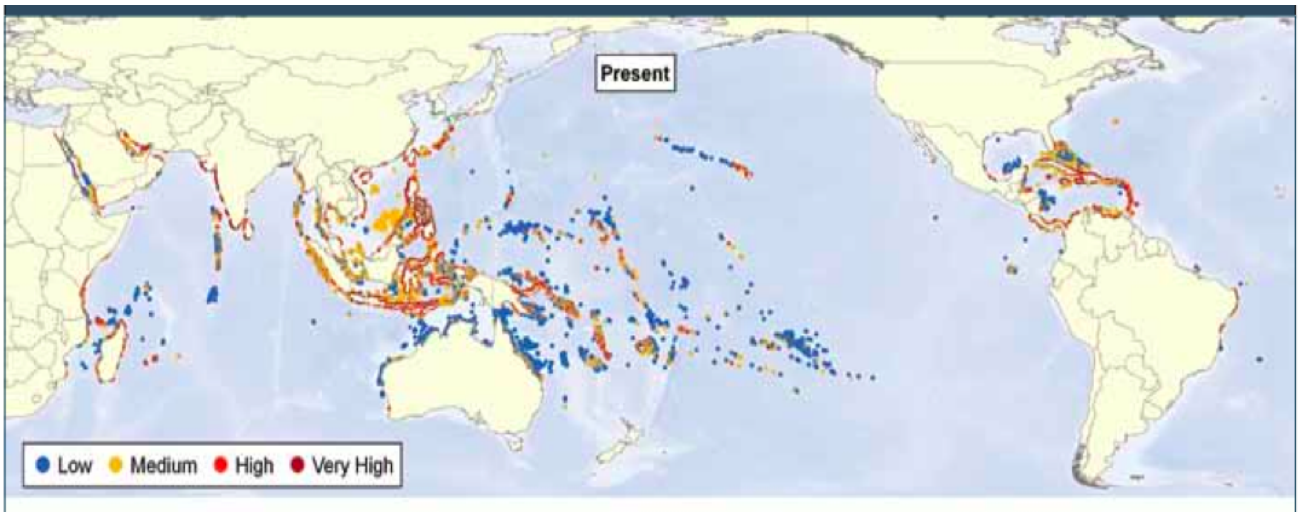

Figure 6. Reefs at risk worldwide, classified by present integrated threats from local activities. Source: Burke *et al.* 2011 at 47.

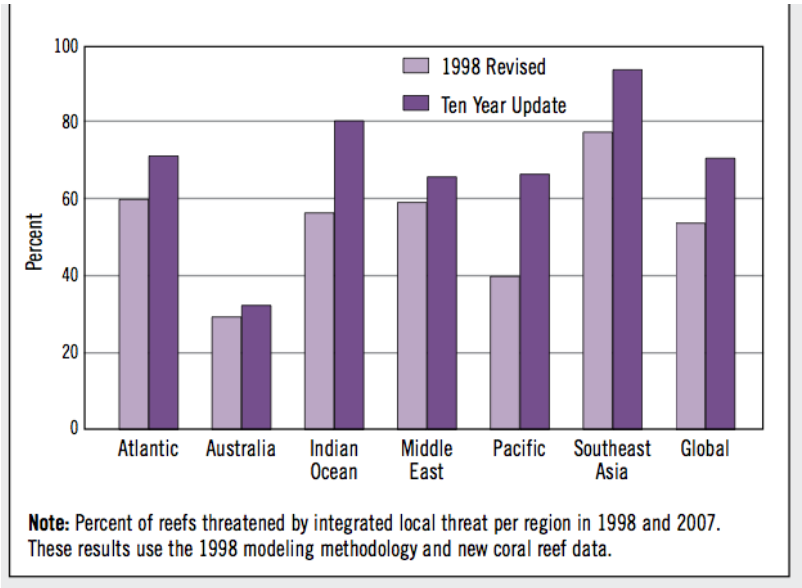

Figure 7. Reefs at risk from integrated local threats in 1998 and 2007. Source: Burke *et al.* 2011 at 44.

Coastal development, pollution, and sedimentation.

> Coastal development and watershed-based pollution each threaten about 25 percent of reefs. Marine-based pollution and damage from ships is widely dispersed, threatening about 10 percent of reefs… Of the six coral reef regions [Atlantic, Australia, Indian Ocean, Middle East, Pacific, and Southeast Asia]… local pressure on coral reefs is highest in Southeast Asia, where nearly 95 percent of reefs are threatened, and about 50 percent are in the high or very high threat category. Indonesia, second only to Australia in the total area of coral reefs that lie within its jurisdiction, has the largest area of threatened reef, followed by the Philippines. Overfishing and destructive fishing pressure drive much of the threat in this region, followed by watershed-based pollution and coastal development. (Burke *et al.* 2011 at 3)
>
> Development in the coastal zone—linked to human settlements, industry, aquaculture, or infrastructure—can have profound effects on nearshore ecosystems. Impacts of coastal development on the reef can occur either through direct physical damage such as dredging or land filling, or indirectly through increased runoff of sediment, pollution, and sewage. Large quantities of sediments can be washed into coastal waters during land clearing and construction. The removal of coastal vegetation, such as mangroves, also takes away a critical sediment trap that might otherwise prevent damage to nearshore ecosystems. Where coastal areas are developed, pollution often follows. Sewage is the most widespread pollutant, and elevated nutrient levels present in sewage encourage blooms of plankton that block light and encourage growth of seaweeds that compete for space on the reef. Many countries with coral reefs have little to no sewage treatment; the Caribbean, Southeast Asia, and Pacific regions discharge an estimated 80 to 90 percent of their wastewater untreated. Toxic chemicals also are a problem. Sources of toxic chemicals in coastal runoff include industries, aquaculture, and agriculture, as well as households, parking lots, gardens, and golf courses. (Burke *et al.* 2011 at 21)
>
> More than one-quarter of the world's reefs are threatened by watershed-based pollution (including nutrient fertilizers, sediment, pesticides, and other polluted runoff from the land), with about 10 percent considered to be highly threatened. Southeast Asia surpasses all other regions with 45 percent of reefs threatened. The magnitude of threat in this region is driven by a high proportion of agricultural land use, steep terrain, heavy precipitation, and close proximity of reefs to land. More than 30 percent of reefs in the Indian Ocean region are similarly threatened by watershed-based pollution. (Burke *et al.* 2011 at 39)

In some areas, regular dredging of shipping channels has resulted in widespread sedimentation on coral reefs (Burke *et al.* 2002 at 20; Bryant *et al.* 1998 at 11, 34). As just one example, the reefs off Singapore lie near one of the world's busiest harbors and largest oil refineries (Burke *et al.* 2002 at 38). Singapore has lost 60 percent of its reefs to land reclamation projects (Id. at 39).

Destructive fishing practices. Destructive fishing practices are a significant threat to the coral reef habitat used by humphead wrasse (NOAA 2009 at 3; Hodgson 1999 at 346). The wrasse is a very valuable species in the live fish business, in which fish are selected live for cooking and consumption from a tank in a restaurant. Overexploitation of the species itself will be discussed

below under Factor B. Here, we detail how the fishing methods most often used to capture the wrasse live also damage its habitat in the process.

To supply the live fish market, "diving fishermen throughout the region use sodium cyanide to stun and capture live humpheads, the bigger the better" (Hodgson 1999 at 346).

> Destructive fishing practices, such as sodium cyanide use which stuns animals for capture and incidentally kills living coral, have been well documented and are spreading in the Indo-Pacific region. Despite its prohibition in many countries (including major exporters such as the Philippines and Indonesia), cyanide is still the preferred method for capturing certain live reef fish for international trade in some areas. Indeed, larger Humphead Wrasse are difficult to catch any other way, other than by night-time capture. When cyanide is applied, the fish often retreats into a crevice and becomes increasingly lethargic as the toxin reduces its ability to take up oxygen. Divers may break away the living coral to get access to the hiding area, and remove the fish to clean water where it will often recover for shipment or holding in net pens. (Russell 2004 at 4, internal citations omitted; *see also* Bryant *et al.* 1998 at 15)
>
> Despite the fact that cyanide fishing is nominally illegal in virtually all Indo-Pacific countries, the high premium paid for live reef fish, weak enforcement capacities, and frequent corruption have spread the use of the poison across the entire region— home to the vast majority of the planet's coral reefs. Since the 1960s, more than one million kilograms of cyanide has been squirted onto Philippine reefs, and the vast Indonesian archipelago now faces an even greater cyanide problem. (Bryant *et al.* 1998 at 15)

Blast fishing is a continuing problem throughout Southeast Asia, where fishers use dynamite, grenades, or homemade explosives to fish. Regularly bombed reefs frequently exhibit 50-80 percent reef mortality (Burke *et al.* 2002 at 28; Chen and Justin 2009 at 123).

Human population growth. Increased economic growth in coastal cities is a major cause of coral reef destruction. With growth comes construction projects, some of which occur on reef communities; dredging of harbors and shipping channels; dumping of waste, run-off pollution and increased sedimentation; and increased tourism. Worldwide, approximately 2.5 billion people live within 100 km of the coastline (Burke *et al.* 2011 at 21). In a recent study, Burke *et al.* (2011 at 38) found that "development along the coast threatens almost 25 percent of the world's reefs… The largest proportion of threatened reefs are in Southeast Asia." The region has the most extensive and diverse coral reefs in the world, with 28 percent of the global total (Id. at 53). However, the reefs in this region are also the most threatened in the world, with approximately 95 percent at risk from local threats (e.g., coastal development, pollution, overfishing, and destructive fishing practices) (Id. at 55). Human populations are dense in many parts of this region; more than 138 million people live on the coast within 30 kilometers of a coral reef (Id. at 54).

Climate change. Climate change effects such as increased water temperature and acidification and increasingly destructive storms are degrading reef ecosystems and causing coral bleaching and other impacts. These factors are discussed further under Factor E.

(B) Overutilization for commercial and recreational purposes

The primary cause of the decline of humphead wrasse populations and the biggest threat to the species' continued existence is human exploitation (Donaldson and Sadovy 2001; NOAA 2009 at 3). The humphead wrasse is especially susceptible to even light fishing pressure due to its biological characteristics (which make the fish vulnerable to take) and because it is naturally uncommon (Sadovy *et al.* 2004 at 357-58). Humphead wrasse have a high retail value – $60.38-120.76/kg – in the live fish trade and are therefore in high demand throughout the Indo-Pacific region (Chen and Justin 2009 at 124; Sadovy *et al.* 2004 at 328, 349).[5] The wrasse is the highest priced among all fishes in the live fish trade (Sadovy de Mitcheson *et al.* 2010 at 707). Juveniles, in particular, are targeted for the live fish trade; they are often maintained in captivity and fed until they attain market size (Sadovy *et al.* 2004 at 342). Chen and Justin (2009 at 124) calculated that in Malaysia, 101,260 humphead wrasse were exported from 2005-2007, and concluded that the wrasse "is being caught and exported in such high numbers that it is quite impossible for the population in the wild to sustain this sort of mass harvesting any longer" (Id. at 125). In a study of the impacts of the live fish trade on the humphead wrasse in Borneo, Scales *et al.* (2007 at 991, Table 1) found that total monthly catches (kg per month) of the fish declined by 98 percent between 1995 and 2003 and relative abundance (kg per fishing boat or fisher per trip) declined by 78 percent during the same time.

As the human population in the Southeast Asian region continues to grow, so will fishing pressure:

> More than 80 percent of the populations of Indonesia, Malaysia, the Philippines, Taiwan, and Singapore reside within 50 km of the coast. Many of these people have come to rely on the coastal zone not only for their food, but also for their livelihoods. However, coastal resources have increasingly been exploited beyond their sustainable limits as populations in the region have skyrocketed. Much of this growth is occurring among people living at subsistence levels. For example, small-scale operations contribute about 95 percent of total marine fisheries production in Indonesia. Although the population explosion has put unprecedented pressures on coastal resources and jeopardized food security throughout the region, regional population increase is not solely responsible for the increasing pressure on coastal fish resources. The demand in wealthy Southeast Asian countries and other nations around the world for marine aquarium fish, live reef food fish, pelagics, and bottomfish has further fueled regionwide exploitation of certain species. (Burke *et al.* 2002 at 26)

In addition, like the bumphead parrotfish,[6] the humphead wrasse is particularly vulnerable to spearfishing at night, especially if the divers use scuba gear and/or compressed air (Fitzpatrick and Donaldson 2007 at 928; Sadovy *et al.* 2004 at 342).

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[5] Despite the fact that in some parts of its range (including Tahiti, Tuvalu, New Caledonia, and the Tuamotu Archipelago) the humphead wrasse is ciguatoxic due to its consumption of poisonous prey, humans continue to consume this species in large numbers (Randall *et al.*1978 at 235; Sadovy *et al.* 2004 at 338; Scales *et al.* 2007 at 989).

[6] *See* NOAA 2010a at 16713 - 16714.

The humphead wrasse's inclusion in CITES as an Appendix II species in 2004 (CITES 2004, *entire*) indicates that CITES member nations recognize the dangers posed by continued trade and overutilization of this species. An Appendix II species is one which "although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival" (CITES, Art. II, subd. 2(a)). The listing indicates that at least two-thirds of the member nations agree that this species faces possible extinction due to unregulated trade and utilization (*see* CITES, Art. XV, subd. 1).

(D) The inadequacy of existing regulatory mechanisms

Inadequate protection from human exploitation. A main cause of the substantial decline in humphead wrasse populations is the lack of protective measures in most countries and the inadequacy of regulatory mechanisms where they do exist. First, there is no coordinated regional-level management of this species (NOAA 2009 at 3; Sadovy *et al.* 2004 at 356). Second, very few countries have promulgated any national protective measures for the wrasse. Of the nearly 50 countries known to be within this species' range, only 10 have implemented fishing restrictions or other measures to conserve the wrasse (Table 2).

Even within these countries, most protective measures are unenforced or ineffective due to various exceptions or lack of resources: "[w]ith few exceptions, protective legislation is largely ineffective as there is little or no enforcement capacity" (Sadovy *et al.* 2004 at 357). For example, Sadovy *et al.* (2004 at 356) determined that in Indonesia, "[t]here appears to be no enforcement of laws protecting this species or monitoring of culture, capture or export, despite the fact that monitoring is required under the law; insufficient funding and human resources apparently preclude control and monitoring in provinces or at export." In Palau, a temporary total moratorium on fishing for this species was instituted in 2006 (NOAA 2009). However, Fitzpatrick and Donaldson (2007 at 928) found that illegal fishing still occurs in Palauan waters by vessels originating from other countries, such as the Philippines and Indonesia, and concluded that even relatively minor illegal fishing may have "significant cumulative negative effects" on the humphead wrasse population. Finally, Chen and Justin (2009) studied the humphead wrasse trade in Malaysia and found that there is extensive illegal, unrecorded, and unmonitored humphead wrasse trading occurring between Malaysia and the Philippines. They found that although the Philippines banned the export of all live fish, "the government of Malaysia is aware and has admitted that most of the [humphead wrasse] stock exported from Sabah [Malaysia] is caught in the Philippines… There appears to be no monitoring or records kept of the trade of [humphead wrasse] between the Philippines and Sabah" (Chen and Justin 2009 at 124).

The humphead wrasse's inclusion in CITES Appendix II has been unsuccessful in protecting the species from further decline. For example, the wrasse trade in Malaysia is regulated, in part, by CITES and pursuant to this convention, CITES permits are required before one can export wrasse. Chen and Justin (2009 at 123) found that prior to 2007 there was only one record of an export of two live wrasse. However, they found that it was common knowledge that the humphead wrasse was exported in large quantities during the same time period. As a result, they concluded that the "unregulated export of [humphead wrasse] from Malaysia is a major loophole in the effectiveness of the CITES listing."

Table 2. Existing fishery and export regulations for humphead wrasse (HHW). Sources: NOAA 2009 at 5, Chen and Justin 2009 at 2, Sadovy *et al.* 2004 at 355-356.

Country	Regulation
Australia	Western Australia – complete protection since 1998; from December 1, 2003, Coral Reef Fin Fish Management Plan (for Queensland waters, including Great Barrier Reef Marine Park) prohibits all take and possession of Humphead Wrasse, other than for limited educational purposes.
Guangzhou Province (China)	Permits required for sale of HHW.
Indonesia	Fishing permitted if: done by researcher with research permit for purposes of scientific and mariculture development, as well as by artisanal fishers with fishing permit; allowable weights are 1-3 kg; allowable fishing methods of HHW are hook and line, fish trap and gill net; artisanal fishers should sell the fish to its collector fisheries business partners; provincial fisheries services must monitor, control and report on permits and volumes 3-monthly.
Malaysia	Permits required for the import or export of live fish.
Maldives	All exports of HHW were banned in 1995.
New Caledonia	Catch of HHW not permitted during spearfishing competitions; occasional poaching may occur in marine protected areas; not exported.
Niue	Interference, take, kill, or bringing to shore of the HHW is prohibited without written approval.
Palau	Illegal to fish, buy, or sell HHW smaller than 64 cm; illegal to export HHW irrespective of size
Papua New Guinea	65 cm minimum size limit for exporting HHW, but does not prevent fishers from catching and holding smaller HHW in cages until they attain 65 cm.
Philippines	Exports of all live fish are prohibited from throughout the Philippines.
United States territories	
American Samoa	Spear-fishing with SCUBA gear banned in 2003 except for scientific purposes, however, spearfishers then participating in the fishery can continue their activities using SCUBA gear; license required to export marine fishery products, and export ventures must be locally owned.
Pacific territories (Wake Island, Johnston Atoll, and Palmyra Atoll)	License required to export marine fishery products; waters from the shoreline out to 50 fathoms are protected as a low-use MPA (any person of the United States fishing for, taking, or retaining coral reef ecosystem management unit species (CRE MUS) must have a special permit); CRE MUS may not be taken by means of spearfishing with SCUBA gear at night (from 6 p.m. to 6 a.m.) in the U.S. EEZ waters; Wake Island fully protected by the U.S. Department of Defense.

Due to the nature of fishing operations in most areas where the wrasse is threatened, government regulations are inadequate to protect the wrasse:

> When overfishing is caused by large-scale commercial operations, government regulations and enforcement may be the key to reducing the problem. However, where coral reefs are adjacent to crowded coastlines, effective fisheries management is crucial. Key elements in improving compliance with fishing regulations include the development of alternative livelihoods, the implementation of small fishing reserves, and the involvement of fishers in resource decisionmaking. (Burke *et al.* 2002 at 26)

Inadequate protection of habitat. Regulations and protected areas worldwide appear to be insufficient to protect coral reef habitat – only 27 percent of reefs are within Marine Protected Areas (MPAs), many of which are only partially effective (Figure 8).

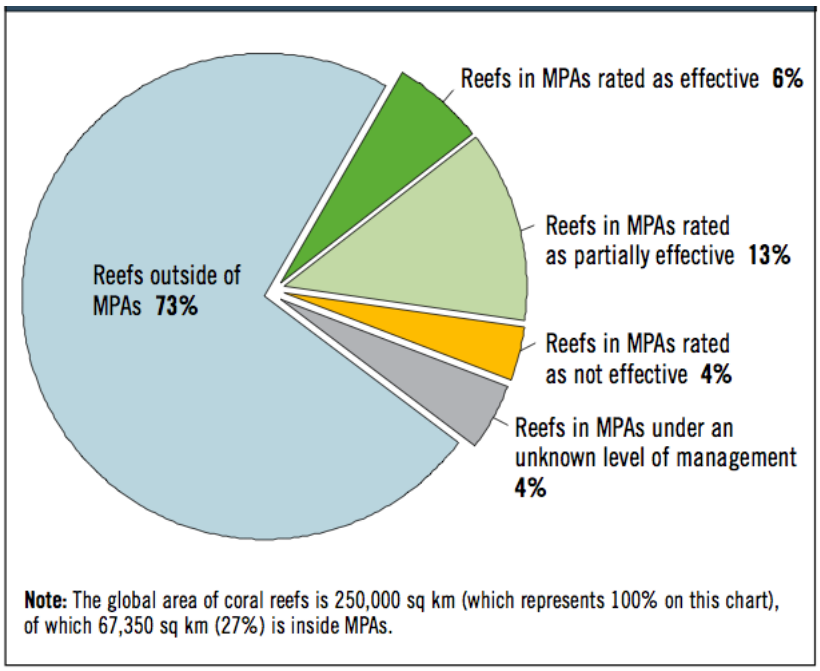

Figure 8. Coral reefs by Marine Protected Area (MPA) coverage and effectiveness level. Source: Burke *et al.* 2011 at 6.

Few reefs are protected within the regions inhabited by the humphead wrasse. In the Middle East, "only 12 percent of the region's reefs are within protected areas, many of which are in Egypt" (Burke et al. 2011 at 50). In the Indian Ocean, about 330 MPAs cover 19 percent of the coral reefs. "Effectiveness assessments obtained for 58 percent of these MPAs concluded that one-quarter were considered ineffective, with just under half being partially effective" (Burke et al. 2011 at 53). In Southeast Asia, "[n]early 600 protected areas cover 17 percent of the region's reefs. Unfortunately, of the 339 that were rated, 69 percent were classified as not effective and only 2 percent as fully effective, covering a mere 16 sq km of coral reef" (Burke et al. 2011 at 56). More than 920 MPAs have been identified across the Pacific, but they cover only about 13 percent of the region's reefs (Burke et al. 2011 at 62). "The reefs of Australia are the least affected by local threats of any region… About three-quarters of Australia's coral reefs fall within marine protected areas. This includes 30,000 sq km (12 percent of the world's coral reefs) in the Great Barrier Reef Marine Park" (Burke et al. 2011 at 57-59).

Inadequate protection from climate change. The U.S. has no regulatory mechanisms to address the effects of global climate change on coral reefs and their inhabitants, or to limit the U.S. contribution to greenhouse gas emissions. "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 somewhere around or below current levels" (Burke et al. 2011 at 31). So far, the U.S. has not been part of the solution. The U.S. Fish and Wildlife Service (USFWS) 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. (USFWS 2011 at 18694)

Climate change also affects the humphead wrasse and its coral reef habitat, as will be discussed under Factor E.

(E) Other natural or manmade factors affecting continued existence

Life history factors. Given the humphead wrasses' long life of 25-32 years, its late sexual maturation at 5-9 years, its seasonal aggregation for spawning, and sex change from female to male, this species is particularly susceptible to disturbance and fishing pressure (Donaldson and Sadovy 2001, Sadovy *et al.* 2004 at 358, Russell 2004 at 4, NOAA 2009 at 3). The humphead wrasse is predictable in its spawning sites and therefore easy to locate, as are adults in their sleeping places (Sadovy *et al.* 2004 at 358). In particular, the fact that fish may change sex from female to male increases susceptibility to the size-selective fishing that occurs in the live reef fish trade, as males are generally larger than females (Id.). These biological characteristics collectively contribute to the species' low replacement rate. "At least a decade would be required for a heavily exploited population to begin recovery from fishing pressure once protection is provided" (Colin 2010 at 1004).

Small population size and natural rarity. The humphead wrasse is already uncommon throughout its range; its natural rarity contributes to its danger of extinction or its likelihood of becoming endangered throughout all or a substantial part of its range (Sadovy *et al.* 2004 at 358). Recent data shows that densities of adults in protected or relatively undisturbed habitats with low rates of fishing are only about 10-20 individual fish per 10,000 m^2. These densities decline rapidly to a few fish per unit area when fishing intensifies (Sadovy *et al.* 2004 at 358; Russell 2004 at 3).

Climate change. Both the atmosphere and the oceans are becoming warmer due to marked increases in greenhouse gas emissions (Munday *et al.* 2008 at 263). Climate change, caused by excessive amounts of greenhouse gases from anthropogenic sources, is causing a range of effects on coral reefs and their resident fishes, including warming ocean temperatures, with consequent coral bleaching, and more extreme whether events leading to reef damage (Munday *et al.* 2008 at 262; Karl *et al.* 2009 at 149, 151-152; McMullen and Jabbour 2009 at 29-31).

Warming waters cause coral bleaching; when corals undergo stress from increased temperatures and/or salinity, the symbiotic algae that provide coral polyps with nutrients are expelled, causing "bleaching" and weakening of the corals (Bryant *et al.* 1998 at 14).

> 2010 was one of the warmest years on record, causing widespread damage to coral reefs. Warmer oceans lead to coral bleaching, which is becoming increasingly frequent around the globe—leaving reefs, fish, and the communities who depend on these resources at great risk. No one yet knows what the long-term impacts of this bleaching will be. But, if the ocean's waters keep warming, the outlook is grim. (Burke *et al.* 2011 at v)

The frequency of intense cyclones is predicted to increase as a result of increased ocean surface temperatures, which will increase the disturbance of coral reefs (Munday *et al.* 2008 at 268).

> Storms can be powerful drivers of change for these coral reefs. They are a natural perturbation in many areas, but nonetheless can dramatically affect reef life by reducing the coral framework to broken rubble that can no longer sup- port high levels of abundance and diversity. Recovery can take years or decades. Where reefs are already weakened by other threats, storms are a complicating factor, bringing an already ailing reef to complete failure… Recent studies have predicted that the frequency of very intense tropical storms may increase as a result of warming sea surface temperatures. Currently, the linkages between climate change and storm activity are still under investigation, and effects will most likely vary regionally. (Burke *et al.* 2011 at 35-36)

Ocean acidification. The increase of carbon dioxide in the atmosphere is acidifying oceans (Karl *et al.* 2009 at 151). About one-third of the anthropogenic carbon dioxide emitted has been absorbed by the ocean, which has resulted in a decrease in the oceans' pH level (Karl *et al.* 2009 at 151). Additional carbon dioxide reacts with water to form carbonic acid, which causes a decline in pH and a shift in the carbonate-bicarbonate ion balance (Munday *et al.* 2008 at 267). The result is that coral calcification rates have declined as well.

> Rising levels of CO2 in the oceans are altering ocean chemistry and increasing the acidity of ocean water, reducing the saturation level of aragonite, a compound corals need to build their skeletons. By 2030, fewer than half the world's reefs are projected to be in areas where aragonite levels are ideal for coral growth, suggesting that coral growth rates could be dramatically reduced. By 2050, only about 15 percent of reefs will be in areas where aragonite levels are adequate for coral growth. (Burke *et al.* 2011 at 5-6)

> In addition to warming the ocean, increases in atmospheric CO2 will have another impact on coral reefs in coming decades. About 30 percent of the CO2 emitted by human activities is absorbed into the surface layers of the oceans, where it reacts with water to form carbonic acid. This subtle acidification has profound effects on the chemical composition of seawater, especially on the availability and solubility of mineral compounds such as calcite and aragonite, needed by corals and other organisms to build their skeletons. Initially these changes to ocean chemistry are expected to slow the growth of corals, and may weaken their skeletons. Continued acidification will eventually halt all coral growth and begin to drive a slow dissolution of carbonate structures such as reefs. Such responses will be further influenced by other local stressors. In addition, acidification has also been shown to produce an increased likelihood of temperature-induced coral bleaching. (Burke *et al.* 2011 at 32-33)

Synergistic effects. Any or all of the aforementioned threats could work synergistically to cause the extinction of the humphead wrasse. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction. Ongoing habitat destruction and fragmentation are the primary drivers of contemporary extinctions, particularly in the tropical realm, but synergistic interactions with hunting, fire, invasive species and climate change are being revealed with increasing frequency" (Brook et al. 2008 at 457). For example, climate change effects will add to the other stressors described in this

petition – destructive fishing practices, pollution, and increased sedimentation – to exacerbate reef degradation and humphead wrasse habitat loss (Munday *et al.* 2008 at 274, McMullen and Jabbour 2009 at 31, Box 3.3).[7]

The combined effects of threats of habitat loss, legal and illegal exploitation, and other factors including low reproductive rates could cause a greater reduction in wrasse populations than would be expected from simply the additive impacts of individual threats. "[H]abitat loss can cause some extinctions directly by removing all individuals over a short period of time, but it can also be indirectly responsible for lagged extinctions by facilitating invasions, improving hunter access, eliminating prey, altering biophysical conditions and increasing inbreeding depression. Together, these interacting and self-reinforcing systematic and stochastic processes play a dominant role in driving the dynamics of population trajectories as extinction is approached" (Brook et al. 2008 at 453).

Humphead wrasse are already at risk due to loss of habitat and life history characteristics, and are especially vulnerable to the synergistic impacts of other threats. "Traits such as ecological specialization and low population density act synergistically to elevate extinction risk above that expected from their additive contributions, because rarity itself imparts higher risk and specialization reduces the capacity of a species to adapt to habitat loss by shifting range or changing diet. Similarly, interactions between environmental factors and intrinsic characteristics make large-bodied, long-generation and low-fecundity species particularly predisposed to anthropogenic threats given their lower replacement rates" (Brook et al. 2008 at 455).

> [O]nly by treating extinction as a synergistic process will predictions of risk for most species approximate reality, and conservation efforts therefore be effective. However challenging it is, policy to mitigate biodiversity loss must accept the need to manage multiple threatening processes simultaneously over longer terms. Habitat preservation, restoring degraded landscapes, maintaining or creating connectivity, avoiding overharvest, reducing fire risk and cutting carbon emissions have to be planned in unison. Otherwise, conservation actions which only tackle individual threats risk becoming half-measures which end in failure, due to uncontrolled cascading effects. (Brook et al. 2008 at 459).

REQUESTED DESIGNATION

The humphead wrasse is declining significantly throughout its entire range, which includes several U.S. territories. As one of the largest reef fishes in the world, the wrasse is a key part of the vitality of coral reef ecosystems. It faces several substantial threats, in particular habitat loss and overfishing. In addition, only a few of the dozens of countries within the wrasse's range have effective regulatory measures in place to protect the species and/or its habitat.

WildEarth Guardians hereby petitions the National Marine Fisheries Service (NMFS) within the U.S. Department of Commerce to list the humphead wrasse (*Cheilinus undulatus*) as an "endangered" or "threatened" species pursuant to the Endangered Species Act.

[7] *See also* NOAA 2010b.

As explained above, the humphead wrasse can be found throughout the entire Indo-Pacific region. Its range includes several U.S. territories: American Samoa, Guam, the Line Islands, and the Northern Mariana Islands. As destruction of its coral reef habitats leads to the disappearance of the humphead wrasse, WildEarth Guardians also requests that NMFS also designate critical habitat for the species within its U.S. range concurrent with listing.

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