Management Report for Bumphead Parrotfish (*Bolbometopon muricatum*) Status Review under the Endangered Species Act:

Existing Regulatory Mechanisms
(per Endangered Species Act § 4(a)(1)(D), 16 U.S.C. § 1533(a)(1)(D))
and Conservation Efforts
(per Endangered Species Act § 4(b)(1)(A), 16 U.S.C. § 1533(b)(1)(A))

September 2012

Bumphead parrotfish for sale in market, Aceh, Indonesia
(photo provided by Crispen Wilson)

Pacific Islands Regional Office
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
Department of Commerce

Executive Summary

Introduction

On January 4, 2010, the National Marine Fisheries Service (NMFS) received a petition from WildEarth Guardians to list bumphead parrotfish (*Bolbometopon muricatum*) as either threatened or endangered under the Endangered Species Act (ESA). In response, NMFS issued a 90-day finding (75 Fed. Reg.16713 (Apr. 2, 2010)), wherein the petition was determined to contain substantial information indicating that listing the species may be warranted. Thus, NMFS initiated a comprehensive status review of bumphead parrotfish, which was completed jointly by our Pacific Islands Fisheries Science Center (PIFSC) and Pacific Islands Regional Office (PIRO). PIFSC established a Bumphead Parrotfish Biological Review Team (BRT) to complete a biological report on the status of the species and threats to the species (hereafter "BRT Report", cited as Kobayashi *et al*. 2011). PIRO staff completed this report on management activities affecting the species across its range, including existing regulatory mechanisms and non-regulatory conservation efforts (hereafter "Management Report"). The BRT Report and Management Report together constitute the comprehensive bumphead parrotfish status review.

The process for determining whether a species should be listed as threatened or endangered is based upon the best scientific and commercial data available and is described in sections 4(a)(1) and 4(b)(1)(A) of the ESA (16 U.S.C. § 1533(a)(1)). A species may be listed due to any one of the five listing factors:

> (A) the present or threatened destruction, modification, or curtailment of its 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

In addition, Section 4(b)(1)(A) of the ESA requires NMFS to take into account conservation efforts being made to protect a species that has been petitioned for listing (§ 1533(b)(1)(A)). Factors A, B, C, and E above were considered in the BRT Report (Kobayashi *et al*. 2011). Factor D and conservation efforts were not considered by the BRT in its report. As such, the first purpose of this report is to identify existing regulatory mechanisms, as per ESA Section 4(a)(1)(D), that address threats to bumphead parrotfish identified by the BRT. The second purpose of this report is to identify conservation efforts that may have a beneficial effect on the status of bumphead parrotfish as per ESA Section 4(b)(1)(A).

The purpose of this Management Report is to summarize existing regulatory mechanisms and conservation efforts relevant to the extinction risk of bumphead parrotfish. The information in this report will then be used in the Bumphead Parrotfish 12-month Finding to determine whether these existing regulatory mechanisms and conservation efforts contribute to the species' extinction risk.

Species Range and Threats

Bumphead parrotfish occur in 45 countries in the Indo-Pacific region and in disputed areas in the South China Sea (Paracel and Spratly Islands). Bumphead parrotfish habitat consists primarily of coral reefs for adults, and mangroves, coral reef lagoons, and backreefs for juveniles (Kobayashi *et al*. 2011). Habitat is distributed very unevenly among the 46 areas, with only five countries (i.e. Australia, Indonesia, Philippines, France, and Papua New Guinea) possessing over 60% of total coral reef area in the 46 areas (Table 2; Appendix A-1). Likewise, Indonesia possesses approximately 40% of total mangrove area in the 46 areas (Table 3, Appendix B).

Bumphead parrotfish are susceptible to a variety of threats, as described in Chapter 3 of the BRT Report (Kobayashi *et al*. 2011). Adult harvest and juvenile habitat loss are the highest-ranked threats that currently exist and are expected to persist into the future. Other threats to bumphead parrotfish that can be addressed via regulatory mechanisms designed to regulate human behavior are adult habitat loss, global warming, ocean acidification, juvenile harvest, and pollution, all of which received current and future impact ratings ranging from nil+ (i.e. very low) to medium+ severity by the BRT (Table 4 below, Kobayashi *et al*. 2011). The seven threats that can be addressed via regulatory mechanisms fall into three groups: (1) Harvest (adult harvest, juvenile harvest); (2) Habitat Loss/Degradation (juvenile habitat loss/degradation, adult habitat loss/degradation, pollution); and (3) Climate Change (ocean warming, ocean acidification).

Bumphead parrotfish possess certain life history characteristics that increase their vulnerability to harvest, such as nocturnal resting behavior, diurnal feeding behavior, large size, accessible habitat choices, and conspicuous coloration. Indo-Pacific coral reef fisheries are nearly as diverse as the species they target, and include many subsistence, commercial, and sport/recreational fisheries employing a vast array of traditional, modern, and hybrid methods and gears (Newton *et al*. 2007; Wilkinson 2008; Armada *et al*. 2009; Cinner *et al*. 2009b). Selective gears and methods are used to target and harvest individual bumphead parrotfish, while less selective gears and methods are used to harvest many different species, which sometimes includes bumphead parrotfish. Selective gears include spears and related gears (e.g., harpoons, bangsticks, bow-and-arrow), as well as hook-and-line and poisoning. Less selective gears and methods include gillnets, drive nets, traps, pots, weirs, and corrals, small-mesh seine nets, and blasting.

Habitat loss and degradation threatens both adults and juveniles, and pollution is a threat throughout all bumphead parrotfish habitat types. Along with adult harvest, loss and/or degradation of juvenile habitat (i.e. mangrove swamps, seagrass beds, coral reef lagoons) was rated as the most severe threat to bumphead parrotfish by the BRT. Juvenile bumphead parrotfish habitat includes mangrove swamps, seagrass beds, coral reef lagoons, and likely other coastal habitats. These nearshore, shallow water areas are vulnerable to pollution, modification, and impacts from coastal development. Loss and/or degradation of adult habitat (coral reefs) and pollution were rated as lower severity threats, but are predicted to worsen in the future (40-100 years) in the absence of management. Coral reefs are susceptible to a variety of local (e.g., pollution, ship groundings) and global (e.g., global warming, ocean acidification; addressed separately below) threats. As with juvenile habitat loss/degradation, the vast array of coastal management regulatory mechanisms are relevant for adult habitat loss/degradation.

Climate Change threats to bumphead parrotfish include global warming and ocean acidification. Impacts from these threats are likely to be somewhat indirect because warming and acidification are predicted to have negative consequences for coral reefs, the primary habitat type for adult and large juvenile bumphead parrotfish. Ocean warming is a primary driver of coral bleaching, wherein corals expel their symbiotic zooxanthellae in response to stress. It is also a primary cause of increased prevalence and severity of coral diseases by creating an environment for pathogens to grow faster and be more virulent. Ocean acidification may reduce coral calcification, leading to reduced coral growth rates and increased mortality, among many other detrimental effects. The BRT rated both threats as lower severity than adult harvest and juvenile habitat loss, but as increasing in severity in the future.

Regulatory Mechanisms

A wide variety of governance structures, laws, statutes, and regulations exist throughout the 46 areas within bumphead parrotfish range. Existing regulatory mechanisms summarized in this Management Report include international treaties, laws, decrees, executive orders, rules and/or regulations enacted and being implemented by some governing body or official, whether they are international organizations, national governments, state and local authorities, heads-of-state, or other so empowered officials, affecting the status of bumphead parrotfish. The manner in which regulatory mechanisms address Harvest and Habitat Loss/Degradation threats is much different than how they address Climate Change threats. As such, these two types of threats were addressed separately in the summary of regulatory mechanisms. Regulatory mechanisms within the range of bumphead parrotfish in relation to Harvest and Habitat Loss/Degradation threats were grouped into two categories: (1) Regulatory mechanisms for fisheries and coastal management; and (2) Additional regulations within MPAs and other relevant protected areas (e.g., mangroves). Generally, the first level encompasses a broad array of laws and decrees across many jurisdictional scales from national to local, whereas the second level consists of additional regulations that may apply within MPAs/protected areas in each jurisdiction.

All global threats identified by the BRT are related either directly or indirectly to global climate change which is, in large part, a result of anthropogenic greenhouse gas (GHG) emissions. A description of regulatory mechanisms addressing Climate Change related threats cannot be limited to the 46 areas within the range of bumphead parrotfish because ocean warming and ocean acidification are results of global processes fueled by anthropogenic GHG emissions worldwide. Regulatory mechanisms for Climate Change related threats are described in two sections. First, international regulatory mechanisms intended to regulate GHG emissions are described, including the Montreal Protocol (1987), United Nations Framework Convention on Climate Change (UNFCCC, 1992), Kyoto Protocol (1997), Bali Roadmap (2007), Copenhagen Accord (2009), Cancun Accord (2010), and Durban agreements (2011). Second, regulatory mechanisms for GHG emissions in the top 25 GHG emitters globally are described. These 25 countries account for approximately 85% of global emissions.

Conservation Efforts

As with existing regulatory mechanisms, conservation efforts for Harvest and Habitat threats are evaluated separately from Climate Change threats. Conservation efforts summarized in this report include actions, activities, and programs undertaken by both governmental and non-governmental organizations ("NGOs," e.g., conservation groups, private companies, academia, etc.) that may eliminate or reduce threats or otherwise improve the status of bumphead

parrotfish. Conservation efforts with the potential to address Harvest and Habitat threats to bumphead parrotfish include fisheries management plans, coral reef monitoring, coral reef resilience research, coral reef education and/or outreach, marine debris removal projects, coral reef restoration, etc. These conservation efforts are often conducted by countries, states, local governments, individuals, NGOs, academic institutions, private companies, etc. They also include global conservation organizations that conduct coral reef and/or marine environment conservation projects, global coral reef monitoring networks and research projects, regional or global conventions, and education and outreach projects throughout the range of bumphead parrotfish.

Conservation efforts with potential to address Climate Change threats to bumphead parrotfish include efforts conducted by countries, states, local governments, individuals, NGOs, academic institutions, private companies, and others. They also include global conservation organizations that conduct coral reef and/or marine environment conservation projects, global coral reef monitoring networks and research projects, regional or global conventions, and education and outreach projects throughout the range of bumphead parrotfish.

Overall Patterns and Summary

Several overall patterns emerged from the compilation and evaluation of existing regulatory mechanisms addressing Harvest and Habitat threats to bumphead parrotfish.

A wide array of regulatory mechanisms exist within the 46 areas in bumphead parrotfish range that are intended to address threats of harvest and habitat loss/degradation for the species. Table 1 below provides an overview of several pertinent regulation types within the range of bumphead parrotfish. Australia, Fiji, Maldives, Micronesia, Palau, and Samoa all have fisheries regulations pertaining specifically to parrotfish species, in some cases specifically bumphead parrotfish. These range from prohibition of take for all parrotfish, to size and bag limits, to seasonal restrictions, to listing as an Endangered Species (Fiji). These countries together represent 26% of total coral reef habitat and 13.1% of mangrove habitat in the 46 areas within bumphead parrotfish range. Twenty-four out of the 46 areas have some sort of regulations on the books pertaining to spearfishing. These include prohibiting spearfishing altogether, prohibiting fishing with SCUBA, prohibiting fishing with lights (limiting night spearfishing), area closures, permit requirements, or various combinations of those. Some regulations may only apply in some areas within a country or jurisdiction and some only within MPAs. Those 24 countries combined represent 63.6% of total coral reef habitat within the 46 areas in bumphead parrotfish range. Again, 24 out of the 46 areas within the species range have some sort of regulatory mechanisms in place that offer some protection to mangrove habitat. These regulations include prohibition on mangrove harvest and/or sale, inclusion of mangroves in protected areas, and sustainable harvest and/or restoration requirements. Combined, these 24 countries account for 94.8% of mangrove habitat in the 46 areas within the range of bumphead parrotfish. Spearfishing regulations exist in a majority (17 out of 24) of the areas within a significant portion of the species range (SPOIR) as determined by the BRT. Regulations providing some level of protection for mangrove habitat exist in an even larger majority (19 out of 24) of areas within SPOIR.

Table 6: Summary of selected relevant regulatory mechanisms for the 46 areas within bumphead parrotfish range. Countries in BOLD are included in SPOIR.

	% coral reefs	% mangroves	Parrotfish-specific laws (* = specific to bumpheads)	Spearfishing Regs (* = only in MPAs)	Mangrove Protection	Traditional Governance (* = recognized by gov't)	Notes
Australia	**19.8**	**12.4**	**X**	**X**	**X**		**Size and bag limits (5) on "regulated parrotfish" in QLD, bag limit of 8 parrotfish in Cocos-Keeling Islands**
Cambodia	**0.1**	**0.9**		**X**	**X**		
China	**0.3**	**0.3**		**X***	**X**		
Comoro Islands	**0.2**	**0**			**X**		
Disputed Areas	**1.8**	**0**					
Djibouti	0.1	0		X[1]			[1] it is noted that although banned, spearfishing is still widely practiced
Egypt	1.5	0					
Eritrea	0.9	0.1					
Fiji	3.1	0.5	X*		X	X*	Bumpheads listed under Endangered Species Act of 2002 which regulates trade, possession, and transport.
France	6.8	0.3		X			
India	**1.6**	**5.4**			**X**	**X**	
Indonesia	**18.5**	**40**			**X**	**X***	
Iran	0.1	0.2					
Israel	0	0.2					
Japan	0.8	0					
Kenya	**0.3**	**0.8**		**X***	**X**		
Kiribati	1.4	0		X*		X	
Madagascar	**1.8**	**3.8**		**X**	**X**	**X**	
Malaysia	**1.4**	**8.9**		**X***	**X**		
Maldives	**2.5**	**0**	**X**	**X**			**Harvest of all parrotfishes is prohibited**
Marshall Islands	1.7	0			X		
Mauritius	0.5	0		X			
Micronesia	**2.3**	**0.1**	**X[2]**	**X[3]**		**X***	**[2] Sale of bumpheads is prohibited in Pohnpei; [3] Some spearfishing bans in Yap only**
Mozambique	**1.1**	**3.6**		**X**			
Myanmar	**0.6**	**6.3**			**X**		
Niue	0	0				X	
Palau	**0.5**	**0.1**	**X***	**X**	**X**		**Minimum size limit for juveniles and time restrictions on take of bumphead parrotfish for Palauans; all take prohibited for non-Palauans**
Papua New Guinea	**6.8**	**5.3**		**X***	**X**	**X***	
Philippines	**10.5**	**3.2**		**X**	**X**	**X***	
Samoa	0.2	0	X*	X	X	X*	Minimum size limit for bumphead parrotfish
Saudi Arabia	2.5	0.3					
Seychelles	**0.9**	**0**		**X**			
Solomon Islands	**3.2**	**0.8**		**X**	**X**	**X***	
Somalia	0.3	0.1					
Sri Lanka	**0.1**	**0.1**			**X**	**X***	
Sudan	0.5	0		X			
Taiwan	**0.3**	**0**					
Tanzania	**1.4**	**1.6**		**X**	**X**		
Thailand	**0.2**	**3.1**			**X**		
Timor-Leste	**0.1**	**0**		**X**		**X**	
Tonga	0.8	0		X	X		
Tuvalu	0.6	0				X*	
United States	**0.3**	**0**		**X**	**X**		**Spearfishing regs only in American Samoa, CNMI, and PRIAs**
Vanuatu	0.8	0			X	X*	
Viet Nam	**0.4**	**1.3**			**X**	**X***	
Yemen	0.4	0					

Color codes:
No SCUBA
Prohibited
No lights
No lights, no SCUBA, area closures
Prohibited within some MPAs
Permit required
Area Closures

There has been recent rapid growth in coral reef and coastal MPAs. In 2000, there were 660 protected areas world-wide that included coral reefs (Spalding *et al.* 2001). The Reefs at Risk Revisited report (Burke *et al.* 2011) (Appendix A-1) indicates that now over 1,800 marine protected areas that include coral reefs are established, just within the range of bumphead parrotfish; a nearly three-fold increase in one decade. An estimated 25% of coral reef area within bumphead parrotfish range is within those MPAs. Additionally, over 650 protected areas have been established throughout the range that include mangrove habitat (Spalding *et al*. 2010) (Appendix B). MPA is a broad term that can apply to a wide range of regulatory structures within designated protected areas; MPAs referred to in this report certainly represent different levels of protection from no-take zones to limited restrictions on fishing and other activities. Effectiveness of protected areas depends not only on implementation and enforcement of regulations, but also on reserve design; reserves are not always created or designed with an understanding of how they will affect biological factors or how they can be designed to meet biological goals more effectively (Halpern 2003). Even results from the same regulatory scheme can differ between species within the protected ecosystem. A detailed evaluation of MPAs within the range of bumphead parrotfish is beyond the scope of this report. In many cases, protections have only recently been established so benefits to biodiversity and particularly to bumphead parrotfish have not yet manifested. Regardless, the large number of established MPAs that include bumphead parrotfish habitat provides evidence of regulatory mechanisms intended to address threats to the species.

Customary governance and management remain important and effective in many areas. After intensive efforts by governments in the past to centrally manage coastal fisheries, there has been a shift in government policies from a centralized or "top-down" approach to restore resources to a "bottom-up" or community-based approach. This community-based management approach is more widespread in Oceania today than any other tropical region in the world (Johannes 2002). Sixteen of the 46 areas within bumphead parrotfish range employ traditional governance systems based on customary and traditional resource management practices, most of which are explicitly recognized and supported by their national governments. Notably, the national government in Indonesia recognizes that customary law and/or traditional management is adapted to local areas and therefore more effective than a homogeneous national law. As such, coral reef fisheries management is decentralized and delegated to the 503 Districts where District laws and regulations are based on customary law and/or traditional management. Indonesia accounts for 40% of mangrove habitat and 18.5% of coral reef habitat in the 46 areas within bumphead parrotfish range.

Climate change threats will continue. It is clear that most regulatory mechanisms and conservation efforts targeting climate change impacts have not yet shown to be effective. This is evident judging from continued increases in global greenhouse gas emissions, despite all efforts that have been initiated to implement reductions in emissions throughout the world. However, the BRT Report states that climate change threats are not thought to be plausible drivers of bumphead parrotfish population dynamics, either now or in the foreseeable future of 40-100 years (Kobayashi *et al*. 2011).

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Tables and Figures

1. Introduction

On January 4, 2010, the National Marine Fisheries Service (NMFS) received a petition from WildEarth Guardians to list bumphead parrotfish (*Bolbometopon muricatum*) as either threatened or endangered under the Endangered Species Act (ESA). In response, NMFS issued a 90-day Finding (75 Fed. Reg.16713 (Apr. 2, 2010)) wherein the petition was determined to contain substantial information indicating that listing the species may be warranted. Thus, NMFS initiated a comprehensive status review of bumphead parrotfish, which was completed jointly by our Pacific Islands Fisheries Science Center (PIFSC) and Pacific Islands Regional Office (PIRO). PIFSC established a Bumphead Parrotfish Biological Review Team (BRT) to complete a biological report on the status of the species, and threats to the species (hereafter "BRT Report", cited as Kobayashi *et al*. 2011). PIRO staff completed this report on management activities affecting the species across its range, including existing regulatory mechanisms and non-regulatory conservation efforts (hereafter "Management Report"). The BRT Report and this Management Report together constitute the comprehensive bumphead parrotfish status review.

The comprehensive status review will form the basis for the Bumphead Parrotfish 12-month Finding, which is NMFS' determination of whether the species warrants listing under the ESA or not. If the 12-month Finding determines that listing is warranted, then NMFS will also publish a proposed rule proposing to list the species as threatened or endangered under the ESA, followed by a public comment period. If the 12-month Finding determines that listing is not warranted, no further action will be taken by NMFS in response to the petition.

The purposes of the ESA are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species. The U.S. Fish and Wildlife Service (USFWS) and NMFS share responsibility for administering the ESA; NMFS is responsible for determining whether marine, estuarine or anadromous species, subspecies, or distinct population segments are threatened or endangered under the ESA.

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." 16 U.S.C. § 1532(16). The term "endangered species" means "any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection under the provisions of this Act would present an overwhelming and overriding risk to man." 16 U.S.C. § 1532(6). 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." 16 U.S.C. § 1532(20).

The process for determining whether a species should be listed as threatened or endangered is based upon evaluating "the best scientific and commercial data available . . . ." 16 U.S.C. § 1533(b)(1)(A). Section 4(a)(1) of the ESA states that:

"[t]he Secretary shall . . . determine whether any species is an endangered species or a threatened species because of any of the following factors:

(A) the present or threatened destruction, modification, or curtailment of its 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."

16 U.S.C. § 1533(a)(1). In addition, Section 4(b)(1)(A) of the ESA requires NMFS to take into account conservation efforts being made to protect a species that has been petitioned for listing. § 1533(b)(1)(A). Factors A, B, C, and E above were considered in the BRT Report (Kobayashi *et al*. 2011). Factor D, and conservation efforts were not considered by the BRT in its report. As such, the first purpose of this report is to identify existing regulatory mechanisms, as per ESA Section 4(a)(1)(D), that address threats identified by the BRT. The second purpose of this report is to identify conservation efforts that may have a beneficial effect on the status of bumphead parrotfish as per ESA Section 4(b).

Existing regulatory mechanisms summarized in this Management Report include international treaties, laws, decrees, executive orders, rules and/or regulations enacted and being implemented by some governing body or official, whether they are international organizations, national governments, state and local authorities, heads-of-state, or other so empowered officials, affecting the status of bumphead parrotfish. Conservation efforts summarized in this report include actions, activities, and programs undertaken by both governmental and non-governmental organizations ("NGOs," e.g., conservation groups, private companies, academia, etc.) that may eliminate or reduce threats or otherwise improve the status of bumphead parrotfish.

In summary, the purpose of this Management Report is to summarize existing regulatory mechanisms and conservation efforts relevant to the extinction risk of bumphead parrotfish. The information in this report will then be used in the Bumphead Parrotfish 12-month Finding to determine whether these existing regulatory mechanisms and conservation efforts contribute to the species' extinction risk.

1.1 Current Range and Habitat Distribution of the Species

According to the BRT Report (Kobayashi *et al*. 2011), bumphead parrotfish currently occur in 45 countries in the Indo-Pacific region, ranging from east Africa to most of Polynesia and southern Japan (Fig. 1). The species also occurs in the disputed Spratly and Paracel Islands in the South China Sea. Because regulatory mechanisms are unclear in those areas, they are treated as a separate entity in this report, collectively referred to as "Disputed Areas". Within the United States, bumphead parrotfish occur in the Commonwealth of the Northern Mariana Islands, Territories of Guam and American Samoa, and the U.S. Pacific Remote Island Areas, but not in Hawaii or at Johnston Atoll (Fig. 1). The BRT Report found no evidence of the species occurring in the Chagos, Cook, Tuamotu, or Marquesas Islands.

Because of how the terms "threatened" and "endangered" are defined in the ESA (see above), the Significant Portion of a species' Range (SPOIR) is an important distinction in ESA status reviews. The BRT Report (Kobayashi *et al*. 2011) developed an ecological SPOIR index based on biogeographical patterns, adult habitat availability, juvenile habitat availability, and larval connectivity. The index was quantified for each area within the current range of the species and

those areas with an index value greater than the median value were considered to be part of SPOIR. The 26 countries (or parts thereof) that are included in SPOIR are shown in Table 1 below. For further information on NOAA's draft policy on the interpretation of the phrase "Significant Portion of its Range" please refer to Federal Register / Vol. 76, No. 237 (76 FR 76987; December 9, 2011).

Bumphead parrotfish habitat consists primarily of coral reefs for adults, and mangroves, coral reef lagoons, and backreefs for juveniles (Kobayashi *et al*. 2011). Habitat is distributed very unevenly among the 46 areas, with only five countries (i.e. Australia, Indonesia, Philippines, France, and Papua New Guinea) possessing over 60% of total coral reef area in the 45 countries (Table 2; Appendix A-1). Likewise, Indonesia possesses approximately 40% of total mangrove area in the 46 areas (Table 3, Appendix B). By comparison, the U.S. possesses only 0.3% of total coral reef area, and even less of total mangrove area.

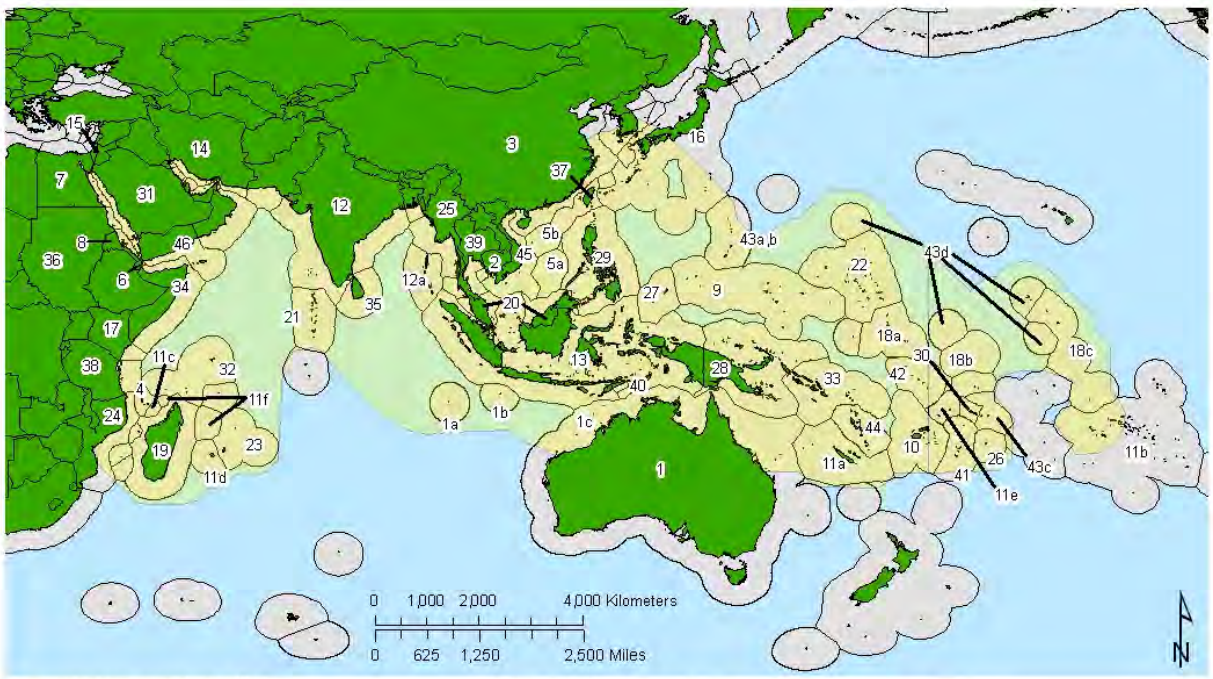

Figure 1. Current range of bumphead parrotfish (green-brown shading), showing the 46 areas (45 countries & Disputed Areas) and their 200 mile Economic Exclusion Zones that are partially or entirely within the current range of the species. The 46 areas are listed below in Tables 1, 2, and 3 showing the proportional coral reefs (Table 2) and mangroves (Table 3) within each area relative to all coral reefs and mangroves in the 46 areas combined. The Significant Portion of its Range (SPOIR) for bumphead parrotfish is not shown in this figure, but rather described in Table 1.

Table 1. The 46 areas (45 nations plus Disputed Areas) shown in Figure 1 within the current range of bumphead parrotfish, divided into: A. the 27 areas within the Significant Portion of its Range (SPOIR), and B. the 22 areas outside of SPOIR. There are 49 areas listed in the table because Australia, France and the U.S. each have areas within and outside of SPOIR.

A. Areas within SPOIR		B. Areas outside of SPOIR	
Australia[1]	Myanmar	Australia[2]	Saudi Arabia
Cambodia	Palau	Djibouti	Somalia
China	Papua New Guinea	Egypt	Sudan
Comoros Islands	Philippines	Eritrea	Tonga
Disputed Areas	Seychelles	Fiji	Tuvalu
Fed. States of Micronesia	Solomon Islands	France[4]	United States[5]
France[3]	Sri Lanka	Iran	Vanuatu
India	Taiwan	Israel	Yemen
Indonesia	Tanzania	Japan	
Kenya	Thailand	Kiribati	
Madagascar	Timor-Leste	Marshall Islands	
Malaysia	United States[6]	Mauritius	
Maldives	Vietnam	Niue	
Mozambique		Samoa	

[1]Includes Australia's mainland, Christmas Island and Norfolk Island.
[2]Limited to Australia's Cocos-Keeling Islands.
[3]Limited to French territory of Mayotte.
[4]Includes the French territories of New Caledonia, French Polynesia, Reunion, Wallis and Futuna.
[5]Includes the Commonwealth of the Northern Mariana Islands, Territory of Guam, and the US Pacific Island Remote Area.
[6] Limited to U.S. territory of American Samoa.

Table 2. The 46 areas (45 nations plus Disputed Areas), showing proportional coral reef area relative to all coral reefs in the 46 areas combined (Appendix A-1). The list of areas is shown alphabetized (L) and by area (R).

COUNTRY/AREA	%
Australia	19.8
Cambodia	0.1
China	0.3
Comoro Islands	0.2
Disputed Areas	1.8
Djibouti	0.1
Egypt	1.5
Eritrea	0.9
Fiji	3.1
France	6.8
India	1.6
Indonesia	18.5
Iran	0.1
Israel	0.0
Japan	0.8
Kenya	0.3
Kiribati	1.4
Madagascar	1.8
Malaysia	1.4
Maldives	2.5
Marshall Islands	1.7
Mauritius	0.5
Micronesia	2.3
Mozambique	1.1
Myanmar	0.6
Niue	0.0
Palau	0.5
Papua New Guinea	6.8
Philippines	10.5
Samoa	0.2
Saudi Arabia	2.5
Seychelles	0.9
Solomon Islands	3.2
Somalia	0.3
Sri Lanka	0.1
Sudan	0.5
Taiwan	0.3
Tanzania	1.4
Thailand	0.2
Timor-Leste	0.1
Tonga	0.8
Tuvalu	0.6
United States	0.3
Vanuatu	0.8
Viet Nam	0.4
Yemen	0.4
Total	100.0

COUNTRY/AREA	%
Australia	19.8
Indonesia	18.5
Philippines	10.5
France	6.8
Papua New Guinea	6.8
Solomon Islands	3.2
Fiji	3.1
Maldives	2.5
Saudi Arabia	2.5
Micronesia	2.3
Madagascar	1.8
Disputed Areas	1.8
Marshall Islands	1.7
India	1.6
Egypt	1.5
Kiribati	1.4
Tanzania	1.4
Malaysia	1.4
Mozambique	1.1
Seychelles	0.9
Eritrea	0.9
Vanuatu	0.8
Japan	0.8
Tonga	0.8
Myanmar	0.6
Tuvalu	0.6
Sudan	0.5
Mauritius	0.5
Palau	0.5
Yemen	0.4
Viet Nam	0.4
Kenya	0.3
United States	0.3
Taiwan	0.3
China	0.3
Somalia	0.3
Thailand	0.2
Samoa	0.2
Comoro Islands	0.2
Iran	0.1
Sri Lanka	0.1
Djibouti	0.1
Timor-Leste	0.1
Cambodia	0.1
Niue	0.0
Israel	0.0
	100.0

Table 3. The 46 areas (45 nations plus Disputed Areas), showing proportional mangrove area relative to all mangroves in the 46 areas combined (Appendix A-1). The list of areas is shown alphabetized (L) and by surface area (R).

COUNTRY	%
Australia	12.4
Cambodia	0.9
China	0.3
Comoro Islands	0.0
Disputed Areas	0.0
Djibouti	0.0
Egypt	0.0
Eritrea	0.1
Fiji	0.5
France	0.3
India	5.4
Indonesia	40.0
Iran	0.2
Israel	0.2
Japan	0.0
Kenya	0.8
Kiribati	0.0
Madagascar	3.8
Malaysia	8.9
Maldives	0.0
Marshall Islands	0.0
Mauritius	0.0
Micronesia	0.1
Mozambique	3.6
Myanmar	6.3
Niue	0.0
Palau	0.1
Papua New Guinea	5.3
Philippines	3.2
Samoa	0.0
Saudi Arabia	0.3
Seychelles	0.0
Solomon Islands	0.8
Somalia	0.1
Sri Lanka	0.1
Sudan	0.0
Taiwan	0.0
Tanzania	1.6
Thailand	3.1
Timor-Leste	0.0
Tonga	0.0
Tuvalu	0.0
United States	0.0
Vanuatu	0.0
Viet Nam	1.3
Yemen	0.0
Total	99.7

COUNTRY	%
Indonesia	40.0
Australia	12.4
Malaysia	8.9
Myanmar	6.3
India	5.4
Papua New Guinea	5.3
Madagascar	3.8
Mozambique	3.6
Philippines	3.2
Thailand	3.1
Tanzania	1.6
Viet Nam	1.3
Cambodia	0.9
Solomon Islands	0.8
Kenya	0.8
Fiji	0.5
Saudi Arabia	0.3
France	0.3
China	0.3
Israel	0.2
Iran	0.2
Sri Lanka	0.1
Somalia	0.1
Palau	0.1
Micronesia	0.1
Eritrea	0.1
Yemen	0.0
Vanuatu	0.0
United States	0.0
Tuvalu	0.0
Tonga	0.0
Timor-Leste	0.0
Taiwan	0.0
Sudan	0.0
Seychelles	0.0
Samoa	0.0
Niue	0.0
Mauritius	0.0
Marshall Islands	0.0
Maldives	0.0
Kiribati	0.0
Japan	0.0
Egypt	0.0
Djibouti	0.0
Disputed Areas	0.0
Comoro Islands	0.0
	99.7

1.2 Threats to the Species

Bumphead parrotfish are susceptible to a variety of threats, as described in Chapter 3 of the BRT Report (Kobayashi *et al*. 2011). The BRT Report describes each threat and provides ratings for the level of historic, current, and future risk (i.e. 40-100 years into the foreseeable future) for each. Additionally, each threat was given a ranking of high, medium, or low based on its perceived significance in terms of posing an extinction risk to bumphead parrotfish throughout its range (Table 4). "NA" indicates there are no data to support the conclusion that this threat is likely to affect the species with the severity and geographic scope ascribed (Kobayashi *et al*. 2011).

Adult harvest and juvenile habitat loss are the highest-ranked threats that currently exist and are expected to persist into the future. Other threats to bumphead parrotfish that can be addressed via regulatory mechanisms designed to regulate human behavior are adult habitat loss, global warming, ocean acidification, juvenile harvest, and pollution, all of which received current and future impact ratings ranging from nil+ (i.e. very low) to medium+ severity by the BRT (Table 4 below, Kobayashi *et al*. 2011). Remaining threats are ones not easily addressed with regulatory mechanisms designed to regulate human activities as they are generally naturally occurring (in italics in Table 4), and the BRT was unable to rate the severity of most of these threats. Several threats were considered likely to worsen in the future, especially those related to climate change. For more detailed information regarding each individual threat, please refer to the threats section in the BRT Report.

Table 4. Summary of threats to bumphead parrotfish considered by the BRT in assessing extinction risk to the species. "Importance" refers to the BRT's ratings of severity of current impact of each threat, and future impact (40-100 years) of each threat (from Table 11, Kobayashi *et al*. 2011). Italicized threats are those not easily addressed with regulatory mechanisms designed to regulate human activities.

Threat	**Importance**	
	Current	**Future**
Harvest or harvest-related adult mortality	High	High
Juvenile habitat loss, or loss of quality	High	High
Adult habitat loss or loss of quality, including nighttime shelters	Medium	Medium+
Global warming	Medium	Medium+
Recruitment limitation or variability	Medium	Medium+
Capture or capture related juvenile mortality	Medium	Medium
Pollution	Low	Medium-
Predation	Low-	Low-
Ocean acidification	Nil+	Low-
Competition	NA	NA
Disease	NA	NA
Parasites	NA	NA
Starvation	NA	NA
Low population effect (depensation, genetic, etc.)	NA	NA

The seven threats that can be addressed via regulatory mechanisms fall into three groups: (1) Harvest (adult harvest, juvenile harvest); (2) Habitat Loss/Degradation (juvenile habitat loss/degradation, adult habitat loss/degradation, pollution); and (3) Climate Change (ocean warming, ocean acidification). They are each described in more detail below.

1.2.1 Harvest

Direct harvest is a threat to both adult and juvenile bumphead parrotfish. Adult harvest is one of the two most severe current and future threats to bumphead parrotfish, rated as "high" both currently and in the future by the BRT (Table 4 above). More is known about the level of adult harvest than juvenile harvest; both are described in more detail below to provide context for the following discussion of regulatory mechanisms addressing these activities.

1.2.1.1 Adult and Sub-Adult Harvest

Bumphead parrotfish possess certain life history characteristics that increase their vulnerability to harvest, such as nocturnal resting behavior, diurnal feeding behavior, large size, accessible habitat choices, and conspicuous coloration. Immature bumphead parrotfish recruit to adult habitat including coral reef forereefs at 40 – 50 cm total length (TL) (considered large juveniles or sub-adults), thus the following descriptions of life history characteristics apply to both sub-adults and adults. As described in the BRT Report (Kobayashi *et al*. 2011), at dusk, bumphead parrotfish move to nocturnal resting sites found among sheltered forereef and lagoon habitats, sometimes as shallow as two meters (Johannes 1981). At night, bumphead parrotfish frequently remain motionless while resting, utilizing caves, passages, and other protected habitat features as refuges, and are often seen resting in groups (Figs. 2A and 2B). Unlike other parrotfish species, bumphead parrotfish do not excrete a mucus cocoon to rest within. They also exhibit resting site fidelity, consistently returning to specific resting sites.

Bumphead parrotfish are also vulnerable to harvest during the daytime for several reasons. As described in the BRT Report (Kobayashi *et al*. 2011), bumphead parrotfish habitat and behavior are distinct between diurnal and nocturnal periods. The species feeds during the daytime by foraging among forereef, reef flat, reef pass, and clear outer lagoon habitats at depths of 1-30 m (Fig. 2C), often in schools of 20 to over 100 individuals (Fig. 2D). Schools effectively announce their presence by loud crunching noises that accompany their feeding behavior, which can be heard under water at least several hundred meters away. In addition, bumphead parrotfish may form spawning aggregations during the daytime. They can be large in size and exhibit conspicuous coloration. Bumphead parrotfish grow to at least 110 cm TL (Kobayashi *et al*. 2011) and well over 50 kg. Large individuals are caught by sport fishers, both by fly-fishing (Fig. 3A) and with spear-guns (Fig. 3B). The current spearfishing world record for the species is 58.9 kg (Figs. 3C and 3D). Even immature individuals may be 50 cm TL and weigh 20 kg. Such large fish are typically preferred over other reef fish for harvest. Adults are primarily olive to blue green or grey with the anterior region near the head being yellow to pink in coloration, and terminal males can be bright green (Figs. 2 and 3).

Indo-Pacific coral reef fisheries are nearly as diverse as the species they target, and include many subsistence, commercial, and sport/recreational fisheries employing a vast array of traditional, modern, and hybrid methods and gears (Newton *et al*. 2007; Wilkinson 2008; Armada *et al*. 2009; Cinner *et al*. 2009b). Selective gears and methods are used to target and harvest individual bumphead parrotfish, while less selective gears and methods are used to harvest many different

species, which sometimes includes bumphead parrotfish. Selective gears include spears and related gears (e.g., harpoons, bangsticks, bow-and-arrow), as well as hook-and-line and poisoning. Less selective gears and methods include gillnets, drive nets, traps, pots, weirs, and corrals, small-mesh seine nets, and blasting. Harvest gears and methods are divided into two categories: (1) spearfishing and harpooning; (2) Other gear types, and described further below.

Spearfishing and Harpooning.

Fishing with a spear underwater while free-diving or scuba diving is commonly referred to as "spearfishing," while fishing with a spear from shore or boat/canoe is commonly referred to as "harpooning." Spearfishing can be done with a hand-spear powered by an elastic loop, (variations of which exist like the Hawaiian sling), or a speargun consisting of a spear, a stock, and a handle with a trigger mechanism. Spearguns can be powered by rubber (Fig. 4A) or pressurized air. Spearfishing for reef fish is very common throughout most of the range of bumphead parrotfish. Harpooning for reef fish is less common within bumphead parrotfish range and typically performed with a long hand spear from the bow of a boat or canoe.

Both spearfishing and harpooning have been historically common methods of bumphead parrotfish harvest in some or all of the species range because they inhabit shallow waters, grow to a large size, and exhibit conspicuous coloration. However, historically, the effectiveness of spearfishing was limited by the absence of modern dive masks, rubber slings, and dive-lights. As technology developed, spearfishing became much more effective, especially at night, when the use of scuba gear, spearguns, and dive-lights became common. Technological improvements in the 20th century led to a vast increase in spearfishing effort, including for subsistence, commercial, and sport reef fish fisheries. Thus, spearfishing is considered a primary method for harvesting bumphead parrotfish. Alternatively, harpooning has become less common with all the improvements in spearfishing efficiency and is not considered a primary method for harvesting bumphead parrotfish, and therefore is not considered further in this report.

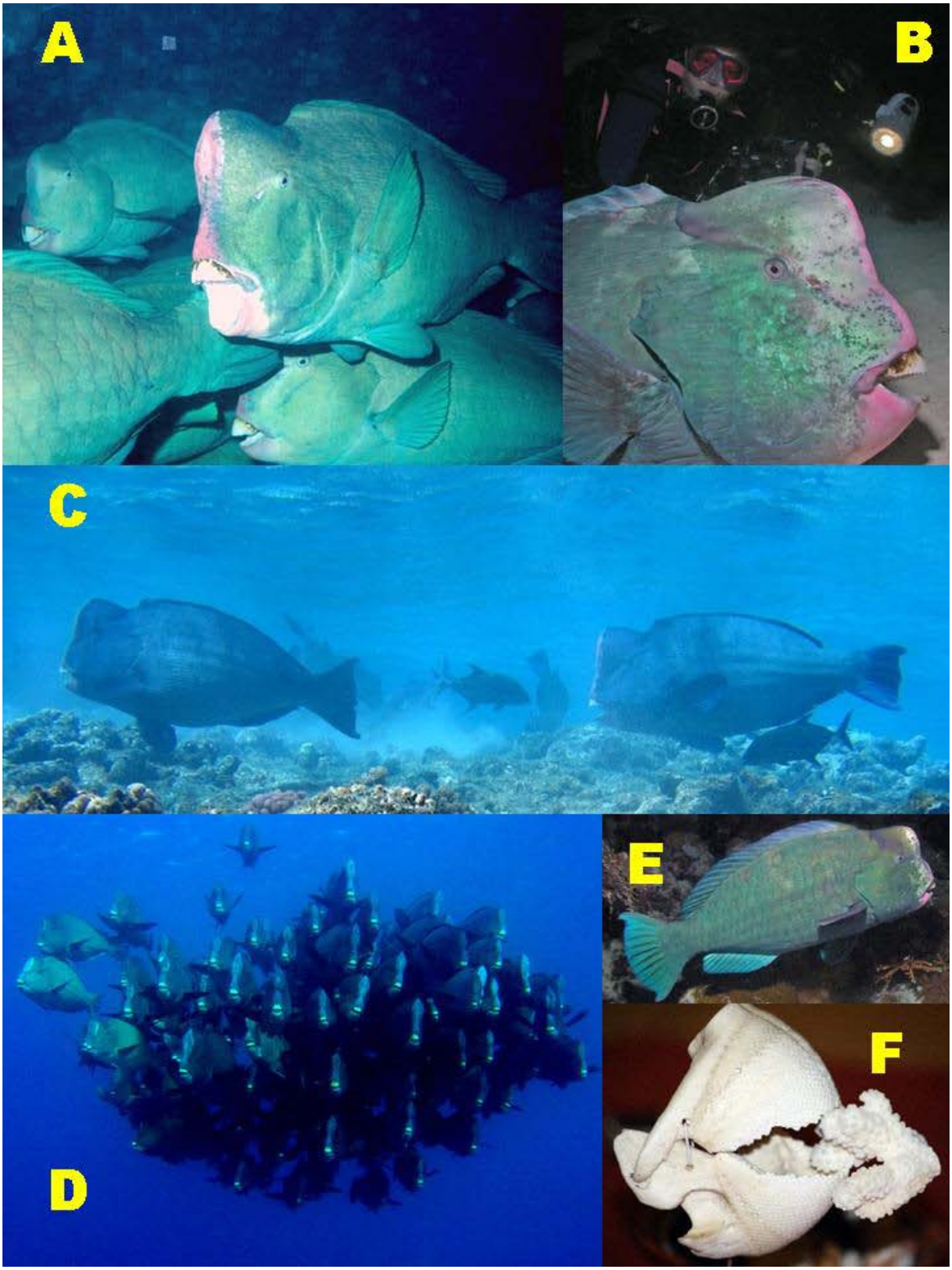

Figure 2. *Bolbometopon muricatum*: (A & B) Resting at night; A, Malaysia (photo by Steve Turek), B, Sudan (photo by Bob & Carol Cox); (C) A pair on Osprey Reef, Coral Sea, Australia (photo by Richard Ling); (D) School on Great Barrier Reef, Australia (photo by David Burdick); (E) At night in Sudan (photo by Bob & Carol Cox); and (F) Jaws purchased in New Caledonia (photo by Malo Hosken). All photos reproduced with permission of identified photographer or organization (photo credit details provided at end of report).

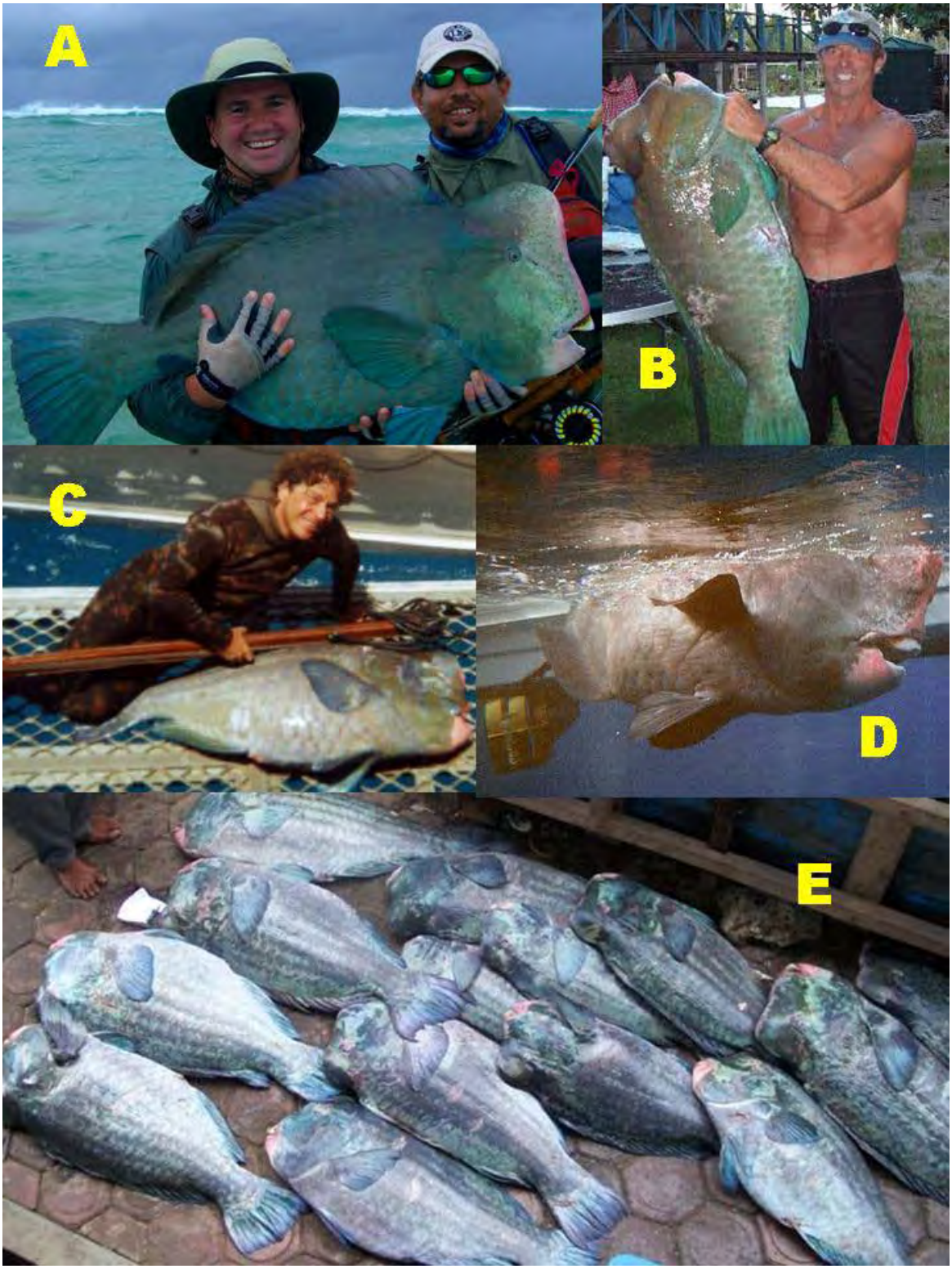

Figure 3. Captured bumphead parrotfish: (A) Fly-fishing in Seychelles (photo provided by Ricko Cronje); (B) Spearfishing at Tabuaeran (photo provided by David Janikowski); (C & D) Spearfishing world record, Australia (photos provided by Marc Alexander); and (E) Group of fish caught by unidentified method, Aceh, Indonesia (photo provided by Crispen Wilson). All photos reproduced with permission of identified photographer or organization (photo credit details provided at end of report).

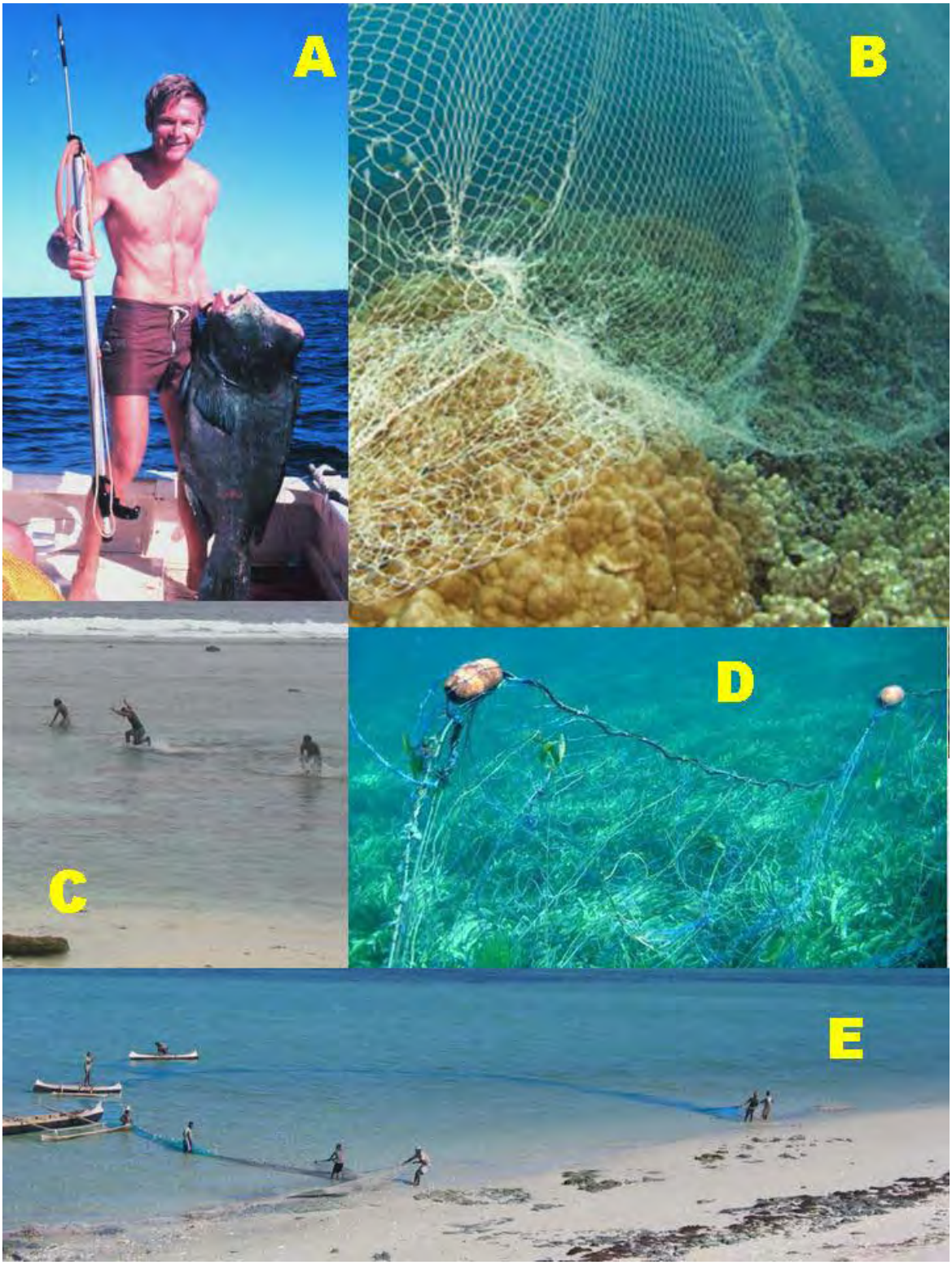

Figure 4. Methods & Gears I: (A) Spearfishing, Tutuila, American Samoa (photo by John Naughton); (B) Bottom-set gillnet, Big Island, Hawaii (photo by Bo Pardau); (C) Shallow lagoon drive netting, Ofu Island, American Samoa; (D) A bottom-set gillnet on seagrass, Kenya (photo provided by Adam Tuller); and (E) Beach seine netting in northwestern Madagascar (photo by Simon Harding). All photos reproduced with permission of identified photographer or organization (photo credit details provided at end of report).

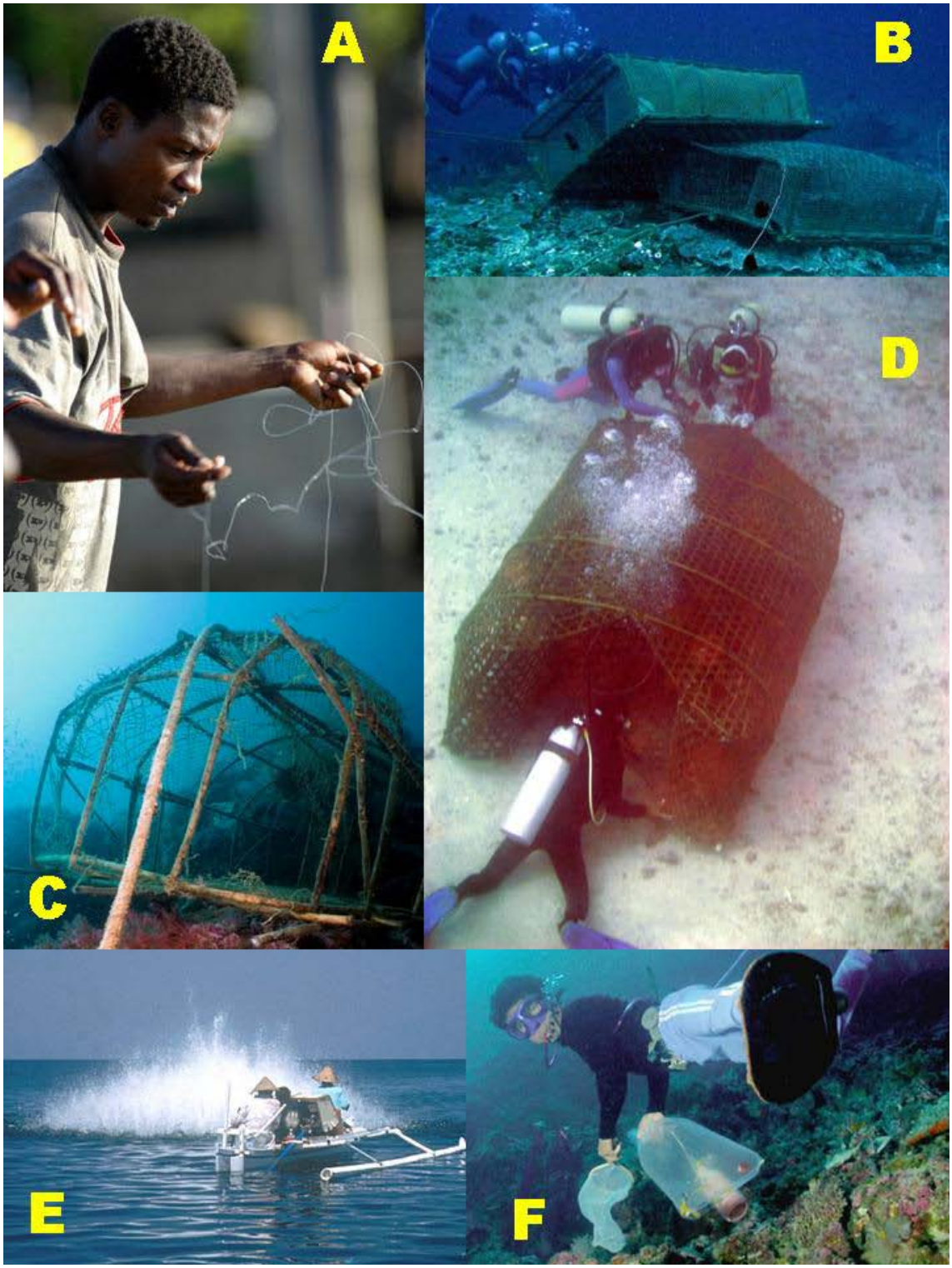

Figure 5. Methods & Gears II: (A) Handline fishing in Kenya (photo provided by Jay Berkley); (B & C) Fish traps in the Philippines and Thailand (photos provided by Phil McGuire [B] and Erika Antoniazzo [C]); (D) Fish trap in Indonesia (photo provided by Bruce Yates); (E) Blast fishing in the Philippines (photo provided by Reef Check Philippines); and (F) Cyanide fishing in the Philippines (photo provided by Reef Check Philippines). All photos reproduced with permission of identified photographer or organization (photo credit details provided at end of report).

Other gear types.

Other less selective gear types are used to harvest adult bumphead parrotfish, including but not limited to various types of nets, handlines, and traps. A variety of nets are used on or near coral reefs in the 45 countries where bumphead parrotfish are found (Fig. 1). Netting gears and methods of primary concern for bumphead parrotfish are gillnets, seine nets, and drive nets.

The most common type of net used on or near coral reefs within the range of bumphead parrotfish is stationary, bottom-set gillnets. These nets fish passively as a panel of net is set on the substrate and not actively tended (Figs. 4B and 4D). Fish are caught as they swim into the net and become entangled. Gillnets are commonly made of monofilament nylon with floats along one side and weights on the other. Use of monofilament gillnets spread rapidly within bumphead parrotfish range after they became widely available and affordable in the 1960s and 1970s. Beach seine nets are commonly used in coral reef lagoons, beaches, and reef flats in some countries within the range of bumphead parrotfish, especially in east Africa (Fig. 4E), India, New Caledonia, and other areas. Such nets fish actively because they are cast and subsequently pulled towards shore or a boat. They are commonly set in sandy areas near coral reefs to target reef fish species, including parrotfishes. Small mesh sizes are common because they capture all but the smallest fish. Like gillnets, beach seine nets are typically made of monofilament, have a float line and a weight line, and became widely available and affordable in the 1960s and 1970s. Even when bumphead parrotfish are not the target species of fishers using gillnets or seine nets, they may be incidentally caught by these gear types (i.e. "bycatch"). Fishermen who catch bumpheads as bycatch likely retain the fish and consider it valuable, although, at times fish caught may be large enough to cause extensive damage to the net.

Drive fishing or hunting refers to herding or chasing fish into a stationary net or onto shore (AKA "drive-in fishing" and "scare fishing"). There are many varieties of drive fishing, including large-scale "muro-ami" in which 30 or more swimmers dragging lines and weights across a forereef herd fish into a bucket shaped net. This method was commonly used on coral reefs in the Philippines, but was banned in the 1980s because of reef damage and child labor concerns. It was replaced by another type of drive fishing that uses air lines instead of weights (i.e. "pa-aling"). Drive fishing may also be done in shallow coral reef lagoons, where waders chase fish through the shallow water into a stationary gillnet or other type of net (Fig. 4C). When bumphead parrotfish are targeted by drive nets, the gear is employed with the intent to capture a bumphead parrotfish school in its entirety. When fishers use this gear to target other reef fishes, it is likely that bumphead parrotfish are caught incidentally as well.

The term "trap," when used in this report, refers to any cage, trap, pot, enclosure, weir, corral, or similar device or structure used to capture reef fish unharmed. Fish traps at least two to three meters in diameter are common in some parts of the range of bumphead parrotfish (e.g., southeast Asia; Figs. 5B, 5C, and 5D). Such traps are baited and left in place on the reef for days or weeks to capture large reef fish. Traps may be tethered (Figs. 5B and 5C) or untethered (Fig. 5D). Smaller traps are very common throughout much of the range of bumphead parrotfish, and may be used in both juvenile and adult habitats. Weirs and corrals are typically constructed on reef flats and used in conjunction with tides to capture reef fish. Large traps, small traps, weirs, and corrals may capture adult and/or juvenile bumphead parrotfish.

Aside from spearfishing, netting, and trapping, several other gears and methods may be used to selectively or non-selectively catch bumphead parrotfish. Bow-and-arrow was used traditionally in many countries to hunt reef fish and may still be used, especially in remote areas. Bang sticks (AKA "shark sticks") can be used to hunt reef fish, especially at night. Sport fly-fishing (Fig. 3A) and rod-and-reel fishing are sometimes used to target bumphead parrotfish. Hand-line fishing (Fig. 5A) is a very common method of fishing for coral reef fish, and in some areas bottom-set longlining is done in proximity to coral reefs. Because the methods and gears in this paragraph are not considered to be of major concern in the harvest of bumphead parrotfish, they are not considered further in this report.

Some of the above gears are prohibited in some countries or when used in certain ways (e.g. SCUBA spearfishing, muro-ami nets, large weirs, and bang-sticks). Even though many destructive gears and methods are illegal in most countries with coral reef habitat within their jurisdiction, they are still used within the range of bumphead parrotfish. Examples include blast fishing using explosives to kill or stun fish, and the use of poisons like bleach or cyanide. Blast fishing is very damaging to coral reef habitat as it gets blasted apart and fishermen sometimes break apart corals and reef structures to reach fish they have poisoned.

1.2.1.2 Juvenile Harvest

Fish less than 50 cm total length are considered juveniles. Most of the information provided above regarding adult harvest is relevant to juvenile harvest because larger juveniles are harvested with spears, and juveniles of all sizes are harvested with nets, traps and other gears. The BRT defined juvenile harvest as "capture or capture-related juvenile mortality." The BRT rated the severity of juvenile harvest as "medium" both currently and in the future (Table 4 above). As noted in the BRT Report, harvest of juvenile bumphead parrotfish is not well documented, but is thought to be very common in much of the species range because juveniles can reach large sizes, and occupy habitats such as coral reef lagoons that are easily accessed by fishers (Kobayashi *et al*. 2011).

1.2.2 Habitat Loss/Degradation

Habitat loss and degradation threatens both adults and juveniles, and pollution is a threat throughout all bumphead parrotfish habitat types. Along with adult harvest, loss and/or degradation of juvenile habitat (i.e. mangrove swamps, seagrass beds, coral reef lagoons) was rated as the most severe threat to bumphead parrotfish by the BRT. Loss and/or degradation of adult habitat (coral reefs) and pollution were rated as lower severity threats, but are predicted to worsen in the future (40-100 years) in the absence of management. These three habitat-related threats are described in more detail below.

1.2.2.1 Juvenile Habitat Loss/Degradation

The BRT rated the severity of juvenile habitat loss/degradation as "high" both currently and in the future (Table 4). Juvenile bumphead parrotfish habitat includes mangrove swamps, seagrass beds, coral reef lagoons, and likely other coastal habitats. These nearshore, shallow water areas are vulnerable to pollution, modification, and impacts from coastal development. Juvenile habitat specificity highlights this phase of bumphead parrotfish life history as highly vulnerable.

After larvae settle in benthic areas, juveniles remain cryptic for several years before recruiting to adult forereef habitat at approximately five years of age (Kobayashi *et al*. 2011). Juvenile

habitat can be destroyed or degraded by many different types of human activities, including but not limited to: timber harvest (mangroves), mining, coastal development, marine structures, terrestrial run-off, pollutant spills, and recreation. Relevant regulatory mechanisms for juvenile habitat loss broadly address different types of juvenile habitat. For mangroves, relevant regulatory mechanisms include those that regulate timber harvest, coastal development, terrestrial run-off, pollution, fishing, recreation, and other activities. For coral reef lagoons and seagrass areas, relevant regulatory mechanisms include those that regulate live coral collection, limestone mining, coastal development, terrestrial run-off, pollution, recreation, and other activities. This vast array of regulatory mechanisms will be collectively termed "coastal management" in this report.

1.2.2.2 Adult Habitat Loss/Degradation

Coral reefs are susceptible to a variety of local (e.g., pollution, ship groundings) and global (e.g., global warming, ocean acidification; addressed separately below) threats. As with juvenile habitat loss/degradation, the vast array of coastal management regulatory mechanisms are relevant for adult habitat loss/degredation. In contrast to juvenile habitat, the BRT concluded that adult habitat loss and/or degradation "is not a high priority concern" (Kobayashi *et al*. 2011).

1.2.2.3 Pollution

The BRT rated the severity of pollution as "low" currently, and "medium-" in the future (Table 4 above). Catastrophic events such as oil spills can wreak havoc on coral reef ecosystems, but such events remain episodic and are usually localized relative to a widely-distributed, mobile species such as the bumphead parrotfish. Habitat degradation as a result of pollution is more likely in juvenile habitat than adult habitat because it is more exposed to such anthropogenic impacts due to shoreline proximity, shallow depth, and restricted circulation (e.g., bays or lagoons).

1.2.3 Climate Change

Climate Change threats to bumphead parrotfish include global warming and ocean acidification. Impacts from these threats are likely to be somewhat indirect because warming and acidification are predicted to have negative consequences for coral reefs, the primary habitat type for adult and large juvenile bumphead parrotfish. The BRT rated both threats as lower severity than adult harvest and juvenile habitat loss, but as increasing in severity in the future. These two threats are described in more detail below.

1.2.3.1 Global Warming

The global mean temperature has risen 0.76°C over the last 150 years, and the linear trend over the last 50 years is nearly twice that for the last 100 years (IPCC 2007). As a result of increasing anthropogenic greenhouse gases (GHGs) in the atmosphere since the Industrial Revolution, sea surface temperatures are also rising, including in waters around many coral reefs. Ocean warming is a primary driver of coral bleaching and disease. Ocean warming results in bleaching of adult coral colonies, wherein corals expel their symbiotic zooxanthellae in response to stress. Corals can withstand mild to moderate bleaching; however, severe, repeated, or prolonged bleaching can lead to colony death. Ocean warming is also a primary cause of increased prevalence and severity of coral diseases, for example by causing pathogens to grow faster and be more virulent. Impacts of global warming on coral reefs may be important for bumphead parrotfish because both adults and large juveniles occur primarily in coral reef habitats. The

BRT rated the severity of global warming as a threat to bumphead parrotfish as “medium” currently, and “medium+” in the future (Table 4 above).

1.2.3.2 Ocean Acidification

Also as a result of increasing atmospheric GHGs, specifically the increasing concentrations of CO_2 in the atmosphere, a corresponding change occurred in the partial pressures of CO_2 in the surface ocean, resulting in reduced pH (i.e., ocean acidification). Ocean acidification may reduce coral calcification, leading to reduced coral growth rates and increased mortality, among many other detrimental effects. Impacts of global warming on coral reefs may be important for bumphead parrotfish because both adults and large juveniles occur primarily in coral reef habitats. The BRT rated the severity of ocean acidification as a threat to bumphead parrotfish as “nil+” currently, and “low-” in the future (Table 4 above).

2. Regulatory Mechanisms

As described in the Introduction, for the purposes of this report, existing regulatory mechanisms are defined as international treaties, laws, decrees, executive orders, rules and/or regulations implemented by some governing body or official, whether they are international organizations, national governments, state and local authorities, head-of-state, or other so empowered official, that address threats identified by the BRT Report, and summarized in Section 1.2 above. While international and national regulatory mechanisms are important for all three categories of threats, the manner in which regulatory mechanisms address Harvest and Habitat Loss/Degradation threats is much different than how they address Climate Change threats. Sections 2.1 and 2.2 describe international and national regulatory mechanisms for Harvest and Habitat Loss/Degradation threats, while Sections 2.3 and 2.4 address international and national regulatory mechanisms for Climate Change threats.

2.1 Regulatory Mechanisms Addressing Harvest and Habitat Loss/Degradation Threats

Regulatory mechanisms (laws, decrees, regulations, etc., for the management of fisheries, coastal habitats, and protected areas) of 46 areas (45 countries and Disputed Areas) within the range of bumphead parrotfish were compiled in relation to Harvest and Habitat Loss/Degradation threats. These mechanisms were grouped into two categories: (1) Regulatory mechanisms for fisheries and coastal management; and (2) Additional regulations within MPAs and other relevant protected areas (e.g., mangroves). Generally, the first level encompasses a broad array of laws and decrees across many jurisdictional scales from national to local, whereas the second level consists of additional regulations that may apply within MPAs/protected areas in each jurisdiction.

Although adult harvest is more well-documented than juvenile harvest, many of the gear types discussed in Sections 1.2.1.1 and 1.2.1.2 may be used to harvest both adults and large juveniles. As such, regulatory mechanisms for harvest methods are not separated into methods specific to adult harvest and juvenile harvest, unless specifically noted. For both large juveniles and adults, spearfishing is a highly selective and primary gear type for bumphead parrotfish harvest, but several other gear types of concern for the species are also in use. Thus, all types of fisheries regulations that may apply to bumphead parrotfish were researched and compiled both inside and outside protected areas, with particular emphasis on spearfishing.

Loss and degradation of juvenile habitat may be caused by a wide variety of activities because juveniles inhabit mangrove swamps, seagrass beds, coral reef lagoons, and likely other coastal habitats. Although adults are typically confined to coral reefs, many of the impacts that exist for juvenile habitat also apply in adult habitat areas. Regulations related to the two primary habitats used by the species, mangrove swamps and coral reefs, were also researched and compiled both inside and outside of protected areas. Pollution as a threat is relevant to habitat loss and degradation for both juveniles and adults and is encompassed within existing regulations for specific habitat types. Because seagrass beds are found in or near mangroves and coral reefs, they are not considered separately. Below is an outline that roughly represents the type of information compiled for each of the 46 areas within bumphead parrotfish range, where available.

1. Fisheries and coastal management regulatory mechanisms:
    a. Harvest
        i. Spearfishing
        ii. Other Fisheries Regs
    b. Habitat Loss/Degradation
        i. Coral Reefs
        ii. Mangroves
2. MPA (and other protected areas) regulations:
    a. Harvest
        i. Spearfishing
        ii. Other Fisheries Regs
    b. Habitat Loss/Degradation
        i. Coral Reefs
        ii. Mangroves

For the U.S., regulatory mechanisms in each of the above categories were compiled for the four U.S. administrative units within bumphead parrotfish range (i.e. the Territory of American Samoa, Territory of Guam, Commonwealth of the Northern Mariana Islands, and the Pacific Remote Island Areas).

2.1.1 International Regulatory Mechanisms Addressing Harvest and Habitat Loss/Degradation Threats

Convention on International Trade in Endangered Species.[1]

The Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) is a treaty that pertains only to international trade. Species are proposed and, if accepted by the Conference of Parties, are included in one of several Appendix listings based on extinction risk. Appendix III listings do not require approval from the COP; the proposing country may list a species here unilaterally. Species in Appendix I are considered to be threatened with extinction and no commercial international trade of these species is permitted; non-commercial trade is permitted only under specific circumstances (e.g., for scientific research). Species in Appendix II are not considered threatened with extinction, but regulation of international trade is necessary to prevent endangerment. Appendix III contains species protected in countries that have asked the CITES Parties for assistance in controlling their trade. Trade of species listed in the three

1 http://www.cites.org/

Appendices requires all specimens to be legally obtained, and, if alive, be treated in a way that minimizes risk to the species in transport. To import any species listed in Appendix I, permits are required to indicate that: (1) the specimen will not be used for commercial purposes; and (2) take of the specimen is not detrimental to the species. No importing permits are required for species listed in Appendix II or III. Exporting permits are required for all species listed in all three Appendices from the country of export. Permitting is essential because it allows for the collection of data on international trade that is often useful in evaluating the degree of threat to a species, data which are generally not otherwise available. Section 9(c) of the ESA prohibits any person subject to the jurisdiction of the U.S. from engaging in any trade of any specimens contrary to the provisions of CITES or to possess any specimens traded contrary to the provisions of CITES (16 U.S.C. §1538(c)). While most reef-building corals are listed under CITES (all scleractinian corals are included in Appendix II), the bumphead parrotfish is not listed under CITES.[2]

Convention on Biological Diversity[3]

The Convention on Biological Diversity (CBD) was signed at the 1992 Rio Earth Summit by 150 governmental leaders to promote sustainable development. Its three main objectives are to conserve biological diversity, sustainably use components of biological diversity recognizing the sovereign use of resources of a State, and establish equal sharing from using genetic resources. Most countries participating in the CBD develop a National Biodiversity Strategy and Action Plan to implement the convention. The latest convention in 2010 focused on biodiversity, establishing the Strategic Plan for 2011-2020 which includes global biodiversity targets for ecosystem resilience.

Jakarta Mandate on Marine and Coastal Biological Diversity

The Jarkarta Mandate on Marine and Coastal Biological Diversity (Jakarta Mandate) is a multi-year program established in 1998 that is part of the Convention on Biological Diversity (CBD), and has the broad goal of conservation and sustainable use of marine and coastal biological diversity. It has five parts including integrated marine and coastal area management, sustainable use of marine and coastal living resources, establishment and maintenance of marine and coastal protected areas, mariculture, and alien species control (Secretariat of the Convention on Biological Diversity 1995).

Ramsar Convention[4]

The Convention on Wetlands of International Importance (Ramsar Convention) is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The Convention's mission is "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world." The Convention uses a broad definition of the types of wetlands covered in its mission, including lakes and rivers, swamps and marshes, wet grasslands and peatlands, oases, estuaries, deltas and tidal flats, near-shore marine areas, mangroves and coral reefs, and human-made sites such as fish ponds, rice paddies, reservoirs, and salt pans. Currently there are

2 www.cites.org/eng/app/appendices.pdf
3 http://www.cbd.int/
4 http://www.ramsar.org/cda/en/ramsar-home/main/ramsar/1_4000_0__

160 Contracting Parties with a total of 1,897 sites designated for the Ramsar list covering a total surface area of 185,621,539 hectares (ha).

United Nations Convention on the Law of the Sea[5]
The United Nations Convention on the Law of the Sea (UNCLOS) is an international agreement ratified by 160 states and the European Union (EU) intended for use in settling all matters related to the law of the sea. It outlines the delimitation of ocean space, environmental control, marine scientific research, economic and commercial activities, transfer of technology, and the settlement of disputes related to ocean matters. For example, the UNCLOS defines that coastal states have sovereign rights to their territorial sea up to 12 nautical miles (nm) from shore and sovereign rights within their exclusive economic zone (EEZ) up to 200 nm from shore. The U.S. has not ratified UNCLOS.

International Convention for the Prevention of Pollution from Ships[6]
The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. It combines two treaties adopted in 1973 and 1978 and includes the Protocol of 1997 (outlined in Annex VI). The Convention currently includes a total of six technical Annexes.

Annex I contains the Regulations for the Prevention of Pollution by Oil (entered into force October 2, 1983). It covers the prevention of pollution by oil from operational measures and accidental discharges. Amendments to Annex I in 1992 made it mandatory for new oil tankers to have double hulls and brought in measures for existing tankers to be fit with double hulls. Annex I was subsequently revised in 2001 and 2003.

Annex II contains the Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk (entered into force October 2, 1983). It outlines discharge criteria and measures for control of pollution by noxious liquid substances carried in bulk. There are 250 substances evaluated and included in the list appended to the Convention. No discharge of residues containing noxious substances is permitted within twelve miles of the nearest land.

Annex III is the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form (entered into force July 1, 1992). Annex III contains general requirements for standards on packing, marking, labeling, documentation, stowage, quantity limitations, exceptions and notifications for preventing pollution by harmful substances. Since 1991, the International Maritime Dangerous Goods (IMDG) Code has also included marine pollutants.

Annex IV is the Prevention of Pollution by Sewage from Ships (entered into force 27 September 2003). It contains requirements that control pollution of the sea by sewage.

Annex V is the Prevention of Pollution by Garbage from Ships (entered into force December 31, 1988). It specifies the distance from land, manner of disposal, and type of garbage allowed to be

5 http://www.un.org/Depts/los/index.htm
6 http://www.imo.org/about/conventions/listofconventions/pages/international-convention-for-the-prevention-of-pollution-from-ships-(marpol).aspx

disposed of at sea. The requirements are much stricter in a number of "special areas" but perhaps the most important feature of this Annex is the complete ban on dumping all forms of plastic into the sea.

Annex VI is the Prevention of Air Pollution from Ships (entered into force 19 May 2005). The regulations in this annex set limits on sulphur oxide and nitrogen oxide emissions from ship exhausts, as well as particulate matter, and prohibit deliberate emissions of ozone depleting substances to 200 nm.

Summary of International Regulatory Mechanisms Addressing Harvest and Habitat Loss/Degradation Threats

Harvest of adult bumphead parrotfish is not regulated by international mechanisms, e.g., the species is not listed under CITES. However, the habitat of adults (coral reefs) and juveniles (mangroves, shallow seagrass areas, coral reef lagoons) is protected by various international regulatory mechanisms, including national and international policies on coastal and coral reef management and international treaties and conventions. While bumphead parrotfish are not protected by CITES, many coral species are protected under the convention, thereby regulating shipment of corals, and thus indirectly benefiting bumphead parrotfish by protecting their habitat. In addition, many countries subscribe to the guidelines set forth by international biodiversity conventions, such as the CBD and the Ramsar Convention, that contribute to the conservation of bumphead parrotfish habitat.

2.1.2 National Regulatory Mechanisms Addressing Harvest and Habitat Loss/Degradation Threats

As shown in Figure 1 and Table 1, bumphead parrotfish occur in 45 nations, including U.S. territorial and commonwealth waters and 44 foreign nations spanning from the East Indian Ocean to the Western and Central Pacific Ocean, and in Disputed Areas in the South China Sea. For each area, we describe the percentage of coral reef and mangrove habitats relative to the total combined area of each habitat type throughout the 46 areas. Next we describe fisheries and coastal management regulatory mechanisms that address threats to bumphead parrotfish including harvest and habitat loss as described above. Examples may include laws that regulate harvest of reef fish, land use, harvest of corals, activities on coral reefs, mangrove harvest/removal, or other relevant human activities in other ways. We further discuss for each area whether there are MPAs that include mangrove and/or coral reefs habitat and any additional laws or regulations that apply within those protected areas. When possible, we include information on the effectiveness and implementation of these regulatory mechanisms, based on the best available information.

2.1.2.1 Australia

Australia has the largest percentage of coral reefs within the 46 areas in the range of bumphead parrotfish. It has approximately 19.8 percent, or 31,736 km^2, of total coral reef area, 75% of which is located within Marine Protected Areas (MPAs) (see Tables 2 and Appendix A-1). Australia contains 12.5% of mangrove forests within the 46 areas (Table 3), with a portion of that within 158 protected areas (Appendix B).

Australia functions as a commonwealth with a constitutional monarchy and parliament that design, implement, and enforce national laws and regulations. Joined together, but operating

under their own constitutions, are the six states of New South Wales, Queensland, South Australia, Tasmania, Victoria, and Western Australia. Also, there are ten territories, eight under the national constitution of Australia and two territories with self-governing assemblies.[7] Community and local governments, which total 565 local government bodies including indigenous groups, are recognized by the Australian Constitution and are managed nationally by the Department of Regional Australia, Regional Development and Local Government.[8]

Fisheries and Coastal Management Regulatory Mechanisms

This section provides an overview of regulatory mechanisms for fisheries and coastal management at the national, state, and territorial levels. At the end of the section is a summary of the regulatory mechanisms relevant to harvest with spears, harvest with other gears, habitat protection for mangroves, and habitat protection for coral reefs.

The national government contains several departments that are important for fisheries and environmental regulations, such as the Department of Agriculture, the Department of Fisheries and Forestry, and the Department of Sustainability, Environment, Water, Population and Communities. Relevant national regulatory mechanisms originating from or implemented by these departments include Australia's Ocean Policy 1998,[9] Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act),[10] Fisheries Administration Act 1991,[11] Great Barrier Reef Marine Park Act 1975,[12] National Parks and Wildlife Conservation Act 1975,[13] National Recreational Fishing Policy 1994,[14] National Strategy for the Conservation of Australia's Biological Diversity,[15] National Strategy for Ecologically Sustainable Development 1992,[16] Sea Dumping Act 1981,[17] and the Wildlife Protection Act of 1982.[18] These national laws and policies establish Australia's national framework for regulation of fisheries and coastal management. However, the states and territories have authority to establish more detailed fisheries and coastal resources regulatory mechanisms, thus the focus of this section is at the state and territorial levels.

The states and territories of Australia within bumphead parrotfish range are the states of Queensland and Western Australia, and the territories of Christmas Island and the Cocos-Keeling Islands. The Torres Strait, located at the northern tip of Queensland, is shared by treaty between Australia and Papua New Guinea. Fisheries and coastal management regulations for Queensland, Western Australia, Christmas Island, Cocos-Keeling, Islands, Torres Strait, and Northern Territory are reviewed below.

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7 http://australia.gov.au/about-australia/our-government
8 http://www.regional.gov.au
9 http://www.environment.gov.au/coasts/oceans-policy/index.html
10 http://www.environment.gov.au/epbc/index.html
11 http://www.comlaw.gov.au/Details/C2011C00046
12 http://www.gbrmpa.gov.au/corp_site
13 http://www.austlii.edu.au/au/legis/cth/num_act/npawca1975390/s1.html
14 http://www.daff.gov.au/fisheries/recreational/policy
15 http://www.environment.gov.au/biodiversity/publications/strategy/cover.html
16 http://www.environment.gov.au/about/esd/index.html
17 http://www.environment.gov.au/coasts/pollution/dumping/act.html
18 http://www.austlii.edu.au/au/legis/cth/num_act/wpoeaia1982578/

Queensland

Within the state, there are a number of regulations for bumphead parrotfish harvest and threats to habitat. The Queensland Fisheries Regulation 2008[19] regulates both fin fishing and coral harvest. It places a take limit of no more than five fish for "regulated parrotfish", although specific species of parrotfish are not mentioned. A harvested fish may not be under 25 cm if a fisher does not have an A1 or A2 license. Fishers cannot be in possession of a spear or speargun in regulated waters, although recreational fishers may use spears or spear guns in tidal (unregulated) waters. The regulation also prohibits spearfishing while using an underwater breathing apparatus other than a snorkel. The regulation requires persons engaged in fishing under the management regime to take all reasonable steps to ensure that listed species (e.g. threatened, endangered, and migratory) are not killed or injured as a result of fishing.

Parrotfish fishing is also managed as part of the Fisheries (Coral Reef Fin Fish) Management Plan 2003. This plan manages commercial coral reef fisheries by promoting ecologically sustainable objectives. The Queensland Fisheries Regulation 2008 also designates corals of the class Anthozoa or Hydrozoa as part of a "coral fishery," allowing take of uncompacted skeletons with a permit. Additionally, any marine organism living in or on corals mentioned previously, other than a marine organism that is a regulated fish, may be taken with a license. The Queensland Fisheries Act of 1994 protects mangroves and other marine plants; the Act makes it illegal to damage them without a permit. Projects may obtain a permit if the damage can be offset and impacts are minimized. The government must approve all projects that threaten mangrove habitat, such as projects that involve development, grazing, agriculture, mining, and aquaculture. Also, the Act creates Fish Habitat Areas consisting of marine and estuarine protected systems. Currently there are forty-one Fish Habitat Areas covering 649,889 ha throughout Queensland[20].

Western Australia

Within the state of Western Australia, there are a number of regulations for bumphead parrotfish harvest and threats to habitat. The Fish Resources Management Act 1994[21] pertains to managing fish and fishing areas and provides guidelines for fishing activities and management plans. The Spear-Guns Control Act 1955 regulates the use of spearguns throughout Western Australia. Within prohibited areas, spearguns cannot be used, and outside of prohibited areas, there are restrictions on use. The Recreational Fishing Guide of North Coast Region (Pilbara/Kimberley) (2010) and the Recreational Fishing Guide of Gascoyne Region (2011) both state that spearfishing is allowed in this region except in marine conservation areas where fishing on compressed air is prohibited. Bumphead parrotfish habitat regulations are included in the Conservation and Land Management Act of 1984 (CALM Act)[22] which establishes authorities that protect and manage certain public lands and waters and flora and fauna in Western Australia. Marine nature reserves and marine parks are applicable to lands and waters covered in this act via the Marine Parks Reserve Authority (MPRA).[23]

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19 http://www.legislation.qld.gov.au/LEGISLTN/SLS/2008/08SL083.pdf
20 www.gbrmpa.gov.au/corp_site/info_services/publications/sotr/latest_updates/mangroves_and_saltmarshes/4
21 http://www.austlii.edu.au/au/legis/wa/consol_act/frma1994256/
22 http://www.austlii.edu.au/au/legis/wa/consol_act/calma1984290/
23 http://www.dec.wa.gov.au/content/section/22/1355/

Christmas Island

Christmas Island located in the Indian Ocean and is a territory governed under Commonwealth law. The national Department of Regional Australia, Regional Development and Local Government helps develop policy and legislation at the state level for Christmas Island. There are no bag limits or fishing restrictions throughout all of Christmas Island outside of Christmas Island National Park which extends out to 50m past the low water mark over more than 50% of the island's coastline (Department of Fisheries Western Australia 2007).

Cocos-Keeling Islands

The Cocos- Keeling Islands, also called Cocos Islands or Keeling Islands, is an Australian territory under Commonwealth law. The islands are located in the Indian Ocean, approximately midway between Australia and Sri Lanka, and include two atolls and twenty-seven coral islands. The national Department of Regional Australia, Regional Development and Local Government helps develop policy and legislation at the state level for Cocos-Keeling Islands and other services are provided by Western Australia. As of July 2000, wildlife protection and management in the Territory is carried out under the Australian Environment Protection and Biodiversity Conservation Act 1999 and Regulations. There are no regulations for spearfishing, and fish from the parrotfish family are considered medium risk with a bag limit of eight fish (Department of Fisheries 2006). These regulations on parrotfish harvest are assumed to include bumphead parrotfish, though this species is not specifically mentioned. Bumphead parrotfish are known to be harvested using nets, particularly by using drive-in nets at low tide, in the Cocos-Keeling Islands (D. Bellwood and H. Choat pers. comm.). Night spearfishing of bumphead parrotfish does not occur in the Cocos-Keeling Islands (H. Choat pers. comm.).

Torres Strait

Between Papua New Guinea and the northern tip of Queensland lies a 150 km wide body of water called the Torres Strait.[24] Both countries have rights in this body of water as agreed upon in the Torres Strait Treaty in 1978.[25] Essentially the Torres Strait is split in two with Papua New Guinea having rights to the seabed and fisheries to the north of the Seabed Jurisdiction Line and the Fisheries Jurisdiction Line, respectively, and Australia having the same rights to the south of those lines. However, there are islands to the north of the lines that belong to Australia, and thus Australia has sole rights to resources within 3 nm of the islands.

Traditional people living within the Torres Strait live within a protected zone operated by the Torres Strait Protection Zone Joint Authority. Fin fish are generally taken by handline or the use of nets by traditional fishers. Use of nets by commercial fishing is extremely low. Fishing gears are regulated by the following restrictions: no more than six hooks can be used on each line; no more than three fishing apparatus can be used per boat; minimum size limits are imposed on all commercial species and there are maximum size limits for some species; it is prohibited to retain, store, or carry live fish; there are regulations on net size, length, and drop; temporary closures for areas west of 142°09', east of 142°09', and north of 10°28'; permanent closures include areas west of 142°31'49", except for traditional fishing; vessels must be less than 20m in length; and

24 http://en.wikipedia.org/wiki/Torres_Strait

25 http://www.dfat.gov.au/geo/torres_strait/index.html#brief

traditional fishing gears are limited to handlines, diving, spearing, reef-gleaning, cast-netting, gillnets, trolling from dinghies, jigging, and seines.[26]

Northern Territory

Although the Northern Territory has very little hard coral along its coastline leading to very low parrotfish abundance generally, bumphead parrotfish have been recorded off Gove in the northeast part of the region (Saunders pers. comm.). The Northern Territory Government, Department of Resources – Fisheries[27] is the entity responsible for fisheries regulations in the Northern Territory (NT). Territorial waters are divided into three areas: the Timor Reef Fishery (an area in the northwest corner of NT waters), Demersal Fishery (seaward of 15 nautical miles from shore) and the area between the high water mark and 15 nautical miles from shore. In the entire NT, amateur fishing and specifically spearfishing with SCUBA is prohibited. There is a possession limit of 30 fish per person for amateur fishers. Within the Timor Reef Fishery, a license is required to fish and approved gear is limited to vertical lines, drop lines, fin-fish longlines, fish traps, scoop nets, and gaffs. The Demersal Fishery consists of commercial fishing that also requires a license and is generally outside the range of most of the reefs where bumpheads might possibly occur. A commercial coastal line fishery can operate between the high water mark and 15 nautical miles offshore with gear limited to a vertical line, cast net, or scoop net and gaff (within 2 nautical miles) plus fish trap and drop line (beyond 2 nautical miles). There is also a commercial coastal net fishery between the high water mark and 3 nautical miles offshore.

Summary of Australian Fisheries and Coastal Management Regulatory Mechanisms

Nationally, there are fisheries policies that emphasize sustainable fisheries management both for commercial and recreational fisheries. Queensland state law implements harvest sizes and take limits for parrotfish and regulates the use of spearguns. In Western Australia, spearguns are also regulated, as is the use of SCUBA while fishing. The Cocos-Keeling Islands have set bag limits for parrotfish. Within Australian waters of the Torres Strait, there are maximum size limits for fish and gear restrictions allowing the use of traditional fishing methods including spears. Christmas Island has no bag limits or fishing restrictions outside of protected areas.

Nationally, regulations also support sustainable development of coastal regions. In Queensland, mangroves and seagrasses are protected and coastal development projects require approval and mitigation. Also, establishing essential fish habitat both inside and outside protected areas helps protect coral and mangrove habitat. Protected areas are established through national and state laws throughout Western Australia, Christmas Island, and Cocos-Keeling Islands and coral and mangrove habitat within them is mostly protected from development.

MPA Regulations

Throughout Australia, there are 172 coral reef MPAs listed in the World Database of Protected Areas (WDPA) (Appendix A) and 158 mangrove protected areas (Appendix B), many of which are within the range of bumphead parrotfish. In particular, Queensland and Western Australia contain large protected areas with multiple MPAs where bumphead parrotfish are found including the Great Barrier Reef Marine Park in Queensland and Rowley Shoals Marine Park in

26 http://www.pzja.gov.au/fisheries/fin.htm

27 http://www.nt.gov.au/d/Fisheries/index.cfm?header=Legislation

Western Australia. Both the territories of Christmas Island and Cocos-Keeling Islands operate under commonwealth law and contain their own MPAs. Regulations for these state and territorial MPAs are reviewed below.

Queensland

A large section of the northern coastline of Queensland contains the largest barrier coral reef in the world called the Great Barrier Reef. The Great Barrier Reef Marine Park (GBRMP), which covers 345,400 km², encompasses and protects a large part of the Great Barrier Reef. Bumphead parrotfish can be seen throughout the park and are known to be speared during the day (D. Bellwood pers. comm.). Regulations within the GBRMP are administered by the Great Barrier Reef Marine Park Authority (GBRMPA), which was established under the Great Barrier Reef Marine Park Act of 1975. The GBRMPA issues permits for various forms of use of resources within the park and usage in the park is monitored to ensure compliance with park management. Regulations within the park are the responsibility of the Queensland Government and include enforcement of the Queensland Fisheries Regulation 2008, the Great Barrier Reef Marine Park Act of 1975, and the Queensland Fisheries Regulation 1994. According to the Recreational Fishing Rules and Regulations for Queensland (DEEDI 2010), there are three closed seasons every year. For nine days during October, November, and December, it is prohibited to harvest coral reef fin fish. The Great Barrier Reef Marine Park Act of 1975 allows no commercial fishing without permission inside the park. The condition of mangrove habitat in or adjacent to the GBRMP is relatively stable due to protections under the Queensland Fisheries Act of 1994.[28]

Western Australia

Marine nature reserves and marine parks are applicable to lands and waters covered in the Conservation and Land Management Act of 1984 (CALM Act)[29] via the Marine Parks Reserve Authority (MPRA).[30] Within the range of bumphead parrotfish located just off the northwestern portion of the Western Australian coast in the Timor Sea is Rowley Shoals Marine Park. The park is composed of three reefs, Mermaid Reef, Clerke Reef, and Imperieuse Reef, and is managed by the Department of Environment and Conservation in Western Australia. The park is a Class A reserve established in 1990 and covers 87,632 ha. The goals of the Rowley Shoals Management Plan (2007-2017) are to preserve unique environments in the area and plan for sustainable use through zoning and different management programs. Fisheries are managed through the Western Australia Fishing Regulations from July 2010. Under the regulations, the parrotfish family is considered at high risk for overfishing and there is a bag limit of four parrotfish per day with no minimum size. Fishers must have a license to spearfish from a power vessel, and spearfishing fishing is not permitted on compressed air in marine conservation areas. Mangroves are not discussed in the Rowley Shoal Management Plan. Only recreational fishing is permitted within the lagoon because it is considered a recreation zone (Department of Conservation 2007).

Christmas Island

Currently, 63 percent of Christmas Island's 135 square kilometers is protected under the Christmas Island National Park. Parks Australia, which is within the Australian Government

28 www.gbrmpa.gov.au/corp_site/info_services/publications/sotr/latest_updates/mangroves_and_saltmarshes/4
29 http://www.austlii.edu.au/au/legis/wa/consol_act/calma1984290/
30 http://www.dec.wa.gov.au/content/section/22/1355/

Department of Environment and Water Resources, is responsible for administering the Environmental Protection and Biodiversity Conservation Act of 1999 on Christmas Island and managing the park for the Director of National Parks in accordance with the Act and the park Management Plan. The park includes a marine area extending 50m seaward of the low water mark where terrestrial areas of the park include the coastline. Management objectives of the park include protecting all marine organisms and habitats in as near a natural state as possible; allowing recreational fishing subject to specified conditions; and managing recreational activities, particularly fishing, boating and diving, so as to minimize physical or biological damage to habitats and wildlife, and physical damage to wrecks or other artifacts. Regulations within the park prohibit commercial fishing or the taking of any organism or object for sale or barter. Periodic creel surveys are done to assess fish diversity (Director of Parks 2002). The park also installed mooring buoys for the use of boat operators. Christmas Island is also home to one marine and terrestrial Ramsar site called Hosnie's Spring.[31]

Cocos-Keeling Islands

The conservation significance of North Keeling Island was recognized when the island was recommended to become a national park or nature reserve by two House committees in 1990 and 1991, following its listing on the Register of the National Estate in 1990. In 1993, the Cocos (Keeling) Islands Shire Council resolved in principle to lease North Keeling Island to the Commonwealth for the creation of a national park. The lease was finalized in 1995 and stipulated that the Island must be developed as a national park of world standard. The Proclamation of Pulu Keeling National Park in December 1995 aims to ensure the long-term conservation of the island's unique biodiversity and safeguard its natural and historical attributes for the benefit of the local, national and international communities. According to the Pulu Keeling National Park Management Plan, the park includes North Keeling Island and the marine area extending 1.5km from the shore. The marine zone is designated as IUCN "national park" while the lagoon and terrestrial environments are designated "strict nature reserve."[32]

To detect changes in coral reef status, reef check sites within the park and effects of anchors are monitored. Patrols take place throughout the marine zone. The park includes the central sandy-bottom seagrass lagoon on North Keeling Island, and the island itself is surrounded by fringing reef. There are two other MPAs called Emden and Historic Shipwreck.[33] The Director of National Parks, assisted by Parks Australia within the Australian Government Department of Sustainability, Environment, Water, Population and Communities is responsible for managing the park in accordance with the Management Plan. Corals are afforded protection under the laws of Australia's National Parks. Commercial fishing is also prohibited in the park and recreational fishing is limited to trolling or deep-water fishing for pelagic fish beyond 100m from shore with a permit.

Summary of Australian MPA Regulations

Overall, MPAs in Australia provide additional regulations with respect to bumphead parrotfish harvest. MPAs within the states and territories where bumphead parrotfish occur have specific regulations that regulate harvest. The Great Barrier Reef Marine Park in Queensland allows

31 http://www.wdpa.org
32 http://www.environment.gov.au/parks/publications/cocos/pubs/management-plan.pdf
33 http://www.wdpa.org/

recreational fishing only and fishers must abide by state regulations for parrotfish sizes, bag limits, and spearfishing. Recreational fishing rules in this region also mandate temporary closures in regions within this MPA for harvest of all coral reef fish. Western Australia regulates spearfishing and prohibits scuba diving in marine conservation areas. Rowley Shoals Marine Park, in Western Australia, allows recreational fishing only and has bag limits and spearfishing regulations. Approximately 63% of Christmas Island is National Park which in many places includes protection out to 50m seaward from the low-water mark and only recreational fishing is allowed. All of North Keeling Island in the Cocos-Keeling Islands is an MPA and only allows recreational fishing for pelagic species via permitted trolling or deep-water fishing beyond 100m from shore.

The MPAs in Queensland, Western Australia, Christmas Island, and Cocos-Keeling Islands, emphasize sustainable use and protect portions of the land from development. It is worth noting that in November of 2011, The Australian government announced the proposed establishment of the world's largest MPA spanning 989,842 sqkm in the Coral Sea. The government wants to set up a no-take area of 51 per cent and ban gillnet fishing and seabed trawling in the Coral Sea. The proposed area is east of and adjacent to the Great Barrier Reef Marine Park and includes three Key Ecological Features: the reefs, cays and herbivorous fish of the Queensland Plateau and the Marion Plateau and the northern extent of the Tasmantid seamount chain. The government opened a public consultation phase with a broad range of marine resource users and interest groups to develop the proposed reserve. The consultation period ended February 24, 2012 and they are currently (as of March 2012) reviewing 300,000 submissions regarding the proposed park.

2.1.2.2 Cambodia

Approximately 0.1% of coral reefs within the 46 areas in bumphead parrotfish range are in Cambodia. A negligible percentage of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Cambodia contains 0.9% of mangrove forests within the 46 areas (Table 3), with a portion of that within four protected areas (Appendix B).

In Cambodia, fisheries and environmental regulations are designed and implemented at the national level. The Ministry of Agriculture, Forestry and Fisheries (MAFF) is the main authority for national fisheries regulations. MAFF includes branches that enforce national laws at the Provincial-Municipal levels and District levels.[34]

Fisheries and Coastal Management Regulatory Mechanisms

MAFF divides marine fisheries into small-scale or artisanal fisheries and middle-scale fisheries. Middle-scale fisheries often have highly efficient fishing gears and are able to fish inshore and offshore using all fishing gears. Middle-scale fisheries use trawls, horizontal longlines, and a variety of different nets including purse seine/ring net, anchovy encircling seine, beach seine, encircling seine, gillnet, mackerel gillnet, shrimp gillnet, trammel net, crab gillnet, and herring gillnet. Small-scale fisheries use crab gillnets, shrimp gillnets, squid traps, fish traps, crab traps, push nets, and hooks.[35] Bumphead parrotfish are harvested using spears, cyanide, gillnets, and dynamite, and were once in high-demand in restaurants in Cambodia (P. Ferber pers. comm.).

34 http://www.maff.gov.kh/en/aboutmaff/orgchart.html
35 http://map.seafdec.org/Monograph/Monograph_cambodia/intro.php

Bumphead parrotfish are not listed on the Endangered Species List in Cambodia and there are no regulations specific to their harvest (P. Ferber pers. comm.). Small-scale, or subsistence, fishing is allowed without a permit, while other types of fishing need to be approved by the Ministry of Agriculture. Decree No. 33 prohibits the use of electrocuting fishing gear, explosives, spearfishing with an illuminated lamp, and the use of a gillnet with mesh size smaller than 1.5 cm. Corals are directly protected through the Law on Environmental Protection and Natural Resource Management 1996, Praka No. 1033 on the Protection of Natural Areas 3 June 1994, and Decree No. 33 on Fishery Management and Administration. According to P. Ferber (pers. comm.), there are also no traditional regulations for harvest.

In general, communities are in charge of managing and conserving their local fisheries resources and establishing conservation areas (Penh 2005). Because the Fisheries Law does not allow community fishing organizations the right to arrest people who fish in community fishing areas, enforcement of laws is left up to the efforts of MAFF.

MPA Regulations

Throughout Cambodia, there are two coral reef MPAs listed in the WDPA (Appendix A) and four protected areas containing mangroves (Appendix B). On November 1, 1993, a Royal Decree was issued, "Creation and Designation of Protected Areas," designating 23 protected areas and covering some 3.3 million hectares or almost 19% of Cambodia's total land area, as National Parks, Wildlife Sanctuaries, Protected Landscapes, and Multiple Use Areas. Also, the Royal Kram NS/RKM/0506/011 on Promulgation of the Fisheries Law, 2006 provides for the classification of Protected and Conservation Areas of Fishery Resources important for the sustainability of fishery resources, with corals specifically included as fishery resources. Coastal Protected Areas are part of this system called the National Protected Area System. Portions of Botum Sakor National Park, Preah Sihanouk (Ream) National Park, Dong Peng Multiple Use Area, and Peam Krasop Wildlife Sanctuary contain protected marine components. Mangroves are also protected within national parks (FAO 2005) with a total area of approximately 467 km² (more than half of the country's mangroves) included within marine protected areas.[36] Fish harvest in MPAs does not appear to be managed differently than outside of MPAs.

2.1.2.3 China

Approximately 0.3% of coral reefs within the 46 areas in bumphead parrotfish range are in China. Six percent, or 36km^2, of these coral reefs are protected nationally in MPAs (see Table 2 and Appendix A-1). China contains 0.3% of mangrove forests within the 46 areas (Table 3), with a portion of that total in 29 protected areas (Appendix B).

China, or the People's Republic of China, is a single-party state with over 22 provinces, five autonomous regions, four directly administered municipalities, and two highly autonomous special administrative regions (SARs). Fisheries are nationally regulated by the Bureau of Fisheries under the Ministry of Agriculture, whose essential function is to devise plans for development, research, and training through its Science and Technology Division. Both the Ministry of Human Affairs and the Ministry of Agriculture, via the China National Fishery Technology Extension Centre, have established fisheries management extension stations at the

36 www.arcbc.org/arcbcweb/publications/mpa.htm

provincial, prefecture, county, and township level to help implement national regulations. Other important government institutions for fisheries and environmental management in China are the State Oceanic Administration (SOA), the National Environmental Protection Agency (NEPA), and the Ministry of Water Resources (FAO 1997).

Fisheries and Coastal Management Regulatory Mechanisms

In general, marine fishers in China use a variety of different gears including trawls, gillnets, set nets, hook-and-line, and purse seines. In 2004, the usage of these gears for commercial fishing was broken down as follows: trawl nets 47.6% of the time, gillnets 17%, set nets 15%, hook-and-line 6%, purse seines 5.3%, and other gears about 9%.[37]

There are a series of laws that regulate fishing around coral reefs. Throughout marine fisheries in China, the government has made an effort to reduce fishing pressure by limiting the number of vessels permitted and steering fishers away from the marine capture sector.[38] Chapter IV, article 30 of the Fisheries Law of the People's Republic of China 2004 bans the use of poisons and explosives. The Fisheries Law of the People's Republic of China 2004, Chapter IV, article 31 prohibits the catch of fry. The SOA of the South Seas Branch of the People's Republic of China includes in the Fisheries-Habitat Management a yearly two-month fishing ban in the South China Sea north of 12 degrees North latitude. This has been in place every June 1 to August 1 starting in 1999. There is a Hot Season moratorium, started in 1994, that bans trawling and sailing stake net fishing from June 16 to September 1, but it permits the use of gillnets, hook-and-line, and traps year-round.[39]

With respect to coral reef habitat, the national government provides various regulations. For example, the State Law of Marine Environment Protection and the State Management Regulation Preventing Coastal Engineering Projects from Marine Environmental Damage and Pollution, strictly prohibit coral destruction by any coastal engineering activities (Zhang 2004). Articles 32 to 37 are regulations to disclose the type and amount of industrial pollution, pesticides, medical waste and rules for pollution discharging facilities. The State Management Regulation was revised in 2002, putting more emphasis on coral reef protection, restoration of damaged reefs and establishment of marine reserves. Finally, the State Law of Ocean Use Management issued in 2001 demands that all coastal development programs be in accordance with the Division of Marine Functional Zonation made by government.

In addition to the national regulations, the Hainan Province Regulation of Coral Reef Protection, which was established in 1998, prohibits coral mining for building materials and limestone; blast fishing and cyanide fishing; coral and shell collection for the curio trade; and the establishment of waste outfalls into coral reef marine reserves. Throughout China, national laws provide gear and size restrictions for fishing. There is also a two-month fishing ban every year in the South China Sea north of 12 degrees North latitude. There are also regional gear restrictions in bumphead parrotfish range within China. Spearfishing is considered poorly regulated because there are no spearfishing regulations outside of MPAs. Coral reefs and mangroves are protected by coastal development and pollution regulations and marine reserves.

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37 http://www.fao.org/fishery/countrysector/FI-CP_CN/en
38 http://www.fao.org/fishery/countrysector/FI-CP_CN/en
39 http://www.fao.org/fishery/countrysector/FI-CP_CN/en

MPA Regulations

Throughout China, there are 18 coral reef MPAs listed in the WDPA (Appendix A) and 29 mangrove protected areas (Appendix B). According to Zhang (2004), the implemented policies of reserves help highlight efforts by the Chinese government in prioritizing conservation, appropriate utilization, and sustainable development in coral reef and mangrove regions. In 2004, there were three established Marine Coral Reef Reserves and they each encompassed strictly no take sections where only scientific research is permitted. These include the Sanya National Coral Reefs Reserve, the Dongshan Bay Provincial Coral Reefs Nature Reserve, and the Dengloujiao Provincial Coral Reefs Nature Reserve in Guangdong Province (Hui, 2004). Also, regionally since 1996, several marine parks or marine protected areas have been established in Hong Kong with the sole aim of conserving coral reefs. There are six marine Ramsar sites and three marine and terrestrial Ramsar sites. Yancheng National Nature Reserves is a marine and terrestrial Ramsar site and a marine UNESCO-MAB Biosphere site. There are two additional marine and terrestrial UNESCO-MAB Biosphere sites.

Regulations within reserves and MPAs encompass the following guidelines important for bumphead parrotfish harvest and threats to habitat: (1) the Marine Parks and Marine Reserves Regulation 1996 mandates no fishing within marine parks specifically stating it is prohibited to use spearguns, electrically charged gear, or dynamite; (2) mangroves are considered forest and are protected under the Mangrove Protection Laws and Regulations made by the forestry sector; (3) the State Forest Administration is in charge of organizing and directing management of mangrove forests, developing and implementing policies and regulations for forest use and protection, and tree planting and forestation projects (Durst *et al*. 2008); and (4) according to Hong and Fei (n.d.), MPAs and nature reserves made for mangrove protection include 75% of all China's mangroves.

MPAs in China implement more stringent gear restrictions, including prohibiting spearguns, within marine parks. There are also no take areas within some reserves. Most of China's mangroves and a portion of coral reefs are located within MPAs. This offers protection to these habitats through no take zones and limited take regulations. Outside of MPAs, adult harvest does not appear to be regulated for any type of gear. Within MPAs, adult harvest is well regulated. Mangroves and coral reefs are well protected by national law, and even more so within protected areas.

2.1.2.4 Comoros Islands

Approximately 0.2% of coral reefs within the 46 areas in bumphead parrotfish range are in the Comoros Islands. A negligible percentage of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Comoros has one protected area containing some mangroves (Appendix B), but a negligible percentage of the mangrove forests within the 46 areas occur here (Table 3).

The nation of the Comoros contains three main islands that are part of the Comoros archipelago: Grande Comore, Moheli, and Anjouan. The island of Mayotte is technically part of the Comoros archipelago, but is governed as a French territory. Fisheries and the environment are regulated by both national and international organizations. The Directorate of the Environment and the Directorate of Fisheries are the main national agencies and international organizations such as

the Indian Ocean Commission and the United Nations help finance projects developed at the national level (Abdoulhalik 1997).

Fisheries and Coastal Management Regulatory Mechanisms
The majority of fishing in the Comoros is for subsistence. Traditionally, fishers were only allowed to fish in waters adjacent to their village, but changing fishing methods increased fishing activity around the islands. Destructive fishing methods, such as dynamite and poisons, are still used, despite national bans. Subsistence fishers also use boat seines, purse seines, gillnets, hooks or gorges, set gillnets, bottom trawls, troll lines, mid-water trawls, lampara-like nets, driftnets, and spearguns (Project GloBAL n.d.). Bumphead parrotfish are harvested using spears, nets (D. Obura pers. comm.), and hand lines (Y. Ali pers. comm.).

Nationally, fisheries and the environment are regulated under the National Environment Policy developed by the United Nations Conference on Environment and Development in 1992. The main objective of this law is to improve social and economic sectors of the country through sustainable use of resources. Additionally, some environmental regulations include the Decree no 93-115/PR of 31 July 1993 which establishes the mission, organization and assignments of the Directorate of the Environment. The 1994 framework law for environment regulates activities relating to the protection of the national heritage and the creation of protected areas. Decree No 93-114/PR of 31 July sets out the mission for the Directorate of Fisheries (Abdoulhalik 1997). In some villages, use of fishing nets, traps, and underwater spearguns is banned (Project GloBAL n.d.).

MPA Regulations
Throughout the Comoros, there are ten coral reef MPAs listed in the WDPA (Appendix A) and one mangrove protected area (Appendix B). Mohéli Marine Park is the most notable MPA because it is managed by local village-nominated "eco-guards" and covers 404 km². It was initially funded by the Global Environment Facility and the United Nations Development Program, but receives continued funding from park entrance fees. The eco-guards of the Mohéli Marine Park monitor sea turtle nesting beaches, reef health, and fisheries (Granek and Brown 2005). Mangroves are protected within other parks and reserves (Drude de Lacerda 2002).

Adult harvest is not regulated at the national level, but some management occurs at the local level for all gears. Fishing within MPAs is regulated at the local level. Mangrove and coral reef management is not regulated at the national level, but both types of habitat are included in some MPAs.

2.1.2.5 Disputed Areas

The Disputed Areas of the South China Sea include the Paracel Islands and the Spratly Islands. Approximately 1.8% of the coral reefs within the 46 areas in bumphead parrotfish range are in the Disputed Areas of the South China Sea, which has no coral reef MPAs (see Table 2 and Appendix A-1). This region does not contain any mangrove forests (Table 3), and contains no mangrove protected areas (Appendix B).

The Paracel Islands are composed of 130 small coral islands and reefs divided into the northeast Amphitrite Group and the western Crescent Group. China has occupied the Paracel Islands since 1974, although claims of territory have also been made by Vietnam and Taiwan.

The Spratly Islands are a group of more than 750 reefs, islets, atolls, cays, and islands in the South China Sea between Vietnam, the Philippines, China, Malaysia, and Brunei. Coral reefs are the predominant structure of these islands. Because the islands are claimed by Vietnam, the Philippines, China, Malaysia, and Brunei, it is nearly impossible to enforce regulations. According to Bryant *et al*. (1998), coral reefs in the Paracel Islands are under high threat from destructive fishing, while the risk to the Spratly Islands is lower due to their proximity to inhabited islands.

Fisheries and Coastal Management Regulatory Mechanisms
No national fishing regulations could be found for the Disputed Areas with the exception of the inclusion of the Paracel Islands in the State Oceanic Administration of the South Seas Branch of the People's Republic of China Fisheries-Habitat Management yearly two-month fishing ban. Destructive fishing practices, such as dynamite and poisons, are known to be used in the Paracel Islands. SCUBA spearfishing is also practiced by recreation fishermen (Hui 2004).

MPA Regulations
Throughout the Disputed Areas, there are no effective coral reef or mangrove MPAs. The Pratas Islands (Dungsha) Group within the Spratly Islands was successfully established as a Taiwanese National Marine Park in 2007, however most regulations that out-law activities in other areas of the region, such as dynamite and cyanide fishing, are not implemented or enforced in the waters of the South China Sea. A proposal to create an international marine peace park in the Spratly Islands has been examined by claimant nations in a series of workshops, but unclear ownership of individual islands makes enforcement of any regulations in this area difficult (Bryant *et al*. 1998; Burke *et al.* 2002).

2.1.2.6 Djibouti

Approximately 0.1% of coral reefs within the 46 areas in bumphead parrotfish range are in Djibouti. Three percent, or 7 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Djibouti contains a negligible percentage of mangrove forests within the 46 areas (Table 3), with one protected area that contains some mangroves (Appendix B).

Djibouti has five districts, each with a regional council and district level management.[40] Fisheries and environmental regulations are managed nationally by divisions within the Department of Agriculture, Livestock and Hydraulic Resources. The Ministry Fisheries Department regulates management of sustainable fisheries, the Department of Maritime Affairs is responsible for registering fishing units, and the Maritime Gendarmerie enforces fisheries regulations.[41]

Fisheries and Coastal Management Regulatory Mechanisms
Much of the marine fisheries in Djibouti are subsistence and fishers often use hook-and-line, gillnets, and throw nets to target demersal and reef species.[42] The Fisheries Code provides national fisheries regulations by prohibiting: (1) fishing without a license; (2) the capture of

40 http://www.presidence.dj/
41 http://acpfish2-eu.org/index.php?page=djibouti&hl=pt
42 http://www.fao.org/fishery/countrysector/FI-CP_DJ/en

immature fish based on minimum sizes or market minimum weight; and (3) the use of toxic bait, poisons, explosives, guns, or crossbows underwater. According to a document published by the Food and Agriculture Organization (FAO), spearfishing is nationally banned but is widely practiced (FAO 2004). Artisanal fishermen are not subject to limitations. It is noted that fishers are moving away from traditional practices in favor of modern methods (De Young 2006). Most fishers have to pass through a government training program allowing the government to teach conservation and stock management (FAO 2004). Regulations in Djibouti affecting coral species include the prohibition of coral and mollusk collection and export of reef fish. Whether or not mangrove harvest is regulated could not be ascertained, but national mangrove harvest appears to be stable (FAO 2007a).

MPA Regulations
Throughout Djibouti, there are two coral reef MPAs listed in the WDPA (Appendix A-1) and one mangrove protected area (Appendix B). Haramous-Loyada is recognized by the IUCN under Ramsar as a wetland of international importance.[43]

Nationally, spearfishing is banned and other gears are regulated. There are no apparent differences in fisheries management inside and outside of MPAs. There is no apparent mangrove management, but there is a prohibition on coral collection. Mangroves and coral reefs are included in some MPAs.

2.1.2.7 Egypt

Approximately 1.5% of coral reefs within the 46 areas in bumphead parrotfish range are in Egypt. Forty-nine percent, or 1544 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Egypt contains a negligible percentage of mangrove forests within the 46 areas (Table 3), a portion of which is within four protected areas (Appendix B).

In Egypt, or the Arab Republic of Egypt, regulations are developed and instituted nationally. The Ministry of Agriculture nationally manages fisheries and aquaculture through the General Authority for Fisheries Resources Development (GAFRD).[44] The Ministry of State for Environmental Affairs (MSEA) nationally manages the environment through the Egyptian Environmental Affairs Agency.[45]

Fisheries and Coastal Management Regulatory Mechanisms.
Traditional artisanal fishing is common along the coast of Egypt facing the Red Sea. Fishers use hook-and-line and inshore set nets. Commercial fishing fleets use purse seines and trawlers in the Suez Gulf and Gulf of Aden.[46]

There are a few national and regional fisheries regulations that could be pertinent to bumphead parrotfish harvest. Nationally, Act No 124/1983 prohibits collection and removal of fish fry without a permit from the GAFRD. Also, this act gives the Ministry the right to decide what species of fish are prohibited to catch, though it is not clear whether or not bumphead parrotfish

43 http://www.wdpa.org/
44 http://www.fao.org/fishery/legalframework/nalo_egypt/en
45 http://www.eeaa.gov.eg/English/main/about.asp
46 http://www.fao.org/fishery/countrysector/FI-CP_EG/en

are on this list (De Young 2006). Regionally, it is prohibited to spearfish and take fish on the Sinai coast to south of El Tur.

Environmental legislation from the MSEA includes the Law of the Environment (Law No. 4 for the year 1994) which established the Egyptian Environmental Affairs Agency (EEAA) which is the administrative body that formulates policies and plans for the protection and promotion of the environment. In 1996, the EEAA released guidelines for the development of coastal areas, establishing rules and regulations for at least the following: mooring and anchoring in the Red Sea; diving and other water sports; hotel ships; and establishment of marinas, embankments, and jetties. Prior to this, the collection of corals, shells, and other marine animals was prohibited by legislation that was passed in 1962 and revised in 1980. The Egyptian Conservation Law No. 102 1983 set up the legislative framework for the establishment of protectorates prohibiting any action that may damage or alter any organism, habitat, or living resource of the marine protectorate. The law also prohibits the introduction of exotic species and the taking of any organisms or materials.

The FAO states mangrove forests in Egypt are compromised due to camel browsing and other threats (FAO 2007a). Aquaculture could also threaten mangrove habitat as Law No. 124/1983 states that brackish and marine water and land not suitable for agriculture can be used for establishing aquaculture farms. According to Presidential Decree No. 465/1983, GAFRD can lease lands within 200m of the shoreline for aquaculture and fisheries activities. Regulation No. 338/1995 requires an Environmental Impact Assessment (EIA) be done on new or renovated areas.[47]

MPA Regulations

Throughout Egypt, there are eight coral reef MPAs listed in the WDPA (Appendix A) and four mangrove protected areas (Appendix B). The Ras Mohamed Marine Park, established in 1983 by the EEAA but not actively managed until 1988, covers 210 km² and was declared Egypt's first National Park in 1989. Two additional marine Protectorates on the Gulf of Aqaba were declared in 1992, Nabq and Abu Galum Managed Resource Protected Areas. In 1994, these protected areas were linked with the Ras Mohamed Marine Park to form the Ras Mohamed National Park Sector which covers 1470 km² and 52% of the littoral coast on the Gulf of Aqaba. The success of the actions of the EEAA on the Gulf of Aqaba, plus strong support from stakeholders, has led to the declaration of the remainder of the littoral coast as protected. The current regulations to protect reefs within protectorates include dive site management; establishing scientific reserves and rehabilitation areas; prohibiting the use of anchors, fish feeding, and the collection of corals and shells; and installing mooring buoys.

Overall in Egypt, all fishing is banned on a section of the Sinai coast, but otherwise fishing is unregulated. There is no apparent mangrove management, but prohibitions on the collection of corals and some other coral reef organisms are present, plus national guidelines exist for mangrove and coral reef management. An extensive MPA network includes half of the country's coral reefs.

47 http://www.fao.org/fishery/legalframework/nalo_egypt/en

2.1.2.8 Eritrea

Approximately 0.9% of the coral reefs within the 46 areas in bumphead parrotfish range are in Eritrea (see Table 2 and Appendix A-1). The country contains 0.1% of mangrove forests within the 46 areas (Table 3). There are no coral reef MPAs (Appendix A) or mangrove protected areas in Eritrea (Appendix B).

Fisheries and environmental regulations are nationally the responsibility of the Ministry of Fisheries and the Ministry of Land, Water and the Environment.

Fisheries and Coastal Management Regulatory Mechanisms

Coral reef fishes are considered commercially valuable in Eritrea and constitute 64% of the total catch. Traditional fishers use gillnets, handlines, and castnets, while commercial fishers also use industrial trawlers and longlines.[48] There are future plans to increase the development of commercial fishing nationally (Arthurton *et al*. 2006), but currently stocks are generally considered underexploited (De Young 2006). Artisanal fishers typically target coral reef fin fish (Kotb *et al*. 2004).

Fisheries legislation in Eritrea was written in 1998 with FAO assistance and is considered a major step forward in establishing a sound legal framework. The 1998 Eritrean Fisheries Proclamation No. 104/1998 is the main fisheries regulation. This proclamation designates the Ministry of Fisheries as the fisheries management agency and it sets up a Fisheries Advisory Committee. It prohibits direct harvest and domestic trade of endangered and protected species, has restrictions on mesh size, and requires fishers to obtain a license. Reserves can be declared as no fishing areas (De Young 2006). Whether or not mangrove harvest and development is regulated could not be ascertained, but the FAO states small-scale afforestation programs have stabilized mangrove loss (FAO 2007a).

International organizations, such as the United Nations, have played a significant role in helping the Ministry of Land, Water and Environment establish plans for mitigating detrimental effects on corals and mangroves, especially with respect to climate change. Under the United Nations Framework Convention on Climate Change (UNFCCC), Eritrea has developed a National Adaptation Program of Action (NAPA) for climate change. NAPA encourages sustainable coastal development and implements a mangrove management plan (MOLWE 2007).

MPA Regulations

Eritrea aims to become the first country in the world to turn its entire coastline, and the 1,950 km of coastline around its more than 350 islands, into an environmentally protected zone to ensure balanced and sustainable development, according to a draft coastal policy document. Currently, however, there are no legally established areas of protection for coral reefs listed in the WDPA (Appendix A) or mangroves (Appendix B), though laws in previous Fisheries Proclamations include a number of initiated articles relevant to the protection and conservation of marine resources, including the establishment of marine protected areas. Dahlak Archipelago Marine Park was established during Ethiopian rule of Eritrea and it is unknown whether it is still

48 http://www.fao.org/fishery/countrysector/FI-CP_ER/en

considered an official marine park by the Eritrean government.[49] The Eritrean government has planned to institute a National Protected Areas Network aiming at maintaining the diversity and viability of the various components of Eritrean's natural heritage to ensure the sustainable utilization of the natural resources within them.

Newly established fisheries and coastal management laws sound promising, but specific regulations apparently are not yet implemented. Plans call for establishment of an MPA network, but they have not yet been implemented.

2.1.2.9 Fiji

Approximately 3.1% of coral reefs within the 46 areas in bumphead parrotfish range are in Fiji. Thirty-two percent, or 2145 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Fiji contains 0.5% of mangrove forests within the 46 areas (Table 3), with a portion of that in one protected area (Appendix B).

The Fijian Archipelago is comprised of 322 islands. The Ministry of Fisheries and Forests nationally regulates fisheries through the Fisheries Department and the environment through the Forestry Department. Customary management at the community level is strong in Fiji and it is recognized by the national government. Enforcement of regulations takes place at both the national and local levels.

Fisheries and Coastal Management Regulatory Mechanisms

Coastal fisheries in Fiji support subsistence, local market sales, and export. Commercial and subsistence fishers spearfish and use hook-and-line. Commercial fishers are more likely to use gillnets, while subsistence fishers use reef gleaning (a destructive method of breaking up habitat to gather invertebrates from reefs).[50] Bumphead parrotfish were once targeted heavily in the Lau Island Group by spearfishers, suggesting high fishing pressure from this gear type may have led to a decline in this area. They have also been harvested using nets or seines (Dulvy and Polunin 2004).

The Fiji Fisheries Department implements national fisheries regulations through the Fisheries Act and the Marine Spaces Act. Fiji's Department of Fisheries listed the bumphead parrotfish as an endangered fish threatened by overharvesting,[51] and thus protected it under the Endangered and Protected Species Act of 2002. The Endangered Species Act of 2002 and subsequent regulations of 2003 regulate trade, possession, and transport of endangered species according to CITES. Other pertinent national fisheries regulations include a government ban on the use of gillnets and a ban on the use of SCUBA for fishing in several fishing rights areas. It is illegal to collect, take, or dive for fish using SCUBA around the rest of the country, but the Permanent Secretary can provide exemptions. The Fisheries Act of 1941 and Fisheries Regulations of 1961 prohibit fishing methods such as the use of dynamite and poison, and require a fisher to obtain a license, except if using a line or spear. It is also illegal to fish in traditional fishing grounds unless approved. Minimum catch size is mandated for some fish species. Local regulations in Kia, Isabel Province are in place for bumphead parrotfish harvest. The Fisheries Department

49 http://www.eritrea.be/old/eritrea-dahlaks.htm
50 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_FJ.pdf
51 http://mesfiji.org/environment/endangered-fish

will only purchase bumphead parrotfish one week out of every month, the week prior to the new moon. This regulation is intended to limit the demand and therefore fishing effort but, during the other three weeks of the month, fishers export bumphead parrotfish via private orders, making it not as effective as intended (R. Hamilton pers. comm.).

Coral and mangrove habitat are protected under a variety of different measures. Regulations specific to coral harvest state that before coral can be harvested, there must be a baseline survey and exporting of coral is banned unless the export provides a full listing of the species. Coastal development is managed through the Environment Management Act of 2005 which provides regulations concerning pollution and waste management as well as requiring Environmental Impact Assessments (EIAs) for development projects. The Land Development Act and the Forest Act regulate development in mangrove habitat. The Land Development Act allows the government to purchase agricultural sites and real estate, and to develop, subdivide, and sell or lease the land to Fijian citizens. Under the Forest Act, mangrove habitat can be declared reserved forest land or a sylvicultural area. Also, export and removal of forest produce, including mangrove poles, is managed. Much of the land in Fiji is considered Native Land (87 percent) and is controlled by the Native Land Trust Board. The Native Land Trust Board makes native land outside reserves available for development. Fishing with spears is allowed but destructive fishing methods have been prohibited and gear restrictions are in place.

Both coral and mangrove harvest are regulated via national laws. Coastal development projects require EIAs. Nationally, the Fijian government encourages conservation and sustainable development. Forest reservations established by national laws help protect mangrove habitat. Other mangrove regulations also help manage harvest.

MPA Regulations

Throughout Fiji, there are 202 coral reef MPAs listed in the WDPA (Appendix A) and one mangrove protected area (Appendix B). The Fiji National Biodiversity Strategy and Action Plan (NBSAP) of 2007 - 2011 mandates conservation and sustainable use of marine biodiversity to maintain ecological function. It also requires establishing reserves and conservation areas at national and local levels. Fiji has 177 MPAs that are part of the Locally-Managed Marine Area Network (LMMA) and are managed by individual villages.[52] LMMAs are sponsored by NGOS and it is not clear whether or not they are recognized by the national government, thus are considered conservation efforts in this report (See Conservation Efforts section).

The government of Fiji recognizes customary management in the Fisheries Act 1978, through the Native Land and Fisheries Commission, and recognizes *qoliqoli* as a form of MPA management. It is important to note that LMMAs include *qoliqoli*. Under the Fisheries Act 1978, honorary fish wardens designated by villages patrol their fishing grounds to enforce fishing regulations, ensure compliance of fishing license holders, and reduce poaching (Ruddle 1995; Johannes 2002). This post is seen as a "natural part of their traditional service to the community" (Johannes 2002). The Native Lands and Fisheries Commission, which is under the Ministry of Fijian Affairs and Rural Development, identifies, surveys, and registers traditional fishing rights territories, or customary fishing rights areas (CFRAs), stating that boundaries must be approved by each social group before a territory can be registered (Ruddle 1995). The government does

52 http://lmmanetwork.dreamhosters.com/fiji

not formally assist in CFRA, though it does issue permits for fishing within *qoliqoli*. Traditionally, *qoliqoli* were fishing areas that were closed for 100-days after a chief dies.[53] Today, *qoliqoli* are temporary no take or restricted take zones within MPAs. Their boundaries and management are decided by chiefs and often constitute about 10 to 20 percent of the area of an MPA (Cooke and Moce 1995).

Portions of MPAs and their management are legally recognized by the Fijian government. MPAs tend to be managed by traditional village chiefs and the chief may choose what additional regulations to enforce. Bumphead parrotfish harvest is regulated within MPAs by instituting traditional no take zones and other fishing regulations. In addition to regulations instituted outside MPAs, no take zones will also help protect coral reef and mangrove habitat.

Overall in Fiji, nationwide there are three major mechanisms that regulate adult harvest: (1) a ban on gillnets and scuba fishing; (2) protection under the Fijian Endangered and Protected Species Act; and (3) local reef fisheries' management practices are very strong. In addition, trade of bumphead parrotfish and Fiji's large network of MPAs are both well-managed at the local level. Mangroves and coral reefs are both protected by several national laws, and coral reefs are further protected by over 200 well-managed MPAs.

2.1.2.10 France (Territories)

Approximately 6.8% of coral reefs within the 46 areas in bumphead parrotfish range are in French territories. Two percent, or 292 km^2, of those are protected in MPAs (see Table 2 and Appendix A-1). French territories contain 0.3% of mangrove forests within the 46 areas (Table 3), with a portion of that in three protected areas (Appendix B).

French territories within the range of bumphead parrotfish are French Polynesia, Iles Esparses, La Reunion, Mayotte, and New Caledonia. These areas are known as the French Overseas Territories and are nationally managed by The Minister of Overseas France applying general French national laws to the territories.[54] Specific fisheries and environmental regulations are the responsibility of each territory to develop and vary from place to place. Overall, the customary land and sea tenure system is a particularly important element as it sets out the group and individual rights and obligations of indigenous people to their land, sea, and resources within each territory.

Fisheries and Coastal Management Regulatory Mechanisms

French Polynesia

French Polynesia is located in the southern Pacific Ocean and is made up of several groups of islands including the Marquesas Islands, Tuamotu Archipelago, Society Islands, Gambier Islands, and Austral Islands. Bumphead parrotfish do not occur in the Marquesas and Tuamotu Island groups. Locally, fisheries and the marine environment are managed by the Fisheries Service (SPE) of the Ministry of Fisheries.[55] According to A. Stein (pers. comm.), there are no territorial regulations specific to bumphead parrotfish. Other pertinent fisheries regulations

53 http://www.lmmanetwork.org/whatwedo/tabufiji
54 http://www.outre-mer.gouv.fr/
55 http://fisherymanagement.wikia.com/wiki/French_Polynesia

include the following: (1) in lagoons, fishers are allowed to use net mesh that is greater or equal to 45 mm, and may spearfish as long as they are 50m from swimmers and greater than 100m from beaches; (2) in coastal areas of Tahiti, there is a range of restrictions from no fishing to restrictions on the type of gear used, such as no net fishing;[56] and (3) other marine environmental regulations. The other marine environmental regulations include: (1) Title III of the Deliberation No. 88-183AT of 8 December 1988 Regulating Fishing in French Polynesia, which assigns an oversight committee for each municipality to monitor the species livestock in marine and freshwater systems; (2) the Management Plan Maritime Spaces (PGEM) sets guidelines for protection, exploitation, and management of lagoons; (3) the Minister for the Environment is responsible for managing coral reefs; (4) the overseas committee of the French Initiative for coral reefs (IFRECOR) established via the Decree of July 7, 2000 by the Minister is responsible for developing a strategy and national action plan for coral reefs, as well as making recommendations and ensuring the protection and sustainable management of these reefs in order to develop information for the public on coral reefs and coastal zone management; and (5) Deliberation on the Protection of Nature was adopted in 1995 (Decision No. 1995-257/AT of December 14, 1995 on the protection of nature, JOPF of December 28, 1995) and represents new principles for the regulation of the protection of nature, calling for the precautionary principle and individual and collective responsibility, and addressing natural protected areas, protection of fauna and flora species, and threatened biodiversity.

Iles Esparses

The Iles Esparses are a group of islands located near Madagascar. This island group is governed as one division of the French Overseas Territory of the Southern and Antarctic Lands (TAFF).[57] The Iles Esparses have no relevant territorial fishing regulations. There are no permanent human populations on either group of islands, but military personnel are temporarily stationed in the territory.

La Reunion

The island of Reunion (La Reunion) has local governing bodies specific to fisheries and environmental management. The Regional Maritime Affairs and Departmental (DRAM) is tasked with regulating fisheries and the coastal environment. The Agency for the Observation of the Meeting, Planning and Housing (AGORAH) and the National Office of Forests (ONF) are in charge of environmental management. Bumphead parrotfish are harvested using spears and nets (D. Obura pers. comm.). No territorial fishing regulations could be found outside of the MPA, which covers much of the coral reef habitat on the island. One relevant environmental plan is the Integrated Coastal Management Plan of the West Island of Reunion. Local Agenda 21 allows stakeholders to be involved in the development of this plan.[58]

Mayotte

Mayotte is part of the Comoros Archipelago, but is not part of the independent Comoros government. The island is governed as a French Overseas Territory, and various governmental decrees regulate fishing in Mayotte. The Decree No. 90-618 of 11 July 1990 Article 4 prohibits spearfishing on compressed air and with chemicals. There is no underwater fishing with a spear

56 www.mer.gov.pf
57 http://www.bartleby.com/151/fs.html
58 http://www.regionreunion.com/fr/spip/spip.php?page=accueilv2

between sunset and sunrise and it is forbidden to use a light while spearfishing. Also, it is prohibited to use dynamite or spear guns in lagoons. Article 5 prevents the degradation of fisheries resources, establishes protection zones around aquaculture facilities, and limits the type of gear used and species taken (Pusineri and Quillard 2008). The Decree No. 90-95 of 25 January 1990 permits the use of trawls, seine nets, and traps for fishing. The Decree No. 2010-1582 of 17 December 2010 establishes the Ministry of Agriculture and Forests. Under this department, agricultural land and forests are sustainably managed for protection and development.[59]

New Caledonia

New Caledonia is internationally recognized as a World Heritage site and this designation is supported by specific local legislation on fisheries, land and water use planning, urban development, and mining. The local government in New Caledonia is divided into the three provinces of Northern, Southern, and the Loyalty Islands. Each province is further divided into municipalities with a total of 33 municipalities in the country. Fisheries regulations are organized at the territory level, but there are also local traditional regulations commonly enforced throughout the provinces through consultation with the Customary Senate.[60] Bumphead parrotfish are harvested by both commercial and recreational fishers using primarily seine nets and spears, are commercially sold (Dulvy and Polunin 2004), and can be found in fish markets in Noumea (D. Bellwood and E. Coutures pers. comm.).

The Memento Sur La Reglementation des Peches Maritimes 2004 (Memento Act) is the primary national fisheries regulation. The Memento Act prohibits the use of explosives or chemicals for fishing, allows spears (between sunrise and sunset without the use of artificial propulsion) and underwater fishing equipment only on leisure and commercial vessels, restricts net size is to 75 m in length with a maximum depth of 1 m and minimum mesh diameter of 45 mm, limits the amount of fish that may be caught to 50 kg, and regulates coral harvest. Commercial take of coral and aquarium fish is permitted in certain areas. Also, it is prohibited to commercially fish for coral from vessels without a permit, with the exception the genera *Acropora* and *Fungia*. The weight of the harvested fragments of the coral genus *Acropora* cannot exceed 300 g.

The Memento Act also provides environmental regulations to protect coral and mangrove habitat. It establishes a national marine protection zone and multiple marine reserves. There is a protection zone of 1,000 m from the leaves of the highest tides around the islands of Grande Terre, Mare Island, Lifou, Ouvea, Ouen, Tiga, Yande, the Isle of Pines, and the archipelago of Belep. Within this zone, fishers must retain a permit to use nets longer than 100 m and coral harvesting is allowed for commercial purposes. The Congress of New Caledonia adopts traditional local government laws that help protect coral and mangrove habitat. One example of this is the Loyalty Islands Government Charter. Here, the Development Council has taken adaptations from Kanak culture and traditions for sustainable development and community participation in decision making. They monitor development indicators, implement orientations, and deal with communications and information issues to address such issues under French national law (Caillaud *et al*. 2004). Strong customary tenure and management practices are common of the Kanak (Melanesian) people, who were involved in developing the management

59 http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000023246361&dateTexte=&categorieLien=id
60 http://goutte.a.goutte.free.fr/rubrique/projets/caledofragile/presentation_politique.html

framework in partnership with French, New Caledonian, and Provincial Governments. About 50% of the main island and all the offshore islands are held in customary tenure through local chiefs and villages, whereas individual land ownership is most prevalent around the capital, Noumea, and on the west coast of Grande Terre. Finally, small-scale reforestation and afforestation programs have been instituted for mangrove forests (FAO 2007a).

Wallis and Futuna.

Wallis and Futuna is a French Overseas Territory consisting of three main islands, Wallis, Futuna, and Alofi. Wallis has fringing reefs around most of its coastline and is surrounded further by a barrier reef. Futuna coasts all have narrow fringing reefs, and Alofi has few such areas. Fishing is important mainly on a subsistence level, with fishers using hand lines, spearguns, and nets to fish. The use of explosives and poisons to fish is prohibited. The territory does not have MPAs. Customary management of the marine environment is common throughout Wallis and Futuna (Vanai 2000).

Summary of Fisheries and Coastal Management Regulatory Mechanisms

Overall, both New Caledonia and Mayotte have well established spearfishing regulations, having restrictions on spearfishing that range from no spearfishing on compressed air to no spearfishing after dark. French Polynesia has some regulated spearfishing in certain areas of the territory. Within these three territories, other gears are also somewhat regulated, but not as well as spearfishing. There are no fishing regulations outside of the MPA in Reunion, but the MPA covers 80% of the coral reef area. Wallis and Futuna have limited local fishing laws and some customary management. Iles Esparses have no relevant fishing laws.

There are relatively few regulations concerning mangroves and coral reefs across the territories. New Caledonia offers specific harvest regulations for coral reefs and legally establishes protection zones and MPAs. In French Polynesia, sustainable management of coral reefs is emphasized and MPAs are legally established. Also, in Mayotte, sustainable management of forest and agricultural land is encouraged. Other than the MPA that covers 40% of the island of Reunion and 80% of the coral reef habitat, there are no other environmental regulations in Reunion. Neither Iles Esparses nor Wallis and Futuna have territorial environmental laws.

MPA Regulations

Throughout the French territories, there are 89 coral reef MPAs listed in the WDPA (Appendix A) and three mangrove protected areas (Appendix B). Regulations within MPAs are specific to each territory and are discussed below. National parks are areas declared by the Division of the Environment of the French national government with the intent to preserve fauna, flora, waters, and some natural environment. These areas contain fishing and environmental regulations and are declared in the different territories below.[61]

French Polynesia

French Polynesia combines traditional resource management and sustainable use approaches with national protected area systems. There are at least seven *rahui*, or traditional rotational closures, which together total 441 km^2 (Govan *et al*. 2009b). These incorporate wide degrees of community participation through co-management arrangements. It is likely that other *rahui* exist

61 http://reserves-naturelles.org/

and various initiatives have raised the possibility of their revival. Some communities in French Polynesia have reinstated traditional bans or *rahui* but with the stated intention of closing access only to "outsiders." In addition to traditional closures, seven MPAs were legally established in 1971 in French Polynesia according to the French Polynesian Environmental Code. Later, in the Management Plan Maritime Spaces (PGEM), the island of Moorea and seven atolls comprising Fakarava were established as MPAs in 2000 (Verducci *et al*. 2007).

Iles Esparses

Iles Esparses does not have any legally established MPAs. The two nature reserves, Iles Glorieuses Nature Reserve and Ile Tromelin Nature Reserve on the islands of Grande Glorieuse and Tromelin Island, respectively, were established in 1975, though it is not clear whether or not this is a national designation (Le Corre and Safford 2001).

La Reunion

Approximately 40% of the island of Reunion is part of a national park call La Reunion National Park created in 2007. In an effort to combat coral reef degradation, Reunion has designated a National Natural Marine Reserve that is recognized by the French national government inside La Reunion National Park. The marine reserve encompasses an area of 35 km^2, or approximately 80% of the territorial island's coral reefs. Under the name Villages Creoles, a network of fifteen communities has united to manage resources in this reserve, employing a quality, responsible approach. The goal of this network is to participate in the development of populations and areas, and to contribute to the preservation of the environment, natural resources, and biodiversity. Within the reserve, there are three levels of protection: level 1 restricts certain uses; level 2 allows commercial fishing in 20% of this area and traditional fishing in certain places; and level 3 prohibits all activities including work, traffic, and moorings, but permits may be obtained for scientific purposes. There are fishing restrictions in the reserve, including no night fishing and no recreational fishing, net fishing, or spearfishing in enhanced protection zones.[62]

Mayotte

There are three regional MPAs in Mayotte: Passe de Longogori Strict Fishing Reserve, Saziley Marine Park, and N'Gouja Zone de Protection.[63] Fishing regulations in Saziley Marine Park include a ban on spearfishing outside the lagoon and a complete ban on fishing nets.[64] There is also one nationally established reserve called Ilot Mbouzi National Nature Reserve.[65]

New Caledonia

The Memento Sur La Reglementation des Peches Maritimes 2004 establishes Yves Merlet reserve, the Bay of Prony reserves, the wreck of Humboldt reserve, l'îlot Ténia marine reserve, Nékoro special reserve, and Ouano special marine reserve, all of which include areas where fishing is prohibited. Marine areas in New Caledonia are managed in a centralized manner with local participatory management committees. The "Lagoons of New Caledonia: Reef Diversity and Associated Ecosystems" was declared a World Heritage site on January 1, 2008, and is comprised of 28,614 km^2 and consists of six major lagoon areas with a core marine area of

62 http://www.reunion.ecologie.gouv.fr
63 http://www.wdpa.org
64 http://www.airesmarines.org/reseau/membres.asp?id=21#
65 http://www.parks.it/world/FR/Eindex.html

15,743 km^2. New Caledonia reported 444.5 km^2 of locally managed marine no-take zones (Govan *et al*. 2009b). There are a total of 17 protected areas that have limited or no fishing and coral harvesting restrictions.

Wallis and Futuna

It is reported that in 1999, the traditional chiefs approached the environment administrators and requested the creation of MPAs (Govan *et al*. 2009b) but no further information is available.

Summary of MPA Regulations

All French territories, except Wallis and Futuna, seem to have established some sort of protected areas regime either locally and/or through territorial laws. Customary management is common throughout the territories, with the exception of Iles Esparses. Spearfishing and gear restrictions appear to be well-regulated inside MPAs. Both Reunion and New Caledonia provide regulations for gear restrictions and establish no take areas within their MPAs. Spearfishing and net use are regulated within one MPA in Mayotte. Traditional no take areas are used on a rotating basis within New Caledonia, French Polynesia, and Wallis and Futuna.

No take areas in New Caledonia, Reunion, and French Polynesia will help protect fish species and coral and mangrove habitat within MPAs. Established national reserves throughout the territories also help to protect coral and mangrove habitat.

Overall, there is an asymmetric distribution of coral reef area throughout the French Overseas territories (i.e., New Caledonia has more coral reef area than the other 5 territories combined). Territorial law bans night spearfishing in New Caledonia, and outlaws it entirely in Mayotte. A variety of restrictions on other gears occur in the territories, and traditional coral reef fisheries management is important in some areas. In some territories, MPAs are small but provide strong protection, e.g., New Caledonia has 17 coral reef MPAs where fishing and coral harvest are banned or restricted. Mangroves are generally not protected, but there are some restrictions on coral harvest. Small MPA networks provide some coral reef protection.

2.1.2.11 India

Approximately 1.6% of coral reefs within the 46 areas in bumphead parrotfish range are in India. Twelve percent, or 420 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). India contains 5.4% of mangrove forests within the 46 areas (Table 3), with a portion of that in 33 protected areas (Appendix B).

The following description of India's regulatory mechanisms includes mainland India as well as the Andaman and Nicobar Islands. Fisheries in India are nationally regulated by the Department of Animal Husbandry, Dairying, and Fisheries under the Ministry of Agriculture. Primary responsibility of managing fisheries is given to each state.[66] The Ministry of Environment and Forests is tasked with setting environmental regulations that protect coral reefs and mangrove forests.[67] India's coral reefs are concentrated in the Andaman and Nicobar Islands, the Gulf of Mannar in Tamil Nadu state on the Indian mainland, and the Lakshadweep Islands. Traditional fisheries and environmental management are common throughout these areas in India.

66 http://www.dahd.nic.in/dahd/default.aspx
67 http://www.envfor.nic.in/legis/legis.html

Fisheries and Coastal Management Regulatory Mechanisms

Marine fishers use a variety of fishing gears in India including trawls, seines, lines, bag nets, stake nets and lift nets. Traditional traps are commonly used in the Gulf of Mannar (Varghese *et al*. 2008). There is no specific fishery for bumphead parrotfish along the Indian coast, though there are occasional reports of sightings in the Gulf of Mannar (V. Elayaperumal pers. comm.).

National fisheries regulations come from the Comprehensive Marine Fishing Policy. In this policy, the Indian government divides fishers into three groups: subsistence fishing, small-scale fishing, and industrial fishing. The policy encourages 50 percent of sea crafts to be traditional non-motorized crafts operated by subsistence fishers in nearshore waters. The policy acknowledges that marine fishing regulations acts developed by states are not always effectively enforced; therefore, provisions to those acts must be provided. This policy broadly bans destructive fishing methods, regulates mesh sizes, prohibits catching juveniles and non-target species, and prohibits discarding less preferred species once caught (Ministry of Agriculture 2004).

Surveys of reef fishes have found bumphead parrotfish living in a region of the Gulf of Mannar, which is part of the Indian State of Tamil Nadu. State fisheries regulations are mandated by the Marine Fishing Regulations Act of 1983 (as amended in 2000), which broadly reserves the right to restrict the number of fishing vessels allowed in an area, regulate fishing areas for certain species, and control fishing gear used (Vadivelu 1983). There is a ban on the use of gillnets from boats with inboard engines from April to May in the Gulf of Mannar (V. Elayaperumal pers. comm.).

The few national laws that apply to coral reef and mangrove habitat are the Environment (Protection) Act (EPA) of 1986, including the Coastal Regulation Zone Notification of 1991 issued under EPA, and the Wildlife (Protection) Act (WPA) of 1972. Mangroves are additionally protected under the Aquaculture Bill 1997. The EPA states that all coastal stretches of seas, bays, and estuaries up to 500 m from the high tide line on landward side are part of the Coastal Regulation Zone (CRZ). Within the CRZ, the 1991 CRZ Notification prohibits the conversion of mangroves into shrimp farms. There is a shrimp farm license system under the Aquaculture Bill 1997. Other laws that would have a bearing on coral reef and mangrove areas are the Indian Forest Act, 1927, the Forest Conservation Act, 1980 and the Indian Fisheries Act. Within mainland India and established under these acts, there are 100 wildlife sanctuaries, or "Pas," that have terrestrial or freshwater ecosystems that border seawater or partially contain coastal and marine environments (Rajagopalan 2008).

Customary management, though not formally recognized by the Indian government, is practiced throughout India. In Tamil Nadu, coral reef fisheries management is strongly rooted in a community-based system (*panchayats*). While generally not directly tied to government regulations, management problems that cannot be resolved at the *panchayats* level are taken to government officials who then intervene (Venkatachalam 2004). In the Lakshadweep Islands, there is a strong customary management of coral reef fisheries (Sivadas and Wesley 2006), although it does not appear to have been incorporated into local government regulations. On Agatti Island, the Indian Government, non-government organizations, and the local community are establishing a large MPA where some fishing will be regulated in accordance with customary

management (BNHS 2011). No information was found on customary coral reef fishing practices in the Andaman and Nicobar Islands.

Gears are poorly regulated in India outside of MPAs. There are no spearfishing regulations at national or state levels. Nationally, nets are regulated and destructive fishing is prohibited. Tamil Nadu is the only state that has other gear restrictions and those are seasonal. Andaman and Nicobar Islands and the Lakshadweep Islands have no regional fisheries regulations.

Coral reef and mangrove management come in the form of coastal zone management and aquaculture regulations. Wildlife sanctuaries containing marine components have also been legally established.

MPA Regulations

Throughout India, there are 106 coral reef MPAs listed in the WDPA (Appendix A) and 33 mangrove protected areas (Appendix B). The Gulf of Mannar is classified as both a regional MPA and a marine and terrestrial UNESCO-MAB Biosphere site and has various fisheries regulations. The Tamil Nadu Marine Fishing Regulation Act of 1983 prohibits fishing by fishing vessel and gives mesh size restrictions in the Gulf of Mannar MPA. The Maharashtra Marine Fishing Regulation Act of 1982 regulates crafts to traditional fishing vessels only between five and ten fathoms, and gives restrictions to net mesh size (Rajagopalan 2008). Another example is the Sunderban (India) and Sundarbans National Park (Bangladesh), which is an area shared between the two countries and is classified as marine and terrestrial World Heritage sites and UNESCO-MAB Biosphere sites. In total, there are four marine Ramsar sites and four marine and terrestrial Ramsar sites in India.[68]

In the Andaman and Nicobar Islands, many coral reefs are protected by an extensive system of MPAs (100 of India's total of 106 MPAs, Appendix A) where fishing is restricted (Kulkarni *et al*. 2001).

Overall, India has few, if any, regulations pertaining to spearfishing nationwide, but MPAs in India ban or restrict fishing in general. National fisheries regulations focus much more on nets, traps, and minimum sizes, rather than spearfishing. Local fisheries management is very important in southern India. Mangroves are protected by several national and state laws and an extensive network of MPAs protect mangroves and coral reefs in the Andaman and Nicobar Islands.

2.1.2.12 Indonesia

Approximately 18.5% of coral reefs within the 46 areas in bumphead parrotfish range are in Indonesia. Twenty-five percent, or 9,885 km^2, of those coral reefs are protected nationally in MPAs (see Table 2 and Appendix A-1). Indonesia contains 40.0% of mangrove forests within the 46 areas (Table 3), with a portion of that in 91 protected areas (Appendix B). Coral reefs may be found all around Sulawesi, Nusa Tenggara, Bali and Maluku; some reefs are also found in West Irian Jaya, islands East and West of Sumatra and East of Kalimantan.[69]

68 http://www.wdpa.org/
69 www.arcbc.org/arcbcweb/publications/mpa.htm

Indonesia is divided into 33 provinces, 503 districts, 6,543 sub-districts, and 75,244 villages. Each level of government has its own set of laws and ordinances. In general, fisheries policy is developed nationally by the Ministry of Marine Affairs (MMAF), and these regulations are enforced at the provincial and district levels. Indonesia National Laws 22 and 25/1999, which were then revised as Law 32 and 33/2004, decentralized coastal fisheries management from the provincial level to the district level, so districts also have management authority, and have developed, or are developing, their own district laws in accordance with national fisheries laws (Siry 2006). In many cases, district laws are based on pre-existing localized customary management practices (Satria and Matsuda 2004).

Fisheries and Coastal Management Regulatory Mechanisms

Marine fishers in Indonesia use portable traps, guiding barriers, beach seines, boat liftnets, set, drift, and encircling gillnets, troll lines, pole and lines, trammel nets, Danish seines, and harpoons.[70] Bumphead parrotfish are visually targeted from boats and are either herded into nets, harpooned from the bow of a chasing boat (M. Erdman and P. Mous pers. comm.), or harvested using a speargun while diving (C. Wilson pers. comm.). Bumphead parrotfish are also sometimes harvested as bycatch in large nets and seines.

Under Indonesian national authority, fishing regulations have been established that impact bumphead parrotfish. The Fisheries Law 31/2004 prohibits the use of chemicals and explosives. Clarification of the Act of the Republic of Indonesia No. 9 of 1985, article 6 prohibits catching or cultivating fish using materials or tools that may endanger or cause pollution to the fishery resource and its environment. This act also prohibits the use of explosives, but states an exception for scientific research.

To protect coral reefs, the Decree of the Minister for Agriculture N°609/Kpts/Um/9/1976 on the Fishing Areas for sea-bed trawlers delineates certain areas in Sumatra, Java, the Nusa Tenggara Islands, Malacca, Borneo, Karimata, and Macassar where vessels are permitted to use sea-bed trawls. The regulation of the MMAF No. PER.06/MEN/2008 from February 26, 2008 allows trawlers to fish in the Northern Part of East Kalimantan, subject to size and weight of the trawler.

Fisheries Law 31/2004 also provides provisions for mangrove habitat and emphasizes the sustainable use of aquatic resources in developing capture and aquaculture fisheries. Development of aquaculture is a major threat to mangrove habitat in this area. Licenses and EIAs are required for shrimp and fish breeders operating facilities larger than 50 ha, however small scale fishers and breeders are not required to get a license. Indonesia is also part of ASEAN, which mandates good shrimp farming management practices (FAO 2010b). In 2007, Indonesia enacted Act No 27/2007 on the management of coastal zone and small islands, regarded as the ICZM policy framework, with the MMAF appointed as leading agency.

In Indonesia, customary management of coral reef fisheries and other coastal resources includes both long-standing informal customary laws that predate decentralization, as well as relatively new formal regulations based on customary practices resulting from decentralization. Regardless, both types of customary management include forms of law enforcement and punishment of violators. For example, some areas use traditional understanding about the

70 http://www.fao.org/fishery/countrysector/FI-CP_ID/en

relationship between intensity of harvest and annual fish production to establish fish harvest restrictions. Enforcement units are specifically established for customary fisheries resource management, and fines or sanctions may be used to discourage noncompliance. The customary management system of *sasi* in Maluku Province is thought to be effective for sustainably managing coral reef resources, as are other forms of customary management in other provinces. Due to the recognition that customary management can be very effective, its incorporation into coral reef and coastal resource management regulations is encouraged throughout Indonesia (Purnomo 2003; BOBLME 2009).

Nationally, there are limited gear restrictions and no spearfishing laws. Since management is decentralized and district level management is encouraged by the government, traditional fisheries regulations enforced at the district level could be beneficial for fisheries management. Coral reefs and mangroves are protected through national coastal zone management and aquaculture policy. Also, traditional no take zones help protect coral reefs and mangrove habitat.

MPA Regulations

Throughout Indonesia, there are 201 coral reef MPAs listed in the WDPA (Appendix A) and 91 mangrove protected areas (Appendix B). MPAs range from national parks to locally-managed marine areas, with management varying from no-take to active management. MPAs are nationally managed by the Ministry of Forestry in Jakarta and provincially managed by Konservasi Sumber Daya Alam (KSDA). Under the Ministry of Forestry, the Spatial Planning Act of 1992 requires MPAs to have a 25-year management plan in addition to short- and medium-term plans for one to five years (Clifton 2003). Spatial Planning Law 26/2007 established under the Spatial Planning Act differentiates the uses of areas within two or more provinces spatially and requires the provinces to determine these areas. MPAs serve as environmental conservation areas under this law.[71] MPAs are also managed nationally by the Ministry of Marine Affairs and Fisheries according to Fisheries Law 31/2004. Komodo National Park is both a marine and terrestrial World Heritage site and a marine UNESCO-MAB Biosphere site. Lorentz National Park is also a marine and terrestrial World Heritage site. There are two marine and terrestrial Ramsar sites, Berbak and Wasur National Park. Siberut and Tanjung Putti are marine and terrestrial UNESCO-MAB Biosphere sites. Conservation areas, particularly areas containing mangrove habitat, are designated by the government.

Overall, the Indonesian national government asserts that customary law and/or traditional management is adapted to local areas, and therefore more effective than a homogeneous national law. Coral reef fisheries management is decentralized to the 503 districts, and district laws and regulations are typically based on customary law and/or traditional management. A large network of MPAs protects 25% of the coral reefs, many of which ban or regulate coral reef fisheries. Mangroves and coral reefs are protected by national laws. A significant proportion of mangrove area is protected within a system of 91 protected areas.

2.1.2.13 Iran

Approximately 0.1% of coral reefs within the 46 areas in bumphead parrotfish range are in Iran. Two percent, or 5 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-

71 http://indonesiaurbanstudies.blogspot.com/2008/09/historical-overview-of-spatial-planning.html

1). Iran contains 0.2% of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with a portion of that in eight protected areas (Appendix B).

The Iranian Fisheries Organization, which is part of the Ministry of Agriculture, manages all fisheries development for the entire country.[72] Regulations for the environment are developed by the Iranian Environmental Protection Organization (IEPO). Corals are mostly restricted to waters near the Arabian Sea and around islands in the Strait of Hormuz (Siddeek 1999).

Fisheries and Coastal Management Regulatory Mechanisms

Marine fisheries in Iran are composed of both commercial and artisanal fishers who often use a combination of gears such as drift gillnets, wire traps, longlines, shrimp trawls, beach seines, purse seines, and traditional gears, including set nets and set barrier nets.[73]

The Law of Protection and Exploitation of the Fisheries Resources of Iran prohibits fishers from carrying or applying illegal fishing gear, explosives, toxic and/or electric materials that cause weakness, illness, or mortality of fish. Areas must develop a resource management plan that identifies exploitable resources and methods of sustainable utilization including quantity extracted, method, and gear used for fishing.

The goals of Iran's IEPO are to: (1) protect the environment and ensure utilization in line with environmental standards and sustainable development; (2) use environmentally friendly technologies and provide environmental guidelines for site location of large industrial projects, and agricultural and human settlements; (3) identify critical habitats of high value; (4) develop regional and international cooperation in the environment; (5) prepare environmental regulations and standards for management and utilization of environmental resources and solid waste management in urban, rural, industrial and agricultural ecosystems; (6) develop environmental awareness; (7) collect, preserve and display plant and animal species through the creation of museums and exhibitions; and (8) provide supervision and legal intervention to prevent pollution. Laws under the IEPO that could potentially protect coral reef habitat are the Environmental Protection and Enhancement Act of 1974 and the Prevention of Water Pollution Regulation of 1994.

MPA Regulations

Throughout Iran, there are currently nine coral reef MPAs listed in the WDPA (Appendix A) and eight mangrove protected areas (Appendix B). As recently as 1999, however, coral reef habitat was only protected in one area – the Shidvar Wildlife Refuge (Siddeek, 1999).

There are limited laws on fisheries management, and a small percentage of Iran's coral reefs are protected within MPAs. There are no specific laws protecting mangroves or coral reefs.

2.1.2.14 Israel

A negligible percentage of coral reefs within the 46 areas in bumphead parrotfish range are in Israel. Fringing coral reefs line the coast of Israel in the Gulf of Aqaba. Fifteen percent of Israel's reefs are in MPAs and thus protected nationally (see Table 2 and Appendix A-1). Israel

72 http://www.fao.org/fishery/countrysector/naso_iran/en
73 http://www.fao.org/fishery/countrysector/FI-CP_IR/en

contains 0.2% of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with a portion of that in eight protected areas (Appendix B).

The Israel Ministry of the Environment is the main governing body with management authority of the marine environment. Under this management authority the most relevant regulations are the Fisheries Ordinance of 1937 and its amendments, originally enacted by the British High Commissioner for Palestine in 1937, the Protection of the Coastal Environment Law 2004, the Prevention of Sea Pollution for Land-Based Sources Regulations 1990, the Prevention of Sea Water Pollution by Oil Regulations 1983, and the Declaration of National Parks, Nature Reserves, National Sites, and Memorial Sites.

Fisheries and Coastal Management Regulatory Mechanisms

Marine fishers in Israel use trawls, gillnets, longlines, and purse seines.[74] Fishing gears are regulated by the Fisheries Ordinance of 1937 and the Fisheries Rules of 1937. The Fisheries Ordinance of 1937 states that the fisher needs a license to fish and prohibits fishing with dynamite or noxious substances; offenders can face imprisonment. The Ministry of Agriculture can designate a minimum size for fish landed and size of mesh for net fishing. In the Fisheries Rules of 1937, it is prohibited to use a fixed net, barrier, grill, line of traps or other devices that halt or disturb the regular migration of fish to or from an estuary, except with special permission. There is also a specified length of certain fish presented in the Schedule, allowing fishers to obtain permits to catch as much as 1 kg of fish. Legislation protects coral reefs from land-based sources, oil pollution, and other threats.

Aquaculture is common in Israel, making up about 84% of domestic fish production. The prevalence of aquaculture is considered a threat to coastal habitat (FAO 2007b). Both development and pollution in the coastal environment are regulated by the Protection of the Coastal Environment Law of 2004, the Prevention of Sea Pollution from Land-Based Sources Regulations of 1990, and the Prevention of Sea Water Pollution by Oil Regulations of 1983. The Protection of the Coastal Environment Law of 2004 aims to protect the coastal environment from damage, preserve the coastal environment and coastal sand for the benefit and enjoyment of the public for present and future generations, and to establish principles and limitations for sustainable management, development, and use of the coastal environment. The Prevention of Sea Pollution from Land-Based Sources Regulations of 1990 authorizes permits for the discharge of waste or sewage into the sea from a land-based source which may or may not be granted by the Permits Issue Committee. The committee decides whether a permit is warranted, and if so under what conditions and for how long. Permits are only issued under special conditions when the waste or wastewater does not contain toxic materials harmful to the marine environment, as specified in the annexes to the regulations. The Prevention of Sea Water Pollution by Oil Regulations (Marine Environment Protection Fee) of 1983 set a fee on the owners of vessels and tankers calling at Israeli ports and on coastal installations handling oil.

MPA Regulations

Throughout Israel, there are two coral reef MPAs listed in the WDPA (Appendix A) and eight mangrove MPAs (Appendix B). Under the Declaration on national parks, nature reserves, national sites and memorial sites (Protected Natural Assets), "protected natural assets," defined

74 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_IL.pdf

as flora or fauna at risk of extinction can, in the opinion of the Minister of Environmental Protection, be declared valuable for protection. The law prohibits destroying, possessing or trading in these protected natural assets. The Red Sea Marine Peace Park between Israel and Jordan was launched in September 1999 to protect coral reefs shared between the two nations.

Overall in Israel, there are limited laws on fisheries management, and a small percentage of coral reef area is protected within MPAs.

2.1.2.15 Japan

Approximately 0.8% of coral reefs within the 46 areas in bumphead parrotfish range are in Japan. Nineteen percent, or 339 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Japan contains a negligible percent of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with a portion of that in eight protected areas (Appendix B).

Japan is an archipelago of 6,852 islands and the major coral reefs are found off the southernmost island groups, the Ryukyu Islands and Ogasawara Islands. Patches of coral reefs are found off other islands all located between 24°N and 30°N (Tsuchiya *et al*. 2004). The Ministry of Agriculture, Forestry and Fisheries (MAFF) is in charge of fisheries management in Japan.[75]. Environmental management is tasked to the Ministry of the Environment. Fisheries and environmental policy are developed and enforced nationally.

Fisheries and Coastal Management Regulatory Mechanisms

Marine fisheries in Japan are divided into distant-water fisheries, offshore fisheries, and coastal fisheries. Coastal fisheries are within waters adjacent to fishing villages and are the most likely to include bumphead parrotfish in their catch. Fishing effort is managed by regulating the number of fishers or vessels and type of gear used in different areas and seasons.[76]

Fisheries management is enforced through the Fisheries Resource Conservation Law, the Fisheries Basic Law, and the Living Aquatic Resources Protection Act. The Fishery Resources Conservation Law, Articles 5 through 7, prohibit the take or gather of aquatic animals by explosives or poisons (except by permit). The Fisheries Basic Law of 2001 emphasizes sustainable utilization of living aquatic resources, stating fisheries must provide a basic management plan of catch and fishing effort in the EEZ. The Living Aquatic Resources Protection Act benefits coral reefs because it designates 116 aquatic protected areas for conservation, mandates restrictions on catch, and prohibits destructive fishing.[77] The Fishery Adjustment Rule also benefits coral reefs because it regulates the collection of biota, as well as the permissibility of particular fishing gears and boats. Collection of hermatypic corals is completely prohibited in Okinawa and the Ogasawara Islands. Also notable is that coastal management is enforced through three separate laws: the Fishery Act, the Harbor Act, and the Coast Act.

MPA Regulations

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75 http://www.maff.go.jp/e/index.html
76 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_JP.pdf
77 http://www.cbd.int/countries/profile.shtml?country=jp

Throughout Japan, there are 28 coral reef MPAs listed in the WDPA (Appendix A) and eight mangrove protected areas (Appendix B). The New National Biodiversity Strategy of Japan aims to achieve a society that can co-exist with nature. The government proclaims to implement nature restoration projects to rehabilitate degraded environments, including coral reefs, while strengthening conservation efforts to preserve healthy environments. Government agencies and local authorities are in charge of coastal management but are separate from each other. Laws have been developed to include conservation measures, and conservation projects are underway in some areas. Marine parks and nature reserves are established via the Nature Conservation Law and the Natural Parks Law. The Nature Conservation Law provides for the establishment of Nature Conservation Areas (areas worthy of protection for both environmental and social reasons), stating natural conservation areas should include "areas that sustain well-preserved nature including native fauna and flora, e.g. tropical fish, coral, and seaweed." It also provides for the establishment of Marine Special Areas where the collection of marine fauna and flora, reclamation, and dredging are prohibited. The Natural Parks Law provides for the establishment of Marine Park Zones. Activities such as collection of marine fauna and flora (specified by the Minister of the Environment), reclamation, and dredging are regulated inside Marine Park Zones.

Japan has a total of 13 marine parks containing coral reefs that were established under the Natural Parks Law, with a number of marine parks considered MPAs. Eleven sites are classified as marine and terrestrial Ramsar sites and Rujimae-Higata and Manko are marine Ramsar sites.[78] According to the Natural Parks Law, fishing can occur in these areas if it does not obstruct the natural scenic beauty.

Extensive centralized national fisheries laws regulate all fisheries in Japan, but spearfishing does not appear to be heavily regulated. A network of 28 MPAs protects 19% of coral reef area. Coral reefs and other coastal habitats are protected by numerous national laws. In some areas, coral collection is banned.

2.1.2.16 Kenya

Approximately 0.3% of coral reefs within the 46 areas in bumphead parrotfish range are in Kenya. Twenty-six percent, or 181 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Kenya contains 0.8% of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with a portion of that in 11 protected areas (Appendix B).

The Ministry of Fisheries Development is nationally in charge of fisheries management in Kenya. Kenya is divided into 47 districts that each have their own government. Traditional fisheries and environmental management is also common throughout the country.

Fisheries and Coastal Management Regulatory Mechanisms

Artisanal fishers are the primary fishers on the coast of Kenya, often fishing in inshore reef systems, mangroves, sandy shores, mudflats, rocky shores, and seagrass lagoons (Government of Kenya 2009). The most common gears used are gillnets, traditional traps, seine nets, long-line hooks, hook-and-line, and other traps.[79] Yields of lagoon reef fish have declined due to the increase in effort and competition for resources, and advanced fishing gear has been introduced,

78 http://www.wdpa.org/
79 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_KE.pdf

leading to signs of overexploitation. Habitat degradation and destructive fishing practices are prevalent due to this increase in extractive pressure (Government of Kenya 2009).

The majority of fisheries activities are nationally regulated by the Fisheries Act, which was revised in 1991. Under the Act, the Minister can impose measures for management by designating prohibited fishing areas for all regulated species of fish, setting the amount, size, and age of the fish caught, landed, or traded, regulating the methods of fishing, and providing limitations on gear and mesh size. The Act also limits the number of people or vessels and the nets and/or gear on the vessel used in a fishery. Additional bumphead parrotfish protections come from the Fish Industry Act, which prohibits dynamite fishing and coral mining inside MPAs. Fishing is regulated at the community level by Beaches Management Units (BMUs), which are legally established by the Fisheries Management Unit Regulations 2007 Part V. BMUs have the authority to employ gear restrictions, limit access to outsiders, and enforce seasonal and full closures—known as *Maeneo Tengefu.*[80]

The national regulation most specific to managing mangrove harvest is the ban on mangrove export that was implemented in 1982 (Macintosh and Ashton 2003). The banning of commercial exploitation of mangrove poles has helped ameliorate deforestation (FAO 2007a). Also, mangroves are protected within forest reserves under N°44 since April 30, 1932 and N°174 since May 20, 1964. These regulations restrict access to and utilization of mangrove forests (Drude de Lacerda 2002).

MPA Regulations

Throughout Kenya, there are 11 coral reef MPAs listed in the WDPA (Appendix A) and 11 mangrove protected areas (Appendix B). Two pieces of legislation affecting the establishment of MPAs in coral reef and mangrove areas in Kenya are the Fish Industry Act of 1968 and the Wildlife (Conservation and Management) Act of 1976. Although neither of these policies specifically mentions coral reef habitat, through the powers vested in the Kenya Wildlife Service, an agency established by the Wildlife Act, coral reefs are now recognized as valuable ecosystems. MPAs in Kenya can be categorized into three different management regimes: fully protected areas, partially protected areas, or areas offering no protection. Regulations in fully protected marine areas, or Marine National Parks, include prohibiting any extractive use either with or without a license. Samples for research or education may only be collected with the authority of the Office of the President in collaboration with the Kenya Wildlife Service.

Partially protected areas, or Marine National Reserves, contain coral reef areas used as buffer zones that transition into the Marine National Parks as well as multiple use areas. Harvesting of fish and other marine organisms is permitted with a license from the Fisheries Department; however, only traditional fishing techniques and universal hook-and-line are permitted. Destructive fishing techniques such as dynamite fishing, seine netting, and coral mining are prohibited. Currently, the Kenya Wildlife Service has established four Marine National Parks covering 54 km² of habitat and six Marine National Reserves covering 956 km² of habitat. Locally managed marine areas (LMMAs) are established by a coordinated effort between NGOs and the Fisheries Department and are regulated by BMUs.[81]

80 http://recomap-io.org/detail/?tx_ttnews%5Btt_news%5D=36&cHash=9e3038e9b71547778c28e564a3cc7473
81 http://recomap-io.org/detail/?tx_ttnews%5Btt_news%5D=36&cHash=9e3038e9b71547778c28e564a3cc7473

Overall, Kenya has little if any regulation of spearfishing nationwide, but MPAs ban or restrict fishing in general. Local fisheries management is very important in Kenya. Mangroves and coral reefs are well protected by national laws. An extensive network of MPAs protects mangroves, as well as 26% of the country's coral reefs.

2.1.2.17 Kiribati

Approximately 1.4% of the coral reefs within the 46 areas in bumphead parrotfish range are in Kiribati. Six percent, or 182 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Kiribati contains a negligible percentage of mangrove forests within the 46 areas (Table 3), with no mangrove protected areas (Appendix B).

Kiribati is made up of 33 low-lying atolls divided into three island groups that span approximately 5,000,000 km^2 of ocean on either side of the International Date Line. The three island groups are, going from east to west, the Line Islands, the Phoenix Islands, and the Gilbert Islands. Nationally, fisheries are managed by the Fisheries Division of the Ministry of Fisheries and Marine Resources Development.[82] Traditional management is practiced throughout Kiribati, though it is not recognized by the Kiribati government (Johannes 2002).

Fisheries and Coastal Management Regulatory Mechanisms

Coastal fisheries in Kiribati are mostly subsistence fishers supporting their families and supplying local fish markets. Commercial fishers use longlines, purse seines, and pole-and-line. Artisanal fishers use hand-lining, trolling, pole-and-line, mid-water hand-lining, spearing, trapping, netting, and reef gleaning.[83] On reef flats and within reef passages, spearfishing and fish traps are used. Splash-fishing (*ororo*) employs a long gillnet and fish are driven into the net by splashing the surface with iron bars. The catch of nearshore commercial fisheries consists of about 54% reef and deep-slope fish (Thomas 2003) and could include bumphead parrotfish.

There are national regulations for fisheries and bumphead parrotfish habitat. According to the Fisheries (Amendment) Act of 2008,[84] a license is needed to fish nationally. Section 14 of the Fisheries Ordinance prohibits the use of explosives, poison or other noxious substances for killing, stunning, disabling or catching fish. The State Lands Act 2001 declares that the state owns the land and it should be made available for development, especially for the permanent settlement of citizens and families.

Below are summaries of fisheries and coastal management presented for each of the three island groups.

Line Group

Adult bumphead parrotfish are harvested primarily via day and night spearfishing, and to a lesser extent using gillnets and harpoon. Spearfishing is commonly done by free-divers as SCUBA equipment is not readily available on all atolls. There are no species-specific regulations for bumphead parrotfish harvest (D.J. McCauley pers. comm.). The Republic of Kiribati National

82 http://fisherymanagement.wikia.com/wiki/Kiribati
83 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_KI.pdf
84 http://www.paclii.org/ki/legis/num act/fa2008190/

Biodiversity Strategy and Action Plan from October 2006 gives a five-year goal of banning destructive fishing methods including coral mining (Environment and Conservation Division 2006).

Phoenix Group

There are no regional fisheries regulations outside of MPAs in the Phoenix Group.

Gilbert Group

There are no regional fisheries regulations outside of MPAs in the Gilbert Group. However, customary management in present in this island group. North Tarawa, in the Gilbert Group, still has some customary sea tenure in place. Moreover, the Republic of Kiribati National Biodiversity Strategy and Action Plan from October 2006 gives a five-year goal of banning destructive fishing methods including coral mining (Environment and Conservation Division 2006). Also, the islands of Tamana and Arorae, which are within the Gilbert Group, have restrictions on pressure lamps for fly fishing (Thomas 2003).

MPA Regulations

Throughout Kiribati, there are 14 coral reef MPAs listed in the WDPA (Appendix A) and no mangrove protected areas (Appendix B).

Line Group

There is one marine protected area in the Cocos Islet of Kiritimati Island in the Southern Line Group that offers in-situ conservation of marine target species for live fish trade. There are also 11 other protected areas that are refuges for "resident breeding marine… biota and critical habitat for many endemic, depleted and endangered species." The Republic of Kiribati National Biodiversity Strategy and Action Plan from October 2006 gives a five-year goal of banning fishing during fish aggregate periods in marine protected areas (Environment and Conservation Division 2006). There are no mangroves in this island group, but there are lagoons and coral habitat.

Phoenix Group

The Phoenix Island Group is home to the world's largest marine protected area. The Phoenix Islands Protected Area (PIPA) was officially formed in 2008 by a partnership between the Government of Kiribati, non-governmental conservation organizations, and the Australian and New Zealand governments.[85] PIPA, which covers 410,500 km², conserves one of the world's last intact oceanic coral archipelago ecosystems, consisting of 8 coral atolls and 2 submerged reef systems in a nearly uninhabited region, with abundant marine and bird life. The Government of Kiribati supports the PIPA, a no take MPA, through a "reverse fishing license" financing program where the government is "reimbursed the amount they would have made from selling fishing licenses if the area were not protected."[86] There are no mangroves on any of the atolls.

Gilbert Group

85 http://www.phoenixislands.org
86 http://www.phoenixislands.org/fish.html

There are five marine protected areas designated on different islands in the Gilbert Group that are either closed part of the year or all year to fishing. The Republic of Kiribati National Biodiversity Strategy and Action Plan (October 2006) gives a five-year goal of banning fishing during fish aggregate periods in marine protected areas (Environment and Conservation Division 2006).

Overall, Kiribati has little if any regulation of reef fish spearfishing nationwide, but MPAs ban or restrict fishing in general. Traditional fisheries management is important on some islands. A network of MPAs protects some coral reefs and other coastal areas.

2.1.2.18 Madagascar

Approximately 1.8% of coral reefs within the 46 areas in bumphead parrotfish range are in Madagascar. Two percent, or 79 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Madagascar contains 3.8% of mangrove forests within the 46 areas (Table 3), with a portion of that in six protected areas (Appendix B).

Fisheries are managed nationally by the Ministry of Agriculture, Livestock and Fisheries (MAEP). The MAEP manages fisheries through the Direction of Fishing and Fishing Resources. MAEP designates enforcement duties to fall to the Centre for Surveillance and Fisheries. Fisheries are further regionally managed by the Regional Directions for Rural Development and the Regional Services for Fishing and Fish Production. These agencies collaborate with the local *Faritany*, or provinces, to apply management decisions (De Young 2006). Traditional fishing and fisheries management are common throughout Madagascar.

Fisheries and Coastal Management Regulatory Mechanisms

Marine fisheries in Madagascar are divided into three categories: traditional, artisanal, and industrial fisheries. Coastal fisheries are mainly exploited by industrial fishers and to a lesser extent by traditional fishers. Industrial fishers tend to harvest shrimp while traditional fishers harvest other marine fish.[87] Bumphead parrotfish are harvested using spears and nets. In northeastern Madagascar, there is an active tourist spearfishing industry and bumphead parrotfish are advertised as a prize catch (D. Obura pers. comm.).

Fishing is regulated nationally by the Charter of the Environment of 1990, stating that any project that might damage the environment must be subject to an Environmental Impact Assessment (EIA). This regulation has been supplemented by further decrees and covers projects in mangrove areas (Percy and Hishamunda 2001). Also, the regulation prohibits the use of SCUBA while fishing (Navalon 2010). All fishers are required to abide by bans on the use of toxic substances, explosives and electrical devices. Also, there are SCUBA and hookah bans stated as a "ban on using equipment to prolong a dive longer than one using only breath" (De Young 2006).

Fishing is also regulated through traditional management practices, though they are not formally recognized by the national government. *Fady* are local taboos that place restrictions on species fished, limit days people can work, and designate sacred areas where fishing is prohibited. *Dina*

87 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_MG.pdf

is a form of enforcement used in the traditional court system, sometime resulting in severe punishments (Cinner *et al*. 2009a).

MPA Regulations

Throughout Madagascar, there are 15 coral reef MPAs listed in the WDPA (Appendix A) and six mangrove protected areas (Appendix B). Protection zones are established and managed through collaboration between the National Office for the Environment and NGOs (De Young 2006). Most notably, there are two marine and terrestrial UNESCO-MAB Biosphere sites called Mananara Nord and Sahamalaza – Iles Radama.[88] Madagascar's northeastern coast features the Mananara Nord National Park and Biosphere Reserve Complex, a protected underwater refuge with coral reefs that covers 2,000 acres of marine habitat. The Sahamalaza/Radama Marine Biosphere Reserve is on the northwest coast containing coral, mangrove, and forest ecosystems, and is used by local people for fishing crab and shrimp. Also, Masoala National Park is comprised of both terrestrial and marine ecosystems and features within three marine parks: Tajona, Tampolo, and Cap Masoala, that protect over 10,000 ha of coral reefs and mangroves. Within each marine park, there are no-take zones present, and multiple-use zones, which local residents can use. The total area of no-take zones in Madagascar's marine parks is approximately 10 km² (Cinner *et al*. 2009b). Other examples of protected areas include the proposed marine park Grand Recif Marine National Park, Nosy Tanikely which contains a no fishing zone, and Nosy Ve which has a community-based marine management area.

Overall, national law in Madagascar bans spearfishing on SCUBA or hookah, and regulates other gears. A network of MPAs protects coral reef habitat, and each MPA includes a no-take area. In many areas, customary law is important for fisheries management. Development of coastal areas, including mangroves and coral reefs, is regulated by national law.

2.1.2.19 Malaysia

Approximately 1.4% of coral reefs within the 46 areas in bumphead parrotfish range are in Malaysia. Seven percent, or 205 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Malaysia contains 8.9% of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with a portion of that in 88 protected areas (Appendix B).

Malaysia is a federation of 13 states and two federal territories, each having their own government.[89] Fisheries are managed nationally by the Department of Fisheries, part of the Ministry of Agriculture. There is also a Department of Fisheries for the Sabah region of Malaysia. The Department of Environment of the Ministry of Science, Technology and Environment and the Forestry Department of each state manage coral reef and mangrove habitat.

Fisheries and Coastal Management Regulatory Mechanisms

The nearshore area in Malaysia is considered to have experienced overfishing in the recent years and the government is encouraging aquaculture, fish processing, or deep-sea fishing to alleviate fishing in this area.[90] Bumphead parrotfish are known to be caught using gill nets, hook-and-line, and possibly explosives, and have been seen in fish markets in Malaysia. There are no

88 http://www.wdpa.org
89 http://www.state.gov/r/pa/ei/bgn/2777.htm
90 http://www.new-ag.info/en/country/profile.php?a=865

regulations specific to bumphead parrotfish harvest, including no traditional practices (K. Kassem pers. comm.).

Marine waters are divided into three different fishing zones, A, B, and C. Zone A is defined as the shoreline out to five nautical miles (nm) from shore and is reserved for small vessels using traditional fishing gears (FAO 2009a). Traditional gears include driftnets, gillnets, bagnets, hook and line, trammelnets, liftnets, and traps (Abu Talib and Alias 1997). Zone B includes waters five to twelve nm from shore, and commercial fishing activities using trawls and purse seines are allowed. Zone C is broken down into two classifications, C1 and C2. Zone C1 is defined as waters 12 to 30 nm from shore and allows vessels below 70 gross tonnage (GRT) to use trawls and purse seines. Zone C2 is all waters beyond 30 nm from shore and allows vessels weighing 70 GRT or above. Commercial fishing operations are not allowed in waters less than 5 nm from shore (FAO 2009a), therefore traditional fishers will fish in these waters closer to shore. Trawl fishers must be licensed.

The Department of Fisheries is the federal government agency tasked with the protection of marine resources in Malaysia. The Fisheries Act of 1985 (amended in 2006) is the main piece of fisheries legislation. It places a moratorium on the issuance of new or additional fishing licenses for vessels in coastal waters stating a license is needed for fishing stakes, fish appliances, and fish-aggregation devices from the Director-General to maintain a maximum sustainable yield in the three fishing zones. A fishing appliance is defined as a fishing net, a fishing trap, and any gear with or without floats, buoys, or sinkers designed to capture fish, not including hook-and-line or a cast net locally called *jala*. The Minister can regulate conduct of use and stowage of these gears when not in use on vessels (FAO 2009a). Protections for using traditional gears are written into the act, which is common in Sarawak and Sabah (Abu Talib and Alias 1997). Most notably, the act prohibits fishing with the aid of explosives, poisons, pollutants, or any apparatus utilizing electric currents.

Mangroves are managed by each state under the jurisdiction of the Forestry Department and management regimes vary between the states. For example, in Peninsular Malaysia, the National Forestry Policy (NFP) institutes degrees of protection on forest land with Matang Mangrove Forest being considered one of the best managed reserves in the world (Choudhury 1997; Traffic International 2004). It is a Permanent Reserved Forest under the NFP where commercial logging is prohibited but allows clearing and replanting as long as the maximum sustainable yield is obtained (Traffic International, 2004). Nationally, approximately 6,412 km² of mangrove area are protected within marine protected areas.[91] In other parts of Malaysia, mangroves are not protected from harvest (Angell 2004). Outside of parks and reserves, environmental pollution protection and waste management in both mangrove and coral reef areas are managed by the Department of Environment of the Ministry of Science, Technology and Environment (UP-MSI *et al*. 2002).

MPA Regulations

Throughout Malaysia, there are 93 coral reef MPAs listed in the WDPA (Appendix A) and 88 mangrove protected areas (Appendix B). Marine parks and reserves are created under guidelines provided by the National Advisory Council for Marine Park and Marine Reserve. This agency

91 www.arcbc.org/arcbcweb/publications/mpa.htm

determines protection, conservation, utilization, control, management, and progress guidelines for creating MPAs. The Fisheries Act of 1985 (amended in 2006) mandates for the establishment of marine parks to protect aquatic flora and fauna for natural regeneration, support scientific study, preserve and enhance the pristine state of an ecosystem, or to regulate recreational activities. In a marine park, there is no fishing and it is unlawful to possess a speargun (FAO 2009a). Taking of coral and anchoring within a marine park is prohibited and all fishing and extractive activities are prohibited within two nautical miles around islands declared as marine parks (UP-MSI *et al*. 2002). The MPA system in Malaysia is relatively well developed with MPAs in most areas of the country. As of 2002, about forty Marine Parks were managed by the federal Department of Fisheries all rated well-managed, or grade "A." There are also three State Parks on Sabah, and three Fisheries Prohibited Areas, established under the Fisheries (Prohibited Areas) Regulations of 1994, on Sarawak. Malaysia has four Ramsar sites including Kuching Wetlands National Park (a marine and terrestrial Ramsar site) as well as three other marine Ramsar sites.

Wildlife sanctuaries and national parks can include coral reef and mangrove habitat and are created by the Department of Wildlife and National Parks of the Ministry of Science, Technology and Environment, the federal government agency tasked with the implementation of the Protection of Wildlife Act 1972 and National Parks Act 1980. The Protection of Wildlife (Amendment) Act 1988 established Wildlife sanctuaries where it is prohibited to shoot, kill or disturb any animal, or disturb or remove any vegetation. States also have control over their coastal waters and can mandate protected areas as well (UP-MSI *et al*. 2002). The National Parks Act 1980 governs the creation and maintenance of national parks.[92]

Overall, Malaysia's centralized fisheries and coastal resource management provides strong regulation of coral reef fisheries and mangrove harvest. The extensive network of coral reef MPAs and mangrove protected areas is strictly managed, e.g., no fishing is allowed in marine parks, and most mangroves are encompassed by protected areas.

2.1.2.20 Maldives

Approximately 2.5% of coral reefs within the 46 areas in bumphead parrotfish range are in Maldives. A negligible percentage of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Maldives contains a negligible percentage of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with no mangrove protected areas (Appendix B).

The Maldives is a nation of about 1190 small, low-lying coral islands scattered across the Indian Ocean; most islands are no more than a meter above sea level. These islands stretch more than 800 km from north to south and cover a total area of about 90,000 km^2, of which about 99% is water (Spalding *et al*. 2001). The Ministry of Fisheries and Agriculture has a Fisheries Division that regulates fisheries and manages protected areas nationally.[93] This agency is legally responsible for the management of all issues and activities relating to marine living resources in the Maldives.

Fisheries and Coastal Management Regulatory Mechanisms

92 http://en.wikipedia.org/wiki/National_Parks_Act_1980_%28Malaysia%29
93 http://www.fishagri.gov.mv/?a=home&l=en

Reef fisheries are a more recent development in Maldivian fishing and are typically small-scale operations within rural communities (Johannes 1997). Evidence that bumphead parrotfish are harvested and the methods used could not be found. Also, there seems to be no local demand for this species (S.A. Sattar and C. Anderson pers. comm.). The Fisheries Law of Maldives (Law No. 5/87, 24-08-87) governs the management of all fisheries activities in the Maldives. Under this law, it is prohibited to kill, capture, or extract any species of parrotfish. Fisheries Regulations 1997 are drawn under the Fisheries Law of Maldives and give details and updates relating to fisheries regulations in the form of notifications and written regulations. Specific destructive fishing practices are banned in the Maldives including the use of dynamite or explosives, the use of spearguns or such devices to catch fish, the use of any chemical to collect or catch fish, and the use of SCUBA gear to collect sea cucumber and lobsters. There is no lagoon fishing on inhabited islands or tourist resorts and no net fishing in Male's lagoon. Where fishing is permitted in lagoons, fish traps and weirs must be registered at the atoll office and permission for installation is granted by the Ministry of Fisheries and Agriculture. Special areas or species can be protected from exploitation or export if the need arises (FAO 2009b).

In 1993 the People's Majlis, the main legislative body in the Maldives, adopted the Environment Protection and Preservation Act (EPPA). The EPPA serves as the foundation for national environmental law and emphasizes the preservation of land and water resources, flora and fauna extending protections to beaches, reefs, lagoons, and all natural habitats. It sets out guidelines for the management of the environment, including nonhazardous waste disposal and oil, poisonous substances, and hazardous/toxic or nuclear waste handling and disposal, establishment of protected areas and natural reserves, and mandates for performing environment impact assessments (EIA). An EIA must be performed on all areas containing coral reefs up for development. These steps were required to protect natural reserves from excessive fishing, garbage dumping, and coral mining. Resource management is also affected through sector specific laws including Fisheries Laws, the Tourism Act of Maldives 1999, and Maritime Law of the Maldives.

MPA Regulations

Throughout Maldives, there are twenty-five coral reef MPAs listed in the WDPA (Appendix A) and no mangrove protected areas (Appendix B). In 1995, under the EPPA, fifteen coral reef dive sites were declared as MPAs. An additional ten MPAs were declared under the EPPA in 1999.

Overall, in the Maldives national law prohibits spearfishing and harvest of all parrotfish. MPAs are atypical in that they are limited to dive sites, and thus make up a very small area. National environmental law regulates development of coral reefs and other coastal habitats.

2.1.2.21 Marshall Islands

Approximately 1.7% of coral reefs within the 46 areas in bumphead parrotfish range are in the Republic of the Marshall Islands. Less than 4%, or 142 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). The Marshall Islands contain a negligible percentage of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with no mangrove protected areas (Appendix B).

The Marshall Islands are composed of thirty-four islands and islets spanning more than 5,025,000 km^2 in the central Pacific Ocean. The primary agencies involved in protecting coral

reef ecosystems are the Office of Environmental Planning and Policy Coordination Marshall Islands (OEPPC), the Marine Resources Authority (MIMRA) and RMI Environmental Protection Authority (RMI-EPA). Under MIMRA, the Community Fisheries Section manages fisheries at the local level.[94]

Fisheries and Coastal Management Regulatory Mechanisms

Coastal fishers often use spears, hand-lines, trolls, gillnets, and cast nets to harvest reef fish and sell catches at markets in Majuro and Kwajalein urban areas.[95] Fisheries management is carried out primarily through the Marshall Islands Marine Resources Act 1998. The Act imposes a fine and/or imprisonment for improper fishery practices. There is a virtual ban on trade in the live fish market for Asia. A license is needed to export live coral and aquarium fish (Smith 1992). The Reimaanlok Process is a natural conservation area planning process, goals of which are to develop conservation targets, define effective conservation for the Marshall Islands, define conservation goals, develop tools for the collection and documentation of traditional knowledge, socio-economic and biological monitoring, and an emphasize community owned, led, and endorsed conservation areas. The national government is working on projects that will encourage community-based management of fisheries and the marine environment on many of the atolls. Community-based fisheries management plans outline management objectives and promise support from the Marshall Islands Marine Resources Authority (Pinca and Harriss 2008; Reimaan National Planning Team 2008). Traditional resource management in the Marshall Islands includes the practice of *mo*. Declaring an area *mo*, restricts fishing practices for certain species, differing between different islands (Reimaan National Planning Team 2008).

Both the National Environmental Protection Act of 1984 and the Coast Conservation Act of 1988 manage mangrove and coastal development. Under the National Environmental Protection Act, the impact of human activity on natural resources is studied and pollutants are regulated. The act also requires environmental impact assessments (EIAs) for proposed actions such as development. The main objective of the Coast Conservation Act 1988 is to protect and preserve the coast. A permit is needed for development and the connection between sea erosion and encroachment of the sea and development activities is acknowledged.

MPA Regulations

Throughout the Marshall Islands, there are three coral reef MPAs listed in the WDPA (Appendix A) and no mangrove protected areas (Appendix B). Marine reserves and other management measures are new but several atolls, namely Jaluit, Arno, Likiep, Mili, and Rongelap, are ramping up efforts with new measures. In 2000, the National Biodiversity Strategy and Action Plan (NBSAP) and the National Biodiversity Report addressed the need for conservation and management of natural resources.

Overall in the Marshall Islands, aside from a virtual ban on the live coral reef fish trade, national laws do not appear to regulate coral reef fisheries. MPAs do not appear to be recognized by the current government. National environmental law regulates development of some coastal habitats.

94 http://wwwx.spc.int/coastfish/Sections/Community/management_initiatives2.htm
95 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_MH.pdf

2.1.2.22 Mauritius

Approximately 0.5% of coral reefs within the 46 areas in bumphead parrotfish range are in Mauritius. Four percent, or 39 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Mauritius contains a negligible percentage of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with six mangrove protected areas (Appendix B).

Mauritius is a volcanic island surrounded by fringing coral reefs that span 150 km around the coast including a lagoon. The Ministry of Fisheries and Rodrigues manages fisheries nationally for Mauritius.

Fisheries and Coastal Management Regulatory Mechanisms

Artisanal fishers primarily fish along the coast of Mauritius using basket traps, hook-and-line, harpoons, large nets, and gillnets. Parrotfish species are among the main species caught.[96] Bumphead parrotfish are harvested via spears and nets (D. Obura pers. comm.).

The Fisheries and Marine Resources Bill of 2007 and the Fisheries and Marine Resources Act of 1998 prohibit the use of driftnets and poisons or explosives for fishing. There is also no underwater fishing, or use of spearguns and artificial lights without permission. There are periods when fishing is closed and size limits on fish caught. The Undersized Fish Regulation of 2006 lists lengths for regulated fish, but does not list parrotfish. The Fisheries Act of 1980 and Fisheries Regulation of 1983 prohibit the import and export of live fish, corals, and shells, dead or alive, without a permit. It also mandates establishing marine protected areas. There are also provisions for the protection of marine areas/habitats and an establishment of the Marine Protected Area Fund. Marine Protected Areas are defined in the Wildlife and National Parks Act of 1993.

Other regulations now prohibit the extraction of sand (although sand extraction is still known to occur) and establish the placement of fixed mooring buoys at popular dive sites. Despite efforts to prohibit the collection and trade of corals, Mauritius still allows the import of corals and seashells, essentially making it impossible to enforce the local law while merely displacing the problem to nearby countries such as Madagascar, Philippines, and Indonesia.

MPA Regulations

Throughout Mauritius, there are twenty-four coral reef MPAs listed in the WDPA (Appendix A) and six mangrove protected areas (Appendix B). The MPAs in Mauritius are divided into three categories: fisheries reserves, marine parks, and estuary reserves. New MPAs have been established in Mauritius and their goals include long term monitoring of coral and fish (Arthurton *et al.* 2006). There are two marine protected areas in the lagoon, plus closed seasons for nets, gear size and type restrictions, minimum catch size restrictions, and a limitation on the number of licenses available. The government also offers a buyback program for nets and pays compensation to net fishers during the closed season. The lagoon fishery is highly exploited and these management tools have contributed to stabilizing stocks (De Young 2006).

96 http://www.fao.org/fishery/countrysector/FI-CP_MU/en

The Forest and Reserves Act of 1983 establishes nature reserves, including mangrove habitat. The Nature Reserves Board advises the Minister on which areas to establish as nature reserves. An area established as a national forest can only be used as forest land; there is no logging or harvesting of forest produce. A successful mangrove plantation program was started in the 1980s. The program helped to increase the extent of mangrove area and balance the net loss from a high demand for fuel wood (FAO 2007a).

Overall, national law regulates spearfishing and establishes closed seasons and size limits for reef fish. A network of MPAs protects some coral reef and mangrove areas. Outside of protected areas, mangroves are not closely managed. National law prohibits the export of live coral and other reef organisms.

2.1.2.23 Micronesia

Approximately 2.3% of coral reefs within the 46 areas in bumphead parrotfish range are in Micronesia. A negligible percentage of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Micronesia contains 0.6% of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with a portion of that total within six protected areas (Appendix B).

Micronesia, or the Federated States of Micronesia (FSM), is comprised of 607 islands that are grouped in four states: Kosrae, Pohnpei, Chuuk, and Yap. There are national fisheries and environmental regulations, but the majority of regulatory efforts are concentrated within each of the four states, which often implement traditional management regimes. National marine resources are managed by the Micronesia Maritime Authority. Overfishing has been identified as the most critical threat across biologically significant marine areas in all states, with evidence of this from markets that are filled with immature fish and fish with eggs (Goldberg *et al*. 2008).

Fisheries and Coastal Management Regulatory Mechanisms

The marine fisheries sector in Micronesia consists of two divisions: offshore and coastal fisheries. Offshore fisheries harvest tuna, while coastal fisheries harvest coastal fin fish. Coastal fishing is mainly for subsistence and sales of locally caught fish species occur in local markets.[97] Subsistence fishers are more likely to use spearguns than commercial fishers and can have a significant impact, especially with 90% of the catch being from subsistence fishing (UNEP 2005). Bumphead parrotfish are known to be harvested by spearfishing throughout Micronesia (B. Yeeting pers. comm.), suggesting they are targeted by subsistence fishers (Dulvy and Polunin 2004).

The main piece of national fisheries legislation is Title 24 of the Code of the Federated States of Micronesia. It prohibits catching of marine life through explosives, poisons, chemicals, or other substances with the intent to kill marine life. There are also seasonal closures and size restrictions of some marine species. The Maritime Wing of the National Police enforces fishing regulations within the EEZ and there are substantial fines for illegal fishing.

Each state is responsible for inshore fisheries and coral reef management within 12 nm of the shoreline. Traditional management is common throughout Micronesia with enforcement by

97 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_FM.pdf

community leaders (FAO 2002a). Fisheries and environmental management for each state is presented below.

Chuuk

Chuuk state is further divided into municipalities that are recognized under constitutional law. Municipalities must operate under state laws, but can develop their own constitutions and traditionally manage marine resources. Title 25 of the Maritime and Marine Resources Act gives different aspects of fisheries management to two fisheries authorities: the Truk Maritime Authority and the Chief of Chuuk State Division of Marine Resources. Chapter 1 gives the Truk Maritime Authority the lead in managing all resources inside the State Fishery Zone that extends from the shoreline out 12 nm. Chapter 6 grants the Chief of Chuuk State Division of Marine Resources the authority to manage nearshore and inshore fisheries by teaching fishers vessel use and maintenance and fishing techniques. Dynamite fishing is prohibited under state law by Chapter 9 of this act.[98] Customary management is common in Chuuk and it mainly includes limiting access to the reef resources from outsiders (FAO 2002a).

Kosrae

Kosrae state is also further divided into municipalities that are recognized under constitutional law. Municipalities must operate under state laws, but can adopt their own self-government. The Department of Agriculture, Land, and Fisheries is tasked with regulating fisheries, mainly for trochus and sea cucumber. The Development Review Commission regulates pollution and land development protecting mangrove and coral reef habitat.[99] In Kosrae, community-based management involves a participatory approach by having fisheries enforcement officers live near the area where they enforce regulations. Traditional systems are enforced by community leaders and often do not involve economic incentives (FAO 2002a).

Pohnpei

Local governments are recognized under the state constitution and each local government may establish their own constitution in Pohnpei state. Areas outside local government jurisdiction are covered under state law.[100] The sale of bumphead parrotfish is prohibited by state law Title 26 Conservation and Resources, Chapter 6. It is also prohibited to fish with explosives, poisons, or chemicals under this act.

Yap

Yap is further divided in sub-divisions and these sub-divisions must operate in accordance with state law. State regulations mandate the Yap Fishing Authority as in charge of developing policies and managing the exploitation of marine resources. Traditional regulations and customs are recognized under the state constitution.[101] Of the four states in Micronesia, Yap is the only one with a customary branch of government. This branch is headed by a council of chiefs from both the main and neighboring islands in the state. The constitution of Yap formally recognizes traditional heritage and village life and requires the government to integrate both modern and traditional ways. There are three forms of customary tenure in Yap. In the first form, all

98 http://www.fsmlaw.org/chuuk/index.htm
99 http://www.fsmlaw.org/kosrae/index.htm
100 http://www.fsmlaw.org/pohnpei/index.htm
101 http://www.fsmlaw.org/yap/index.htm

resources are owned and managed by the highest ranking clan. Another form requires clans to co-manage natural resources through consultations and meetings with elders. The final form divides the responsibility of managing resources and rights to use them among the chiefs. In neighbor islands within Yap state, spearfishing has been banned through customary management because chiefs recognize it as a method for overharvest (Tafileichig and Inoue 2001).

Summary of Fisheries and Coastal Management Regulatory Mechanisms

Gear use and spearfishing are somewhat regulated throughout Micronesia. There are national gear restrictions including bans on explosives and chemicals and size restrictions. Seasonal closures and no take zones instituted nationally also help regulate harvest. Within each state, however, regulations vary, with only Pohnpei restricting the sale of bumphead parrotfish. There are no spearfishing regulations enforced by the states. There are local regulations banning spearfishing in some islands within Yap state. Seasonal closures across Micronesia help protect coral reef and mangrove habitat outside of MPAs.

MPA Regulations

Throughout Micronesia, there are 20 coral reef MPAs listed in the WDPA (Appendix A) and six mangrove protected areas (Appendix B). Some protected areas established within Micronesia that encompass coral reefs are managed either nationally or by community stakeholders. Historically, the national government was not very involved in establishing MPAs, but with the national establishment of the FSM Protected Areas Network (PAN), they have become an important part of the National Biodiversity Strategy and Action Plan (NBSAP) under the goal of preserving "a full representation of the FSM's marine, freshwater, and terrestrial ecosystems." Also, by supporting the Micronesia Challenge, government officials have gained financial, technical, and community support for establishing the FSM PAN, both from the states and internationally. Pohnpei has eleven legally established marine sanctuaries and a central Watershed Forest Reserve. The five MPAs in Kosrae are co-managed at the local and state level. Traditional management is common throughout Chuuk. Throughout Micronesia, there are marine reserves with no-take zones for both fishing and mangrove harvest.[102]

NGOs are active in setting up and managing MPAs throughout Micronesia. For example, the Conservation Society of Pohnpei has a Marine Program that has implemented MPAs across Pohnpei state with the help of state and local traditional governments. These MPAs protect both mangrove and coral reef habitat.[103] Both Yap and Pohnpei have Locally Managed Marine Areas (LMMAs) (George *et al*. 2008).

Overall in Micronesia, reef fisheries management is decentralized to the state level, and customary law is very influential. Spearfishing in some areas is banned, as dictated by customary law. MPAs are very small. National and state laws do not appear to protect coral reefs and other coastal habitat outside of MPAs.

2.1.2.24 Mozambique

Approximately 1.1% of coral reefs within the 46 areas in bumphead parrotfish range are in Mozambique. Fifteen percent, or 365 km^2, of those are protected nationally in MPAs (see Table

102 http://www.seacology.org/projects/micronesia_projects.htm
103 http://www.serehd.org/Marine.html

2 and Appendix A-1). Mozambique contains 3.6% of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with six mangrove protected areas (Appendix B).

Mozambique is divided into ten provinces, thirty-three municipalities, and 224 districts.[104] The Ministry of Fisheries is in charge of nationally regulating fisheries in Mozambique. Communities often manage protected areas.

Fisheries and Coastal Management Regulatory Mechanisms

Artisanal and commercial fishing and tourism are the main uses of coral reefs in Mozambique, and major threats include destructive fishing practices and illegal fishing by international boats. Bumphead parrotfish are found within these coral reefs and are harvested using nets and spears (D. Obura pers. comm.).

Nearshore fisheries in Mozambique are divided into industrial, semi-industrial, and artisanal. Industrial fisheries operate in both shallow and deep water, and are often joint-venture companies with the State. Semi-industrial fisheries are classified with vessels that are under 20 m in length and typically do not venture far from the shore. Artisanal fisheries operate mainly near to the shoreline and use a wide variety of gears including beach seines, handlines, gillnets, traps, spears, and manual extraction (De Young 2006). Artisanal fisheries are considered open-access thus over-exploitation of resources around bays and estuaries has occurred, according to the Master Plan of Fisheries of 1995.

Several regulations are in place that are pertinent to fisheries and coral reef protection. Underwater fishing using any means of artificial respiration is prohibited[105] Nationally, there are designated closed seasons, limits on the number of fishing vessels, catch quotas, and net mesh size regulations (De Young 2006). Decisions of the Minister of Agriculture and Fisheries of 2/99 and 5/99 imposed a complete ban on coral and aquarium fish export until 2001. Other regulations for coral include prohibition on harvest and exportation of live and dead corals.

Laws protecting mangrove habitat include Law No. 16/91, allowing the private use of water for marine aquaculture as long as it does not harm the environment or conflict with protected zones established by land legislation, and the Environmental Law of 1997 which requires mandatory Environmental Impact Assessments (EIAs) for all marine aquaculture projects (Percy and Hishamunda 2001).

MPA Regulations

Throughout Mozambique, there are two coral reef MPAs listed in the WDPA (Appendix A) and six mangrove protected areas (Appendix B). Some examples for national parks with marine components are Bazaruto Archipelago National Park and Quirimbas National Park. In Bazaruto Archipelago National Park, there is industrial fishing by foreign vessels even though it is not permitted. Communities living in and around the park are encouraged to participate in management activities (Cunliffe *et al*. 2005). In Quirimbas National Park, fishing by local residents using traditional techniques is permitted, while 30% of the park is closed to all fishing. In certain zones within the park, it is prohibited to damage coral, take live fish for sale, use

104 http://www.state.gov/r/pa/ei/bgn/7035.htm
105 http://www.fao.org/fishery/countrysector/FI-CP_MZ/5/en

gillnets, spearguns, or harpoons, or to kill fish using chemicals, poisons, or explosives. It is also forbidden to sell mangrove cuttings or mine for coral. Tourists are not permitted to fish at night. Net mesh size restrictions are advertised in the gazette (Johnstone 2004). Another protected site is Marromeu Complex, the only marine and terrestrial Ramsar site. Since 2004, the national government has been working on developing a 1.7 million ha MPA in the Primeiras and Segundas Archipelago off the northern coast.

Overall in Mozambique, national law prohibits spearfishing on SCUBA, and regulates other gears. The country only has a small number of coral reef MPAs, but they include no-take areas. Development of mangrove, coral reef, and other coastal habitats is regulated by national law. Export of live and dead coral is prohibited.

2.1.2.25 Myanmar

Approximately 0.6% of coral reefs within the 46 areas in bumphead parrotfish range are in Myanmar. Four percent, or 54 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Myanmar contains 6.3% of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with four mangrove protected areas (Appendix B). The Department of Fishery (DoF), part of the Ministry of Livestock and Fisheries, manages fisheries nationally for Myanmar.

Fisheries and Coastal Management Regulatory Mechanisms

Inshore fisheries are classified by craft (motorized and non-motorized vessel) and by fishing gear: inshore purse seine, driftnet, gillnet, and other traditional gears (mainly hook-and-line, bag nets, list nets, seine nets, traps, barrier nets, and scoop nets) (De Young 2006). Based on methods of harvest in other locations, bumphead parrotfish can be harvested by inshore fishers using all types of nets, traps, and hook-and-line.

The Fisheries Law of 1990 requires getting a license to fish inshore and offshore. It prohibits the use of explosives, poisons and toxic chemicals, harmful agents and damaging gears. The Director General can determine the method of harvest, catch period, harvestable species and acceptable fishing grounds.

MPA Regulations

Throughout Myanmar, there are five coral reef MPAs listed in the WDPA (Appendix A) and four mangrove protected areas (Appendix B). National regulations do not currently exist for establishing MPAs within Myanmar, though protected areas do exist. Approximately 4,219 km^2 of mangrove area and 387.5 km^2 of coral reefs are protected. MPAs exist within national parks, marine national parks, wildlife sanctuaries, and protected areas (UP-MSI *et al*. 2002). Mangrove habitat is protected under the Protection of Wildlife and Conservation of Natural Areas Law[106] and the Forest Law.[107] Both laws institute protections for natural areas declaring reserves and protected forests, and the Forest Law specifically mentions mangroves. It is illegal to use blast fishing and log mangroves within Wunbaik mangrove forest reserve, and Lampi Island Marine National Park (Latt 2000).

106 http://www.blc-burma.org/html/Myanmar%20Law/lr_e_ml94_06.html
107 http://www.blc-burma.org/html/Myanmar%20Law/lr_e_ml92_08.html

Overall in Myanmar, spearfishing is not specifically regulated, but general national fishing laws may apply. Other gears are regulated or banned. MPAs protect some coral reef areas, and protected areas encompass the majority of the country's extensive mangroves.

2.1.2.26 Niue

A negligible percentage of coral reefs within the 46 areas in bumphead parrotfish range are in Niue. Four percent, or 2 km^2, of reefs in Niue are protected nationally in MPAs (see Table 2 and Appendix A-1). Niue contains a negligible percentage of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with no mangrove protected areas (Appendix B). The Niue Fisheries Department is in charge of fisheries management for Niue. Community-based management is common for both fisheries and environmental issues (Vunisea 2005).

Fisheries and Coastal Management Regulatory Mechanisms

Niue is the largest raised coral atoll in the world with coastline measuring 64 km.[108] Approximately 90% of catch is from subsistence fishing (UNEP 2005). Coastal fisheries are primarily composed of artisanal fishers who use spears, hook-and-line, gillnets, and reef gleaning.[109] The Environment Act of 2003 established the Department of Environment as well as a national council for sustainable development. Fisheries in Niue are regulated by the Domestic Fishing Act of 1995, Domestic Fishing Regulations of 1996, and the Territorial Sea and Exclusive Economic Zone Act of 1997. The Domestic Fishing Regulations of 1996 prohibit exporting live tropical fish and killing or interfering with any undersize fish. It also provides specific protection for all coral species, and prohibits interfering with, taking, killing, or bringing ashore any live coral. The Territorial Sea and Exclusive Economic Zone Act of 1996 is used to establish an EEZ for New Zealand adjacent to the territorial sea of Niue with the purpose of exploration, exploitation, conservation, and management. The cabinet may declare a designated fishery and commercial fishermen need a license to fish. No driftnets, explosives, poisons, or noxious substances can be used (Fisk 2007).

Each of the 14 villages in Niue has its own council. They link the national government and the people. Natural resources tend to be customarily owned, with fishers following both nationally developed laws and "unwritten" traditional regulations. Coastal areas are managed by villages in the direct vicinity and these villages can impose bans on fishing for certain species (Vunisea 2005).

MPA Regulations

Throughout Niue, there are four coral reef MPAs listed in the WDPA (Appendix A) and no mangrove protected areas (Appendix B). Agriculture is an important industry and large forest areas across Niue have been cleared for taro farming with the overall forest cover reduced to 64% of the island and a deforestation rate of 0.9% a year. The Department of Agriculture Forest and Fisheries manage land degradation nationally.[110] Anono (formally Namoui) Marine Reserve, an IUCN category VI MPA, is the only marine reserve and serves to protect and

108 http://www.fao.org/ag/AGP/AGPC/doc/Counprof/southpacific/niue.htm
109 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_NU.pdf
110 http://www.fao.org/ag/AGP/AGPC/doc/Counprof/southpacific/niue.htm

preserve marine biodiversity. Hakupu Cultural and Heritage Park and Huvalu Forest Conservation Area are both marine and terrestrial protected areas.[111]

Overall in Niue, reef fishing is regulated by national laws, as is development of coral reefs and other coastal habitats. MPAs protect some coral reef areas.

2.1.2.27 Palau

Approximately 0.5% of coral reefs within the 46 areas in bumphead parrotfish range are in Palau. Twenty-seven percent, or 261 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Palau contains 0.1% of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with a portion of that in seven protected areas (Appendix B).

There are sixteen states that comprise the country of Palau, each having their own state government. Governors are either elected or chosen based on traditional status. There is also a Council of Chiefs, one from each state, who advise the President of Palau on traditional customs and regulations. Traditional management of fisheries and the environment are common throughout all states in Palau.[112]

Fisheries and Coastal Management Regulatory Mechanisms

Coastal fisheries can be divided into commercial and subsistence fisheries. Catch from coastal fishing is mostly distributed for domestic urban fish markets. Fishing techniques include hand-collection, hook-and-line, underwater spearfishing, net fishing, and trolling.[113] Historically, bumphead parrotfish were heavily harvested by spearfishermen at night in Palau (Johannes 1981). During the day, bumphead parrotfish were usually herded together using multiple boats, allowing spearfishers to harvest more fish at once (G. Davis pers. comm.). Spearfishing is still considered the most common method of harvest (B. Yeeting pers. comm.). Extreme declines of bumphead parrotfish noted by fishers (Sadovy 2007), prompted national restrictions on harvest of the species in 1994. National regulations on bumphead parrotfish harvest include the following: Senate Bill No. 8-56 prohibits the take and export of adult bumphead parrotfish, except from November 1 to January 31, for citizens of Palau (Baules 2009). Senate Bill No. 7-202, SD1 states that any non-Palauan taking, possessing, selling, or exporting bumphead parrotfish from Palau's EEZ or fishing zone will be fined $1,000 and/or imprisoned for up to one year (Koshiba and Baules 2007). The Marine Protection Act of 1994 prohibits the take of juvenile bumphead parrotfish less than 63.5 cm (25 inches). It is unlawful to commercially export or fish/sell/buy for commercial export any bumphead parrotfish (Whipps 2005). Section 4(6) of the Marine Protection Act of 1994 prohibits fishing while using any form of underwater breather apparatus (DMR 1998).

Other national fishing regulations that affect bumphead parrotfish are represented in Title 24 of the Palau National Code. Chapter 31 of this act prohibits catching and selling marine life caught with explosives, poisons, chemicals, or other substances that kill marine life. The act also prohibits the export of sponges and marine rocks, including four types of hard corals (Maibrel 2010). It is prohibited to fish with a gill net or surround net having a mesh size of less than three

111 http://www.wdpa.org/
112 http://www.mfat.govt.nz/Countries/Pacific/Palau.php
113 ftp://ftp.fao.org/fi/DOCUMENT/fcp/en/FI_CP_PW.pdf

inches measured diagonally. Kesoke nets with no bag or having a bag with a mesh size of less than three inches measured diagonally are also prohibited to use, possess, or abandon. Taking fish for local aquarium use or scientific research requires a permit (Mariur 1994).

Mangroves and coral reefs are protected via several mechanisms. The states of Ngiwal, Melekeok, and Ngeremlengui have regulatory mechanisms prohibiting the harvest and/or sale of mangroves outside of the state (FAO 2009c). A National Communication with the UNFCC was submitted in response to climate change adopting some adaptation strategies that effect mangroves. These include zoning rules for new development, rehabilitating existing mangrove areas, re-vegetating coastal strand, preventing unsustainable harvest and clearing, reducing anthropogenic stressors (e.g. pollution), and discouraging reclamation and government leasing of mangrove land (Gilman *et al*. 2006). To assist with coral reef protection efforts, the government of Palau has received grants from NOAA for development and implementation of the Palau Coral Reef Monitoring Program (NOAA 2005). Also, Palau joined the Global Seagrass Monitoring Network in 2001, and plans to manage seagrass habitat (Goldberg *et al*. 2008).

MPA Regulations

Throughout Palau, there are twenty-nine coral reef MPAs listed in the WDPA (Appendix A) and seven mangrove protected areas (Appendix B). Community-based management has shifted from village leaders to the centralized state and national government system. Chiefs represent villages within the state governments (Johannes, 2002), however, and some protected areas have been established based on traditional knowledge. Seasonal closures are implemented through the Marine Protection Act of 1994 that are based on traditional knowledge of spawning areas. Most of Palau's MPAs have been designated by the states and management of these areas falls under the authority of the local governments. The Protected Areas Network Act encourages national and state governments to work together when establishing cross-boundary MPAs (Caillaud *et al*. 2004). It aims to support Palauan state government efforts directed at protecting marine resources through the establishment of MPAs. In addition, there are MPAs designated by the national government for the purpose of protecting biodiversity and significant habitats. The Ngerumekaol Spawning Area, designated in Title 24 of the Palau National Code, is a no take zone between April 1 and July 31 every year. Ngerukewid Islands Wildlife Preserve is a no take and no fishing preserve. The Palau Ministry of Resources and Development has overlapping jurisdiction with each of Palau's sixteen state governments for all marine areas from the hightide watermark out 12 nm seaward. Seven of the sixteen states have established one or more marine reserves with seasonal closures on important reef-fish spawning aggregation sites (Johannes 2002). Both traditional and nationally established MPAs are present throughout Palau. Fisheries regulations can vary, but seasonal closures are in place.

Bumphead parrotfish harvest is heavily regulated by multiple national laws specific to the species. In addition, national law prohibits fishing with any gear while on SCUBA. Customary reef fisheries management laws have been heavily incorporated into state laws. Mangrove harvest is regulated by state laws. A network of well-regulated MPAs protects over a quarter of the coral reef area in the country, including important reef fish spawning areas where take is not allowed. Some mangroves are also included in some protected areas.

2.1.2.28 Papua New Guinea

Approximately 6.8% of coral reefs within the 46 areas in bumphead parrotfish range are in Papua New Guinea. Four percent, or 581 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Papua New Guinea contains 5.3% of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with a portion of that in twelve protected areas (Appendix B).

Fisheries are managed nationally by the National Fisheries Authority. Forest regulations, including mangrove forests, are instituted by the Papua New Guinea Forest Authority.[114] Traditional fisheries and environmental management are common throughout Papua New Guinea and are legally recognized by the national government.

Fisheries and Coastal Management Regulatory Mechanisms

Coral reefs and mangrove forests support coastal fishing communities across the country (FAO 2010a). Fishing is the dominant activity on outer islands, where agricultural land is limited (Kailola *et al*. 1995). Coastal fisheries in Papua New Guinea are divided into commercial and subsistence (including live reef fish export). Fishers employ hand-harvest, spearfishing, hook-and-line, nets, and traps along reef flats and parrotfish species (*Scaridae*) are often targeted by coastal fisheries (FAO 2010a). Adult bumphead parrotfish are vulnerable to all types of harvest employed by coastal fishers, and are occasionally present within spearfishing catches (Kailola *et al*. 1995). Bumphead parrotfish are also known to be harvested by night spearfishing (D. Bellwood pers. comm.).

Fisheries regulations are managed nationally via the Fisheries Act of 1994, the Fisheries Management Act of 1998, and the Fisheries Management Regulation of 2000. The Fisheries Act poses limits on the sizes of fish harvested and provides exceptions for equipment used in catching certain fish. The Minister can institute time/area closures for certain fish species, set size limits, and prohibit certain fishing methods or equipment. It is prohibited to use a driftnet defined as a "gillnet greater than 2.5 km in length." The Fisheries Management Act requires fishers to get a license, prohibits the use of poisons or explosives for fishing, and provides guidelines for developing fisheries management plans.

Outside of MPAs and reserves, mangroves are protected nationally by the Papua New Guinea Logging Code of Practice which prohibits logging in mangrove areas.

MPA Regulations

Throughout Papua New Guinea, there are 85 coral reef MPAs listed in the WDPA (Appendix A) and 12 mangrove protected areas (Appendix B). Maza Wildlife Management Area is managed specifically for the harvest of dugongs by the Fauna (Protection and Control) Maza Wildlife Management Area Rules, 1979. Another example is the Sinub Wildlife Management Area. Regulations include banning the use of dynamite, hand lines, spear guns, traps, and nets for fishing. All night fishing is banned and it is prohibited to collect reef life (Jenkins, 2002). In the Tonda Wildlife Management Area, the committee places traditional size limits to some fish

114 http://www.commonwealth-of-nations.org/Papua_New_Guinea/Government

species (Chatterton n.d.). Tonda Wildlife Management Area is a marine and terrestrial Ramsar site.

MPAs and reserves can be declared under three different national acts. Mainly, the Fauna (Protection and Control) Act of 1966 is used to declare sanctuaries, protected areas, and wildlife management areas (WMA). Sanctuaries offer the most protection as regulations state that fauna may not be taken or killed within a sanctuary. Within protected areas, specific fauna may not be taken. WMAs are managed at the local level, often by a committee of members that have traditional rights to land and natural resources,[115] and licenses may be obtained to harvest animals within a WMA. The Conservation Areas Act of 1978[116] promotes delineation of conservation lands and establishes a Conservation Management Committee made up of land owners and provincial or local governments. Development is not allowed in conservation areas. The National Parks Act of 1982[117] ensures the conservation of sites and areas with biological, topographical, geological, historical, scientific, or social importance.

The government of Papua New Guinea recognizes customary management in fisheries and MPAs. The Customs Recognition Act legally recognizes the customary basis of rights to marine areas and resources as long as it can be legally proven. Community rights are reinforced in a civil litigation under this act (Ruddle 1998a). Customary sea tenure is used to manage WMAs in marine areas as part of locally adapted management strategies (Aswani and Hamilton 2004).

Several conservation areas operated by NGOs help preserve mangrove areas. For example, the World Wildlife Fund (WWF) operates the Kikori Integrated Conservation and Development Project in the Gulf Province that helps preserve extensive stretches of mangroves. The main goal of this project is to promote rural development while still promoting sustainable management.

Overall, Papua New Guinea does not specifically regulate spearfishing at the national level, but the strong role of customary law in fisheries management likely results in some regulation of this gear. National, local, and customary laws regulate reef fisheries in general. Logging of mangroves is regulated by national law but development near coral reef areas is not. A network of MPAs and protected areas includes some coral reef and mangrove areas.

2.1.2.29 Philippines

Approximately 10.5% of coral reefs within the 46 areas in bumphead parrotfish range are in Philippines. Seven percent, or 1,574 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). The Philippines contains 3.2% of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), a portion of which is in 52 protected areas (Appendix B).

The Philippines is an archipelago consisting of over 7,100 islands, covers an area of approximately 26,000 km^2. Coral reefs are widespread, and may be found around almost the entire archipelago except in some small portions of Mindanao and Luzon.

115 http://www.worldwildlife.org/wildplaces/ng/pubs/PNG_Largest_Protected_Area.pdf
116 http://paclii.org/pg/legis/consol act/caa1978203/
117 http://paclii.org/pg/legis/consol act/npa1982159/

The two government agencies mainly responsible for the national planning, policies, and evaluation of the Philippines marine environment are the Department of Environment and Natural Resources (DENR) and the Department of Agriculture's Bureau of Fisheries and Aquatic Resources (BFAR). The DENR's Protected Areas and Wildlife Bureau (PAWB) in particular is responsible for marine protected areas and wildlife. Within the DENR, the Coastal Environment Project conducts coastal monitoring and evaluation, and the Environmental Management Bureau regulates pollution management issues. However, much of the actual management authority and implementation has been decentralized to local government units, especially at the Municipal level, through the ratification of the Local Government Code of 1991.

Fisheries and Coastal Management Regulatory Mechanisms

Reef fisheries in the Philippines can be divided into marine, including commercial and municipal fisheries, inland fisheries, and aquaculture.[118] Commercial fisheries fish outside municipal water using vessels greater than three gross tonnage (GRT). Commercial fisheries can further be divided into small, medium, and large scale fishing, and are defined by the type of gear used (passive or active) and size of the vessel. Passive gears, defined to include gillnets and hook-and-line, are used by municipal and small-scale commercial fishers only. Active gears include beach seines and pa-aling. Commercial and municipal fisheries each contributed about half of the marine fisheries production in 2003 with municipal fisheries at 45% and commercial fisheries at 55% of total production. Municipal fishers dominate the fishing community as far as number of fishers and a majority are individual operators. Municipal fisheries, or artisanal fisheries, primarily operate within 15 km of the coastline, within municipal waters, either with or without the use of vessels less than 3 GRT. They use both passive and active gear including gill net, hook-and-line, beach seine, fish corral, ring net, baby trawl, spear, longline, Danish seine, fish pot, bag net, crab lift net, purse seine, and others not defined (including harpoons and hand-hooks).[119]

In the Philippines, adult bumphead parrotfish are typically harvested with hook-and-line and spear, often on reef ledges and drop-offs. It is suggested, however, that they are not always specifically targeted by fishers (B. Francisco pers. comm.). Also, bumphead parrotfish are harvested by spearfishing at night (D. Bellwood pers. comm.) and fish corrals and fish pots also may be used (N. Barut pers. comm.). Bumphead parrotfish can be harvested along with many other species of reef fish using large fishing nets (pa-aling) which is often carried out on the forereef. There are no national or local regulations limiting the harvest of bumphead parrotfish (A. Maypa pers. comm.). According to the Philippine National Stock Assessment Program, landings of bumphead parrotfish are recorded from Lingayen Gulf (Northern Philippines), Leyte Gulf (Eastern Philippines), and Visayan Sea (Central Philippines) (N. Barut pers. comm.).

The Philippine Fisheries Code of 1998 (also Republic Act 8550) is administered by the BFAR and is the primary piece of legislation that regulates commercial and municipal activities. Many regulations within the Act are for activities in municipal waters which are defined as marine and tidal waters that extend 15 km from the coastline and are not included in protected areas such as forest or fishery reserves. Section 88 of the act prohibits the use of explosives, noxious, or poisonous substances for fishing. The Official Gazette volume 71, no. 28 of July 14, chapter VI

118 http://www.fao.org/fishery/countrysector/FI-CP_PH/en

119 http://map.seafdec.org/Monograph/Monograph_philippines/marine.php

section 33 states that it is prohibited to use these substances unless the user is permitted for scientific, research, or educational purposes. The code also establishes a fine mesh width in Section 89 stating it is unlawful to use a smaller size than 3 cm measured between two opposite knots, as defined by the Department of Fisheries. In 1986, the large net reef fish commercial fishery called "muro-ami" was banned in Fisheries Administrative Order 163 and again in 2000 in Fisheries Administrative Order No 203, but another type of large net fishing has since been adopted called "pa-aling." Pa-aling uses air bubbles instead of the weights used in muro-ami to drive fish into large nets. Fisheries Administrative Order No 190, Series 1994 deems pa-aling as not destructive to coral reefs and as a viable alternative to muro-ami but prohibits its use in fish sanctuaries, protected areas, and marine parks and reserves. Section 92 of the Fisheries Code bans the use of muro-ami and Section 90 puts restrictions on the use of pa-aling. Section 90 of the code states it is unlawful to fish in municipal waters, including all bays and fishery management areas, using active gear. While SCUBA fishing is regulated in reserves, the use of dive lights, which are also known as superlights, is prohibited in Section 93 in municipal waters. It is unlawful to operate or construct a fish corral or fish trap without a license. The Presidential Decree 1219 of 1977 prohibits the collection, sale, and export of coral, but makes exceptions for scientific research. It is unlawful to use fishing gear that destroys coral reefs, seagrass beds, or other marine habitat. The Fisheries Code includes corals under the provision for aquatic resources.

Mangrove habitat is protected nationally by the Philippine Fisheries Code of 1998 which defines activities permitted in fishing refuges and development in mangrove areas. The Presidential Decree No. 705 states that twenty seed trees per ha must be retained in a mangrove forest. There is a fifty-year rotation and regulation of annual allowable cut. The World Bank has funded small-scale afforestation projects in the Philippines (Choudhury 1997). Section 94 of the Republic Act 7586 states that mangroves cannot be converted into fishponds or for any other purpose.

Though fisheries modernization and globalization is important to the Philippine government, the importance of management through community is also emphasized. Modern techniques and globalization in the agriculture and fisheries sectors are encouraged through the Republic Act No 8435. Methods and techniques used by indigenous people are supposed to be taken into account with this Act. The Fisheries Code of 1998, Section 24 requires communities to establish advisory committees called Barangay Fisheries and Aquatic Resource Management Councils (BFARMC) that communicate with the Department of Environment and Natural Resources, Department of Agriculture, Department of Interior, Local Government, and the Philippine Coast Guard. The BFARMC assist in enforcing fisheries laws, rules, and regulations of municipal waters. Patrol offices for the BFARMC are often volunteers from the community called Bantay Dagat.[120]

MPA Regulations

Throughout the Philippines, there are 85 coral reef MPAs listed in the WDPA (Appendix A) and 52 mangrove protected areas (Appendix B). MPAs and reserves are established via several regulations managed by the PAWB that include designations for mangrove habitat, lagoons, and coral reefs. Introduced in 1992, the Republic Act 7586 provided for the establishment of a

120 http://www.psdn.org.ph/sdvillage.ph/coastal/bantaydagat.htm

National Integrated Protected Areas System (NIPAS) to aid in developing effective protection and management of habitats throughout the Philippines, including a few marine areas.[121] Refuges and sanctuaries are established via sections 80 and 81 of the Act which states that Fish Refuges and Sanctuaries can be established 15 km from shore and must allow for 25 to 40% of bays, foreshore lands, continental shelf, or fishing grounds designated beyond municipal waters to be set aside for the cultivation of mangroves and to strengthen fish spawning grounds. It is unlawful to fish in a fishery reserve, refuge, or sanctuary, according to Section 95.

Among Southeast Asian countries, the Philippines has the highest number of community managed marine protected areas. An example of a nationally managed MPA is Tubbataha Reefs National Marine Park, classified as both a marine Ramsar site and a marine World Heritage site. Olango Island is also a marine Ramsar site. Puerto-Princesa Subterranean River National Park is a marine UNESCO-MAB Biosphere site. There are two marine and terrestrial UNESCO-MAB sites, Palawan and Puerto Galera.[122] Bumphead parrotfish can be found in MPAs in Palawan, but it is suggested that the loss of coral reefs through dynamite and cyanide fishing has contributed to their decline in abundance (B. Francisco pers. comm.).

Apo Island is an example of traditional management of bumphead parrotfish in the Philippines. Prior to 2008, bumphead parrotfish were harvested using fish traps. After 2008, if local community leaders found bumphead parrotfish in fish traps they released them back into the ocean. An agreement was made between fishers and community leaders that they would no longer catch bumphead parrotfish (A. Maypa pers. comm.).

Overall, national laws and Presidential Decrees regulate the management of mangroves, greatly limit the collection, sale, and export of coral, and prohibit the use of fishing gear that destroys coral reefs, seagrass beds, and other marine habitat. There are no spearfishing restrictions outside of MPAs but night fishing is restricted by prohibiting the use of dive lights outside of reserves. MPAs are legally established and often contain “no take” areas and prohibit the use of SCUBA. There are also community-established MPAs that have established fishing regulations, some of which are specific to bumphead parrotfish. In some areas, traditional management is very important, whether it has been incorporated into local law or not. A large network of MPAs encompasses 7% of the country’s coral reefs, and most MPAs include no-take areas. Mangroves are also included within a network of protected areas.

2.1.2.30 Samoa

Approximately 0.2% of coral reefs within the 46 areas in bumphead parrotfish range are in Samoa. Twenty percent, or 80 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Samoa contains a negligible percentage of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with two mangrove protected areas (Appendix B). The Independent State of Samoa encompasses the western part of the Samoan Islands in the south Pacific Ocean. Two main islands, Upolu and Savaii, contain most of the human population and are partially surrounded by coral reefs. The entire Samoan archipelago is 500 km long.[123]

121 http://www.iapad.org/pa/about_nipap.htm
122 http://www.wdpa.org/
123 http://www.fao.org/ag/AGP/agpc/doc/Counprof/southpacific/Samoa.htm

The Ministry of Agriculture and Fisheries (MAF) regulates fisheries through the Fisheries Division.[124]. Partnerships have been developed between the national government and communities helping bring national recognition to community-developed regulations.

Fisheries and Coastal Management Regulatory Mechanisms

Generally, coastal Samoan fisheries are divided into commercial and subsistence fisheries. About 94% of catch is from subsistence fishing (UNEP 2005). Fishers use spears, nets, and hook-and-line. Spearfishing is common with fishers often using sling spears and underwater torches for night fishing.[125] Spearfishing resulted in almost half the catch harvested in Upolu, as reported in an FAO-sponsored survey in 1991, and was the main method used in harvesting fish from lagoons in another survey from 2003 (Gillett and Moy 2006). Bumphead parrotfish are harvested during the day (D. Bellwood pers. comm.) and at night by spearfishing (Gillett and Moy 2006).

National regulations specific to the harvest of bumphead parrotfish are included in the Local Fisheries Act of 1996, the Fishing (SCUBA Fishing) Regulation 2003, and the Fisheries Act of 1988. The Local Fisheries Act of 1996 mandates undersized fish of certain species cannot be sold or taken. The minimum size for parrotfish is 200 mm (7.9 inches) and bumphead parrotfish is specifically mentioned in the document. Other important regulations include the Fishing (SCUBA Fishing) Regulation 2003, which prohibits SCUBA fishing without a license (Gillett and Moy 2006), the Fisheries Act of 1988, and the Fisheries Regulation Order No. 83 of 1965 which prohibit the use of explosives and poisons for fishing. The Head of State prescribes measures for conservation management of fisheries including closed seasons/areas and the type of gear that may be used.

Marine resource management in Samoa is a combined effort between the government of Samoa and the coastal villages and their *fonos*, or councils. When the the Fisheries Act of 1988 was developed, it gave legal recognition of village regulations for nearshore fishing grounds as bylaws once the *fono* has consulted with the Fisheries Division. Bylaws are gazetted by the Legislative Assembly and advertised by the local media so they are known nationally (Faasili and Kelokolo 1999; Johannes 2002). The Village Fono Act 1990 establishes the right of *fonos* to exercise authority in accordance with Samoan customs including the management of natural resource and fisheries. The following are some examples of village fishing bylaws applicable to the harvest of bumphead parrotfish: (1) national mesh size limits on nets (75% of villages); (2) a ban on capture of fish less than the minimum size (41% of villages); and (3) use of underwater torches for spearfishing is restricted (21% of villages). Examples of common fisheries by-laws (or regulations) that affect coral reefs are: (1) a ban on use of chemicals and dynamite to kill fish (100% of villages); (2) a ban on use of traditional plant-derived fish poisons (100% of villages); (3) establishment of small protected areas in which fishing is banned (86% of villages); and (4) a ban on other traditional destructive fishing methods (e.g. smashing coral; 80% of villages). Community enforcement includes posting signs, using patrol canoes, and having regular watchmen. There are traditional fines within a village and legal action for outsiders (Faasili and Kelekolo 1999).

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124 http://www.maf.gov.ws/

125 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_WS.pdf

Mangroves and forests are nationally managed through various Acts. The Forest Act 1967 and Forest Regulation 1969 both declare lands as state forests or protected areas, respectively. Sustainable forest management is achieved through the Code of Logging Practice (COLP) and the Reduced Impact Logging Guidelines (RIL). The Secretariat of the Pacific Communities (SPC/GTZ/Pacific Regional Forest Programme) manages a 400 ha plot of natural forest promoting sustainable indigenous forestry management.

MPA Regulations

Throughout Samoa, there are 108 coral reef MPAs listed in the WDPA (Appendix A) and two mangrove protected areas (Appendix B). Marine parks and reserves have been established across the country from the support of the Australian Government Overseas Aid program (AusAID) and the Samoan Environmental Department (Govan *et al*. 2009a). The Aleipata Marine Protected Area has multiple no take zones and surveys are conducted by the surrounding community and spearfishing is discouraged (Gillett and Moy 2006). The Safata Marine Protected Area has ten no take zones within the reserve. Palolo Deep Marine Reserve is located just outside of Apia, the capital of Samoa, prohibits fishing and is managed by a family that has established rights to the area in conjunction with the Samoa Division of Environment and Conservation (DEC) (Lovell and Toloa 1994). There are over sixty locally managed fisheries and many of these areas contain mangroves, seagrass, lagoons, and/or coral reefs. The Village Fisheries Management Plan is an initiative to establish community managed MPAs around Samoa, encouraging communities to implement and enforce regulations and conservation strategies in their area (King and Faasili 1999). A was submitted in response to climate change. Some adaptation strategies that effect mangroves included in Samoa's National Communication to the UNFCC in response to climate change include re-vegetating coastal strand, managing coastal zones, discouraging reclamation, and government leasing of mangrove land (Gilman *et al*. 2006).

Overall in Samoa, reef fisheries are regulated by national law, which recognizes and incorporates customary laws at the village level. Fishing for parrotfish and other reef fish is specifically managed and varies by village. Customary law also prohibits destructive fishing practices, thereby protecting corals and coral reefs. Mangroves are managed under national law. A large network of MPAs protects 20% of the country's coral reefs.

2.1.2.31 Saudi Arabia

Approximately 2.5% of coral reefs within the 46 areas in bumphead parrotfish range are in Saudi Arabia. One percent, or 53 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Saudi Arabia contains 0.3% of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with a portion of that in four protected areas (Appendix B). Coral reefs, seagrass lagoons, and mangroves exist along the Red Sea and Arabian Gulf.

The Fisheries Sector of the Ministry of Agriculture and Water is tasked with managing fisheries throughout Saudi Arabia. Enforcement is carried out by the Coast Guard and other marine agencies. Artisanal fishing is common throughout Saudi Arabia and fisheries management is primarily at the national level (De Young 2006).

Fisheries and Coastal Management Regulatory Mechanisms

Artisanal and commercial fisheries exist along the Red Sea coast of Saudi Arabia. Fishers use gillnets, handlines, trolls, shrimp trawl nets, and fish traps.[126] Fisheries regulations are managed by the Ministry of Agriculture and Water. The Regulation on Fisheries prohibits fishing with explosives, poisons, or chemicals. It is also prohibited to install fish nets that utilize the tide to catch fish, or to use gillnets with mesh sizes smaller than 2.5 in. Closed seasons have been instituted for coral reef species of grouper in the Red Sea. The Regulations for Fishing, Exploitation and Protection of Live Aquatic Resources in the Territorial Waters of the Kingdom of Saudi Arabia of 1989 prohibits commercial fishing for indigenous species, fishing for ornamental fish, and trade of coral flora without a permit from the Ministry.

Saudi Arabia has developed a National Biodiversity Strategy as a member of the Convention on Biodiversity (CBD), which includes goals like conservation and sustainable use inside and outside protected areas, conserving and developing marine resources, enacting environmental legislation and education, and allowing environmental research (Abu Zinada *et al*. n.d.). As part of this plan, the National Commission for Wildlife Conservation and Development (NCWCD) has demarcated two marine reserves in the Red Sea, Aqaba and Fatul Wajd (Vincent 2008). A National Contingency Plan has also been developed to respond to oil spills. The purpose of the National Coastal Zone Management Plan of 2003 is to protect coastal environments through sustainable development (Abu Zinada *et al*. n.d.).

Artisanal fishing is the largest fishery by volume and is mostly made up of hand line and gill net fisheries. Artisanal fishers receive government subsidies in the form of soft loans, grants and other assistance. Stakeholders often participate though traditional discussions with the government on fisheries development policy and management. Some major fish stocks are showing signs of over-exploitation which has led to the extension of the length of the fishing season to compensate for lower catches since 2002 (De Young 2006).

MPA Regulations

Throughout Saudi Arabia, there are three coral reef MPAs listed in the WDPA (Appendix A) and four mangrove protected areas (Appendix B). Saudi Arabia has established a number of extensive terrestrial protected areas and a few MPAs in the Red Sea and Arabian Gulf that include mangrove and coral reef habitats. Many protected areas have been proposed dating back to the mid- and late 1980s, and the boundaries and regulations remain unchanged today.[127] With the exception of the Farasan islands, protected in 1996, and the Jubail Wildlife Sanctuary which was developed shortly after the Gulf war, there have been no other recent marine protected areas established. Recently, however, the Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden developed a Strategic Action Plan which proposes up to 32 MPAs in the Red Sea alone (www.persga.org). There are also coastal rehabilitation projects, such as replanting mangroves in the Red Sea and Arabian Gulf that are active in Saudi Arabia (De Young 2006).

Overall in Saudi Arabia, although coral reef fisheries are regulated by national law, spearfishing does not appear to be directly regulated. Development of mangroves, coral reefs, and other

126 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_SA.pdf
127 http://www.fao.org/fi/oldsite/FCP/en/SAU/body.htm

coastal habitats is not heavily regulated. There are some coral reef MPAs and mangrove protected areas.

2.1.2.32 Seychelles

Approximately 0.9% of coral reefs within the 46 areas in bumphead parrotfish range are in Seychelles. Five percent, or 95 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Seychelles contains a negligible percentage of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with a portion of that in five protected areas (Appendix B). The Seychelles is a nation comprised of approximately 115 islands. Fisheries are managed nationally by the Seychelles Fishing Authority.

Fisheries and Coastal Management Regulatory Mechanisms

The marine fisheries sector is sectioned into artisanal, semi-industrial, and industrial fisheries. Industrial and semi-industrial fisheries primarily target pelagic species. The artisanal fishery targets reef fish species that inhabit shallow coral banks, thus bumphead parrotfish are only vulnerable to artisanal fishers. Bumphead parrotfish are harvested using spears and nets (D. Obura pers. comm.), mostly by artisanal fishers who harvest reef fish in nearshore areas (Robinson and Shroff 2004). While not considered harvest, there are fisheries blogs showing catch and release fishing for bumphead parrotfish by hook-and-line in the Seychelles.[128]. Parrotfishes are also caught in fish traps on the reef, especially when south east trade winds make conditions rough (Alexis and Chang-Sam 2006).

The Seychelles Regulations of 1991 prohibit spear gun fishing and use of dynamite. Several artisanal fisheries, though, are not subject to regulatory measures or are poorly managed (De Young 2006). Large nets must be marked with a license number and it is an offense to tamper with these tags in territorial waters. Net use is prohibited in protected areas, reef passages, and channels. Nets must be mounted on lead ropes so as not to damage coral. Coastal waters are regularly patrolled to monitor compliance with mesh size restrictions.

MPA Regulations

Throughout Seychelles, there are three coral reef MPAs listed in the WDPA (Appendix A) and five mangrove protected areas (Appendix B). With the designation of the Ste. Anne Marine National Park in 1973, Seychelles became recognized as the first country East Africa to create an MPA. The creation of Ste. Anne National Marine Park was an explicit conservation measure to address the over-exploitation of shells, corals, and fish. Regulations for the park prohibit touching, taking, and/or disturbing any shells, corals, or fish. Another protected area within the Seychelles is Aldabra Atoll, which is also a UNESCO World Heritage Site. Marine parks in the Seychelles have mooring systems as well as entry fees to support management and enforcement. Cousin Island is managed by local residents and poaching is virtually zero within the reserve (Arthurton *et al*. 2006). Mangrove management includes educational activities (FAO 2007a) and mangroves are protected within some parks and reserves (Drude de Lacerda 2002).

128 http://www.mediastorehouse.com/pictures_1631345/bumphead-parrotfish-on-the-fly.html

Overall in Seychelles, national law prohibits the use of spearguns for fishing. A network of MPAs protects coral reef and mangrove areas. Outside of protected areas, mangroves do not seem to be closely managed.

2.1.2.33 Solomon Islands

Approximately 3.2% of coral reefs within the 46 areas in bumphead parrotfish range are in the Solomon Islands. Six percent, or 405 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). The Solomon Islands contain 0.8%of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with a portion of that in ten protected areas (Appendix B).

The Solomon Islands encompasses over 900 islands in the western Pacific. There are nine provinces and one administrative area, the town of Honiara.[129] Fisheries are managed by cooperating entities from these provinces and the national authority of the Ministry of Fisheries and Marine Resources. Customary tenure is recognized by the national government and traditional resource management is common throughout the country.

Fisheries and Coastal Management Regulatory Mechanisms

Coastal fisheries in the Solomon Islands are divided into subsistence and commercial fisheries. Approximately 90% of catch is from subsistence fishing (UNEP 2005). Subsistence fisheries, including almost all areas outside of Honiara, are managed under customary fishing rights. Community leaders restrict outsiders and impose various bans for residents; the goal, in most cases, is to prevent over-exploitation. Enforcement is carried out by the community. Commercial fisheries often supply finfish for urban markets and export, and fishers use hand lining, trolling, spearing (including hand spears and spearguns), netting, and hand collection.

There are studies of commercial bumphead parrotfish fisheries in Roviana Lagoon in the Solomon Islands. Currently, commercial fishing for finfish occurs mostly in urban areas due to proximity to urban markets; in the 1980s and 1990s, however, markets were common in rural areas which supported finfish fishing in these areas.[130] Hamilton (2001) suggested that opening rural areas to market-based systems increased demand for bumphead parrotfish which led to an increase in the use of goggles and an underwater flashlight, which gave spearfishers an advantage over the traditional method of using a handspear and torch. Two spearfishers using an underwater torch could take between 50 and 70 bumphead parrotfish in a night and sell the fish to markets.

Some national regulations are enacted to ameliorate the decline of bumphead parrotfish. The Fisheries Act of 2004, Regulation 29 states: "Any person using under-water breathing apparatus for the purpose of harvesting any marine resource shall be guilty of an offence and liable to a fine not exceeding five thousand dollars or six months imprisonment or both such fine and imprisonment." Some communities in the Solomon Islands had banned the use of SCUBA for fishing several years before this act came into effect (Gillett and Moy 2006).

129 http://www.state.gov/r/pa/ei/bgn/2799.htm
130 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_SB.pdf

Other pertinent national fishing regulations are set by the Fisheries Acts of 1998 and 2004. The Fisheries Act of 1998 states that marine biodiversity, coastal and aquatic environments of Solomon Islands shall be protected and managed in a sustainable manner and calls for the application of the precautionary approach to conservation, management, and exploitation of fisheries resources in order to protect fisheries resources and preserve the marine environment. It provides guidelines for fisheries management plans stating that the Provincial Assembly can designate open/closed areas for fishing, regulate net mesh size, and prohibit the use of driftnets. The Act also provides Provincial Governments with the ability to establish marine reserves. Fishing with explosives or noxious materials is prohibited, although still known to occur. Live fish cannot be imported or exported.

Mangroves outside protected areas are threatened from commercial logging and export, even though they are protected nationally under the Forest Resources and Timber Utilization Act (FAO 2007a). The Act emphasizes the precautionary approach to applied fisheries, conservation management, and exploitation and observes customary fishing rights. Through the Fisheries Act of 1998, Provinces may regulate or prohibit the destruction of mangroves.

MPA Regulations

Throughout the Solomon Islands, there are 116 coral reef MPAs listed in the WDPA (Appendix A) and ten mangrove protected areas (Appendix B). There are both nationally established MPAs and those established through traditional systems. Traditional management systems are still of considerable importance in the Solomon Islands and customary marine tenure is widely recognized such that all reefs are owned by particular groups who have fishing rights to the area. Often Christian leaders, traditional *kastom* men, or even villagers themselves regularly place taboos on particular reefs, closing them to fishing for a certain period of time. The government of the Solomon Islands recognizes customary tenure, but not specifically sea tenure, as a form of environmental management in the constitution (S. Aswani pers. comm.). This includes holding the rights to natural resources, but customary owners cannot own land (Caillaud *et al*. 2004). One example of a community managed MPA is the Arnavon Islands Marine Conservation Area (ACMCA). The ACMCA was first established in 1975 to protect sea turtles and is currently managed by three neighboring communities and the Nature Conservancy who agreed to protect this area and declared it a legal no-take zone in 1995.[131] No commercial fishing is allowed; only subsistence fishers may harvest some reef fish species. Other small marine conservation areas (MCAs) have been established by communities in Marau Sound, Ngella, Marovo Lagoon, Tetepare, Roviana Lagoon, and Gizo and are established as part of a larger network of MCAs. In Roviana Lagoon, it is recognized that bumphead parrotfish have been overfished due to increased pressure from fishers participating in the cash economy (Green *et al*. 2006). Tetepare is managed by the Tetepare Descendents' Association (TDA) and has a 13 km-long a no-take zone. The TDA patrols and monitors activity on the island, and conducts fish abundance surveys on surrounding reefs.[132] The eastern third of Rennell Island was declared a World Heritage Site in 1998, with boundaries extending seaward for three nautical miles. The Ministry of Fisheries and Marine Resources is moving toward providing scientific/technical advice to customary rights holders to aid in more effective management of MCAs (FAO 2002b).

131 http://www.nature.org/ourinitiatives/regions/asiaandthepacific/solomonislands/placesweprotect/arnavon-islands.xml

132 http://www.tetepare.org/tetepare-conservation-programs.html

Overall in the Solomon Islands, customary laws for coral reef fisheries harvest are very strong in most areas, serving to both sustainably manage fish stocks as well as to limit the effects of destructive fishing practices on coral reefs. Fisheries are somewhat well regulated nationally with regulations on spearfishing and other gears; use of nets and SCUBA are also prohibited. Threats to coral reefs and mangroves are well regulated inside of MPAs as well within established no take areas. Mangroves are managed by national law and there is an extensive network of mostly locally-managed MPAs.

2.1.2.34 Somalia

Approximately 0.3% of coral reefs within the 46 areas in bumphead parrotfish range are in Somalia. A negligible percentage of those are protected nationally in one MPA (see Table 2 and Appendix A-1). Somalia contains 0.1% of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with one mangrove protected area (Appendix B). The Somali Ministry of Fisheries manages fisheries nationally.

Fisheries and Coastal Management Regulatory Mechanisms

Fishing in Somalia is very limited and is nearly entirely artisanal in nature, with 40% of the catch from coral reef fin fish harvest.[133] The Somali Fishery Law No 23 of 30 November 1985 states that it is forbidden to carryout activities that result in the death, pollution, or injury of aquatic animals (not including fish). It is prohibited to carry materials that cause damage to animals in the fishing area. Fish caught while carrying out an activity that results in the death, pollution, or injury of aquatic animals are forbidden to be sold or exchanged. The Maritime Code, Decree 1, 31.2.59 amended by Decree 7, 1.11.66 prohibits dynamite, electric currents, and chemical methods of fishing.

MPA Regulations

Throughout Somalia, there is one coral reef MPAs listed in the WDPA (Appendix A) and one mangrove protected area (Appendix B). The World Conservation Monitoring Center Protected Area Database lists eight proposed terrestrial and marine parks.[134] There are a total of three proposed areas of protection in Somalia along the north coast, Aibat, Saad ad-Din and Saba Wanak area and only one of them contains coral reefs.

Overall, Somalia currently has limited national laws on fisheries management and coastal development, and apparently little or no relevant local and/or customary laws. It is not clear if any MPAs have been established.

2.1.2.35 Sri Lanka

Approximately 0.1% of coral reefs within the 46 areas in bumphead parrotfish range are in Sri Lanka. A negligible percentage of those are protected nationally in ten MPAs (see Table 2 and Appendix A-1). Sri Lanka contains 0.1% of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with nine mangrove protected areas (Appendix B).

133 http://www.fao.org/fi/oldsite/FCP/en/SOM/profile.htm
134 http://www.wdpa.org

Fisheries in Sri Lanka are managed by three institutions: the Ministry of Fisheries and Aquatic Resources (MFAR), the Provincial Ministries of Fisheries, and the Department of Fisheries and Aquatic Resources (DFAR). Two agencies have the authority to establish marine parks and sanctuaries in Sri Lanka: the National Aquatic Resources Research and Development Agency (NARA) and the Department of Wildlife Conservation.

Fisheries and Coastal Management Regulatory Mechanisms

Within marine fisheries in Sri Lanka are coastal, offshore, and deep-sea subsectors. The coastal subsector extends about 22 km to the edge of the continental shelf. Most fishers use traditional crafts that are owned by individuals; cooperative societies or commercial fishing companies are rare.[135] Bumphead parrotfish are vulnerable to spears and nets used for fishing on the continental shelf. Administered by MFAR, the Provincial Ministries of Fisheries, and DFAR, the Fisheries and Aquatic Resources Act of 1996 prohibits the use of poisons or explosives and fish caught this way cannot be bought, sold, possessed, or transported. The Minister declares when fishing season is open or closed and designates fisheries reserve areas, offering protection to a species in danger of extinction or promoting regeneration of aquatic life. There is no fishing in a reserve except by permit. The Minister can also declare fisheries reserves to protect aquatic life, the environment, or for scientific use. The Export and Import of Live Fish Regulations 1998 prohibits the import and export of live fish and lists certain marine species. Bumphead parrotfish are not included in this regulation. In 1993 and 1994 a ban on the operation of lime kilns within the coastal zone was implemented, thus banning coral mining. The National and Aquatic Resources Policy is written to help protect the rights of traditional fishers in coastal communities (Ministry of Fisheries and Aquatic Resources 2006).

Other important regulations include the Coastal Zone Management Plan of 1990, the National Environmental Act, the Fisheries Ordinance and the Fauna and Flora Protection Ordinance all provide the necessary guidelines and regulations for the use and protection of the marine environment in general and sensitive marine ecosystems in particular. The Coastal Zone Management Plan of 1990, supported by Coastal Conservation Act of 1981 and managed by the Coastal Conservation Department (CCD), addresses pollution and construction issues on the coast and is reviewed every four years. This plan covers a 300 m strip of land along the coast out to 2 km seaward (White 1997; Samaranayake n.d.). Special Area Management sites under this plan provide management activities and opportunities for community involvement (Bandara n.d.). Traditional fisheries management by local communities is encouraged through the declaration of Special Area Management Sites. At these sites, communities are in charge of management while local and national government entities act as catalysts providing funding and tools to organize, develop, and implement management plans (White 1997). Protection has been given to selected marine species listed under the Fisheries ordinance as well as the Fauna and Flora protection Ordinance of the Department of Wild Life Conservation (Rajasuriya 1997). Bumphead parrotfish are not listed under this ordinance.

Two regulations include protections for mangrove habitat: the National Forestry Policy 1995 and the National Policy on Wetlands 2005. Both policies declare and manage protected areas and multiple-use forests.[136] Prior to the development of the National Forestry Policy in 1995, the

135 http://www.fao.org/fishery/countrysector/FI-CP_LK/en
136 http://www.environmentmin.gov.lk/policies.htm

government of Sri Lanka decided to manage forest reserves scientifically under guidelines in the National Environmental Act in 1988. Environmental Impact Assessments (EIAs) must be done before development in forest areas outside of reserves. In addition to these national laws, community management is also seen as an important tool in protecting forest reserves and managing multiple-use forests (De Zoysa 2001).

MPA Regulations

Throughout Sri Lanka, there are ten coral reef MPAs listed in the WDPA (Appendix A) and nine mangrove protected areas (Appendix B). The National Aquatic Resources Research and Development Agency (NARA) was established under the NARA Act No. 54 of 1981 and is tasked with research, development, and management activities for aquatic resources in Sri Lanka. NARA manages resources within the EEZ including fisheries, coastal zone management, and coral reef conservation.[137] Marine parks and sanctuaries are established by the Marine Parks, Sanctuaries and Refuge Committee within NARA (Ranjith and De Silva 1997). The Department of Wildlife Conservation uses the National Wildlife Policy to develop and implement management plans for protected areas.[138] Traditional fishing, including spearfishing, is allowed in marine parks (for example within Hikkaduwa Nature Reserve), but other extractive uses are prohibited (Senaratna 2001).

Overall in Sri Lanka, fisheries are not closely regulated by national or other laws. However, threats to mangroves and coral reefs are heavily regulated by multiple national laws limiting extraction and development. MPAs and protected areas are limited but the ones that are established appear heavily regulated.

2.1.2.36 Sudan

Approximately 0.5% of coral reefs within the 46 areas in bumphead parrotfish range are in Sudan. A negligible percentage of those are protected nationally in one MPA (see Table 2 and Appendix A-1). Sudan contains a negligible percentage of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with no mangrove protected areas (Appendix B). The Ministry of Animal Resources and Fisheries manages fisheries nationally in Sudan.

Fisheries and Coastal Management Regulatory Mechanisms

Within the EEZ, primary types of fishing are traditional and subsistence fisheries. Artisanal fishers often use pole-and-line, longlines, trolls, cast nets, gillnets, and beach seines to target finfish.[139] Fisheries are managed by multiple regulations specifically outlined in the Comprehensive National Strategy (1992-2002). The Comprehensive National Strategy (1992-2002) provides a utilization and conservation framework for marine living resources and attempts to coordinate efforts for integrating coastal management at the national, regional, and international levels. It states that local fishermen and their vessels must be licensed and foreign vessels need permission to enter the EEZ. It also prohibits use of explosives, poisons, and spearguns for fishing (De Young 2006). The Marine Fisheries Regulation of 1975 prohibits the take of certain fish (names given in Sudanese) less than 20.3 cm (8 inches) and undersize fish are confiscated. Net mesh size is regulated to 3.8 cm (1.5 inches) for all fish except sardines. The

137 http://www.nara.ac.lk/12/library%20search/index.html
138 http://www.dwc.gov.lk/index.php/policies-a-legislations
139 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_SD.pdf

Marine Fisheries Regulations of 1927, Amendments 19754 prohibits the collection of corals, shells, and aquarium fish.

MPA Regulations

Throughout Sudan, there is one coral reef MPA listed in the WDPA (Appendix A) and no mangrove protected areas (Appendix B). The only marine protected area in Sudan is the Sanganeb Marine National Park (est.1990) which is comprised of the 12 km² atoll and associated highly diverse and complex coral reefs. The park is managed by the African Parks Network in partnership with the Sudanese Wildlife Administration. Management plans for the park were developed by the Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA) in 2003.[140] The Comprehensive National Strategy (1992-2002) designates Saganab Atoll Marine National Park, a IUCN category II MPA, closed to fishing and Dongonab Bay closed to oyster farming and small-scale fishing. Dongonab Bay and Mukkawar Island are also proposed MPAs.

Overall in Sudan, national law prohibits the use of spearguns for fishing, but otherwise coral reef fisheries do not appear to be closely regulated. Likewise, mangroves and coral reefs are not closely regulated. The single coral reef MPA prohibits fishing.

2.1.2.37 Taiwan

Approximately 0.3% of coral reefs within the 46 areas in bumphead parrotfish range are in Taiwan. Nine percent of those are protected nationally in twenty MPAs (see Table 2 and Appendix A-1). Taiwan contains a negligible percentage of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with no mangrove protected areas (Appendix B). The Taiwan Fisheries Agency is tasked with managing fisheries nationally.

Fisheries and Coastal Management Regulatory Mechanisms

Bumphead parrotfish are found throughout the eastern and southern coastal areas of Taiwan, Penghu Island, Green Island, and Lanyu Island. They are known to be harvested using longline, pole-and-line, gillnet, and pot. Currently, there are no species-specific national regulations, but in 1989 the Council of Agriculture stopped issuing dive fishing licenses due to the high fishing efficiency and selectivity of this method (Taiwan Council on Agriculture pers. comm.).

The Taiwan Fishery Law and the Wildlife Conservation Law of 1989 contain the primary fishing regulations. The Taiwan Fishery Law (Article 48) and Fisheries Act both prohibit the use of poisons, dynamite and other explosives, electric shocks or anesthetic agents for fishing. The Wildlife Conservation Law of 1989 (amended in 1994) conserves and protects wildlife, including fish, and associated habitat.

Coastal resources are protected under the National Park Law and the Coastal Environmental Protection Plan which are both administered by the National Park Department within the Ministry of Interior. The National Park Law of 1972 ensures the preservation of unique natural scenery, flora and fauna, public recreation areas, and scientific research areas. There is no fishing or altering of the landscape in national parks and cultural and recreation areas, without

140 http://www.fao.org/docrep/009/a0477e/a0477e0t.htm

permission. In an effort to ameliorate fishing pressure, the government has established fisheries resource conservation areas, artificial fish reef areas, and fisheries protection areas along some coasts. To prevent net fishing boats from fishing within 3 nm of the coast, cross-shaped cement reefs have been laid in select waters by cities and counties since 1990.

In addition to national regulations, the Taiwan Wetland Conservation Declaration seeks to implement Wetlands conservation, restoration, and education programs (CRE) to help protect lagoon and mangrove habitat. Wetlands CRE programs follow the principle of the Basic Environment Act and provide policies, effective management, long-term perspectives and goals, and financial support for areas considered and designated natural conservation areas.[141]

MPA Regulations

Throughout Taiwan, there are twenty coral reef MPAs listed in the WDPA (Appendix A) and no mangrove protected areas (Appendix B). Most of Taiwan's coral reef resources are within the boundaries of its National Parks or National Scenic Areas: Kenting National Park, the Northeastern Coast National Scenic Area, the East Coast National Scenic Area, Tapengwan National Scenic Area, and Penghu National Scenic Area.

Overall in Taiwan, national law limits the number of dive fishing licenses but otherwise regulations are limited for all coral reef fishing gears. Development near mangroves, coral reefs, and other coastal habitats is regulated by national law. A network of well-regulated coral reef MPAs protects a small proportion of the country's reef areas.

2.1.2.38 Tanzania

Approximately 1.4% of coral reefs within the 46 areas in bumphead parrotfish range are in Tanzania. Forty-seven percent, or 1414 km^2, of those are protected nationally in MPA (see Table 2 and Appendix A-1). Tanzania contains 1.6% of the mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with twenty-four mangrove protected areas (Appendix B). Approximately two-thirds of the coastline of Tanzania is lined with fringing and patch coral reefs. Coral reefs, seagrass beds, and mangrove forests are especially well-developed around Rufiji and Zambezi deltas (Arthurton *et al*. 2006).

Fisheries in mainland Tanzania are managed nationally by the Fisheries Department of the Minister for Natural Resources and Tourism. In Zanzibar, fisheries are managed by the Department of Fisheries and Marine Resources of the Ministry of Agriculture, Natural Resources, Environment, and Cooperatives. Management does not extend through to the district level so districts are in charge of managing their fisheries through local District Councils (Wilson 2004).

Fisheries and Coastal Management Regulatory Mechanisms

There are both artisanal and industrial fisheries operating in the marine waters of Tanzania. Fishers commonly use gillnets, shark nets for fin fish, and traps.[142] Bumphead parrotfish can be harvested using spears and gillnets (D. Obura pers. comm.), though they are rarely or never seen

141 http://www.cpami.gov.tw/english/index.php?option=com_content&view=article&id=10895&Itemid=3

142 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_TZ.pdf

(T. Davenport and T. McClanahan pers. comm.). Fish from the Scaridae family are known to be harvested using seine nets and box traps at Mafia Island, Songo Songo Archipelago, and Mnazi and Mikandani Bays (seine nets only) in southern Tanzania (McClanahan *et al*. 2000).

The United Republic of Tanzania is the name given to the union between the previously independent People's Republic of Zanzibar and Republic of Tanganyika. Although there is now a centralized 'Union' government system, semi-autonomous governments are maintained in the two entities and fisheries resources are among the matters not ruled by the Union government. Zanzibar and Mainland Tanzania maintain separate fisheries departments that govern their territorial waters. Spearfishing using a harpoon gun or spear gun is illegal throughout the United Republic of Tanzania unless a permit is acquired from the appropriate fisheries department. Fishing with a non-mechanized pole spear is legal throughout the country.

Fisheries in mainland Tanzania are nationally regulated by the Tanzania Fishing Act 2003 and the Fishing Regulations of 2005. The Fishing Act states that the Minister can regulate and/or prohibit the use of certain gears, including gillnets and traps, and the use of explosives and poisons for fishing. Using a spear gun by skin or SCUBA diving is considered an illegal fishing technique, but the specific law citing this could not be found (Silva 2006). Under both acts, fisheries are co-managed by the national government and community-based collaborative fisheries management units or BMUs. BMUs locally prepare bylaws that fit into national regulations and enforce these bylaws (Ministry of Livestock and Fisheries Development and WWF 2009). BMUs can also be called *Bwana Dikos* and are considered the local link with the government.[143]

Mangrove forests are managed nationally under the 1996 Forest Resources Management and Conservation Act of Zanzibar which institutes Community Forest Management groups. The Forest Bill of Tanzania requires communities around Forest Reserves must submit management plans that state how they are going to use resources within the reserve (Wily 2000). There are varying zones of protection for mangrove forests defined as: zone I which offers total protection, zone II which includes forests ready to be brought into production, zone III which includes degraded areas that are closed for recovery, and zone IV which includes areas set aside for different development (Drude de Lacerda 2002).

MPA Regulations

Throughout Tanzania, there are 15 coral reef MPAs listed in the WDPA (Appendix A) and 24 mangrove protected areas (Appendix B). Tanzania has a well-developed policy and institutional framework to oversee the development and administration of MPAs. The Fisheries Act of 2003 is currently the main piece of legislation guiding the fisheries industry and MPAs. This Act provides regulations for the general purposes of protecting, conserving, developing, regulating or controlling the capture, collection, gathering, manufacture, storage or marketing of fish, fish products and aquatic flora. The Marine Parks and Reserves Act No. 29 of 1994 established MPAs in mainland Tanzania. The National Integrated Coastal Management Strategy of 2003 outlines general guidelines for sustainable use and development of coastal resources in relation to economic growth.

143 http://www.ecologyandsociety.org/vol11/iss2/art35/

Two notable marine protected areas include Mafia Island Marine Park and Chumbe Island Coral Park. The Tanzania Marine and Coastal Environmental Management Program from the World Bank shows management plans for Pemba Channel Marine Conservation Area and Rufiji-Mafia-Kilwa Marine. The Pemba Channel Marine Conservation Area on the west coast of Pemba Island contains lagoon, seagrass, mangrove, and coral habitats (Grimsditch *et al*. 2009). Community participation in management of these areas is encouraged (Arthurton *et al*. 2006). The Chumbe Island Coral Park (CHICOP) is an example of a privately managed coral reef sanctuary that is officially gazetted and nationally recognized as a marine park in Zanzibar. In 2001, the Chumbe Education Program developed a module called "The Coral Reef" that was recognized by the Ministry of Education as an official teaching aid. The program was expanded to encompass teacher training workshops and evaluation seminars, where teachers were trained to link learning experiences with Science syllabi[144].

Overall in Tanzania, fisheries laws prohibit use of spearguns unless permitted, and coral reef fisheries are closely regulated by a combination of national and local laws and institutions. Mangroves are regulated by national law. Tanzania has a large network of mostly locally-managed coral reef MPAs encompassing almost half of the country's reef area, and there is also a network of mangrove protected areas.

2.1.2.39 Thailand

Approximately 0.2% of coral reefs within the 46 areas in bumphead parrotfish range are in Thailand. Thirty-seven percent, or 193 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Thailand contains 3.1% of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with a portion of that in twenty-three protected areas (Appendix B). The coastline of Thailand contains mostly small fringing coral reefs found both in the Gulf of Thailand and the Andaman Sea (Burke *et al*. 2002).

The Department of Fisheries (DOF) manages fisheries nationally in Thailand. The DOF and the Royal Thai Forestry Department are the agencies responsible for enforcing regulations in coral reef and mangrove habitats.

Fisheries and Coastal Management Regulatory Mechanisms

Marine fisheries in Thailand are divided into small-scale fisheries and commercial fisheries. Commercial fisheries use inboard-powered boats of over five gross tonnage, use efficient fishing gears like trawls, purse seines, encircling gillnets, and large drift nets, and spend several days at sea. Small-scale fishers use vessels with no power or small vessels with inboard/outboard engines and fish near shore using traditional fishing gears. These gears include small trawls, gillnets, push nets, lift nets, set bay nets, traps, hook-and-line, and other stationary gears (FAO 2009d). Bumphead parrotfish are harvested using spearguns and hook-and-line. Use of gillnets and trammel nets is limited (E.A. Poblacion and D. Griffiths pers. comm.).

The Fisheries Act of 1947 regulates fisheries management. The Act prohibits the use of explosives for fishing. The Minister determines mesh size, what fishing implements are forbidden to use anytime or during spawning or breeding season. A license is required to use a

144 http://www.chumbeisland.com/Reef%20Sanctuary/reef%20sanctuary.html

net for fishing. The Fisheries Act B.E. 2490 prohibits using poisonous substances to fish (section 19) and electric currents (section 20). It is prohibited for coastal fishers to use trawlers and push netters to operate within 3,000 m of the shoreline (FAO 2009d). There are two areas closed for spawning on either side of the Thai peninsula. One is closed from mid-February to mid- May and the other is closed from mid-April to mid-June. The Fisheries Act B.E. 24909 (amended in 1972) prohibits the collection of corals. The DOF encourages "bottom-up" fisheries management through programs like the DOF Conservation Unit, which trains village representatives to help enforce conservation measures (Hartmann 2011). There are no regulations specific to parrotfish in Thailand (E.A. Poblacion and D. Griffiths pers. comm.). Management plans are not used in managing artisanal fisheries; instead, regulatory processes like enforcing the Fisheries Act are more prevalent (De Young 2006).

In 1993 the DOF initiated a program for marine and fisheries protected areas to enhance the protection and conservation of breeding grounds in the Gulf of Thailand (Agenda 21). Since 1995, the DOF has been implementing a coral reef management program, which includes research, training and public education for reefs outside marine parks (UP-MSI *et al*. 2002).

MPA Regulations

Throughout Thailand, there are twenty-four coral reef MPAs listed in the WDPA (Appendix A) and twenty-three mangrove protected areas (Appendix B). The National Park Act of 1961, enforced by the Royal Thai Forestry Department, and the Fisheries Law of 1947, enforced by the DOF, both provide for the establishment of MPAs. Also, certain areas can be declared as "areas under protection," under the National Environment Quality Act, and any measures deemed necessary can be imposed to protect these areas. There are five different categories of protected areas in Thailand: national parks, national marine parks (or marine national parks), wildlife sanctuaries (or wildlife conservation areas), forest parks, and non-hunting areas. The National Park Act of 1961 states that all national parks are to be, "preserved in their natural state for the public's education and enjoyment." The Wildlife Protection and Preservation Act of 1960 states that wildlife sanctuaries are areas for, "the conservation of wildlife habitat so that wildlife can freely breed and increase their populations in the natural environment." Nationally, approximately 1,946 km² of mangrove area are protected within marine protected areas.[145]

MPAs cover about 40% of coral reefs and NGOs are assisting communities in establishing community-based management efforts in coral reef and mangrove areas.[146] A coastal resource management program was established in 1986 and with the help of USAID, the royal family is working with local residents to protect marine resources (Jameson *et al*. 1995). There are twenty-one legally recognized Marine National Parks (MNPs) in Thailand and an additional five MPAs that are in the process of being finalized (Sethapun 2000). Of the twenty-one legal MNPs, sixteen parks include coral reef areas in the Andaman Sea and five are located in the Gulf of Thailand (Sethapun 2000; UP-MSI *et al*. 2002).

Some mangrove forests are located in reserves and are managed by the Royal Forest Department of Thailand with a thirty year rotation and fifteen-year felling cycle (Choudhury 1997). Mangrove habitat is recovering with 15% protected and 82 percent under sustainable

145 www.arcbc.org/arcbcweb/publications/mpa.htm
146 http://www.reefbase.org/global_database/dbt5,32,THA,5.aspx

management, although there are still large areas under illegal private possession for shrimp farming and salt production. Threats to mangroves are reduced through the creation of awareness of the value of mangrove forest by NGOs and reclamation of shrimp farms. Governments ameliorate these threats further through laws to control expansion of shrimp farms, limit pollution, establish reserves and fisheries conservation areas, replant abandoned farms, and by encouraging local participation and NGO involvement (Angell 2004). There is also a ban on further prawn pod construction and mangrove destruction (Jameson *et al*. 1995).

Laws are limited for coral reef fisheries management. Mangroves and coral reefs are closely regulated by national law. A considerable proportion of the country's mangroves and coral reefs are protected in MPAs and protected areas.

2.1.2.40 Timor Leste

Approximately 0.1% of coral reefs within the 46 areas in bumphead parrotfish range are in Timor Leste with no MPAs (see Table 2 and Appendix A-1). Timor Leste contains a negligible percentage of the mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with no mangrove protected areas (Appendix B). The Ministry of Agriculture, Forestry and Fisheries (MAFF) manages fisheries and the environment nationally for Timor Leste. Traditional management is also common throughout the country.

Fisheries and Coastal Management Regulatory Mechanisms

Subsistence and artisanal fisheries are the primary types of fisheries in Timor Leste.[147] Common fishing methods used by artisanal fishers include spearfishing, fish traps (*bu-bu*), and fishing nets.[148] Bumphead parrotfish are harvested using spearguns and handlines (E.A. Poblacion pers. comm.).

Marine fisheries in Timor Leste are nationally regulated by various government decrees. The Government Decree 5/2004 of the General Regulation on Fishing authorizes the use of trawl nets, purse seine nets, gillnets, lines, and traps for fishing. There are some restrictions authorized by the Minister on these gears regulating mesh size for nets and traps and depth set. It also states that skindiving with a spear is permitted but it must be 200 meters from the coast and there are minimum age limits. SCUBA spearfishing is permitted once the fisher passes a diving course to get a license. The Government Decree-Law No. 6/2004 of 21 April 2004 General Bases of the Legal Regime for the Management and Regulation of Fisheries and Aquaculture states that fishing gear that adversely affects the seabed in national maritime waters is banned and fishing in coral reefs is prohibited. The decree bans the use of double purse seine, drift net fishing, and prohibits the import and sale of fishing nets with mesh sizes smaller than one inch. The introduction of poisons that destroy fishing resources in the aquatic environment is prohibited. Additionally, using explosives, electrocution, or toxic products for fishing is prohibited. National parks can be established by the MAFF and the Minister for Environment can prohibit fishing within national parks. Corals cannot be removed, collected, or destroyed.

Indigenous or local traditional management was not recognized when Timor-Leste was governed by Indonesia and it is not recognized under the current constitution. There are, however, areas

147 http://www.gov.east-timor.org/MAFF/English/animal_fishers.htm
148 http://www.reefbase.org/global_database/default.aspx?section=s2

under traditional management. For example, Jaco Island is a reserve protected by customary management prohibiting hunting and agriculture. Also, Doloc Oan, in the Dili district, has traditional restrictions on the exploitation of coastal mangroves. Both *sasi* and *tara bandu* impose traditional prohibitions and are practiced around the country. Membership within the Territorial Users Fishing Rights (TURF), as part of the Fisheries Strategy under the current government, will help determine what traditional activities are involved in fisheries, especially next to reserves (McWilliam 2003).

MPA Regulations

Throughout Timor Leste, there are no established MPAs listed in the WDPA (Appendices A and B). Timor Leste is part of the Coral Triangle Initiative agreeing to create MPAs in coral reef and mangrove habitats that, among other objectives, strive to improve fisheries and recover threatened species[149]. According to the Coral Triangle Support Partnership, there is one ecosystem-based management fishery in Nino Konis Santana National Park.

Overall, Timor Leste has limited laws on reef fishing, and even fewer regulating threats to mangroves and coral reefs. There are no MPAs or protected areas.

2.1.2.41 Tonga

Approximately 0.8% of the coral reefs within the 46 areas in bumphead parrotfish range are in Tonga. Thirty percent, or 499 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Tonga contains a negligible percentage of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with three mangrove protected areas (Appendix B). Tonga is an archipelago in the South Pacific Ocean comprised of 169 islands, 36 of which are inhabited.

The Ministry of Agriculture and Food, Forests and Fisheries houses the Fisheries Department, which manages fisheries nationally for Tonga. The Fisheries Department works with local community members to establish community-based management programs throughout Tonga.[150]

Fisheries and Coastal Management Regulatory Mechanisms

Coastal fisheries are largely for subsistence fishing with fishers using diving, handlining, droplining, netting, and gleaning. Subsistence fishers also spearfish, including night spearfishing, and sling spears tend to be more common than spearguns.[151]

The Environmental Management Plan for the Kingdom of Tonga (ESCAP 1990) manages the legislative responsibilities of the marine environment. Key national regulations under this plan include the Fisheries Act of 1988 (updated in 1989), the Fisheries Regulation Act, and the Tourist Act 1976. The Fisheries Act of 1988 provides for the management and development of fisheries on Tonga. The Fisheries Act of 1989 prohibits SCUBA spearfishing without written authorization from the Registrar. The Fisheries Regulation Act instructs fishers to obtain a license every year to fish and if they want to build a fish fence. The mesh size of drag nets cannot be less than 38 mm and gill nets cannot be less than 50 mm. Hand throwing and trammel

149 http://www.conservation.org/explore/oceans/CTI/Pages/overview.aspx
150 http://www.tongafish.gov.to/Community%20Based%20Management.html
151 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_TO.pdf

nets can have smaller mesh sizes. Poison and dynamite are forbidden to be used to kill fish. The Tourist Act 1976 Regulates and controls tourism through the Tonga Visitors Bureau and established a licensing system for tourist facilities.

The State owns the rights to all coastal resources, but under the Fisheries Management Act (2002), communities can establish Special Management Areas (SMAs) for community-based fisheries management. Management within SMAs includes controlling fishing activities, imposing no-fishing areas called Fish Habitat Reserves (FHRs), and promoting sustainable development of fisheries at the community level. There are currently six SMAs each having at least one FHR, O'ua, Ha'afeva, Felemea, Ovaka, Atata, and Eueiki.[152] An example of community management is community supported fishing in Lofanga. It is regulated by an "insurance" strategy set for the whole village where members of the village police illegal gears and catch sizes (Bender *et al*. 2010).

MPA Regulations

Throughout Tonga, there are 20 coral reef MPAs listed in the WDPA (Appendix A) and three mangrove protected areas (Appendix B). The Ministry of Lands, Survey, and Natural Resources established legislation for protected areas in Tonga. The Parks and Reserves Act of 1972 established the Parks and Reserves Authority with goals of protecting, managing, and developing natural areas in the Kingdom, including marine reserves. Under this Act, the creation of marine reserves can be declared offering protection, preservation, and control of any form of aquatic life. Five reserves were created under this act: Hakaumama'o Reef Reserve, Pangaimotu Reef Reserve, Fanga'uta and Fangakakau Lagoons Marine Reserve, Monuafe Island Park and Reef Reserve, Ha'atafu Beach Reserve, and Malinoa Island Park and Reef Reserve. Hakaumama'o Reef Reserve was created to protect parrotfish, while Pangaimotu Reef Reserve has mangrove and seagrass habitat. The Birds and Fish Preservation Act gives guidelines for protected areas. Under this Act, Fanga'uta and Fangakakau Lagoons prohibit commercial fishing, use of traditional fish traps, pollution, and mangrove tree harvest. Permission is needed to use noxious substances, erect harbors or structures, destroy mangroves, erect fish-fences, or conduct any drilling or dredging. The World Database on Protected Areas lists four MPAs and eight marine and terrestrial protected areas (Lovell and Palaki 2000).[153]

Overall in Tonga, national law regulates coral reef fisheries, and includes restrictions on spearfishing. Customary law is an important influence on coral reef fisheries management nation-wide. Development of all coastal habitats is regulated by both national and customary law, with an emphasis on coral protection. An extensive network of coral reef MPAs protects 30% of the country's reefs.

2.1.2.42 Tuvalu

Approximately 0.6% of coral reefs within the 46 areas in bumphead parrotfish range are in Tuvalu. Three percent, or 36 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Tuvalu contains a negligible percentage of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with no mangrove protected areas (Appendix B).

152 http://www.tongafish.gov.to/Community%20Based%20Management.html
153 http://www.wdpa.org/

Tuvalu is a small independent nation made up of a chain of nine reefs and atolls. Islands have been built up on coral reefs that formed around peaks of a series of underwater mountains created by volcanic eruptions.[154]

The Tuvalu Fisheries Department manages fisheries nationally for the Ministry of Natural Resources and Lands. Traditional management of fisheries and the environment are common in parts of Tuvalu.

Fisheries and Coastal Management Regulatory Mechanisms

Subsistence fishers are the primary fishers operating in Tuvalu. Fishers use spears, bottom fishing, netting, and trolling. Spearfishing can occur during the day and at night in the lagoon and on the ocean side of all islands mostly using a sling spear, but occasionally spearguns are used. SCUBA is not known to be used, but hookah gear is used for spearfishing.[155] Bumphead parrotfish could potentially be selectively harvested using spears, although this information is not known. It is known that parrotfish are harvested in nets and fish drives (Dulvy and Polunin 2004).

The Marine Resources Act of 2006 states that if a fish is taken and it is protected, there is a $50,000 plus the fair market value fine and/or up to six months imprisonment. Fishers are required to get a permit to fish. The use of prohibited gear results in a $250,000 fine or six months imprisonment under this law. Prohibited gear includes smaller than regulated net mesh size or the use of chemicals, poison, or explosives. The Wildlife Conservation Ordinance of 1975 regulates sand and coral removal. The Foreshore and Land Reclamation Ordinance states it is the right of the public to fish and navigate the foreshore and seabed but a license is needed to remove corals.

Community-based management is practiced in parts of Tuvalu. For example, it is still prevalent on the island of Nanumea and is supported by NGOs and the Department of Fisheries and the Environment. An emphasis on local residents' tie to *fenua*, meaning community or homeland,[156] is a common cultural belief that affects resource allocation and property rights (Govan *et al*. 2009a).

MPA Regulations

Throughout Tuvalu, there are ten coral reef MPAs listed in the WDPA (Appendix A) and no mangrove protected areas (Appendix B). The Conservation Areas Act 1999 provides guidelines for establishing and managing conservation areas. Conservation areas encompass areas with the purpose of protecting the environment, conserving living and non-living resources, preserving biological diversity, preserving and enhancing the natural beauty of an area, promoting enjoyment of the people, and allowing scientific study and research. Fishing within a wildlife sanctuary is permitted according to the Wildlife Conservation Ordinance.[157] The Marine Pollution Act 1991 regulates the discharge of pollution, garbage, and sewage.

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154 http://www.fao.org/ag/AGP/AGPC/doc/Counprof/southpacific/tuvalu.htm
155 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_TV.pdf
156 http://www.janesoceania.com/tuvalu_nanumea_family/index.htm
157 http://www.paclii.org/tv/legis/consol act/wco289/

An example of an MPA is the Funafuti Conservation Area (FCA), which covers 33 square kilometers of water and land on the western side of the atoll. It includes reef, lagoon, channel, ocean and islands habitats. The people who own land within the Conservation Area, the Falekaupule, the Funafuti Town Council and the Government of Tuvalu have agreed to protect the natural resources within the Conservation Area to allow the populations of animals to increase and contribute to the biodiversity of Funafuti atoll. Fishing, hunting and collecting of animals and marine plants and destruction of habitat is prohibited within the Conservation Area at the present time and is enforced under the Tuvalu Conservation Areas Act and the Funafuti Conservation Area By-Laws. A management plan for the FCA provides information on what activities are allowed in the area and how income generating activities and sustainable use of the area are to be implemented and managed.

Overall in Tuvalu, national law regulates coral reef fisheries, but does not include restrictions on spearfishing. Customary law is an important influence on coral reef fisheries management nation-wide. Development of coastal habitats is not closely regulated. There is a small network of locally-managed coral reef MPAs.

2.1.2.43 United States

The U.S. has approximately 0.3% of the total coral reef area within the 46 areas in bumphead parrotfish range, 30% of which is located within MPAs (see Table 2 and Appendix A-1). The U.S. has almost no mangroves within the 46 areas in bumphead parrotfish range (Table 3, Appendix B). The U.S. is a federal constitutional republic comprised of fifty states, a federal district, and several territories. The bumphead parrotfish only occurs in the following Pacific territories of the US: American Samoa, Guam, the Commonwealth of the Northern Marianas (CNMI), and portions of the Pacific Remote Island Areas (PRIA; portions in range of the species are Jarvis Atoll, Wake Island, Palmyra Atoll, and Howland and Baker Islands).

Fisheries and Coastal Management Regulatory Mechanisms

This section provides an overview of regulatory mechanisms in the U.S. for fisheries and coastal management at the federal (national) level, and at the non-federal (territorial) level for American Samoa, Guam, and CNMI. At the end of the section is a summary of the regulatory mechanisms relevant to harvest with spears, harvest with other gears, habitat protection for mangroves, and habitat protection for coral reefs.

As described in detail in Section 1.1 of Appendix C, a multitude of federal laws and executive orders address fisheries and coastal management in the U.S. The most relevant federal laws include the Clean Water Act, the Coastal Zone Management Act, the Coral Reef Conservation Act, the Endangered Species Act, the Magnuson-Stevens Act, the Rivers and Harbors Act, the Act to Prevent Pollution From Ships, the Marine Plastic Pollution Research and Control Act, the Antiquities Act, the National Environmental Policy Act, the Ocean Dumping Ban Act, the Lacey Act, the Sikes Act, the Water Resources Development Act, and their implementing regulations. The most relevant executive orders include Executive Orders 12962 (to increase recreational fishing opportunities, including by improving habitat quality) and 13089 (to conserve coral reefs).

U.S. territories within bumphead parrotfish range are American Samoa, Guam, CNMI, and portions of the PRIAs (Jarvis Atoll, Wake Island, Palmyra Atoll, and Howland and Baker

Islands). The PRIAs have no local government and are thus entirely federally governed. As described in detail in Section 1.2.1 of Appendix C, territorial laws and executive orders addressing fisheries and coastal management in American Samoa include Title 24 Ecosystem Protection and Development (including water quality and fisheries management chapters), Title 26 Environmental Safety and Land Management, Coastal Management Program Administrative Rules, and others. As described in detail in Section 1.2.2 of Appendix C, territorial laws and executive orders addressing fisheries and coastal management in Guam include the Organic Act of Guam, the Guam Coral Reef Protection Act, Guam Seashore Protection Act, various executive orders protecting coastal habitats, among others. As described in detail in Section 1.2.3 of Appendix C, commonwealth laws and executive orders addressing fisheries and coastal management in CNMI include several articles of Title 85, Executive Directive 235, Saipan Local Law No. 13-13, the Commonwealth Environmental Protection Act, among others.

As described in Appendix C, regulation of fish harvest in non-federal waters around American Samoa and Guam (shore to 3 nm) is within the jurisdiction of the territorial governments. In CNMI, where federal waters are from shore to 200 nm, the commonwealth government only has authority to regulate nearshore fisheries conducted by its citizens. In areas where coral reefs occur in federal waters (e.g., >3 nm from shore in American Samoa and Guam, all marine waters of CNMI and PRIA), the federal government has authority under the Magnuson-Stevens Act to establish Fishery Ecosystem Plans (FEPs) for the management of coral reef fish species such as the bumphead parrotfish. Notably, the Governor of American Samoa issued an executive order in August 2012 banning the take of all species of shark, humphead wrasse, and bumphead parrotfish within territorial waters.

The current American Samoa, Mariana Islands (Guam and CNMI combined), and PRIAs FEPs list the bumphead parrotfish as "currently harvested management unit species," but generally do not directly limit its harvest (harvest of bumphead parrotfish is effectively banned in PRIAs, because its habitat is entirely within MPAs – see below). Therefore, bumphead parrotfish harvest threats are for the most part regulated at the non-federal level in American Samoa, Guam, and CNMI, as summarized below (and harvest threats are non-existent in PRIA).

As described in Section 1.2.1 of Appendix C, SCUBA spearfishing was banned in American Samoa in April 2001 by executive order from the governor of American Samoa based on the interest of maintaining healthy parrotfish populations. Territorial law (ASCA section 24.0915) now bans spearfishing with SCUBA or any other underwater breathing apparatus (e.g., hookah), or possession of SCUBA, hookah, etc. and spearfishing gear at the same time (ASCA section 24.0916), unless permitted by the Director of the American Samoa Department of Marine and Wildlife Resources, which does not appear to occur often, if ever. However, free-dive spearfishing at night is legal (unless otherwise restricted, e.g., within MPAs). Other gears that could be used for harvest of adult or juvenile bumphead parrotfish are regulated by American Samoa territorial law, such as gillnets and seine nets. Most recently, another Executive Order from the Governor was issued that bans the take or possession of rare marine species including all species of sharks, humphead wrasse, giant grouper, and bumphead parrotfish (Office of the Governor 2012).

As described in Section 1.2.2 of Appendix C, in Guam, although a bill was proposed in 2010 to ban scuba spearfishing in the territory, it did not pass, and spearfishing is otherwise little

regulated. However, other gears that could be used for harvest of adult or juvenile bumphead parrotfish are regulated by territorial law. As described in Section 1.2.3 of Appendix C, in CNMI, fishing while on SCUBA (i.e., using any gear, including spears) is banned by commonwealth law (85-30.1-401), as well as local laws on Saipan and Tinian. Commonwealth and local laws also heavily regulate or ban other gears that can be used to harvest adult and juvenile bumphead parrotfish, such as gillnets, seine nets, other types of nets, and other gears.

As described in Sections 1.2.1 – 1.2.3 of Appendix C, federal laws have a much more prominent role in controlling habitat threats (juvenile and adult habitat loss/degradation, including by pollution) than harvest threats, because regulation of harvest in nearshore waters is generally within the authority of non-federal governments. Federal regulation of habitat threats in nearshore waters occurs via the federal Clean Water Act, Coastal Zone Management Act, and Rivers and Harbors Act, which together strongly regulate bumphead parrotfish habitat threats in all types of coastal habitats. The Coral Reef Conservation Act and Executive Order 13089 emphasize protection of coral reefs but have little regulatory authority. In some cases, the Endangered Species Act (through Section 7 consultations) can heavily regulate habitat threats.

In addition to federal laws that heavily regulate bumphead parrotfish habitat threats in the U.S., these threats are also regulated by certain territorial and commonwealth laws. As described in Sections 1.2.1 – 1.2.3 of Appendix C, in American Samoa, Guam, and CNMI, multiple territorial and commonwealth laws in each jurisdiction, and in some cases executive orders, specifically protect mangroves, coral reefs, and other coastal habitats by limiting development, controlling pollution, and greatly restricting or banning coral collection. These non-federal regulatory mechanisms reinforce federal regulatory mechanisms, together mitigating habitat threats to bumphead parrotfish.

MPA Regulations

A system of fifty-two coral reef MPAs has been established in American Samoa, Guam, CNMI, and PRIAs, consisting of both federally and non-federally administered areas. These MPAs together include approximately 30% of the coral reef area within the U.S. portion of the bumphead parrotfish range (Table 1, Appendix A-1). The U.S. contains a negligible proportion of the mangrove areas within the range of the species (Table 2, Appendix B).

As described in Section 2 of Appendix C, the U.S. MPA network within the range of bumphead parrotfish includes a variety of federal MPAs (National Marine Sanctuary, National Park, National Wildlife Refuge, Marine National Monument, and National Historical Park), as well as a separate network of non-federal MPAs in American Samoa, Guam, and CNMI. Since MPA regulations are additional regulatory mechanisms layered over federal and non-federal fisheries and coastal management regulatory mechanisms, they generally provide increased protection against harvest and habitat threats for bumphead parrotfish.

As described in Section 2.1 of Appendix C, within federal MPAs, harvest is generally not totally banned, but more restricted than outside of MPAs. In the National Marine Sanctuary of American Samoa (formerly the Fagatele Bay National Marine Sanctuary), no spears or nets are allowed for fishing, and commercial fishing is banned. In July 2012, a final rule was published expanding the Sanctuary by adding five additional discrete geographic units and amending regulations within the sanctuary. The new regulations prohibit take of all sanctuary resources

within the Fagatele Bay unit (77 FR 144, July 26, 2012). In American Samoa National Park, only subsistence fishing is allowed. In American Samoa's Rose Atoll National Wildlife Refuge, night spearfishing is banned (6 pm – 6 am). In Rose Atoll Marine National Monument, commercial fishing is banned, while noncommercial, sustenance fishing, and traditional indigenous fishing may be authorized. In addition, recreational fishing may be authorized as a sustainable activity. In Guam National Wildlife Refuge, fishing gears are not restricted, but taking bumphead parrotfish is banned. In Guam's War in the Pacific National Historical Park, fishing is regulated according to territorial laws and regulations (i.e., no additional federal restrictions). In the Marianas Trench Marine National Monument, commercial fishing is prohibited within the waters around the islands, but subsistence, recreational, and traditional indigenous fishing may be permitted on a sustainable basis.

The Pacific Remote Islands Marine National Monument includes the waters and submerged and emergent lands which extend approximately 50 nautical miles from the mean low water lines of Wake, Baker, Howland, and Jarvis Islands, Johnston Atoll, Kingman Reef, and Palmyra Atoll. Commercial fishing is prohibited within the boundaries of the Monument. However, the respective Secretaries may permit noncommercial fishing upon request, and noncommercial fishing opportunities currently allowed by the U.S. Fish and Wildlife Service at Palmyra Atoll may continue unless the Secretary of the Interior determines such fishing would not be compatible with the purposes of the Palmyra Atoll National Wildlife Refuge.

The Pacific Remote Islands National Wildlife Refuge Complex lies within the boundaries of the Monument and includes much of bumphead parrotfish adult and juvenile habitat. Existing NMFS regulations established a system of low-take and no-take MPA's. Under 50 CFR 665.599, all fish harvest is banned at Baker, Howland, and Jarvis Islands, and Kingman Reef from 0 to 50 fathoms (fm). At Johnston Atoll, Palmyra Atoll, and Wake Island, from 0 to 50 fm, some fishing is allowed, as described in Section 2.1 above. At Wake, Howland, Baker, and Jarvis Islands, and at Johnston and Palmyra Atolls, there is no SCUBA spearfishing from 6pm to 6am in the EEZ.

As described in Sections 2.2.1 – 2.2.3 of Appendix C, within non-federal MPAs, bumphead parrotfish harvest is restricted or banned in different ways. In American Samoa's Ofu Vaoto Territorial Marine Park, only residents of Ofu Island may harvest fish. American Samoa's Community-based Fisheries Management Program is establishing a system of village-managed no-take MPAs. Via this program, Fagamalo Village recently worked with the territorial government to establish a long-term no-take marine protected area, the first on Tutuila[158]. In Guam's five non-federal MPAs, fishing is generally restricted to hook-and-line and cast-nets (spearfishing is banned). CNMI also has at least five non-federal MPAs, where fishing is mostly or entirely banned.

Within the range of bumphead parrotfish in the U.S., 30% of coral reef area is protected by federal and non-federal MPAs (Table 1). Coral reefs (forereefs and back reefs combined) provide adult and juvenile bumphead parrotfish habitat, although the U.S. possesses only 0.3% of the coral reef area within the range of the bumphead parrotfish (Table 1). Juvenile habitat is also provided by mangrove swamps and seagrass beds. However, the U.S. possesses 0.05% of

[158] http://ip-208-109-238-104.ip.secureserver.net/viewstory.php?storyid=30819&edition=1317459600

the total mangrove habitat within the range of the bumphead parrotfish (Table 2), and an unknown but likely very small proportion of seagrass habitat.

As described in Section 2.1 of Appendix C, a variety of federal MPAs (National Marine Sanctuary, National Park, National Wildlife Refuge, Marine National Monument, and National Historical Park) protect bumphead parrotfish habitat by prohibiting or severely restricting human activities that may result in juvenile habitat loss/degradation, adult habitat loss/degradation, and pollution within their boundaries. Examples of the types of activities that are prohibited or severely restricted include collection of live and dead coral, coral and sand mining, coastal development, road construction, wastewater discharge, timber harvest, and other activities. In addition, as described in Sections 2.2.1 – 2.2.3 of Appendix C, a separate network of non-federal MPAs in American Samoa, Guam, and CNMI similarly protect bumphead parrotfish habitat.

American Samoa. Executive Order 002-2012 from the Office of the Governor prohibits the take or possession of rare marine species, specifically including bumphead parrotfish, in all territorial waters. SCUBA spearfishing is banned by territorial law and other gears are closely regulated by territorial law. Federal and territorial laws regulate and restrict loss of mangroves, coral reefs, and other coastal habitats throughout the territory. Within MPAs, whether managed by federal or local governments, some fishing is allowed. All MPAs ban the removal of coral.

Guam. Although a bill was proposed in 2010 to ban SCUBA spearfishing in the territory, it did not pass, and spearfishing is otherwise little regulated. Other gears are closely regulated by territorial law. Federal and territorial laws regulate and restrict loss of mangroves, coral reefs, and other coastal habitats throughout the territory. Spearfishing is banned in some MPAs, and other gears are banned or heavily regulated. All MPAs ban the removal of coral.

CNMI. Fishing while on SCUBA (i.e., using any gear, including spears) is banned by commonwealth law, and other gears are banned or closely regulated by commonwealth law. Federal and commonwealth laws regulate and restrict loss of mangroves, coral reefs, and other coastal habitats throughout the commonwealth. Fishing with spears, nets, and weirs is banned in most MPAs. All MPAs ban the removal of coral.

PRIAs. All of this area is some form of MPA, where fishing is either banned or very restricted. Federal laws heavily regulate loss of mangroves, coral reefs, and other coastal habitats throughout the area.

2.1.2.44 Vanuatu

Approximately 0.8% of coral reefs within the 46 areas in bumphead parrotfish range are in Vanuatu. Two percent, or 36 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Vanuatu contains a negligible percentage of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3) and has five mangrove protected areas (Appendix B). Vanuatu consists of eighty islands surrounded by fringing coral reefs.

Both the Fisheries Department within the Ministry of Agriculture, Quarantine, Forestry and Fisheries and the Environment Unit within the Ministry of Lands and Natural Resources are responsible for national regulations in the marine and coastal zones. Traditional management regimes are practiced throughout the country for managing fisheries and the environment.

Fisheries and Coastal Management Regulatory Mechanisms

Coastal fisheries are dominated by subsistence fishers using fishing lines, hand-spears, spearguns, bow and arrow, and gillnets.[159] Indiscriminate net use is common (Naviti and Aston 2000). Bumphead parrotfish are harvested during the day (D. Bellwood pers. comm.) as there is a ban on night spearfishing in village-managed fishing grounds (Johannes 1978).

The Fisheries Department manages coastal fisheries through the Fisheries Act of 2005, the Fisheries Act of 1982, and the Fisheries Regulations of 1983. The Fisheries Act of 2005 has prescribed measures for protection of trochus, turtles, and other species. Fisheries Act, CAP 158 of 1982 includes provisions to prohibit the use of explosives, poisons, and noxious substances for fishing. The government of Vanuatu has considered banning SCUBA fishing in the past under the Fisheries Act of 1982, but this has yet to be included as a national regulation. Fisheries Regulations Order No 49 of 1983 mandates the conservation and regulation of fisheries including aquarium fish and coral. Other pieces of legislation affecting corals in Vanuatu include the Marine Zones Act of 1982 and Foreshore Development Act (Naviti and Aston 2000). There are also periodic closures of fishing grounds (Hickey and Johannes 2002). Both agencies are responsible for enforcing the Marine Zones Act and the Foreshore Development Act.

Protections exist for coral reefs and mangroves outside MPAs. Nationally, the government of Vanuatu has banned commercial logging of mangroves (FAO 2007a). Fisheries Regulations of 1983 limit coral collection and require permits for the export of coral among other marine taxa. The Environmental Unit also provides guidelines for conducting Environmental Impact Statements (EISs) for coastal management and development (Naviti and Aston 2000).

The Constitution of Vanuatu (Chapter 21, Article 71) ascribes "all land in the Republic as belonging to the indigenous custom owners and their descendants," thus recognizing customary tenure. This concept is important because the State provides blanket regulations but it falls to communities to determine what, if any, additional regulations are needed and to provide enforcement (Johannes 2002). Village chiefs are the first line of enforcement and state police informally support and back-up chief decisions (Hickey and Johannes 2002). Nationally, there are two regulations that protect customary rights to marine resources. The Land Reform Act (CAP 123) defines land as "extending from the seaside of any foreshore or reef but no further." Contrary to the law, though, customary ownership has been extended to uninhabited offshore and detached reefs and islands, reinforcing the notion that customary ownership of nearshore areas, such as coral reefs, is inherited. Fishing grounds owned by clans or villages are often not subject to exploitation of open access fisheries (Naviti and Aston 2000). Also, the Environmental Management and Conservation Act (2002) recognizes traditionally managed marine protected areas by stating that enforcement of regulations is the duty of the community managing the area. The community decides permitted activities and penalties for violations, and the government provides support if needed (Govan *et al*. 2009a; Caillaud *et al*. 2004). Community regulations often include fishing ground closures, trochus harvest closures, bans on taking turtles or their eggs, beche-de-mer, and, most notably for bumphead parrotfish, spearfishing and fish net controls (Johannes 2002). There is evidence that banning night spearfishing helps conserve

159 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_VU.pdf

parrotfish in Vanuatu (*B. muricatum* is specifically mentioned as a target for conservation) (Hickey and Johannes,2002).

MPA Regulations
Throughout Vanuatu, there are fifty-five coral reef MPAs listed in the WDPA (Appendix A) and five mangrove protected areas (Appendix B). The Land Reform Act (CAP 123) states there is no fishing or take of coral in marine reserves (Naviti and Aston 2000). Initiating taboo sites, or periodic closures, within MPAs is a form of customary management used by individual communities (Caillaud *et al*. 2004).

Overall in Vanuatu, national law regulates coral reef fisheries, and while it does not include restrictions on spearfishing, the constitution recognizes customary law. These traditional practices strictly manage coral reef fisheries, including harvest of bumphead parrotfish. Development of all coastal habitats is regulated by both national and customary law, with an emphasis on coral protection. A network of small but numerous coral reef MPAs restrict or ban fishing, and ban coral collection.

2.1.2.45 Vietnam

Approximately 0.4% of coral reefs within the 46 areas in bumphead parrotfish range are in Vietnam. Thirty percent, or 233 km^2, of those are protected nationally in MPAs (see Table 2 and Appendix A-1). Vietnam contains 1.3% of the mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with seventeen mangrove protected areas (Appendix B).

The specific protection of marine resources falls under the jurisdiction of the Ministry of Fisheries and the Ministry of Forestry. Traditional management is practiced in central and southern Vietnam.

Fisheries and Coastal Management Regulatory Mechanisms
Marine fisheries are divided into inshore and offshore fisheries. Inshore fisheries include harvesting from beaches, mangroves, estuaries, lagoons, and river deltas. Fishers employ traditional gears along with gillnets, longlines, life-nets, push nets, and traps. Offshore fisheries use small trawlers, purse seines, longlines, and traps in shallow-water.[160] Bumphead parrotfish are harvested using handlines or spearfishing since other gears are not effective in coral habitats (S.H. Nguyen pers. comm.).

Vietnam has broad and basic framework for environmental protection policy that is established by the Law on Environmental Protection (LEP), passed by the National Assembly on December 27, 1993. Chapter II of this legislation focuses on prevention and mitigation of environmental degradation and pollution incidents. Established in 1993 under the Ministry of Fisheries, the Ordinance on Fisheries Resource Protection contains specific regulations on fish catch, methods, and seasons that are being enforced by the Department of Fisheries Resources Protection.[161] The Law of Conservation and Management of Living Aquatic Resources of 2005, article 8 prohibits using toxic and harmful substances, explosives, gun powder, or electric currents to kill fish. The Fisheries Law of 2005 mandates the creation of marine protected areas where there are fauna and

160 http://www.fao.org/fishery/countrysector/FI-CP_VN/en
161 www.arcbc.org/arcbcweb/publications/mpa.htm

flora of significance either nationally or internationally. The Fisheries Law 2003, Circular 01/2011/TT/BNNPTNT prohibits exploitation of coral reefs and mangrove forests, regulates harvest of smaller fish, regulates land use development of marine parks and protected areas, provides regulation for seasonal closures, and regulates aquaculture development.[162]

Local traditional management is called *van chai* and is practiced in central and southern Vietnam. It addresses rules for gears used, fisher behavior, conflict management, and sanctions. The Vietnam Fisheries Association is an organization that was developed at the community level. Participation is voluntary and it helps promote unity of fishers in each community. Fisheries management within each province can differ from what is instituted nationally depending on local social and economic conditions. For example, rural poverty is common in Khanh Hoa Province, therefore coral exploitation and mangrove cutting are allowed, even though they are nationally banned. Also, fishers are allowed to operate in Nha Phu Lagoon even though provincial laws prohibit it (Ruddle 1998b).

MPA Regulations

Throughout Vietnam, there are twenty-nine coral reef MPAs listed in the WDPA (Appendix A) and seventeen mangrove protected areas (Appendix B). Development in mangrove habitat outside of MPAs is regulated by the Environmental Quality Order 1987 requiring land-base aquaculture projects that clear mangroves and cover 50 ha or more to conduct an EIA before developing (Yong 1987).

Overall in Vietnam, national law regulates coral reef fisheries, but does not include restrictions on spearfishing, and few restrictions on other coral reef fishing gears. Development of all coastal habitats is regulated by national law, and in some cases customary law. An extensive network of coral reef MPAs protects 30% of the country's reefs.

2.1.2.46 Yemen

Approximately 0.4% of coral reefs within the 46 areas in bumphead parrotfish range are in Yemen. A negligible percentage of Yemen's coral reefs are protected nationally in MPAs (see Table 2 and Appendix A-1). Yemen contains a negligible percentage of mangrove forests within the 46 areas in bumphead parrotfish range (Table 3), with one mangrove protected area (Appendix B). Coral reefs line the coast of Yemen in the Red Sea and around the Socotra archipelago.

The Ministry of Fish Wealth manages fisheries nationally for Yemen. This Ministry also collaborates with the Ministry of Tourism and Environment, the Ministry of Transport and Marine Affairs, the Ministry of Planning and Development, and the Ministry of Defense for fisheries management and enforcement issues.[163]

Fisheries and Coastal Management Regulatory Mechanisms

Yemen is located in the southeastern part of the Arabian Peninsula and is bordered by the Red Sea, Gulf of Aden, and Arabian Sea. Marine fisheries are divided into artisanal and industrial. Industrial fishers primarily harvest demersal fish and cuttlefish species, and are required to

162 http://www.vietlinh.com.vn/canbiet/luatquidinh/luatthuysan_en.htm
163 http://www.fao.org/fi/oldsite/FCP/en/YEM/body.htm

operate six miles from shore in the Red Sea and five miles from shore in the Gulf of Aden. Artisanal fisheries operate close to shore and use seines, handlines, gillnets, and traps to harvest a wider variety of fish species.[164]

There are several fisheries laws instituted in Yemen. First, Law No. 26 of 1995 aims at fulfilling the international commitments with respect to protecting the environment and combating pollution. It places the responsibility of protecting the environment and its natural resources, combating pollution, and protecting terrestrial and marine wildlife on formal government authorities, public and private institutions, and individuals. Second, Law No. 11 of 1993 was established for the protection of the sea from pollution. This Law is mainly concerned with pollution by oil and pollution from passing ships and determines procedures for prosecuting, penalizing and requesting compensation from ships that violate the law. It gives the Public Corporation for Maritime Affairs the legislative power to deal with oil pollution at sea. In its article No. 35, this law prohibits any form of discharge of pollutants of any kind and from any source into the sea without prior treatment. Third, Law No. 42 of 1991 is the main legal framework for organization, exploitation and protection of fishing and aquatic resources. It deals with the protection of fisheries resources and regulation of fishing activities prohibiting the use of destructive fishing methods such as poisons and chemicals. It also indicates means of limiting and/or dealing with pollution. This law was amended in 1997 according to the Presidential Resolution No. 43 of 1997. In this amendment the Law also prohibits plucking and cutting of seaweed, seagrasses, and corals except in exceptional cases and after securing prior permission from the responsible Ministry. Finally, Fisheries Law No. 20 of 1978, Article 7 of the Basic Fisheries Legislation states it is illegal to fish in a conservation zone unless approved by a Minister, and any area within fishing limits can be declared a prohibited area or conservation zone. Law 24 from 1979 prohibits the use of toxic, explosive, or chemical substances for fishing and states that fishers and their vessel need licenses to fish.

MPA Regulations

Throughout Yemen, there is one coral reef MPA listed in the WDPA (Appendix A) and one mangrove protected area (Appendix B). Presidential Decree No. 275 of 2000 established the Conservation Zoning Plan of Socotra Islands and includes a marine conservation zoning plan covering resource use reserves, general use zones, national parks and nature sanctuaries. The Socotra Islands is also a candidate to be declared a World Heritage Site by UNESCO. The Socotra Islands contains some of the most diverse coral reefs in the region. The Ministry of Water and Environment (MWE) Environment Protection Authority (EPA) also established Yemen's National Programme of Action for the Protection of the Marine Environment from Land-Based Sources. Two additional marine parks, Ras Isa Marine Park and Zuqur Islands Marine Park have recently been established. There are many community managed marine areas such as Rosh Protected Area and Bir Ali-Belhaf Marine Protected Area started under PERSGA.

Overall in Yemen, national law regulates coral reef fisheries, but does not include restrictions on spearfishing, and few restrictions on other coral reef fishing gears. Development of all coastal habitats is regulated by national law, and in some cases customary law. While there is only one coral reef MPA, it is large (Socotra) and encompasses high quality habitat, plus additional marine parks are recently established.

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164 ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_YE.pdf

2.2 Regulatory Mechanisms Addressing Climate Change Threats

All global threats identified by the BRT are related either directly or indirectly to global climate change which is, in large part, a result of anthropogenic greenhouse gas (GHG) emissions. A description of regulatory mechanisms addressing Climate Change related threats cannot be limited to the 46 areas within the range of bumphead parrotfish because ocean warming and ocean acidification are results of global processes fueled by anthropogenic greenhouse gas (GHG) emissions worldwide. For the purposes of this report, international agreements are considered regulatory even though, thus far, they have all included voluntary action by member countries with the exception of the Kyoto Protocol which is considered legally binding (see below for further detail). In many cases, regulatory initiatives at the national, regional, state, and county levels are instituted in an effort to meet the requirements of or comply with commitments made via particular international agreements. Regulatory mechanisms for Climate Change related threats are described in two sections. First, international regulatory mechanisms intended to regulate GHG emissions are described, including the Montreal Protocol (1987), United Nations Framework Convention on Climate Change (UNFCCC, 1992), Kyoto Protocol (1997), Bali Roadmap (2007), Copenhagen Accord (2009), Cancun Accord (2010), and Durban agreements (2011). Second, regulatory mechanisms for GHG emissions in the top 25 GHG emitters globally are described. These 25 countries account for approximately 85% of global emissions.

2.2.1 International Regulatory Mechanisms Addressing Climate Change Threats

The First World Climate Conference was held from February 12-23, 1979 in Geneva and sponsored by the World Meteorological Organization (WMO). As one of the first major international meetings on climate change, it was essentially a scientific conference attended by scientists from a wide range of disciplines. In addition to the main plenary sessions, the conference organized four working groups to look into climate data, the identification of climate topics, integrated impact studies, and research on climate variability and change. The Conference led to the establishment of the World Climate Program and to the creation of the Intergovernmental Panel on Climate Change (IPCC) by WMO and the United Nations Environment Program (UNEP) in 1988. The World Climate Program facilitates, among other things, the effective collection and management of climate data and the monitoring of the global climate system, including the detection and assessment of climate variability and changes. The IPCC, on the other hand, does not conduct scientific research on various aspects of climate change; rather they compile, review, and summarize all relevant scientific literature that will help inform policy makers dealing with climate change mitigation and adaptation. They are both scientific bodies that were created to fulfill a global need for a clear, broad, and balanced scientific view of what is happening to the world's climate.

The Second Climate Conference was held again in Geneva from October 29 to November 7 and represented an important step towards a global climate treaty and somewhat more political than the first conference. The initial task for the IPCC as outlined in the UN General Assembly Resolution 43/53 of 6 December 1988 was to prepare a comprehensive review and recommendations with respect to the state of knowledge of the science of climate change; social and economic impact of climate change, possible response strategies, and elements for inclusion in a possible future international convention on climate. The scientific evidence summarized in the first IPCC Assessment Report (1990) succeeded in bringing climate change and its potential

consequences to the forefront as an important topic for countries to address, as evidenced by continued international efforts and actions described below. Eventually, developments at this second World Climate Conference led to the establishment of the United Nations Framework Convention on Climate Change (UNFCCC) that was finalized and opened for signature at the Earth Summit in Rio in 1992. World Climate Conference-3 (WCC-3) was held in Geneva, Switzerland, August 31 to September 4, 2009. Its focus was again firmly rooted in science, primarily on climate predictions and information for decision-making at seasonal to multi-decadal timescales. The goal was to create a global framework that will link scientific advances in these climate predictions and the needs of their users for decision-making to better cope with changing conditions.

2.2.1.1 International Treaties and Conventions

Montreal Protocol, 1987. In 1974, Molina and Rowland provided early warning of the potential for chloroflourocarbons (CFCs) to deplete stratospheric ozone. The warning led national actions and regulations to reduce ozone depleting substance (ODS) emissions (UNEP 2003). Ten years later, the ozone hole was discovered over Antarctica (Farman *et al.* 1985) and ODSs were identified as the cause (Solomon *et al.* 1986; WMO 1988) which prompted heightened concern and global action. The Montreal Protocol on Substances that Deplete the Ozone Layer (MP), a protocol to the Vienna Convention for the Protection of the Ozone Layer, is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances believed to be responsible for ozone depletion including CFCs and hydrochlorofluorocarbons (HCFCs). It was opened for signature in 1987 and entered into force in 1989. The MP has been ratified by 196 states and is generally considered "perhaps the single most successful international agreement to date," as stated by Kofi Annan, Former Secretary General of the United Nations. Although there are no formal climate considerations in the MP, ODSs addressed within it are also greenhouse gases that contribute to radiative forcing of climate (Wigley 1988; Ko *et al*. 1993). As such, even though it does not contain specific climate related intentions, the MP is one of the first international agreements to address emissions of certain greenhouse gases, having consequences for climate warming.

UNFCCC, 1992. As stated in the previous section, the first IPCC Assessment Report prompted an international effort to address climate change more specifically. The United Nations Conference on Environment and Development (UNCED; known by its popular title, the Earth Summit) was held in Rio de Janeiro from June 3 – 14, 1992. It is generally considered the first global initiative to take action to slow or reverse human induced climate change. One of the primary outcomes of the Earth Summit was the opening of the UNFCCC for signature. Upon ratification, the UNFCCC committed signatories' governments to a voluntary, non-binding aim to reduce atmospheric concentrations of greenhouse gases with the goal of "preventing dangerous anthropogenic interference with Earth's climate system" (United Nations 1992). These actions were aimed primarily at industrialized countries, with the intention of stabilizing their emissions of GHGs (specifically those not covered by the Montreal Protocol) at 1990 levels by the year 2000. On June 12, 1992, 154 nations signed the UNFCCC. The parties agreed in general that they would recognize "common but differentiated responsibilities," with greater responsibility for reducing GHG emissions in the near term on the part of developed/industrialized countries, which were listed and identified in Annex I of the UNFCCC. Having received over 50 countries' instruments of ratification, the UNFCCC entered into force March 21, 1994. As of November 2010, UNFCCC has 194 parties.

One of the first tasks of the UNFCCC was to establish national greenhouse gas inventories of emissions by sources and removals by sinks using methodologies and guidelines prepared by the IPCC. These inventories were used to create the 1990 benchmark levels for accession of Annex I countries to the Kyoto Protocol (see below) and for the commitment of those countries to GHG reduction targets. Updated inventories must be submitted annually by Annex I countries. Since the UNFCCC entered into force, the parties have been meeting annually in Conferences of the Parties (COP) to assess progress in dealing with climate change, and beginning in the mid-1990s, to negotiate the Kyoto Protocol to establish legally binding obligations for developed countries to reduce their GHG emissions.

Kyoto Protocol, 1997. COP 3 for the UNFCCC took place from December 1 – 11, 1997 in Kyoto, Japan. The objective of the Kyoto climate change conference was to establish a legally binding international agreement, whereby all the participating nations commit themselves to addressing the issue of global warming and GHG emissions. After intensive negotiations, parties adopted the Kyoto Protocol to the Convention, which outlined GHG emissions reduction obligations for participating Annex I countries, along with what came to be known as Kyoto mechanisms[165] (United Nations 1998). These are market based mechanisms that can be used in addition to national measures as a means of meeting targets and include emissions trading, the clean development mechanism, and joint implementation. The IPCC Second Assessment Report (1995) provided key input for the formation and adoption of the Kyoto Protocol. Most industrialized countries and some central European economies in transition agreed to legally binding[166] reductions in GHG emissions of an average of 6 to 8% below 1990 levels between the years 2008-2012, defined as the first emissions budget period. Under the terms of Kyoto, the U.S. would have been required to reduce its total emissions an average of 7% below 1990 levels, however neither the Clinton administration nor the Bush administration sent the protocol to Congress for ratification. The Bush administration rejected the protocol in 2001 acknowledging that one condition outlined by S.Res. 98, passed in mid-1997 — meaningful participation by developing countries in binding commitments limiting greenhouse gases — had not been met and that climate policy in the U.S. would instead remain focused on domestic voluntary and market-based approaches to reducing GHG emissions (CRS 2006).

UNFCCC COP 11 (or COP 11/MOP 1) took place between November 28 and December 9, 2005, in Montreal, Quebec, Canada. COP 11 was also the first Meeting of the Parties (MOP 1) to the Kyoto Protocol since their initial meeting in Kyoto in 1997. It was therefore one of the

[165] The Kyoto mechanisms stimulate sustainable development through technology transfer and investment, help countries with Kyoto commitments to meet their targets by reducing emissions or removing carbon from the atmosphere in other countries in a cost-effective way, and encourage the private sector and developing countries to contribute to emission reduction efforts. Joint Implementation enables industrialized countries to carry out joint projects with other developed countries, while the Clean Development Mechanism involves investment in sustainable development projects that reduce emissions in developing countries.

[166] The Kyoto Protocol is considered legally binding in that there are consequences outlined in the agreement for those countries that fail to meet the GHG emission reduction commitments they pledged. If the enforcement branch determines that an Annex I country is not in compliance with its emissions limitation, the Party is then required to make up the difference between its emissions and its assigned amount during the second commitment period, plus an additional reduction of 30%. In addition that country would be suspended from making transfers under an emissions trading program (United Nations 1998).

largest intergovernmental conferences on climate change ever and marked the entry into force of the Kyoto Protocol (February 16, 2005). As of November 2010, 192 parties have signed and ratified the Protocol. The U.S. signed but has yet to ratify the Protocol, meaning the U.S. has not committed to a legally binding GHG emissions reduction target by 2012 via this agreement. However, the U.S. made a voluntary pledge to work toward reducing emissions 7% below 1990 levels by 2012.

Bali Roadmap, 2007. After the United Nations Climate Change Conference in Bali, Indonesia in December of 2007, the participating nations adopted the Bali Road Map as a two-year process to finalizing a binding agreement in 2009 in Copenhagen. The conference encompassed meetings of several bodies, including the UNFCCC COP 13 and Kyoto Protocol MOP 3. The Bali Road Map includes the Bali Action Plan (UNDP 2007), which charts the course for a new negotiating process designed to tackle climate change, with the aim of completing this by 2009. The Conference decided to establish subsidiary bodies under the Convention to conduct the process, the Ad Hoc Working Group on Long-term Cooperative Action and the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol, that were to complete their work in 2009 and present the outcome to the COP15/MOP 5. It also includes the launch of the Adaptation Fund, the scope and content of the Article 9 review of the Kyoto Protocol, as well as decisions on technology transfer and on reducing emissions from deforestation.

Copenhagen Accord, 2009. With the impending expiration of the Kyoto Protocol in 2012, a Climate Conference was held in Copenhagen from December 6 – 18, 2009. It included the COP 15 for UNFCCC members and MOP 5 for signatories to the Kyoto Protocol. Known as the Copenhagen Summit, the goal of this conference was to fulfill the culmination of the Bali Road Map and produce a new protocol to address climate change on a global level after the existing Kyoto treaty expires in 2012. The Copenhagen Summit was generally considered a failure at the time in that no legally binding agreement (i.e. with an established enforcement branch and explicitly stated consequences for non-compliance like the Kyoto Protocol) was reached. The U.S., China, India, Brazil, and South Africa drafted the Copenhagen Accord on December 18, which the U.S. delegation considered a "meaningful agreement." It was "taken note of," but not "adopted," in a debate of all the participating countries the next day, and it was not passed unanimously. The document recognizes that climate change is one of the greatest challenges of the present day and that actions should be taken to keep any further global temperature increase to below 2°C (United Nations 2010) but does not contain commitments for reduced emissions that would be necessary to achieve that aim. Many countries and non-governmental organizations were opposed to this agreement and the way it was reached (negotiated by only the five countries mentioned above), but, as of January, 2010, 138 countries have signed the agreement. To date, countries representing over 80% of global emissions have engaged with the Copenhagen Accord in some form or other (see Table 5 in Section 4.1.1 for GHG emissions reduction commitments of the top 25 emitters). Participating countries have established an unconditional (or "low") pledge which is what they commit to regardless of other pledges, and a more ambitious "high" pledge that is conditional on whether or not other countries make similar commitments. More recently there are varying opinions on the significance of the Accord and some analysts feel it represents progress in climate negotiations by re-engaging the U.S. and provides a solid baseline for future negotiations (Grubb 2010; Light 2010).

Cancun Accords, 2010. COP 16/MOP 6 was held in Cancun, Mexico November 29 – December 10, 2010. The Cancun Accords are a series of documents that resulted from international negotiations that ensued. Some participants agree that objectives set forth in the text of the Cancun Accords are not rigorous enough to reduce global warming but climate talks in Cancun were considered a success by the general media in that they appear to have 'saved the process' of international climate negotiations that was badly damaged after the previous year's COP 15 in Copenhagen (Iqbal and Ghauri 2010). There was formal agreement on a number of issues including acknowledgement that emissions cuts need to be in line with scientific estimates of 25 to 40% cuts by 2020, and the global temperature rise target should be kept below 2°C instead of at 2°C as stated in the Copenhagen Accord. Most notably, a Green Climate Fund that was first mentioned in the Copenhagen Accord has been established and it was agreed that developing countries will receive 300 billion U.S. dollars in short-term funding to address climate change in 2010-2012 from industrialized countries, and after 2020 they will be funded 100 billion U.S. dollars per year. However, the agreement establishing the fund does not specify how the funding will be raised, confirming only that parties remained committed to providing $100 billion a year of climate funding from 2020 that will be generated from a "wide variety of sources, public and private, bilateral and multilateral, including alternative sources" (UNFCCC 2010). The intent is to secure the design of the fund from March – November 2011 and approval to begin the fund is expected at COP 17 in Durban, South Africa.

Japan, Canada, the U.S., and Russia successfully opposed a binding agreement on how to reach reduction targets by lobbying to abandon the Kyoto Protocol and replace it with a pledge and review system as proposed in the Copenhagen Accord. The U.S. never ratified the Kyoto Protocol and is opposed to binding GHG emissions reduction commitments extending into a second commitment period under Kyoto (post-2012). Canada, Japan, and Russia have also declared they will not agree to binding commitments for a second Kyoto commitment period. These positions caused some contention since developing countries have long insisted that developed countries should agree to binding reductions under the Kyoto Protocol or a similar agreement. Addressing some critical issues regarding financing and new GHG emission reduction targets were deferred until next year's COP 17 to be held in Durban, South Africa.

Durban Agreement, 2011. The UNFCCC held its COP17 in Durban, South Africa from November 28 through December 9, 2011. One notable decision was agreement among the Parties on the design of the "Green Climate Fund", first mentioned in the Copenhagen Accord, to provide up to $100 billion U.S. dollars per year to poor nations, although little was achieved on establishing where the money would come from (UNFCCC 2011a). More importantly, all Parties including developed and developing nations agreed to a process to develop a "new protocol, another legal instrument, or agreed outcome with legal force that will be applicable to all Parties to the UN climate convention" (UNFCCC 2011b). This new legal instrument is to be developed no later than 2015 and come into force by 2020. This is the first consensus agreement in which all countries, regardless of their state of development, will be held accountable to an agreement to reduce GHG emissions. In the short term, work of reducing emissions will fall to individual nations to take the initiative since action is needed sooner rather than later in order to curb continued planet warming.

2.2.2 National Regulatory Mechanisms Addressing Climate Change Threats

The 25 countries responsible for the highest percentages of global GHG emissions account for approximately 85% of global emissions. Twelve of them are Annex I countries that have signed and ratified the Kyoto Protocol and have therefore committed to GHG emission reductions by 2012. Those 12 account for ~24% of global emissions. The U.S. alone accounts for ~20% of global emissions. The aggregated reduction target by 2020 of all Annex I pledges under the Copenhagen Accord ranges from 12 to 18% relative to the 1990 level (den Elzen and Höhne 2008).

The remaining 12 countries in the top 25 emitters are non-Annex I countries and therefore are not obligated to establish reduction targets under the Kyoto Protocol. They account for approximately 41% of global emissions. In contrast to the relatively precise pledges of developed countries under the Copenhagen Accord, developing countries specify their mitigation actions, labeled as Nationally Appropriate Mitigation Actions (NAMAs), in a variety of ways, making it difficult to determine an aggregate reduction target for this group (Rogelj *et al.* 2010).

This section briefly describes, for each country, commitments made via the Kyoto and Copenhagen agreements, GHG emissions trends from 1990 to the most recent year available[167], and regulatory mechanisms or initiatives in place at the national level to reduce GHG emissions. Numbers in ( ) in each heading are the approximate % of total global GHG emissions produced by each country in 2007 (excluding land use, land use change, and forestry sector (LULUCF)). Except where noted (for Indonesia and Brazil), figures for CO_2 and GHG emissions and emissions trends are reported excluding contributions LULUCF. Because of large uncertainty and a lack of consistent reliable data globally for LULUCF, emissions estimates and projections are often given in two forms: including LULUCF and excluding LULUCF. If one form is reported, it is typically excluding LULUCF for the reasons described. For most countries, the burning of fossil fuels in the energy sector is the primary source of CO_2 and overall GHG emissions and LULUCF does not contribute a significant portion. For some, however, LULUCF contributes substantially and including estimates from this sector in an assessment dramatically changes the proportion of global GHG emitted. This is the case for Brazil and Indonesia as described in more detail below. In 2010, emissions from LULUCF have dropped globally and so has the proportion of global emissions that are related to LULUCF to ~10% (Houghton 2010).

2.2.2.1 UNFCCC Annex I Countries

The United States (19.9%). The United States is currently the 2nd highest emitter of GHGs in the world (after China). The U.S. did not ratify the Kyoto Protocol, however at the time of Kyoto negotiations it pledged a voluntary commitment of 7% below 1990 levels by the year 2012. According to the Environmental Protection Agency's (EPA) 2010 National Greenhouse Gas Inventory Report, total U.S. GHG emissions have risen by approximately 16.5% from 1990 to 2008 (EPA 2010). Although U.S. emissions dropped by approximately 3% percent from 2007 to 2008, this reduction is attributed to lower fuel and electricity consumption as a result of high fuel prices (EPA 2010). This reduction in emissions is expected to be temporary and emissions will

[167] Estimates for Annex I countries are in terms of total GHG emissions. Source: UNFCCC Summaries of GHG Emissions for each country prepared using information submitted via National 2010 Annual GHG Inventories (1990 – 2008). Estimates for Non-Annex I countries are in terms of CO_2 emissions from the burning of fossil fuels. Source: World Bank via Google Public Data (http://www.google.com/publicdata/overview?ds=d5bncppjof8f9_)

likely continue to grow to equal and surpass previous levels with the recovery and increase of economic activity. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, the U.S. is ranked 54th overall with a performance rating of 'very poor' (1 being the best performance to address GHG emissions, 60 being the worst) (Burck *et al*. 2010).

Originally, the U.S. had pledged a reduction commitment of 17% relative to 2005 levels under the Copenhagen Accord. However the Obama Administration has yet to issue regulations to limit GHG emissions in accordance with the U.S.'s pledge (Capiello 2010). During the UNFCCC COP16 held in Cancun, Mexico from November 29 – December 10, 2010, the U.S., along with several other developed nations, once again rejected the idea of binding emissions reduction commitments. As a leader in the developed world and one of the top two producers of GHGs, the U.S.'s approach to international negotiations has and will continue to stall global consensus on an effective path forward to reduce GHG emissions aggressively enough to prevent warming beyond the 2°C target.

The EPA is the regulatory agency responsible for issuing and implementing regulatory initiatives predominantly under the Clean Air Act (CAA), and some other statutory authorities, to address issues related to climate change. In April 2007, the Supreme Court in *Massachusetts v. EPA* (127 S. Ct. 1438 (2007)) found that the EPA was required to determine whether or not emissions of GHGs from new motor vehicles cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision. In response, in December 2009 EPA issued a final finding that emission of 6 key greenhouse gases constitutes a threat to the public health or welfare, and that EPA has authority under the Clean Air Act to regulate tailpipe emissions of GHGs. In May of 2010, EPA and the Department of Transportation's National Highway Safety Administration (NHTSA) issued the first national rule limiting GHG emissions from cars and light trucks (light duty vehicles) model years 2012 through 2016 (75 FR 25324, May 7, 2010). The requirements of the GHG light duty vehicle rule took effect on January 2, 2011, the date when 2012 vehicles meeting the standards can be sold in the United States. On December 1, 2011, EPA and NHTSA issued their joint rule to extend the National Program of harmonized greenhouse gas and fuel economy standards to model year 2017 through 2025 light duty passenger vehicles (76 FR 74854). On Sept. 15, 2011, EPA and NHTSA jointly published a final rule to establish Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles (76 FR 57106).

The EPA also regulates pollutants from large stationary sources through the New Source Review Prevention of Significant Deterioration (PSD) and title V Operating Permit programs of the Clean Air Act. If a facility meets certain emissions thresholds, they are required to obtain a permit which requires the application of Best Available Control Technology (BACT) which is determined on a case by case basis taking into account, among other factors, the cost and effectiveness of the control. The CAA permitting program emissions thresholds for criteria pollutants such as lead, sulfur dioxide, and nitrogen dioxide are 100 and 250 tons per year (tpy). While these thresholds are appropriate for criteria pollutants, they are not feasible for GHGs because GHGs are emitted in much higher volumes.

To address GHG emissions from stationary sources, in 2009 EPA proposed the Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule which focuses on setting new thresholds for GHG emissions from large facilities that will trigger PSD permit requirements, specifically facilities emitting over 25,000 tons of GHG each year. The proposed thresholds that define when PSD permits are required would be limited to large facilities such as power plants, oil refineries and cement production facilities, but would cover nearly 70% of national GHG emissions from stationary sources. The final rule was published June 3, 2010 (75 FR 31514), became effective as of August 2, 2010, and requirements have since been implemented in phases, starting January 2, 2011. Currently (July 1, 2011 to June 30, 2013), the new permitting requirements apply to new construction projects that emit 100,000 tons per year of GHG, even if they do not exceed permitting thresholds for any other pollutant. Modifications at existing facilities that increase GHG emissions by at least 75,000 tons per year will be subject to permitting requirements, even if they do not significantly increase emissions of any other pollutant. These thresholds simply trigger the requirement to obtain a permit under the CAA and to implement BACT. The next phase of implementation was intended to include smaller sources of GHG emissions. However, on February 24, 2012, EPA issued a proposed rule to keep GHG permitting thresholds at current levels established under the GHG Tailoring Rule (77 FR 14226); after evaluating the progress of GHG permitting so far, EPA believes that state permitting authorities have not had sufficient time to develop necessary program infrastructure, and to increase their GHG permitting expertise, to make it administratively feasible to apply PSD and title V permitting requirements to smaller sources of GHG emissions.

In addition to creating regulations to control GHG emissions, the EPA has many current and near-term initiatives that encourage voluntary reductions from a variety of stakeholders. Initiatives, such as Energy Star, Climate Leaders, and Methane Voluntary Programs encourage emissions reductions from large corporations, consumers, industrial and commercial buildings, and many major industrial sectors.

Russian Federation (5.2%). Russia's carbon emissions are now the 3rd highest in the world, behind China and the United States. Its original commitment under the Kyoto Protocol was to maintain emissions at 1990 levels by 2012. Since 1992, fossil-fuel CO_2 emissions from Russia have dropped 25.9% (Boden *et al.* 2010) and total GHG emissions have dropped to 34.1% below 1990 levels as of 2008. The country's overall GHG emissions dropped far below the baseline level established by the Kyoto Protocol throughout the 1990s due to economic collapse; an increasing trend began to return around 1998 (WRI 2010). In association with the Copenhagen Accord, Russia has committed to a 15 to 25% reduction in emissions by 2020 based on 1990 levels. However, necessary regulatory mechanisms have not been enacted to achieve these goals. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, the Russian Federation is ranked 48th overall with a performance rating of 'very poor' (Burck *et al*. 2010).

In 2009, President Dmitry Medvedev released the Climate Doctrine of the Russian Federation (IEA 2009). The Doctrine represents a blueprint to harmonize domestic climate-related

legislation with international standards, improve climate monitoring, stimulate the adoption of stronger environmental standards, the adoption of energy-efficiency and energy-saving measures, as well as greater use of alternative (including renewable) energy sources. In regards to mitigation of climate change, the Doctrine outlines measures to be developed and implemented including enhanced energy efficiency in all economy sectors, expanded renewable and alternative energy use, reduced market disproportions, implementation of financial and tax policy measures stimulating the reduction of anthropogenic greenhouse gas emissions, protection and improvement of carbon sinks and receivers including sustainable forest management, deforestation and reforestation on a sustainable basis, and expansion of research and development in energy efficiency, renewable energy, and environmentally friendly technology and GHG sink technologies.

While the plan does not adopt any firm position in terms of CO_2 reduction targets, President Medvedev announced at the 2009 G8 Summit that Russia will try to reduce GHG emissions levels by 10-15% below 1990 in 2020 and by 50% below 1990 levels by 2050 (RIA Novosti 2009a). Although it appears possible for Russia to cut GHG emissions by 20-30% by 2030, this is an ambitious plan that would require political action and is not currently backed by any legal regulatory framework (RIA Novosti 2009b). The only recent relevant regulatory mechanism enacted in Russia is the 2009 State Policy Guidelines for Promoting Renewable Energy in the Power Sector. The guidelines establish targets for the share of electricity generation from renewable energy sources up to 2020. The targets are 1.5% in 2010, 2.5% in 2015 and 4.5% in 2020. At the time the policy passed, less than 1% of total electricity generation came from renewable energy sources, excluding large hydro (IEA 2009).

Japan (4.3%). Japan currently ranks 5th in overall GHG emissions. Japan's original commitment under the Kyoto Protocol was to reduce GHG emissions by 6% below 1990 levels by 2012. According to Japan's 2010 National GHG Inventory Report submission to the UNFCCC, Japan's total GHG emissions have increased 1% between 1990 and 2008. In association with the Copenhagen Accord, Japan set an additional target of reducing GHG emissions to 25% below 1990 levels by 2020. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Japan is ranked 38th overall with a performance rating of 'poor' (Burck *et al*. 2010).

In 1998, Japan enacted the Act on Promotion of Global Warming Countermeasures: Act No. 117 (Government of Japan 2005a), which came into force in 1999 and was revised in 2002 and 2005. The purpose of this law is to: "…promote global warming countermeasures by formulating a plan for attaining targets under the Kyoto Protocol and taking measures to promote the control of greenhouse gas emissions due to social, economic, and other activities, thereby contributing to the health and cultural life of the Japanese people, both now and in the future, as well as contributing to the wellbeing of all humankind" (Government of Japan 2005a). The Act calls for the establishment of a Council of Ministers for Global Environmental Conservation, development of the Kyoto Achievement Plan, and establishment and implementation of countermeasures by local governments. With the 2002 revision, the Government's New Climate Change Program was adopted. The program intensifies previous guidelines concerning basic measures that should be taken by every sector of society to reduce GHG emissions in line with Japan's Kyoto commitment. The program introduced 45 new approaches including further

promotion of renewable energy, energy conservation, and energy efficiency, giving a total of more than 100 approaches to climate change policy. Reduction goals to be imposed on each sector were proposed for the first time.

The Act on the Rational Use of Energy: Act No. 49 (Energy Conservation Act) (Government of Japan 2005b) was passed in 1979 and revised in 1993, 1998, 2002, and 2005. The 1993 revisions strengthened the quantitative goals, reporting requirements, and non-compliance penalties for designated energy management factories. They also established a new enforcement authority concerning display requirements for energy efficiency and other information. Standards for cooling-only air conditioners and passenger cars were strengthened, and new standards issued for: Heat pump air conditioners (dual use, heating and cooling); fluorescent lamps; televisions; photocopiers; computers; and magnetic hard-disk drives. The 2008 revisions strengthen measures to enhance energy efficiency, including those for the commercial sector. Also in this revision, sectoral approaches used in domestic regulation were introduced, to be implemented as of April 2009.

While the Acts described above are its primary climate change-related legislation, Japan has a number of other regulatory programs regarding fuel efficiency standards for passenger vehicles, housing energy efficiency standards, strategies to reduce transport emissions, among others.

Germany (2.7%). Germany currently ranks 6th in overall GHG emissions. Germany's original commitment under the Kyoto Protocol (and the European Union's (EU) Burden Sharing Agreement[168]) was to reduce GHG emissions by 21% below 1990 levels by 2012. Between 1990 and 2008, Germany's GHG emissions have declined 21.4%. Germany's ultimate goal is to become one of the most energy-efficient and greenest economies in the world (Federal Ministry of Technology and Economics 2010) by setting ambitious GHG reduction targets and utilizing renewable energies. Under the Copenhagen Accord, the EU has pledged an overall reduction of 20-30% below 1990 levels by 2020, which Germany will contribute to in some proportion. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Germany is ranked 7th overall with a performance rating of 'good' (Burck *et al*. 2010). It is also highlighted as having one of the best rankings for emissions trend.

In October of 2003, the European Parliament and Council of the European Union (of which Germany is a member) adopted a Directive for establishing an emissions trading scheme in Europe. The Directive applies to energy-intensive installations that fall within activities specified in Annex I of the Kyoto Protocol (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety 2004). In response, Germany enacted the 2003 Greenhouse Gas Emission Trading Act, which established the German Federal Environment Agency as the enforcing agency in the field of climate protection (GETA 2011). To meet the new demands set forth by the EU, Germany founded the German Emissions Trading Authority (Deutsche Emissionshandelsstelle; GETA) which verifies information submitted by companies that wish to obtain emissions allowances, evaluates and corrects the information where necessary and issues

[168] The EU as a whole is committed to reducing its emissions by 8% during the period 2008-2012 compared with 1990 levels. For the EU to reach its reduction targets, in 1998 a political agreement was reached to divide the burden of reaching this target unequally amongst member states. This method takes into account: national conditions, including current greenhouse gas emissions; the opportunities for reducing them; and the level of economic development.

emission certificates (GETA 2007). Germany released its National Allocation Plan for emissions allowances in 2004.

In 2010, Germany passed the Ordinance on the Auctioning of Emission Allowances in accordance with the Allocation Act 2012 of 2007. The Ordinance provides for the auctioning of emissions allowances and sets regulations regarding auction procedure, the number of allowances that can be traded, and several other guidelines.

Most recently, in September 2010, the Federal Ministry of Technology and Economics along with the Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety released Germany's Energy Concept for an Environmentally Sound, Reliable and Affordable Energy Supply. The Energy Concept establishes Germany's targets of cutting GHG emissions by 55% by 2030, 70% by 2040 and an 80-95% reduction by 2050, with 1990 as the base year. This plan came out even after Germany reached its GHG reduction targets set under Kyoto in 2009 (3 years in advance) by reducing GHG emissions by approximately 23% since 1990.

Descriptions of all of Germany's programs and initiatives for reducing GHG emissions and utilizing renewable energy can be found in English at http://www.bmu.de/english/climate_energy/doc/41327.php.

Canada (1.9%). Currently, Canada ranks 7th in overall GHG emissions. Canada's original commitment under the Kyoto Protocol was to reduce GHG emissions by 6% below 1990 levels by 2012. Between 1990 and 2008, Canada's total GHG emissions have increased approximately 24.1%. Canada's 2008 GHG emissions decreased 2.1% from 2007 levels, attributed partly to a slowdown in economic growth which began in 2008, and to increased use of hydropower for electricity generation. Although emissions rose 24.1% between 1990 and 2008, the overall emissions growth trend has slowed slightly in recent years and emissions since 2003 have decreased by 0.8% (Environment Canada 2010).

Under the Copenhagen Accord, the Government of Canada has committed to reducing total greenhouse gas emissions by 17% from 2005 levels by 2020, in alignment with the final economy-wide emissions target of the United States in enacted legislation. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Canada is ranked 57th overall with a performance rating of 'very poor' (Burck *et al*. 2010). It fell eight ranks from last year's performance index with respect to emissions levels because of it high emissions trend.

In April 2007, the Government of Canada released "Turning the Corner: An Action Plan to Reduce Greenhouse Gases and Air Pollution" (Environment Canada 2008) which provided the ground work for Canada's approach to tackling climate change. This plan set out an approach for reducing GHG and air pollution emissions from the industry and transportation sectors, as well as actions on consumer and commercial products, and actions to improve indoor air quality. In December 2007, the Government of Canada formally required industry to provide information about their emissions of air pollutants and GHG which is used to report facility level emissions, which Environment Canada publishes every fall as part of its Greenhouse Gas Emissions Reporting Program. The Action Plan requires big companies to reduce their emission intensity

by 18% below 2006 levels by 2010. For each year thereafter, industry will have to reduce its emission intensity by a further 2%.

Most recently, the Canadian Government attempted to pass legislation in the form of Bill C-311, the Climate Change Accountability Act. This Act, Canada's only climate change-specific legislation, would have committed Canada to a 25% reduction of emissions below 1990 levels by 2020, and 80% reduction by 2050, with progress reports due every 5 years. While the bill had passed the House of Commons, for the first time in Canadian history, a bill did not pass the Senate (Levangie 2010). Canada also withdrew from the Kyoto Protocol in December of 2011.

United Kingdom (UK) (1.8 %). Currently, the UK ranks 8th in overall GHG emissions. The UK's original commitment under the Kyoto Protocol was to reduce GHG emissions by 12.5% below 1990 levels by 2012. From 1990 through 2008, total GHG emissions in the UK have decreased by almost 17%. Under the Copenhagen Accord, the EU has pledged an overall reduction of 20-30% below 1990 levels by 2020, to which the UK will contribute in some proportion. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, the UK is ranked 8th overall with a performance rating of 'good' (Burck *et al*. 2010). It is also highlighted as having one of the best rankings for emissions trend, although the report points out that even these countries are not on track to prevent dangerous climate change.

The Department of Energy and Climate Change[169] is the regulatory agency that aims to bring together energy policy and climate change mitigation policy. The Department of Energy and Climate Change's goal is to ensure the right legislative framework is in place to meet policy objectives including reducing GHG emissions in the UK, confirming global commitments to tackle climate change, and ensuring secure, affordable energy supplies (Department of Energy and Climate Change 2010). The Climate Change Act of 2008 introduced a new, more ambitious target for the UK to reduce GHG emissions to 80% below base year levels by 2050, with five year GHG budgets. Other provisions of the Act include developing a carbon budgeting system which caps emissions over five-year periods, creation of the Climate Change Committee, inclusion of aviation and shipping emissions, and implementation of a domestic trading scheme, among others (Department of Energy and Climate Change 2010).

Other key pieces of legislation include the Energy Acts of 2008 and 2010 which include provisions for carbon capture and storage, renewable energy, decommissioning of offshore renewables, offshore electricity transmissions, renewable heat incentives, etc. Enacted in 2008, the Planning and Energy Act enables local planning authorities in England and Wales to set requirements for energy use and energy efficiency in local plans. Additionally, the recent Carbon Reduction Commitment Energy Efficiency Scheme targets large private and public sector organizations and aims to improve energy efficiency and energy savings, reduce GHG emissions, and help large organizations generate cost savings through reduced energy expenditure (Department of Energy and Climate Change 2010)

Most recently, the UK outlined its "Green Deal" in the Energy Bill 2010-2011. This Bill is predominantly intended to enhance energy efficiency for homes and businesses, as 25% of the

[169] http://www.decc.gov.uk/default.aspx

UK's CO_2 emissions come from the energy used to heat homes due to old, inefficient housing (Department of Energy and Climate Change 2010). In summary, the Green Deal is the UK Government "establishing a framework to enable private firms to offer consumers energy efficiency improvements to their homes, community spaces and businesses at no upfront cost, and recoup payments through a charge in installments on the energy bill" (Department of Energy and Climate Change 2010).

Building efficiency regulations, incentives for renewable energy use, as well as vehicle excise taxes according to emissions level are all additional regulatory and incentive tools implemented by the UK government.

Italy (1.6%). Italy currently ranks 12th in overall GHG emissions. Italy's original commitment under the Kyoto protocol was to reduce GHG emissions by 6.5% below 1990 levels by 2020. As of 2008, Italy's GHG emissions had increased approximately 6.9% from the base year of 1990. It is estimated that Italy will not reach its Kyoto target of -6.5%, even with current and additional regulatory mechanisms (Europe Environment Agency 2007a). Between 2004 and 2008, however, Italy's emissions have shown a steep downward trend (WRI 2010). Under the Copenhagen Accord, the EU has pledged an overall reduction of 20-30% below 1990 levels, to which Italy will contribute in some proportion. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Italy is ranked 41st overall with a performance rating of 'poor' (Burck *et al*. 2010).

Italy has planned and implemented numerous initiatives to ensure their compliance under the Kyoto Protocol. In June 2007, the Italian Parliament's environment committee set out a comprehensive Climate Change Action Plan, aimed at helping Italy achieve its GHG emissions reduction targets under Kyoto. The plan includes a ban on the sale of household appliances ranked below A on the EU energy efficiency labeling scale. Additionally, these appliances will be removed from sale by 2010, and low efficiency incandescent light bulbs will be banned by 2012. The industrial sector is encouraged to switch to low energy devices and install more efficient engines and motors. These provisions target small and medium sized firms. Energy saving is encouraged through various incentives aimed at industrial and domestic consumers. Under a new system of energy tariffs, heavy users and daytime users will pay more per unit of energy. The committee also proposed a 10% increase in waste recycling and says this could prevent four million tons of CO_2 emissions annually. It further sought a shift in goods transport to rail from road, which currently carries 85% of goods traffic. The plan was endorsed by the lower house, but has yet to be implemented by the government as national policy.

Italy also implements policies and regulations set by the EU, such as the EU Emissions Trading Scheme and EU Energy Performance of Buildings Directive. Italy passed Legislative Decree n. 115 of 30 May 2008 set to implement into domestic legislation the EU Energy Services Directive (2006/32/EC), creating a legal framework for greater efforts to improve energy efficiency and addressing a spectrum of activities in the energy sector. Italy released its National Energy Efficiency Action Plan in July 2007.The plan considers measures already undertaken under the budgetary law of 2007 (which provides for various fiscal incentives and financial measures to improve energy efficiency and to abate emissions) and other measures, such as application of energy efficiency standards in buildings. The proposed measures aim to achieve an energy

saving target of 9.6% by 2016. Sectors addressed in the Plan include industrial, residential, tertiary and transport sectors.

Italy has also implemented a number of regulatory and incentive programs to reduce emissions from vehicles, buildings and appliances.

Australia (1.3%). Australia currently ranks 16th in overall GHG emissions. Australia's original commitment under the Kyoto Protocol was to limit GHG emissions to 8% above 1990 levels by 2012. According to their 2010 National Inventory submission, as of 2008, Australia's GHG emissions have increased approximately 29.4% above 1990 levels. Under the Copenhagen Accord, the Government has committed to reduce Australia's GHG emissions at minimum to 25% below 2000 levels by 2020 if the world agrees to an ambitious global deal to stabilize levels of GHGs in the atmosphere at 450 parts per million CO_2 equivalent or lower. If the other countries fail to reach the agreement of the 450 parts per million target, Australia will only commit to reducing its emissions by between 5 and 15% below 2000 levels by 2020. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Australia is ranked 58th overall with a performance rating of 'very poor' (Burck *et al*. 2010).

Australia's Department of Climate Change and Energy Efficiency is the lead agency responsible for creating and implementing the regulatory framework for dealing with issues related to climate change. The driving legislation to curb Australia's GHG emissions is the Carbon Pollution Reduction Scheme; it was designed to guide the country in reaching its goal of 25% below 2000 levels by 2020. However, due to a lack of bipartisan support for the Carbon Pollution Reduction Scheme and slow progress on reaching a credible global agreement to limit carbon emissions, the Government has delayed the introduction of the Carbon Pollution Reduction Scheme. Emissions projections released in August 2009 showed that in the absence of the Carbon Pollution Reduction Scheme, Australia's GHG emissions are projected to rise to 20% above 2000 levels. Australia has numerous voluntary and incentive programs and initiatives to help abate GHG emissions. A comprehensive list of these can be found at http://www.climatechange.gov.au/government/initiatives.aspx. Without a clear agreement within Australia's government regarding the Carbon Pollution Reduction Scheme, it is unclear whether or not Australia will meet its reduction goals under Kyoto.

France (1.3%). France currently ranks 17th in overall GHG emissions. France's original commitment under the Kyoto Protocol (and the EU Burden Sharing Agreement) was to stabilize emissions at 1990 levels. Between 1990 and 2008, France's GHG emissions (excluding LULUCF and emission credits) decreased 5.6%. More recently, in association with the Copenhagen Accord, the EU has committed to reducing overall GHG emissions by 20-30% by 2020, to which France will contribute in some proportion. France is also one of the G8 countries who have agreed to cut their emissions by 80 percent by 2050 (Serre 2010). According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, France is ranked 9th overall with a performance rating of 'good' (Burck *et al*. 2010).

Domestically, under the Energy Strategic Law of 2005, France has committed to average yearly reductions of 3% resulting in a projected division of emissions by four by 2050 - so called

"Factor 4" (Serre 2010). Most recently, France passed a major new bill that will likely transform environmental law in the country, including its approach to climate change. The Grenelle 2 bill includes various measures that aim to reduce GHG emissions. The bill contains incentives to embed sustainability into French urban planning; "urban master plans" (Schéma de Cohérence Territoriale) will be finalized before 2017 to enhance policy coherence between urban, industrial, farming, tourism, and natural zones, and also to help tackle urban sprawl. Grenelle 2 also allows for a possible exception for energy-efficient buildings to the Building Density Limit, which specifies the maximum building density of a landed property allowed, by acreage. In general, Grenelle 2 improves the energy efficiency of buildings which account for around 18% of France's GHG emissions. The new law sets a target of reducing the average energy consumption of buildings nearly 40% by 2020, and puts a focus on advanced energy performance for both old and new buildings (Serre 2010).

While France has already reached (and surpassed) its GHG reduction goals under Kyoto, it is likely they will also reach their current domestic reduction goals as well.

Spain (1.2%). Spain currently ranks 19th in overall GHG emissions. Spain's original commitment under the Kyoto Protocol (and the EU Burden Sharing Agreement) was to cap increasing emissions at 15% above 1990 levels by 2012. However, between 1990 and 2008, Spain GHG emissions increased by 42.5%. Despite these policy and regulatory implementations, Spain is not expected to reach its Kyoto target with current measures. Even with the use of Kyoto Mechanisms and carbon sinks, a gap to the Kyoto target of about 14 percentage points remains (Europe Environment Agency 2007b). Under the Copenhagen Accord, the EU has pledged an overall reduction of 20-30% below 1990 levels by 2020, to which Spain will contribute in some proportion. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Spain is ranked 35th overall with a performance rating of 'poor' (Burck *et al*. 2010).

In efforts to reach their GHG reduction goals under Kyoto, the Spanish Government developed the Spanish Climate Change and Clean Energy Strategy in 2007 (Government of Spain 2007). This Strategy includes provisions for clean energy, energy efficiency, and renewable energy. Examples of specific measures targeting the transport sector include better infrastructure and territorial planning and modal change. In addition, efficient building and power generation technologies and renewable energy sources are to be used when developing transport facilities. Other efficiency measures include eco-driving programs, improved energy labels for vehicles, and integration of energy efficiency criteria in administrative contracts to increase the number of clean-air vehicles in the public vehicle fleet. In the residential, commercial and institutional sectors, most measures concentrate new buildings through strengthening thermal building code requirements and promoting energy performance certificates and existing buildings through incentives for renovation. Measures also encourage the use of efficient appliances, heating equipment and light bulbs. Regarding renewable energy, proposed measures extend the use of solar thermal panels in new housing projects as well as non-residential buildings and public facilities. In addition, the use of wood as heating fuel is promoted.

In 2008 the Spanish government approved the Spanish Industry Minister's 2008-2011 Energy Saving and Efficiency Plan. The plan contains 31 recommendations aimed at reducing CO_2

emissions. The new plan will cover the transport, industrial, residential, tertiary and agricultural sectors. Measures follow four lines of action: transversal measures, mobility, buildings and energy savings.

More recently, the Spanish Government drafted the Sustainable Economy Law in 2010. The Draft Bill for the Sustainable Economy Law has been drawn up as the cornerstone of the Spanish government's strategy to define the new growth model for the Spanish economy. It is formulated around three central themes: improvements to the economic environment, the promotion of competitiveness and the development of sectors working in the fight against climate change. As such, the law will contain specific measures that will benefit companies in renewable energy, and other climate change mitigation sectors, including energy efficiency and savings. The Sustainable Economy Law sets national targets in accordance with European objectives in renewable energy including a 20% share of renewable sources in energy consumption, with at least 10% of renewable sources in the transport sector.

Ukraine (1.1%). Ukraine currently ranks 20th in overall GHG emissions. Ukraine's commitment under the Kyoto Protocol was to ensure that its annual GHG emissions during the period 2008-2012 do not exceed the 1990 level. According to the Ukraine's 2010 national inventory report submission to the UNFCC, total GHG emissions decreased by 53.9% between 1990 and 2008. Under the Copenhagen Accord, the Government of Ukraine plans to keep GHG emissions 20% and 50% below 1990 levels by 2020 and 2050, respectively. The latter target would require maintaining the GHG emissions in 2050 to roughly today's levels, implying a net zero growth in emissions between now and 2050 despite an expected strong economic growth (NEIAU 2010). Projections for Ukrainian total GHG emissions in 2012 and 2020 are estimated to remain well below 1990 levels (NEIAU 2010). According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Ukraine is ranked 36th overall with a performance rating of 'poor' (Burck *et al*. 2010). Despite being ranked as one of the highest for emissions trend, Ukraine's low ranks for climate policy and emission level brought down its overall score.

In 2007, the Ukraine passed Regulation #977 establishing the National Environmental Investment Agency of Ukraine[170] (SEIAU). Within this regulation, responsibilities of financing and implementing mechanisms to mitigate climate change and reduce emissions were delegated to the Agency. The Agency is also responsible for executing the requirements under the UNFCCC and implementing the mechanisms of the Kyoto Protocol, including completing the annual inventories of anthropogenic GHG emissions as well as providing the National communications on climate change to the UNFCCC.

Ukraine's primary energy policy and priorities are defined in its Energy Strategy to 2030 (Government of Ukraine 2006),[171] which was approved by the Cabinet of Ministers in 2006. The overriding objectives the Strategy are to ensure its energy security and status as a significant transit country. Priorities include increasing transit volumes, reducing the economy's energy intensity, improving its energy efficiency, integrating with the European energy system and expanding domestic energy production. In order to meet these objectives and priorities a set of

[170] http://www.neia.gov.ua/nature/control/en/publish/category?cat_id=80484
[171] http://www.esbs.kiev.ua/en/energy-sector-cooperation-and-reforms/ukraine-s-energy-strategy-to-2030

policy measures is specified, which includes modernizing and rehabilitating infrastructure that transports hydrocarbons, diversifying supplies and routes, increasing domestic production of coal and nuclear energy, implementing broad-ranging energy efficiency measures, adopting relevant EU laws and undertaking pricing reform.

Poland (1.1%). Poland currently ranks 21st in overall GHG emissions. Poland's original commitment under the Kyoto Protocol was to reduce GHG emissions by 6% below 1988 levels[172]. As of 2008, Poland's total GHG emissions decreased by 29.6% from 1988 levels. Under the Copenhagen Accord, the EU has pledged an overall reduction of 20-30% below 1990 levels, to which Poland will contribute in some proportion. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Poland is ranked 55th overall with a performance rating of 'very poor' (Burck *et al*. 2010).

The regulatory agency in Poland responsible for implementing policies and regulations related to climate change is the Poland Ministry of the Environment and its Department of Climate Change and Atmosphere Protection. As of April 29, 2008 Poland met specific criteria and became eligible to engage in international emissions trading (Article 17 of the Kyoto Protocol) including trading of Assigned Amount Units (Poland Ministry of Economy 2009). In 2009, Poland enacted the System to Manage the Emissions of Greenhouse Gases and Other Substances, which provides the legal framework for Poland's Green Investment Scheme. The System allows the profits generated from trade of Assigned Amount Units to be used for various programs and projects including improving energy efficiency, clean coal technologies, fuel replacement with low-emission alternatives, renewable energy, GHG sequestration, among others. The operating entity for the National Green Investment Scheme is the National Fund for Environmental Protection and Water Management.

Also in 2009, the Council of Ministers adopted the Energy Policy of Poland until 2030. Prepared within the Ministry of Economy, it includes a long-term strategy for the energy sector, fuel and energy demand forecasts, and an implementation program of policies and measures until 2012. The policy specifies six basic directions for the development of the Polish energy sector including improvement of energy efficiency, enhancement of fuel and energy supply security, diversification of electricity generation mix by introducing nuclear energy, use of renewable energy sources including biofuels, development of competitive fuel and energy markets, and reduction of the environmental impact of the power industry. In order to reduce GHG and other industrial emissions, the Energy Policy outlines a system of national ceilings on emissions of GHGs and other substances, along with admissible product-specific emission indicators (Poland Ministry of the Environment 2009).

There have been several other regulatory instruments and policies enacted in Poland to continue on the track of their long-term emission goals. These include the Act on electricity production from cogeneration, the Regulation for Obligation for Power Purchase from Renewable Sources,

[172] The economies in transition were granted the right to choose a different base year than 1990. Poland adopted 1988 as its base year. It was the last year before the crisis when its economy functioned in a relatively normal manner and when the greenhouse emissions were highest in the decade.

and the Long-term Program for Promotion of Biofuels or Other Renewable Fuels among others. More details on these and other regulatory measures in Poland and elsewhere can be found via the International Energy Agency's Climate Change Policies and Measures Database[173].

Turkey (1.0%). Turkey currently ranks 22nd in overall GHG emissions. Turkey was not yet a UNFCCC Party at the time of signing the Kyoto Protocol and therefore has no reduction commitment assigned under it. Between 1990 and 2008, Turkey's GHG emissions increased 103.2%. Turkey has not yet made an emissions reduction pledge under the Copenhagen Accord. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Turkey is ranked 50th overall with a performance rating of 'very poor' (Burck *et al*. 2010).

In 2004, the Coordination Board on Climate Change was established under the Chairmanship of the Ministry of Environment and Forestry to determine the policies to be followed, measures to be taken and activities to be conducted by Turkey in the field of climate change. The Energy Efficiency Law is the primary legislation that aims to increase the efficient use of energy and energy resources for reducing the burden of energy costs on the economy and protecting the environment. This law includes the organization, principals, and procedures for increasing energy efficiency in industry, electrical power plants, transmission and distribution systems, building, service, and transport sectors. The Energy Efficiency Law also amended Law no.5346 dated 2005 on Utilization of Renewable Energy Sources for the Purpose of Generating Electrical Energy. Renewable electricity receives a fixed purchase price of between EUR cents 5 and 5.5/kWh for 10 years. The price is valid for plants installed until end of 2011, though the government can extend this date for two years. The Electricity Market Law of 2001 was also modified by the Energy Efficiency Law, exempting certain categories of power plants from the obligation to obtain licenses and establish companies. The exemption applies to: renewable energy plants with installed capacity of maximum 500kW; cogeneration plants with at least 80% overall efficiency; micro cogeneration plants with 50 kW installed capacity (IEA 2009b).

Turkey's initial communication to the UNFCCC in 2007, Turkey noted that it was in the process of seeking to establish a National Action Plan on Climate Change. As of the end of 2010, an initial Climate Change Strategy paper has been completed but a comprehensive National Plan has not yet been developed. Additional regulations in Turkey include laws regarding labeling appliances and passenger vehicles for energy use and fuel efficiency, efficient outdoor lighting, renewable energy use, regulations on heat insulation for new buildings, and several others. More detail can be found here:
http://www.iea.org/textbase/pm/?mode=cc&action=view&country=Turkey.

2.2.2.2 UNFCCC Non-Annex I Countries

China (22.3%). China surpassed the U.S. sometime around 2006/2007 to become the world's largest emitter of greenhouse gases[174] (Netherlands Environmental Assessment Agency 2007, 2008). As a non-Annex I country, China has made no commitment under the Kyoto Protocol to

[173] http://www.iea.org/textbase/pm/?mode=cc
[174] Even though it has been widely accepted outside of China that it became the world's top GHG emitter sometime around 2006/2007, China itself has acknowledged this position as of November 2010 (Samuelsohn 2010).

reduce GHG emissions below 1990 levels by the year 2012. It has submitted only one GHG Inventory to the UNFCCC in 1994. China has opposed numerous proposals by UNFCCC parties that would require non-Annex I countries to submit GHG Inventories on a regular basis. Between 1990 and 2007, CO_2 emissions in China from the burning of fossil fuels increased 165%. Since 2000, total GHG emissions in China have more than doubled and in 2009, they grew by 9% over the previous year (Olivier and Peters 2010). As one of the primary parties that negotiated the Copenhagen Accord in 2009, it has pledged to reduce carbon dioxide emissions intensity[175] (emissions per unit of GDP) 40-45% by 2020 compared to 2005, increase the share of non-fossil fuels in primary energy consumption to around 15% by 2020 and increase forest coverage by 40 million hectares and forest stock volume by 1.3 billion cubic meters by 2020 from the 2005 levels (Government of China 2010). There is speculation, however, as to whether or not these goals are realistic or achievable as they would put great pressure on China's continued development; according to a researcher at the Chinese Academy of Social Sciences, "In 2020, the country's GDP will at least double that of now, so will the emissions of greenhouse gases. But the required reduction of emissions intensity by 40 to 45 percent in 2020 compared with the level of 2005 means the emissions of greenhouse gases in 2020 has to be roughly the same as emissions now." (Government of China 2009). Stern and Jotzo (2010) surmise that while China's targeted reductions in terms of emissions intensity are on par with those implicit in the U.S. and EU targets (which are framed in terms of absolute reductions of carbon emissions and not emissions intensity), the Chinese government will have to adopt ambitious carbon mitigation policies in order to achieve this target. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, China is ranked 56th (down from 52nd in 2010) and in the 'very poor' performance category (Burck *et al*. 2010). China is ranked by far the highest for emissions trend.

The National Development and Reform Commission Department of Climate Change takes the lead for domestic climate change activities and the Ministry of Foreign Affairs leads on international climate change issues in China. Domestically, as a developing country, China's focus remains on developing their economy and eradicating poverty more so than environmental issues including climate change. In the international climate change arena, it abides by the notion of "common but differentiated responsibilities" as described in the UNFCCC and argues that industrialized countries are responsible for the historical accumulation of GHG in the atmosphere and should therefore lead the way in mitigating emissions. The former head of China's National Development and Reform Commission, Ma Kai, said "Our general stance is that China will not commit to any quantified emissions reduction targets, but that does not mean we will not assume responsibilities in responding to climate change" (China Department of Climate Change 2009).

As such, in 2007 China released its National Climate Change Program outlining domestic policies and actions to be implemented to improve energy efficiency and expand low-carbon energy supply. Out of the 52 policies and measures stated in the National Climate Change

[175] Framing reduction targets in emissions intensity has been criticized because a targeted reduction in intensity can mean continued increase in absolute levels, but they have valuable properties in managing economic uncertainty and focus the target formulation on structural and technological change rather than GDP growth which is not a policy variable (Jotzo and Pezzey 2007).

Program, ten of them are quantitatively described in terms of how much of a GHG emissions reduction will result, many of them estimated by 2010 (See Table A-1 in the Appendix of Leggett *et al.* 2008 for a summary of measures, expected emissions reduction, and progress as of 2008). The primary domestic policies and programs of note are described briefly in the Appendix (also see Leggett *et al.* 2008 and China's National Climate Change Program for more detailed information). In General, they include renewable energy laws, increased efficiency targets, promotion of nuclear power, and updated building codes and vehicle fuel economy standards, among others. While several of these policies and programs have shown measurable progress toward their stated goals and were on track to meet or surpass them as of 2008 (see Leggett *et al.* 2008), China's overall emissions have continued to increase.

India (5.5%). India currently ranks (a distant) third in its contribution to global greenhouse gases behind China and the U.S. at around five percent of the global total. It has submitted only one GHG inventory to the UNFCCC in 1994. As a non-Annex I country, India has made no commitment under the Kyoto Protocol to reduce GHG emissions below 1990 levels by the year 2012. Between 1990 and 2007, India's CO_2 emissions from the burning of fossil fuels increased 133%. India's pledge to the UNFCCC under the Copenhagen Accord is to reduce their emissions intensity per unit of GDP by 20-25% by 2020 in comparison to 2005 levels (Government of India 2010a). Despite their on-going policies and initiatives, India's CO_2 emissions in 2009 increased 6% over the previous year. Together with China's 9% increase, this was enough to nullify the overall decrease in GHG emissions of most Annex I countries that year (Olivier and Peters 2010). According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, India is ranked 10th overall with a performance rating of 'good' (Burck *et al.* 2010). Out of the top 10 emitters, India ranks third in overall climate change performance.

India has numerous policies in place that contribute to reducing or avoiding GHG emissions. Many of the policies are contained within the Five Year Plans to guide economic policy in India (the 11th Five Year Plan covers 2007-2012[176]) prepared by the Planning Commission and some are found in the Integrated Energy Policy from 2006. The government is mandating the retirement of inefficient coal-fired power plants and supporting the research and development of alternative technologies. Under the Electricity Act 2003 and the National Tariff Policy 2006, the central and state electricity regulatory commissions must purchase a certain percentage of grid-based power from renewable sources. Under the Energy Conservation Act 2001, large energy consuming industries are required to undertake energy audits and an energy labeling program for appliances has been introduced (Government of India 2008; see Pew Center for Global Climate Change 2008a for summary). On June 30, 2008, India released its first National Action Plan on Climate Change outlining existing and future policies and programs addressing climate mitigation and adaptation. The plan identifies eight core "national missions" running through 2017, four of which are in some way related to reducing GHG emissions. These missions include activities like making solar power competitive with fossil-fuel based energy sources, increasing energy efficiency, extending the existing Energy Conservation Building Code, enforcing fuel economy standards and providing incentives for fuel-efficient vehicle purchasing,

[176] http://planningcommission.gov.in/plans/planrel/11thf.htm

afforestation of six million hectares of degraded forest lands and expanding forest cover from 23% to 33% of India's territory, and a whole separate National Mission to facilitate science and research on climate change (Government of India 2008; see Pew Center for Global Climate Change 2008a for summary). Other on-going initiatives and regulations for adaptation to climate change are also described in the National Action Plan on Climate Change. Specific estimates of the emission impacts of most of these policies are not available but an analysis prepared for the Ministry of Environment and Forests in 2005 concluded that in the absence of several energy policies being implemented at the time, CO_2 emissions would likely be ~20% higher compared to business as usual scenarios in both 2021 and 2031 (Pew Center for Global Climate Change 2008b).

In October of 2009, the government of India launched the Indian Network of Climate Change Assessment[177] within the Ministry of Environment and Forests in an effort to research and produce updated reports on GHG emissions. The first Indian Network of Climate Change Assessment report from 2010 provides updated emissions estimates for 2007. According to their report, total GHG emissions without LULUCF grew 52% between 1994 and 2007 at a compounded annual growth rate of 3.3%; with LULUCF the compounded annual growth rate is 2.9%, although emissions intensity of India's GDP declined by more than 30% during the period 1994-2007 (Government of India 2010b). At that time, India ranked fifth in total emissions.

Iran (1.7%). Iran currently ranks 10th in overall GHG emissions. As a non-Annex I country, Iran has made no commitment under the Kyoto Protocol to reduce GHG emissions below 1990 levels by the year 2012. Iran submitted a GHG Inventory for the year 1994 in 2003 (Government of Iran 2003). In 2003, the amount of total GHG emissions in all sectors in Iran was predicted to increase 80% between 1994 and 2010. Between 1990 and 2007, Iran's CO_2 emissions from the burning of fossil fuels increased 118%. As of Jan. 2011, Iran has not submitted a reduction target pledge under the Copenhagen Accord. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Iran is ranked 52nd overall with a performance rating of 'very poor' and is in the bottom three in emissions trends over the last five years (Burck *et al*. 2010).

National Policy measures proposed for reduction of GHGs in Iran, known as Mitigation Scenarios, were included in Iran's Third Five Year Development Plan which covers 2001 - 2005. The fourth Five Year Development Plan was ratified in 2005 (2006 – 2010) and the Fifth was announced in 2010 and will cover 2011-2015. According to Iran's Initial Communication to the UNFCCC in 2003, domestic policies addressing climate change apply primarily to the energy sector (which accounted for 83% of GHG emissions in 1994). These include clean and efficient power generation, environmentally friendly refineries, improved vehicle and public transport and energy-efficient buildings and appliances. In the non-energy sector, policies and reduction strategies include modern farm and livestock management, protection of forestlands and other natural resources, control and treatment of wastewater, disposal management, and recycling of solid wastes. Iran's Fifth Five-Year Plan and its journey through the legislative process highlights tensions within the Iran government. Critics of the plan claim it is more of an "essay" or "collection of wishes" lacking specific objectives and ways to reach them, it is not well

[177] http://moef.nic.in/modules/others/?f=event

structured and lacks both quantitative indices and transparency regarding sources of revenue. Some critics claim it conflicts with other legislation and even the constitution (Farhi 2010). Iran's renewable energy consumption is low. With 9% of the world's oil reserves and 15% of its natural gas reserves (80% of which have not been developed), Iran has an abundant supply of fossil fuel resources, which tends to discourage the pursuit of alternative, renewable energy sources (Mostafaeipour and Mostafaeipour 2009).

South Korea (1.7%). South Korea currently ranks 9th in overall GHG emissions. As a non-Annex I country, South Korea has made no commitment under the Kyoto Protocol to reduce GHG emissions below 1990 levels by the year 2012. Total GHG emissions in South Korea increased 98% between 1990 and 2005 and the primary source of CO_2 emissions is the energy sector (Jick Yoo 2008). Emissions of CO_2 from the burning of fossil fuels increased 108% between 1990 and 2007. Emissions are estimated to continue to grow at a rate of ~2.2% through 2020 for an overall continued increase of 37.7% without mitigation actions (Jick Yoo 2008). Under the Copenhagen Accord, South Korea has pledged to reduce national GHG emissions by 30% from business as usual emissions by 2020 (Republic of Korea 2010) which allows for further increase over 2005 levels of only 7.7%. According to Energy Information Administration (EIA) data, CO_2 emissions from consumption of fossil fuels in South Korea increased over 9% between 2005 and 2008 (EIA 2010b). According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Korea is ranked 34th overall with a performance rating of 'poor' (Burck *et al*. 2010). This is, however, an improvement over their previous ranking of 41st due mostly to recent improvement in climate policy.

The Government of South Korea established a Climate Change Committee in 1998 to create a National Action Plan. A Special Committee for Climate Change was also established in the National Assembly in 2001. A Task Force was formed in 2004 to help energy intensive industries lower their GHG emissions. A National GHG Inventory System was established in 2006 and a National Registry established to provide incentives and record voluntary reductions of GHG emissions by registered firms and businesses.

In August of 2008, President Lee Myung-bak proclaimed "Low carbon, Green Growth" as Korea's new national vision for the next 60 years. As such, the Presidential Committee on Green Growth was established in 2009 and they have developed 27 national strategies for Green IT, finalized the Five-Year National Plan for Green Growth (2009-2013), confirmed a 30% target reduction of national GHG emissions below business as usual by 2020, announced the enforcement of a 'Framework Act on Low Carbon, Green Growth', and launched the Global Green Growth Institute. The National Strategy for Green Growth has both mid- (2009 – 2013) and long-term (2009 – 2050) objectives and describes ten policy directions to be implemented, including the effective reduction of GHG emissions (Jung and Ahn 2010). The Five-Year National Plan represents a significant investment as US$83.6 billion has been dedicated to mitigation and adaptation to climate change (that is equal to ~2% of GDP). The new National Energy Plan includes a renewable energy target of 11% by 2020 which means reducing the use of fossil fuels. According to an analysis by UNEP, several of the targets Korea has set forth under this new Green initiative appear modest compared to those of other countries, however they will still require a rapid pace of change since very little has taken place since the early 2000s (UNEP 2010a).

Mexico (1.6%). Mexico currently ranks 11th in overall GHG emissions. As a non-Annex I country, Mexico has made no commitment under the Kyoto Protocol to reduce GHG emissions below 1990 levels by the year 2012. Between 1990 and 2007, Mexico's CO_2 emissions from the burning of fossil fuels increased 32%. Under the Copenhagen Accord, Mexico has pledged to reduce its GHG emissions up to 30% with respect to the business as usual scenario by 2020 (Government of Mexico 2010). According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Mexico is ranked 11th overall with a performance rating of 'good' (Burck *et al*. 2010). Mexico is one of the developing nations considered to have taken a leadership role in domestic greenhouse gas mitigation policy and international climate change negotiations (WWF 2010).

Since President Felipe Calderón took office in 2006, climate change has been an integral part of his administration's agenda. The president's Special Climate Change Program (2009 – 2012)[178] has been developed and builds on elements contained in the National Climate Change Strategy completed in 2007. Although the program is specific to objectives intended to meet goals by 2012, it also includes intermediate aspirational targets for 2020 and 2030 with the ultimate target of reducing GHG emissions by 50% by 2050 as compared to 2000 levels, although it is noted that this target will only be met with financial and technological support mechanisms from developed countries. A portion of the government's Climate Change Program focuses on raising energy efficiency standards while helping Mexicans replace out-of-date refrigerators and air conditioning units and enforcing mandatory emissions controls for vehicles. A program providing tax credits to home owners who install solar panels and other environmentally friendly fixtures is also included. Sustainable forest management, renewable energy, incandescent bulb replacement, increased use of rail for freight, green buildings and wind generation, among others, are all included as mitigation targets to be implemented via policies and incentive programs.

South Africa (1.5%). South Africa currently ranks 13th in overall GHG emissions. As a non-Annex I country, South Africa has made no commitment under the Kyoto Protocol to reduce GHG emissions below 1990 levels by the year 2012. Between 1990 and 2007, South Africa's CO_2 emissions from the burning of fossil fuels have increased 30%. Prior to the Climate Talks in Copenhagen in 2009, South Africa announced a voluntary commitment to reduce emissions by 34% below business as usual levels by 2020. This reduction is, however, conditional upon international support that is not certain to materialize. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, South Africa is ranked 29th overall with a performance rating of 'moderate' (Burck *et al*. 2010).

South Africa provided its Initial National Communication to the UNFCCC in 2000 which includes GHG inventories for 1990 and 1994. The second National Communication was submitted in 2009 and included an additional GHG inventory for the year 2000. The proportion of emissions from the energy sector increased from 75% in 1990 to 78% in 1994 while emissions

[178] http://www.cop16.mx/en/climate-change/executive-summary-special-climate-change-program-20092012-mexico/index.htm

from agriculture, industry, and waste all fell slightly between 1990 and 1994 (Government of Republic of South Africa 2000). The year 2000 showed further increase in overall emissions (Government of Republic of South Africa 2010a). As development continues, GHG emissions under business as usual terms are expected to rise steeply through 2050 (Letete *et al*. 2009).

South Africa is in the early stages of climate change mitigation policy with only policy intentions and directions existing at this stage (Tyler 2009). The National Committee on Climate Change was established in 1994 to act as an advisory body to the Minister of Environmental Affairs and Tourism. South Africa released a National Climate Change Response Strategy in 2004. In 2005, a South African Country Study on Climate Change was completed, a Climate Change Conference was held, and in 2007, a resolution on climate change was adopted at the African National Congress. The resolution resolves to set a GHG mitigation target for the future and to emphasize wind and solar energies over the use of coal. The Long Term Mitigation Scenarios process was undertaken by the Cabinet in 2007 to determine what trajectory their targets need to take and how ambitious policies need to be to achieve them. Comparing 'Growth without Constraint' and 'Required by Science' scenarios, they determined that a Required By Science scenario could not be met with the implementation of current existing mitigation policies and the use of new and as of yet unidentified technologies and behavioral change would be required to achieve a reasonable mitigation trajectory (Energy Research Centre 2008).

Despite good climate change mitigation policy intentions, it has been a slow process for South Africa to actually develop its policies. As of December 2010, a draft 'green paper' of South Africa's climate change mitigation policy[179] has been released for public comment and the final is expected in mid-2011 (van der Murwe 2010). The paper describes general strategies in various mitigation sectors including energy, industry, and transport and describes intended policies including fuel standards, renewable energy requirements, and financial incentives to encourage behavior change (Government of Republic of South Africa 2010b). Although considered a step in the right direction, the green paper is seen by some as not specifying intended rules or specific policies, but rather defining an ultimate policy objective and identifying principles and strategies to be used to achieve the objective (van der Murwe 2010).

Saudi Arabia (1.4%). Saudi Arabia currently ranks 14th in overall GHG emissions. As a non-Annex I country, Saudi Arabia has made no commitment under the Kyoto Protocol to reduce GHG emissions below 1990 levels by the year 2012. Between 1990 and 2007, Saudi Arabia's CO_2 emissions from the burning of fossil fuels increased 87%. Saudi Arabia submitted its initial National Communication to the UNFCCC in 2005[180] and provided a GHG inventory for the base year 1990. Saudi Arabia has yet to make any pledge under the Copenhagen Accord. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Saudi Arabia is ranked last in 60th place overall with a performance rating of 'very poor' (Burck *et al*. 2010). Within the three categories of index variables, Saudi Arabia was among the worst in relative emissions levels and emissions trend and it ranked lowest out of all the countries in climate policy.

[179] http://www.environment.gov.za/HotIssues/2010/cgreenpaper.pdf
[180] http://unfccc.int/resource/docs/natc/saunc1.pdf

Saudi Arabia is the world's largest exporter of oil; 75% of Saudi Arabia's budget revenues and 45% of GDP is accounted for by the country's petroleum sector (OPEC 2011). It has done little to diversify its economy despite large potential for renewable energy sources like solar power. In international climate negotiations, Saudi Arabia has opposed measures like taxing oil supplying nations and other measures that encourage using alternatives to fossil fuels as its economy stands to be severely impacted by such actions in other countries. A vulnerability assessment and list of adaptation measures are included ib Saudi Arabia's initial National Communication to the UNFCCC; however, mitigation in the form of GHG reduction policies or initiatives are not discussed. At the UN climate talks in Bangkok in October of 2009, Saudi Arabia initiated negotiations requesting financial assistance in the form of a bailout for oil producing countries that would be adversely affected by any resulting climate change agreement (Associated Press 2009). The Saudi delegate held this position despite an International Energy Agency (IEA) report released the same week showing that revenues for the Organization of Petroleum Exporting Countries (OPEC) members would still increase $23 trillion between 2008 and 2030 — a fourfold increase compared to the period from 1985 to 2007 — even if countries agree to significantly slash emissions and thereby cut their use of oil (Whittington 2009).

Indonesia (1.4%). Currently, excluding emissions from LULUCF, Indonesia ranks 15th in overall GHG emissions. Important to note, however, is that Indonesia's estimated percentage of global GHG emissions and resulting rank reported here do not incorporate CO_2 emissions from LULUCF, for the sake of consistency. For most other countries, fossil fuel consumption in the energy sector is the primary source of CO_2 emissions. Because of the high uncertainty and lack of reliable data globally regarding CO_2 emissions from LULUCF and because it is not the primary source of CO_2 emissions for most countries, it is often not excluded from assessments of the relative contributions of nations to global emissions. In Indonesia, however, LULUCF and peat fire contributions to CO_2 emissions are highly variable on an annual basis but typically represent more than 50% of total emissions. In 2005, LULUCF and peatland degradation contributed almost 80% of Indonesia's CO_2 emissions. Incorporating these sectors, Indonesia has been estimated to contribute a much higher percentage to global emissions of around 5% (bringing their rank among the top 25 emitters closer to 4th overall) which is predicted to remain consistent through 2030 (DNPI 2010a).

As a non-Annex I country, Indonesia has made no commitment under the Kyoto Protocol to reduce GHG emissions below 1990 levels by the year 2012. Between 1990 and 2007, Indonesia's CO_2 emissions from the burning of fossil fuels increased 166%. Under the Copenhagen Accord, Indonesia has pledged to reduce GHG emissions by 26% below business as usual by 2020. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Indonesia is ranked 21st overall with a performance rating of 'moderate' (Burck *et al*. 2010). Of note, however, is that deforestation and land use, making up around 20% of global GHGs, are not included in the index either due to lack of consistent available data globally.

In 2008 via Presidential Regulation, the National Council on Climate Change (DNPI) was established to formulate national policies, strategies, programs and activities on climate change control[181]. In November 2007, the Indonesian Government published a National Action Plan on

[181] http://adaptasi.dnpi.go.id/index.php/main/contents/54

Climate Change which contains initial guidance and multi-sectoral coordination efforts to address mitigation and adaptation to climate change. In December, 2007, Bappenas (National Development Planning Agency) published a document entitled National Development Planning: Indonesia Responses to Climate Change which was revised in July 2008. In 2009, the Indonesia Climate Change Sectoral Roadmap[182] was released as a summary and synthesis of previous documents as well as a guide for future policy actions through 2029. The roadmap highlights specific policy and regulatory initiatives for both sink enhancements and emissions reduction in the transportation, energy, forestry, industry, and waste sectors.

Indonesia proposes to meet their commitment under the Copenhagen Accord via sustainable peat land management, reductions in deforestation and land degradation, carbon sequestration projects in forestry and agriculture, energy efficiency, alternative and renewable energy sources, reductions in solid and liquid waste, and shifting to low-emission transportation options (DNPI 2010b). A DNPI study has analyzed emissions and reduction potential in six sectors; it estimates Indonesia's annual GHG emissions in 2005 at 2.3 Giga tons, projects that emissions will increase an estimated 57% by 2030 if there are no changes in the way several sectors are managed, and claims that Indonesia has the potential to reduce its GHG emissions by as much as 46% below 2005 levels by 2030, with the right mixture of domestic policies and international support. This would reportedly accomplish 7% of the overall global reduction estimated to be necessary to prevent surpassing the 2°C additional warming target (DNPI 2010a).

At the September 2009 G-20 meeting in Pittsburgh, President Susilo Bambang Yudhoyono laid out a vision where significant reductions would be achieved through land use, land use change and forestry (LULUCF), primarily through a 'reforestation rather than a deforestation reduction approach'. However, attempts to achieve significant emissions reductions through a plantation expansion program alone would not be feasible, as planting the number of trees needed to fully achieve emissions reduction targets would require a land area twice the size of Indonesia, even if planted on degraded lands (Verchot *et al.* 2010).

Brazil (1.3%). Excluding emissions from LULUCF, Brazil currently ranks 18th in overall GHG emissions. Important to note, however, is that Brazil's estimated percentage of global GHG emissions and resulting rank reported here do not incorporate CO_2 emissions from LULUCF, for the sake of consistency. For most other countries, fossil fuel consumption in the energy sector is the primary source of CO_2 emissions. Because of the high uncertainty and lack of reliable data globally regarding CO_2 emissions from LULUCF and because it is not the primary source of CO_2 emissions for most countries, it is often excluded from assessments of contributions of individual nations to global emissions. In Brazil, however, LULUCF (primarily deforestation) contributions typically represent more than 50% of total CO_2 emissions. According to Brazil's initial National Communication to the UNFCCC, in 1994, LULUCF contributed 75% of Indonesia's CO_2 emissions and 55% of overall GHG emissions (Ministry of Science and Technology 2004). More recently, those estimates still hold true for 2005 (Cerri *et al*. 2009). Incorporating these sectors, Brazil has been estimated to contribute a much higher percentage to global emissions of around 3% (bringing their rank among the top 25 emitters closer to 7th overall).

[182] http://csoforum.net/attachments/Synthesis%20Roadmap%20Dec09.pdf

As a non-Annex I country, Brazil has made no commitment under the Kyoto Protocol to reduce GHG emissions below 1990 levels by the year 2012. Between 1990 and 2007, CO_2 emissions from the burning of fossil fuels in Brazil increased 76%. Total GHG emissions from LULUCF in Brazil are estimated to have increased 11% between 1990 and 2005. Under the Copenhagen Accord, Brazil has pledged a variety of quantified targets in various sectors that will ultimately result in an estimated reduction in GHG emissions of 36.1 to 38.9% by 2020. In 2009, Brazil announced that it had already met its target for reducing deforestation originally set for 2013 (Pimm 2009). According to the Brazilian government, after successfully implementing the National Climate Change Action Plan, they have met their 2020 goals as of late 2010, primarily through increased enforcement leading to a large reduction in deforestation. In 2009, Brazil reduced its GHG emissions 33.6% below 2004 levels. At the U.N. climate conference in Copenhagen last year Brazil had pledged to reduce its emissions a further 5% from 2009 levels by 2020 (Colitt 2010). According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Brazil is ranked fourth overall with a performance rating of 'good'. This actually equates to the top spot out of all countries because the first three ranks are reserved for countries doing enough to reduce their GHG emissions per capita enough to meet the requirements for keeping further global temperature increase to below 2° C and no countries meet those criteria (Burck *et al*. 2010). Of note, however, is that deforestation and land use, making up around 20% of global GHGs, are also not included in the index due to lack of consistent available data globally.

Brazil released its National Climate Change Action Plan in 2008 (Government of Brazil 2008), to be implemented by the Interministerial Committee on Climate Change and its Executive Group, established a year earlier, in collaboration with other fora and institutions such as the Brazilian Forum on Climate Change, Interministerial Commission on Global Climate Change, the III National Conference on the Environment and the State Fora on Climate Change, and civil society organizations. One of the primary objectives outlined in the plan is increasing energy efficiency. The National Energy Efficiency Policy will represent a reduction in electricity consumption of around 10% in 2030, which can avoid emissions of 30 million tons of CO_2 the same year, through increased use of solar heating, replacement of old refrigerators, replacing coal with charcoal, increasing recycling, and other agricultural projects. Renewable energy already represents a large proportion of Brazil's energy source (45.8% as of 2008) so maintaining that position is another plan objective. The plan also calls for increased use of biofuels, reduced deforestation, and dedicated scientific research on climate change and its impacts.

Taiwan (1.0%). Taiwan currently ranks 23rd in overall GHG emissions. Taiwan is included in the list of top 25 GHG emitting countries, but because Taiwan lacks UN membership (due to its political relationship with mainland China), Taiwan is not a signatory party to the UNFCCC or its Kyoto protocol, and thus cannot be formally represented at the UN's annual climate conference (EPA Taiwan 2009a). However, Taiwan has and continues to show a desire and willingness to be included as a member in the UNFCCC. GHG emissions in Taiwan increased by 122% from 1990 to 2008 (EPA Taiwan 2009b). While its GHG emissions decreased for the first time between 2007 and 2008, outside factors such as the economic recession and decrease of energy consumption due to oil and electricity prices were the main factors in GHG reduction (EPA Taiwan 2007). Again, as a non-member of the UN, they are also unable to make a pledge

under the Copenhagen Accord. In 2008, however, newly-elected President Ma Ying-jeou laid out an ambitious plan to cut GHG emissions, and established targets to keep emissions to the 2008 level by 2020, reducing to the 2000 level by 2025, and then to half the 2000 level by 2050 (EPA Taiwan 2009c). According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Taiwan (Chinese Taipei) is ranked 47th overall with a performance rating of 'poor' (Burck *et al*. 2010).

Taiwan's Environmental Protection Administration has been implementing a GHG inventory project since 2004. In order to show the international community their efforts and achievements to gain support for acceptance into the UNFCCC, Taiwan has implemented a number of laws and actions related to GHG emission reductions[183]. In 2008, the Executive Yuan (the executive branch of the Republic of China Government) passed the draft Greenhouse Gas Reduction Act, which was then submitted to the Legislative Yuan for deliberation. Jointly developed by the government and the private sector, the Act establishes a framework to regulate GHG emissions based on emission efficiencies and new-source emissions, as well as penalties for non-compliance. In addition to serving as the legal basis for developing and implementing domestic GHG emission reduction measures, the Act is also expected to demonstrate to the international community Taiwan's willingness to participate in global actions to reduce GHG emissions and to fulfill its responsibilities as a member of the international community. The legislative process for this Act is still in progress as of January 2011. When the Act becomes effective, an emissions permit system, inventory verification and reporting, and emission performance standards will be enforced. In 2009, Taiwan passed the Renewable Energy Act, establishing a foundation for long-term renewable energy development. This Act intends to reduce GHG emissions by enhancing energy efficiency, scaling up the total amount of renewable energy over the next 20 years, and using an incentive-based purchasing mechanism to encourage renewable energy use. In addition, Taiwan's Ministry of Economic Affairs developed a Sustainable Energy Policy, which targets energy, the economy and the environment and has three specific objectives listed. Objectives include improving energy efficiency by more than 2% per annum, so that when compared with the level in 2005, energy intensity will decrease 20% by 2015, developing clean energy by increasing the share of low carbon energy in electricity generation systems from the current 40% to 55% in 2025, and building a stable energy supply system to meet economic development goals, such as 6% annual economic growth rate from 2008 to 2012, and US$30,000 per capita income by 2015.

Thailand (1.0%). Currently, Thailand ranks 24th in overall GHG emissions. As a non-Annex I country, Thailand has made no commitment under the Kyoto Protocol to reduce GHG emissions below 1990 levels by the year 2012. As in other parts of Asia, Thailand's CO_2 emissions per capita per year have increased in recent decades, rising approximately 170% between 1990 and 2004. Although emissions dropped following the 1997-1998 financial crisis, they continued to increase from 1999 through 2007 (Bangkok Metropolitan Administration 2010). Overall, between 1990 and 2007, Thailand's CO_2 emissions from the burning of fossil fuels increased 190%. Thailand has yet to make an official commitment under the Copenhagen Accord. According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change

[183] http://estc10.estc.tw/ghgenglish/Reduction_GHG.asp

policy, Thailand is ranked 19th overall with a performance rating of 'moderate' (Burck *et al*. 2010).

Thailand's climate strategy includes taking advantage of the Clean Development Mechanism under the Kyoto Protocol (Ministry of the Environment, Japan 2006). In 2003, the Ministry of Natural Resources and Environment was named the designated national authority in matters pertaining to Clean Development Mechanism projects. The Office of Natural Resources and Environmental Policy[184] is the designated national authority Secretariat and the national focal point for UNFCCC. The National Climate Committee provides overall policy direction. The Office of Natural Resources and Environmental Policy has drawn up the national sustainable development criteria and indicators and Clean Development Mechanism approval procedures. Thailand has already registered 17 Clean Development Mechanism projects. In August 2006, the Government of Thailand set up a National Board on Climate Change Policy, Climate Change Coordinating Office under the Office of Natural Resources and Environment, and Thailand Greenhouse Gas Management Organization[185] to supervise Clean Development Mechanism implementation in Thailand (Ministry of the Environment, Japan 2006).

The government also developed various Action Plans and strategies to deal with climate change in different sectors of the government. Its first National Strategy on Climate Change (2008-2012) was released in 2006. Thailand's 10th five year economic development plan (2007-2011) focuses on the "self-sufficiency economy" and briefly incorporates the National Climate Action Plan which sets a target of CO_2 emission reduction of 5% from 2003. Thailand presented its Initial National Communication to the UNFCCC in 2000 which summarized available mitigation options including improvement of energy efficiency, renewable energy sources, reforestation, and agriculture waste treatment (Office of Environmental Planning and Policy 2000). The Bangkok Metropolitan Administration developed an Action Plan on Global Warming Mitigation 2007 – 2012 which is intended to reduce GHG emissions by at least 15% of those anticipated in the year 2012 under a business as usual scenario. The Ministry of Energy developed an Alternative Energy Development Plan (2008 – 2022) to serve as a roadmap to promote alternative energy use by increasing the share of commercial alternative energy from 0.5% in the year 2003 to 20% of total country final energy demand in the year 2022. For the most part, these plans focus on promotion of renewable energy and energy conservation as important strategies that will enable the country to achieve its aim of energy security and reduction of dependence on imported fuels. Because the highest GHG emitting sector is the electricity sector (Limmeechokchai and Suksuntornsiri 2006), principle mitigation strategies include energy efficiency, renewable energy and cleaner technology, urban green space, eco-buildings, mass transport infrastructure, and reduced emissions from industrial processes. Goals for institutional capacity building and international cooperation are also commonly included.

In April 2008 the Government announced new energy conservation measures aimed at saving around $50 billion per year in energy bills including things like interest free household loans for energy saving appliances, incentives to retrofit industry for energy conservation, mandatory power usage labeling for manufacturers of electric and electronic appliances, compulsory energy

[184] http://www.onep.go.th/cdm/
[185] http://www.tgo.or.th/english/index.php?option=com_content&task=section&id=6&Itemid=30

saving features to be included in design of new buildings, and energy standards for commerce and industry.

After the 2009 climate talks in Copenhagen, the Royal Thai Government, in partnership with the Thai Working Group for Climate Justice and the United Nations in Thailand, held a major development cooperation seminar entitled "Beyond Copenhagen: Implementing Thailand's Climate Change Strategy." Over 150 representatives from government, civil society, local communities, international organizations, academia, the private sector and the media, came together to debate the outcome of the COP 15 Conference and its implications for Thailand, and how best to ensure that the general public is better informed and more closely involved in future climate change policy planning and implementation. The general consensus was that the National Climate Change Strategy is a good one.

Kazakhstan (0.8%). Currently, Kazakhstan ranks 25th in overall GHG emissions. Kazakhstan's first National Communication to the UNFCC (1998) announced that it was prepared to join Annex I and take on a quantified GHG emissions reduction target. Upon entry into force of the Kyoto Protocol, it became an Annex I Party under the Protocol, although remains a non-Annex I party under the UNFCCC. As this declaration had not been made when the Protocol was adopted, Kazakhstan does not have an established emissions reduction target under the Kyoto agreement. Nevertheless, in its Second National Communication to the UNFCCC in 2009, Kazakhstan notes that it has undertaken annual GHG inventories since 2001 and analyzes emissions from 1990, 1992, 1994, and 1998 – 2005 and states it is working toward a voluntary target of 15% below 1992 levels of GHG emissions under the Copenhagen Accord. Kazakhstan's GHG emissions showed a steady decline through the 1990s due to the reduction of livestock animals, size of agricultural lands and amount of mineral fertilizers. This trend changed following the reorganization of the agricultural sector in 2000, with GHG emissions in 2005 exceeding the 2000 level by one third (Government of Kazakhstan 2009)[186]. Despite annual growth in GHG emissions since 1999, emissions through 2005 still remained below the 1992 Kyoto baseline year levels. Overall, between 1990 and 2007, Kazakhstan's CO_2 emissions from the burning of fossil fuels have dropped 23% (down 13% from their base year 1992 levels). According to the 2011 Climate Change Performance Index which ranks the top 60 emitting countries in various factors including emissions level, emissions trend, and climate change policy, Kazakhstan is ranked 59th overall, ahead only of Saudi Arabia, with a performance rating of 'very poor,' primarily due to its high relative emissions level (Burck *et al*. 2010).

In Kazakhstan, the Ministry of Natural Resources and Environment is the lead on climate issues and the Climate Change Coordination Center is a quasi-governmental institute under its auspices. The Interagency Commission on Ratification of the Kyoto Protocol and Implementation of obligations under the UNFCCC was established in 2000 and oversees climate policies in the context of international agreements. Thirteen key sources of emissions were identified in 2009, seven of which comprise the 'energy activity' category. A primary source of GHG emissions is energy (fuel combustion) amounting for 72% in 2005. The second contributor is agriculture, the proportion of which has reduced from 15% in 1990 to 9% in 2005 (Government of Kazakhstan 2009). As such, Kazakhstan's primary climate change related policies are geared toward the

[186] Although EIA estimates 2005 levels are 17.5% higher than 2000 and 2006 levels are closer to one third higher at a 28% increase (EIA 2009).

energy sector and increasing energy efficiency. Its main policy came into effect in 1997 and more recently the government is focusing on an energy saving program for 2005-2015. In particular, they plan to focus on increasing renewable energy sources like wind, hydroelectric, solar, and geothermal power. As of 2009, three projects to restore or build new hydroelectric power stations were underway. Wind electrical station legislation is being coordinated which, along with hydro-power, is expected to increase electrical energy output from renewable sources to 5% by 2024. It is also acknowledged that to reduce GHG emissions, the country will have to move away from a large emphasis on agriculture and toward a more modernized industry.

Kazakhstan estimates that, if renewable energy policies and measures are implemented effectively, the total reduction of GHG emissions relative to the baseline scenario could amount to more than 31 million tons of CO_2 by 2016 and 72 million tons by 2024 (Government of Kazakhstan 2009). They acknowledge, however, that the future scenario including increased use of renewable energy sources will require substantial financial investment, a source for which they have yet to identify.

2.2.3 Summary of Regulatory Mechanisms Addressing Climate Change Threats

The Montreal Protocol has been contributing to the reduction of global GHG emissions since 1989. By phasing out ozone depleting substances (ODS), the world has avoided the equivalent of 135 Gt CO_2 between 1990 and 2010 which is thought to have effectively slowed the rate of warming and other climate change impacts by 7 to 12 years, as compared to what would have happened under the continued use of ODS. As of 2010, net emissions reductions from ODSs are ~11 Gt CO_2 eq. per year which is 5-6 times the reduction target of the first commitment period of the Kyoto Protocol (2 Gt CO_2 eq. per year) (Velders *et al*. 2007; see Figure 3). This progress, however, is threatened by the rapidly increasing use of hydroflourocarbons (HFCs) and continued use of HCFCs as replacements for the ODSs that have been phased out. The Protocol recognizes HCFCs as transitional substitutes for CFCs being phased out that will eventually be phased out themselves. In September 2007, the parties agreed to an accelerated phase-out of HCFCs under the Montreal Protocol (UNEP 2007).

HFCs, commonly used to replace CFCs, are not covered by the Montreal Protocol as they are not ozone depleting substances and their consumption is projected to increase rapidly over the next few decades without regulation, particularly in developing countries (Velders *et al.* 2009). HFCs range from 140 to over 11,000 in global warming potential (GWP)[187] and so are considered a suite of "super" greenhouse gases. While HFCs are included under the Kyoto Protocol, the issue remains that the rapid growth in HFC consumption in non-Annex I countries will not be addressed via Kyoto because non-Annex I parties do not have emissions reduction targets. Recent developments among parties to the Montreal Protocol have included discussions of expanding the scope of the Protocol to incorporate more of a climate related purpose and negotiating agreements to phase-out the use of HFCs (Sustainable Business.com News 2010; Broder 2010). The Federated States of Micronesia has been promoting this approach for the past four years. In 2010, the U.S., Canada, and Mexico showed support by submitting a proposal to

[187] The concept of a global warming potential (GWP) was developed to compare the ability of each greenhouse gas to trap heat in the atmosphere relative to another gas. The definition of a GWP for a particular greenhouse gas is the ratio of heat trapped by one unit mass of the greenhouse gas to that of one unit mass of CO_2 over a specified time period; typically 100 years is used. (http://www.epa.gov/highgwp1/scientific.html)

the rest of the Parties proposing a phase-out schedule for HFCs by which developed countries would reduce production and consumption to 15% of current levels before 2035 and developing countries would match that reduction by 2045 (UNEP 2010b). The EPA estimates adopting this phase out schedule could eliminate 3.1 Gt CO_2 eq. by 2020 and 88 Gt CO_2 eq by 2050, and slow global warming by another decade. Velders *et al.* (2009) propose an estimate of direct effect in the range of 110 – 170 Gt CO_2 eq. by 2050 (see Figure 3). The 22nd meeting of the Parties to the Montreal Protocol took place in Bangkok, Thailand, November 8-12, 2010. During discussions of the proposal to include HFC phase-out under the Montreal Protocol, Brazil, India and China voiced their opposition, stating that HFCs are not ODSs and are therefore outside the purview of the Protocol. Other parties were also hesitant to make decisions on a GHG at these talks and suggested tabling the issue as it would be addressed in December 2010 in Cancun, Mexico at the next round of UNFCCC climate talks (IISD 2010). No formal decision was adopted by the meeting of the parties.

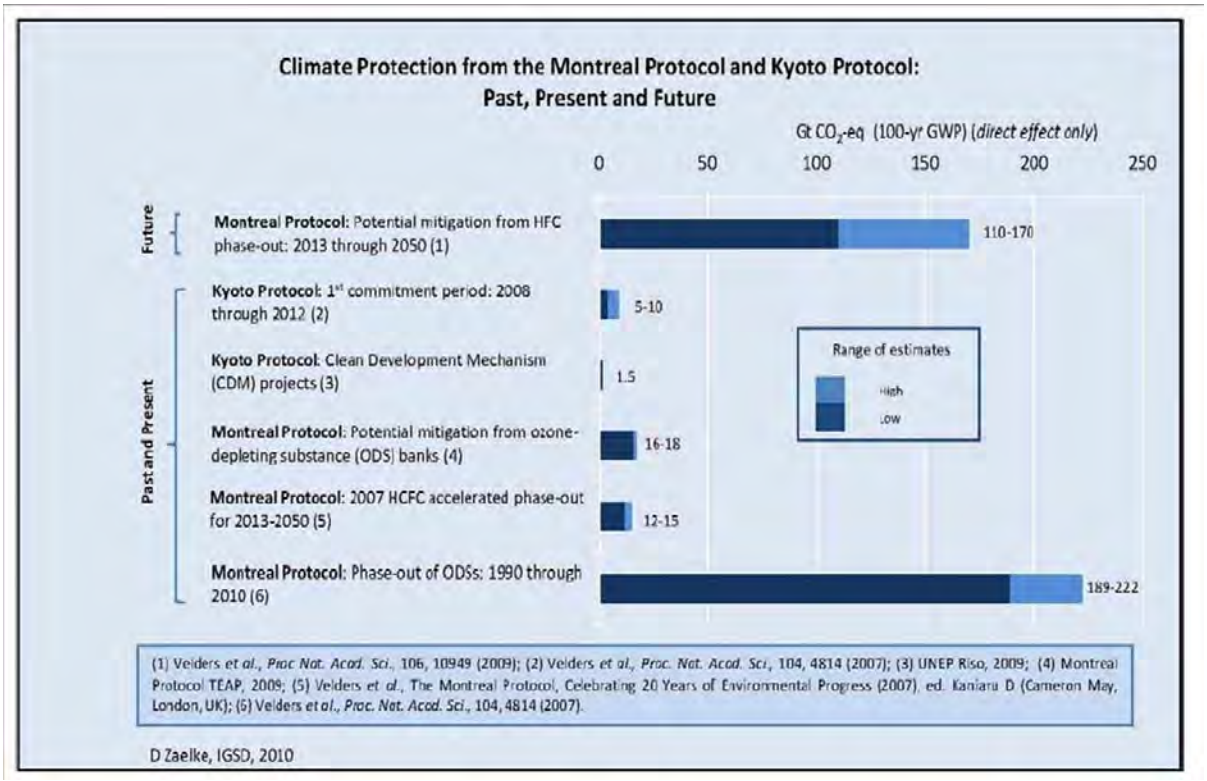

Figure 6. From: Summary of Federated States of Micronesia 2010 Proposal to Strengthen Climate Protection Under the Montreal Protocol presented to the 22nd Meeting of the Parties (MOP-22) of the Montreal Protocol in Bangkok, Thailand November 2010.

Although the UNFCCC was a widely supported effort with a large number of signatories, the Convention originally called for voluntary action to reduce emissions of GHG to 1990 levels by 2000. Although many Annex I countries met this goal individually, globally, GHG emissions grew well above 1990 levels by 2000. In 2009, global GHG emissions had increased 25% since 2000 and almost 40% since 1990 (Olivier and Peters 2010; Global Carbon Project 2010a) (See Table 5). Without the introduction of new laws and policies to reduce GHG emissions or changes to the existing ones, total world GHG emissions are projected to increase to 97% above 1990 levels by 2035 (EIA 2010a).

The Kyoto Protocol to the Convention is the first legally binding agreement intended to continue global progress in reducing GHG emissions. It is stronger than the original terms of the UNFCCC in that it is a legally binding agreement that sets specific ceilings on GHG emissions for individual countries. However, the top three contributors to global GHG emissions (China, the U.S., and India; accounting for ~ 48% of global GHG emissions) have not established official reduction targets under Kyoto. The United States has signed but does not intend to ratify the Protocol as long as non-Annex I countries are not committed to emissions reductions targets alongside Annex I countries (CRS 2006). Instead, the U.S. pledged a voluntary GHG emission reduction target of 7% below 1990 levels by 2012, although as of 2008, emissions have grown in the U.S. to 14% above 1990 levels. India and China are non-Annex I countries and are not required to establish reduction targets under Kyoto. Collectively, participating Annex I countries reduced CO_2 emissions in 2009 by about 7%. Assuming that the non-CO_2 greenhouse gas emissions show a similar trend, total 2009 emissions of Annex I countries are about 6% lower than in 1990 (10% lower including LULUCF), the base year for the Protocol (Olivier and Peters 2010), indicating the world is on track to meet the individual obligations at the national level set forth under Kyoto. However, this does not necessarily translate into a reduction of the rate of global warming or in overall emissions for several reasons. First, in most cases, the driver of reduced GHG emissions has not been policy change for long-term stability or infrastructure changes including conversion to cleaner energy sources; rather, a large part of the decrease is due to a freeze or drop in economic activity in response to the recent credit crisis. Greenhouse gas emissions could rapidly increase toward pre-recession levels as industrialized countries grow out of recession (Olivier and Peters 2010). Secondly, overall there was no reduction in global GHG emissions in 2009 because emissions in India and China increased at a high enough rate (6% and 9% respectively) to nullify reductions made by Annex I countries (Olivier and Peters 2010). While the targets outlined in Kyoto provide a good foundation for future negotiations for further reductions in GHG emissions, not including commitments for non-Annex I countries that contribute a large portion of global emissions limits the potential effectiveness of the Protocol in actually reducing the rate of global climate warming. Additionally, the Kyoto Protocol and its current requirements expire as of the end of 2012.

The Copenhagen Summit was expected to produce a subsequent agreement to the Kyoto Protocol defining GHG emissions reduction targets beyond 2012. While no agreement was universally adopted, the Copenhagen Accord resulted which recognizes the importance of keeping global warming capped at a 2°C increase. There has been widespread participation by countries making pledges for GHG emissions reduction targets under the Copenhagen Accord, which are intended to meet the 2°C target in aggregate. The 2°C target is described as the maximum allowable warming to avoid dangerous anthropogenic interference in the climate in terms of disruptions in economic, social, political, and biological systems on a global scale. The target has both supporters and critics who argue that it is infeasible, expensive, and an inappropriate way to frame climate policy (Randalls 2010). Nevertheless, UNFCCC member countries have agreed upon this target.

Table 5. Summary of Top 25 GHG emitters: Emissions reduction commitments, progress, and emissions trends since 1990.

Country	% of Total Global Emissions (in 2007, ex. LULUCF)[1]	Kyoto Commitment (change relative to 1990 levels by 2012)	Change in GHG emissions 1990-(most recent year available) (ex. LULUCF)[2]	Copenhagen Commitment (change by 2020 relative to (base year))
Annex I:				
U.S.	19.9%	-7%[3]	+16.5% (2008)	-17% (2005)
Russian Fed.	5.2%	0%	-34.1% (2008)	-15 – 25% (1990)
Japan	4.3%	-6%	+1% (2008)	-25% (1990)
Germany	2.7%	-21%	-21.4% (2008)	-20 – 30% (1990)[4]
Canada	1.9%	-6%	+24.1% (2008)	-17% (2005)
U.K.	1.8%	-12.5%	-16.9% (2008)	-20 – 30% (1990)[4]
Italy	1.6%	-6.5%	+6.9% (2008)	-20 – 30% (1990)[4]
Australia	1.3%	+8%	+29.4% (2008)	-5% - 25% (2000)
France	1.3%	0%	-5.6% (2008)	-20 – 30% (1990)[4]
Spain	1.2%	+15%	+42.5% (2008)	-20 – 30% (1990)[4]
Ukraine	1.1%	0%	-53.9% (2008)	-20% (1990)
Poland	1.1%	-6%	-29.6% (2008)	-20 – 30% (1990)[4]
Turkey	1.0%	none yet[5]	+103.2% (2008)	none
	Total: 44.4%	**Average Commitment: -7%**	**-6.1% [ex. LULUCF] (2008)**[6]	**Aggregate: -12 - 18% (1990)**[7]
Non-Annex I:				
China	22.3%	N/A	+ 165% (2007)	-40 - 45% (2005)[8]
India	5.5%	N/A	+133% (2007)	-20 – 25% (2005)[8]
Iran	1.7%	N/A	+118% (2007)	none
South Korea	1.7%	N/A	+108% (2007)	-30% (BAU)[9]
Mexico	1.6%	N/A	+32% (2007)	-30% (BAU)[9]
South Africa	1.5%	N/A	+30% (2007)	-34% (BAU)[9]
Saudi Arabia	1.4%	N/A	+87% (2007)	none
Indonesia	1.4% (~5%)[10]	N/A	+166% (2007)	-26% (BAU)[9]
Brazil	1.3% (~3%)[10]	N/A	+76% (2007)	-36 - 39% (BAU)[9]
Taiwan[11]	1.1%	N/A	N/A	N/A
Thailand	1.0%	N/A	+190% (2007)	none
Kazakhstan	0.8%	N/A[12]	-23% (2007)	-15% (1992)
	Total: 41.3%	N/A		N/A[14]
Global Totals:	**85.7%**		**World: +49% (2010)**[13]	

[1] Data from World Bank via Google Public Data. http://www.google.com/publicdata/overview?ds=d5bncppjof8f9 .
[2] Data for Annex I countries are from their 2010 Annual GHG Inventory submissions to UNFCCC. Data for Non-Annex I countries are from World Bank via Google Public Data.
[3] The US is a signatory to Kyoto but has not ratified therefore has made no official pledge under the Protocol. The US instead made a voluntary plegde to reduce GHG emissions to 7% below 1990 levels by 2000.
[4] The European Union as a whole has pledged a 20-30% reduction below 1990 levels, to be accomplished by varied reductions among different member countries.

[5] Annex I countries that were not UNFCCC parties at the time of signing the Kyoto Protocol have no reduction target assigned.
[6] Source: http://unfccc.int/resource/docs/2010/sbi/eng/18.pdf.
[7] Source: den Elzen and Hohne 2008.
[8] Reductions in Emissions Intensity (emissions per unit of GDP), not overall emissions.
[9] Expected reduction below projected 2020 emissions under the "Business As Usual" (BAU) scenario.
[10] Because the majority of GHG emissions in Brazil and Indonesia are from the LULUCF sector which contributes minimally to most other countries, including these data for Brazil and Indonesia substantially changes their overall % contributions to global emissions and rank within the top 25 emitters.
[11] Although Taiwan wants to become a UNFCCC Party, they have thus far been precluded from doing so because of their political relationship with China. Therefore, emissions estimates are unavailable and pledges cannot be made under Kyoto or Copenhagen.
[12]Kazakhstan is a Party included in Annex I for the purposes of the Kyoto Protocol in accordance with Article 1, paragraph 7, of the Protocol, but Kazakhstan is not a Party included in Annex I for the purposes of the Convention
[13] Source: Global Carbon Project Carbon Budget 2010. Released Dec. 5 2011 (http://www.globalcarbonproject.org/carbonbudget/index.htm).
[14]In contrast to the relatively precise pledges of developed countries under the Copenhagen Accord, developing countries specify their mitigation actions, labeled as Nationally Appropriate Mitigation Actions (NAMAs), in a variety of ways, making it difficult to determine an aggregate reduction target for this group (Rogelj *et al.* 2010).

The Climate Change Performance Index (Burck *et al*. 2010) evaluates and compares the climate protection performance of the top 60 GHG emitting countries that are together responsible for more than 90% of global energy-related CO_2 emissions. Performance rankings are based on an index including emissions level, emissions trend, and national and international climate change policy in each country. Each year, the top three ranks are reserved for countries that have reduced per capita emissions enough to meet the requirements to keep the increase in global temperature below 2°C. According to the 2011 report, no countries are meeting those criteria. Importantly, the performance of the top 10 emitters that account for over 60% of global emissions is of particular concern as all but three of them are ranked as either 'poor' or 'very poor' in overall performance (Burck *et al*. 2010). Among participants in the Copenhagen agreement, a common theme among non-Annex I party pledges is that they contain ambitious goals but are dependent upon external funding and contingent upon what developed countries pledge to accomplish. In particular, the U.S. and China both contribute the largest proportions to global emissions and both have 'very poor' ranks in the 2011 Climate Change Performance Index.

3. Conservation Efforts

As mentioned in the Introduction, the purpose of this Management Report is also to identify and summarize conservation efforts pursuant to ESA section 4(b)(1). For the purposes of this report, conservation efforts are defined as non-regulatory or voluntary conservation actions undertaken by both governmental and non-governmental organizations (NGOs, e.g., conservation groups, private companies, academia, etc.) intended to abate threats described in the BRT Report (Kobayashi *et al*. 2011) or incidentally doing so. Conservation efforts with the potential to address threats to bumphead parrotfish include, but are not limited to: fisheries management plans, coral reef monitoring, coral reef resilience research, coral reef education and/or outreach, marine debris removal projects, coral reef restoration, and others. These conservation efforts may be conducted by countries, states, local governments, individuals, NGOs, academic institutions, private companies, individuals, or other entities. They also include global conservation organizations that conduct coral reef and/or marine environment conservation projects, global

coral reef monitoring networks and research projects, regional or global conventions, and education and outreach projects throughout the range of bumphead parrotfish.

As described in Section 1.2, threats to bumphead parrotfish that can be addressed by regulating or influencing human behavior include: Harvest (adult harvest, juvenile harvest), Habitat loss/degradation (juvenile habitat loss/degradation, adult habitat loss/degradation, pollution), and Climate Change (global warming, ocean acidification). As with regulatory mechanisms, our discussion of existing conservation efforts addresses Harvest and Habitat Loss/Degradation threats separately from Climate Change threats because Harvest and Habitat Loss/Degradation threats are generally due to localized human activities, whereas Climate Change threats are generally due to global processes fueled by anthropogenic carbon emissions worldwide. These two types of threats are generally targeted separately and on different scales by entities implementing conservation efforts throughout the range of bumphead parrotfish.

3.1 Conservation Efforts Addressing Harvest and Habitat Loss/Degradation Threats

Several international, regional, and local programs exist that conserve bumphead parrotfish habitat under the umbrella of biodiversity conservation. Numerous international and multinational agreements and conventions regarding the conservation of both coral reef ecosystems specifically and the marine environment in general have been implemented as well. In addition, numerous non-governmental organizations (NGO) support coral research, monitoring, restoration and protection. For a relatively exhaustive list of coral-centric NGOs visit the International Coral Reef Information Network (ICRIN) website.[188]

International Conservation Efforts:

Conservation International (CI)[189] CI is an NGO whose mission is to assist communities to responsibly and sustainably care for nature, biodiversity, and humanity. CI is staffed with scientists, managers, and policy analysts all working to provide current information used by governments and international organizations in policy making decisions. One example of a project CI is working on the range of bumphead parrotfish is the Oceanscapes Initiative, which works closely with the heads of state and six governments in the Coral Triangle[190] region. Also through Oceanscape, CI is working closely with the government of Kiribati to launch a multi-governmental effort to improve ocean health.

Global Coral Reef Monitoring Network (GCRMN)[191] The objectives of the GCRMN are to connect and train people and organizations in monitoring ecological, social, cultural, and economic aspects of coral reefs by providing a monitoring program framework; and to enable people at the local, regional, and global level to disseminate information on the sustainable use and conservation of coral reefs. Monitoring experts in each of these fields train trainers in participating countries and information on coral reef status is gathered into databases within the GCRMN. For example, experts from Reef Check train people in ecological monitoring and the Socioeconomic Manual for Coral Reef Management is used to train people in socioeconomic

188 http://www.coralreef.org

189 http://www.conservation.org/Pages/default.aspx

190 http://www.conservation.org/sites/marine/initiatives/oceanscapes/cti/Pages/overview.aspx

191 http://www.gcrmn.org/

monitoring. All these data are gathered into ReefBase so that researchers around the world can access it.

The Global Programme of Action (GPA)[192] The GPA for the Protection of the Marine Environment from Land-Based Activities was adopted in 1995 and is designed to be a source of conceptual and practical guidance to national and/or regional authorities for devising and implementing that prevents, reduces, controls, and/or eliminate marine degradation from land-based activities. More specifically, it is recommended that States identify and assess problems related to food security, poverty alleviation, public health, coastal and marine resources, ecosystem health, economic and social benefits, cultural values, impacts of contaminants, physical alteration and degradation of habitat, and affected or vulnerable areas of concern.

International Coral Reef Initiative (ICRI)[193] ICRI was originally initiated by the governments of Australia, France, Japan, Jamaica, the Philippines, Sweden, the United Kingdom, and the United States in recognition that tropical and sub-tropical coral reefs are facing serious degradation. Additional partners from governments, United Nations organizations, multilateral development banks, environmental and developmental NGOs, and the private sector have subsequently joined the partnership and are currently collaborating in ICRI. The partnership strives to protect and preserve coral reefs and their related ecosystems by calling on states to: "identify marine ecosystems exhibiting high levels of biodiversity and productivity and other critical habitat areas and should provide necessary limitations on use of these areas, through, inter alia, designation of protected areas" (Chapter 17, Section 17. 86, ICRI). ICRI objectives call for governments and international organizations to strengthen their commitments to programs at the local, national, regional, and international levels to conserve, restore, and promote sustainable use of coral reefs and associated environments. Objectives also include development of management provisions for protection, restoration, and sustainable use of coral reefs and associated environments, strengthening capacity for development and implementation of policies, management, research, and monitoring of coral reefs and associated environments, and establishment or maintenance of international, regional and national research and monitoring programs to ensure efficient use of scarce resources and a flow of information relevant to management of coral reefs and associated environments.

International Coral Reef Action Network (ICRAN)[194] ICRAN was established in 2000 with a historic grant from the United Nations Foundation (UNF). It was formed in response to a Call to Action by the International Coral Reef Initiative (ICRI), ICRAN supports the implementation and regular review of ICRI's Framework for Action. The main objectives of ICRAN are to link scientific monitoring and management activities in coral reefs systems across local, national, and global scales. Traditional knowledge, training, and information about alternative livelihoods are shared within ICRAN.

International Union for Conservation of Nature (IUCN) Also known as the World Conservation Union, IUCN helps the world find pragmatic solutions to our most pressing environment and development challenges. It supports scientific research, manages field projects all over the world

[192] http://www.seafriends.org.nz/issues/cons/gpa.htm
[193] http://www.icriforum.org/
[194] http://www.icran.org/

and brings governments, non-government organizations, United Nations agencies, companies and local communities together to develop and implement policy, laws and best practices.

IUCN Marine Programme[195] The IUCN's Marine Programme is broken down into 8 separate themes: Climate Change Mitigation & Adaptation, Conserving Threatened Species, Energy & Industry, Fisheries & Aquaculture, Managing Marine Invasive Species, Marine Protected Areas, and Ocean Governance. Under the Climate Change Mitigation & Adaptation theme, the IUCN conducts work in the areas of coral reef monitoring, research, resilience, and ocean fertilization and other geo-engineering issues.

IUCN Climate Change and Coral Reefs Marine Working Group (CCCR)[196] The main objective of the Working Group is to form a bridge between theoretical science and management in coral reef ecosystems. They address this by identifying information gaps and issues through workshops and research tracks to synthesis the most recent and relevant information, especially that pertaining to coral reefs and climate change. Projects under implementation of the CCCR include measuring resilience in coral reef monitoring programs and rapid resilience assessments of coral reefs around the world, improving bleaching early warning and response plans, measuring herbivory, and creating a resilience bibliography and coral reef resilience and resistance DVD.

IUCN Red List of Threatened Species[197] The main objective of the IUCN Red List is to organize and evaluate the conservation status of plant and animal species around the world. Many government institutions and NGOs refer to, or adopt, this list to help in conservation decisions. The IUCN had listed the bumphead parrotfish as vulnerable.

Man and the Biosphere Programme (MAB)[198] The MAB, started in the early 1970s, proposes an interdisciplinary research agenda and capacity building aiming to improve the relationship of people with their environment globally. It notably targets the ecological, social and economic dimensions of biodiversity loss and the reduction of this loss. It uses its World Network of Biosphere Reserves as vehicles for knowledge-sharing, research and monitoring, education and training, and participatory decision-making. Coastal marine biosphere reserves are reference sites for monitoring coastal and marine biodiversity. Marine protected areas are essential for observing and measuring human impacts on the coastal/marine habitats and developing more rigorous and innovative guidelines for their conservation and sustainable management. Biosphere reserves are sites of excellence recognized under UNESCO's Man and the Biosphere Programme. They offer privileged arenas for melding science and society. Their system of zoning allows targeted management, with different requirements for protection, scientific research, and human use; a great number of these requirements encompass coastal and marine areas.

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[195] http://www.iucn.org/about/work/programmes/marine/
[196] http://www.iucn.org/cccr/
[197] http://www.iucnredlist.org/about/red-list-overview#introduction
[198] http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/man-and-biosphere-programme/

The Nature Conservancy (TNC)[199] TNC is an NGO with marine conservation staff and projects in more than 33 countries and all coastal U.S. states and territories, The Nature Conservancy works with partners to create lasting conservation results that benefit marine life, local communities and economies. TNC's Marine Conservation Initiative is working toward a future of healthy oceans that support plants, animals and people for generations. Their work is focused on restoring coastal habitats, helping people and marine life adapt to climate change, developing better approaches for fisheries, and expanding ocean protection and improving management. The Nature Conservancy also works to create networks of protected areas, in order to help nearby degraded marine habitats recover and rebuild. TNC also works with local communities to provide managers with tools and training to help make their reefs stronger in the face of climate change and are currently partnering with NOAA to advance coral reef conservation efforts in seven United States coral reef jurisdictions. TNC, along with partners like NOAA, offer reef resilience training to coral reef managers around the world to implement strategies that address the effects of climate change.

Regional seas partnership on marine and coastal protected areas (UNESCO-UNEP (United Nations Environment Programme) Regional Seas- CBD (Convention on Biological Diversity))[200] This is a partnership on Marine and Coastal Protected Areas. It is designed to coordinate information related to marine and coastal protected areas in United Nations and other international processes. The aim is to contribute to establishing representative networks of marine protected areas by 2012, as agreed at the World Summit on Sustainable Development.

Reef Check Foundation[201] Reef Check is a global NGO established to facilitate community education, monitoring and management of coral reefs. Reef Check is active in more than 70 coral reef countries and territories, where it seeks to: educate the public about the coral reef crisis and how to prevent it; create a global network of volunteer teams that regularly monitor and report on reef health under the supervision of scientists; scientifically investigate coral reef processes; facilitate collaboration among academics, NGOs, governments and the private sector to solve coral reef problems; and stimulate community action to protect remaining pristine reefs and rehabilitate damaged reefs worldwide using ecologically sound and economically sustainable solutions. Under the ICRI framework, Reef Check is a primary GCRMN partner and coordinates GCRMN training programs in ecological and socio-economic monitoring, and coral reef management throughout the world.

Territorial Use Rights in Fisheries (TURFs) TURFs are community-controlled fishing areas established around the world. They are managed either by traditional or modern methods by legal or illegal terms (Christy 1982).

United Nations Environment Programme (UNEP)[202] The UNEP was established in 1972 to address environmental issues within the United Nations system. UNEP's mission is to "provide leadership and encourage partnering in caring for the environment by inspiring, informing, and

[199] http://www.nature.org/
[200] http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/specific-ecosystems/island-and-coastal-areas/
[201] http://www.reefcheck.org/
[202] http://www.unep.org/

enabling nations and peoples to improve their quality of life without compromising that of future generations." UNEP promotes conservation and sustainable development at the global scale through partnerships and programs around the world. It often acts as a catalyst, advocate, educator, and facilitator to other United Nations entities, international organizations, and private businesses. UNEP's work encompasses assessing global, regional and national environmental conditions and trends; developing international and national environmental instruments; strengthening institutions for the wise management of the environment; facilitating the transfer of knowledge and technology for sustainable development; and encouraging new partnerships and mind-sets within civil society and the private sector.

UNEP's Regional Seas Programme[203] UNEP's Regional Seas Programme was launched in 1974 after the 1972 United Nations Conference on the Human Environment held in Stockholm to address the "accelerating degradation of the world's oceans and coastal areas." The Regional Seas Programme seeks to accomplish this through the sustainable management and use of the marine and coastal environment, by engaging neighboring countries in comprehensive, and though specific actions to protect their shared marine environment. It has accomplished this by stimulating the creation of Regional Seas programmes prescriptions for sound environmental management to be coordinated and implemented by countries sharing a common body of water. There are more than 140 countries participate in 13 Regional Seas programmes established under the auspices of UNEP.

UNESCO's Programs The United Nations Educational, Scientific, and Cultural Organization (UNESCO) has several major programs aimed at conservation of corals and coral reefs, including the World Heritage Convention, the Man and Biosphere Program, and the Regional Seas Partnership on Marine and Coastal Protected Areas.

World Heritage Convention[204] The World Heritage Convention defines the kind of natural or cultural sites which can be considered for inscription on the World Heritage List. The Convention sets out the duties of States Parties in identifying potential sites and their role in protecting and preserving them. By signing the Convention, each country pledges to conserve not only the World Heritage sites situated on its territory, but also to protect its national heritage. The States Parties are encouraged to integrate the protection of the cultural and natural heritage into regional planning programs, set up staff and services at their sites, undertake scientific and technical conservation research and adopt measures which give this heritage a function in the day-to-day life of the community.

Regional/national conservation efforts:
Action Plan for the Protection and Development of the Marine and Coastal Areas of the East Asian Region (1981)[205] This is a plan steered by the Coordinating Body on the Seas of East Asia (COBSEA) made up of the countries of Australia, Cambodia, the People's Republic of China, Indonesia, the Republic of Korea, Malaysia, the Philippines, Singapore, Thailand, and Vietnam. Under this plan, COBSEA assesses the effects of human activities on the marine environment;

[203] http://www.unep.org/regionalseas/about/default.asp
[204] http://whc.unesco.org/en/conventiontext
[205] http://www.cobsea.org/

controls of coastal pollution; protection of mangroves, seagrass and coral reefs; and wastewater management.

The Action Strategy for Nature Conservation in the Pacific Islands Region[206] Developed through the cooperation of countries within the Roundtable for Nature Conservation, this strategy addresses issues concerning nature conservation in the Pacific Islands. The Roundtable had its first meeting in 1997. More recently, each meeting includes representatives from national governments, donors, NGOs, and regional organizations, and produces an action strategy that is updated every five years. In 2007, the Action Strategy for Nature Conservation 2008-2012 was drafted and it links national biodiversity strategies and action plans (NBSAPs) to the regional strategy of nature conservation. Notably, it also suggests that countries within the Roundtable recognize community involvement, traditional rights over natural resources, and sustainable use of resources.

Apia Convention (1976, in force in 1990)[207] This is an agreement between Australia, the Cook Islands, Fiji, France, and Samoa that seeks to preserve unique natural ecosystems across the South Pacific. These can include superlative scenery; striking geological formations; or regions and objects of aesthetic interest or historic, cultural, or scientific value.

Association of the Southeast Asian Nations (ASEAN) Heritage sites[208] ASEAN is an economic and geo-political organization of Indonesia, Malaysia, the Philippines, Singapore, Thailand, Brunei, Burma (Myanmar), Cambodia, Laos, and Vietnam. A list of nature parks, called ASEAN Heritage Parks, was started in 1984 and relaunched in 2004 to protect the natural and cultural sites in this region.

ASEAN Policy Framework for Forestry Cooperation[209] ASEAN countries participate in a Strategic Plan of Action on Forestry with goals to conserve biological diversity, promote sustainable forest management, and eradicate unsustainable practices namely illegal logging and associated trade.

Bay of Bengal Large Marine Ecosystem Project (BOBLME)[210] This project involves the countries of Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka, and Thailand. It is broken into five parts: the Strategic Action Programme; coastal/marine national resources management and sustainability use; improved understanding and predictability of the BOBLME environment (including MPAs); maintenance of ecosystem health and management of pollution; and project management, monitoring and evaluation, and knowledge management.

Coral Reef Initiative for the South Pacific (CRISP)[211] This initiative is sponsored by France and was prepared by the French Development Agency (AFD) as part of an inter-ministerial project

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[206] http://www.sprep.org/Roundtable/

[207] http://www.sprep.org/Factsheets/pdfs/Archive/The%20Apia%20Convention.%20Fact%20sheet%2012-5-Reduced.pdf

[208] http://www.asean.org/15524.htm

209 http://www.aseanforest-chm.org/issue_pages/about/asean_policy_framework_for_forestry_cooperation.html

210 http://www.boblme.org/

[211] http://www.icran.org/action-crisp.html

started in 2002. The Secretariat of the Pacific Community (SPC) is also involved in CRISP which aims to develop a vision for the future of these unique ecosystems and the communities that depend on them and to introduce strategies and projects to conserve their biodiversity, while developing the economic and environmental services that they provide both locally and globally. Also, it is designed as a factor for integration between developed countries (Australia, New Zealand, Japan and US), French overseas territories and Pacific Island developing countries. CRISP has 3 main components:
1) Integrated Coastal Management and Watershed Management (marine biodiversity conservation planning, marine protected areas (MPAs), institutional strengthening and networking, integrated coastal reef zone and watershed management).
2) Development of Coral Ecosystems (knowledge, beneficial use and management of coral ecosystems, reef rehabilitation, development of active marine substances, development of regional data base (ReefBase Pacific)).
3) Programme Coordination and Development (capitalization, value-adding and extension of CRISP Programme activities, coordination, promotion and development of CRISP Programme, support to alternative livelihoods, vulnerability of ecosystems and species, economic task force).

Coral Triangle Initiative[212] This agreement between Indonesia, the Philippines, Malaysia, Timor-Leste, Papua New Guinea, and the Solomon Islands states that each country will develop an action plan to implement four objectives: sea conservation, sustainable marine resource management, protection of endangered species, and adapting to climate change. Partner nations in this initiative include Australia, France, Germany and the United States. Partnering organizations (and sources of funding) include the World Wildlife Fund, Conservation International, and The Nature Conservancy. Destructive fishing is practiced in this region and this initiative is developed to help curtail this practice. This initiative developed a plan for the region entitled "CTI Plan of Action" with the objectives of conducting meetings and working groups, researching topics of interest to the region, promoting the World Ocean Conference, developing a network of MPAs, and establishing an alternative livelihood program.

Eastern and Southern Africa (ESA) Workshop This workshop was organized by the ICSF and International Ocean Institute (IO) to bring together fishworker organizations, NGOs, research institutions, universities, and policy makers from Kenya, Tanzania, Mozambique, South Africa, the Seychelles, and seven other countries bordering the Indian Ocean. It was meant to identify fisheries issues in this area and discuss policies for sustainable fisheries development. To date, two workshops have taken place, one in 2006 and the second in 2008. Among the main issues are human rights, biodiversity and fisheries management strategies that incorporate traditional fishing techniques[213].

Indian Ocean Commission (IOC)[214] This organization composed of the Comoros, Madagascar, Mauritius, the Seychelles, and France promotes sustainable development through diplomacy, the economy, trade, agriculture, fishing, the conservation of resources and ecosystems, culture, science, and education. The IOC regulates illegal fishing as well, mostly tuna and tuna-related fisheries.

[212] http://www.cti-secretariat.net/
[213] http://www.icsf.net/icsf2006/jspFiles/eastAfrica/statement/english/statement_2008.jsp
[214] http://www.fao.org/newsroom/en/news/2007/1000608/index.html

Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment (The Jeddah Convention (established in 1982)[215] This convention was the result of a Regional Intergovernmental Conference and supported by UNEP. It provides an important basis for environmental cooperation in the Region. The Regional Intergovernmental Conference also adopted a "Programme for the Environment of the Red Sea and Gulf of Aden (PERSGA)," and established a Secretariat for the Programme in Jeddah. Additionally, the Conference produced two important tools: (a) an "Action Plan for the Conservation of the Marine Environment and Coastal Areas in the Red Sea and Gulf of Aden"; and (b) a "Protocol Concerning Regional Cooperation in Combating Pollution by Oil and Other Harmful Substances in Cases of Emergency." These provisions are complemented by those of MARPOL and the Basel Conventions. Participating Parties to the Jeddah Convention include: Djibouti, Egypt, Jordan, Palestine, Saudi Arabia, Somalia, Sudan and Yemen. In addition to the Convention, the Conference produced and signed another important instrument, which is also legally binding: the "Action Plan for the Conservation of the Marine Environment and Coastal Areas in the Red Sea and Gulf of Aden." While, as the case in all international and regional conventions, the Jeddah Convention is a legally binding document, it does not include specific control measurements and actions. Hence, the mechanisms of developing associated protocols allow countries for a wide range of actions to be agreed upon on specific problems.

The Kuwait Regional Convention for the Co-operation on the Protection of the Marine Environment against Pollution from Land-Based Sources, 1978 (Kuwait Convention)[216] Through this convention, the governments of Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates agree to coordinate efforts to protect the marine environment. The Convention was adopted with the objective to ensure that development projects and other human activities do not in any way cause damage to the marine environment, jeopardize its living resources or create hazards to human health. Another objective of the Convention was the development of an integrated management approach to the use of the marine environment and the coastal areas in a sustainable way which will allow the achievement of environmental and developmental goals.

The Protocol for the Protection of the Marine and Coastal Environment of the Western Indian Ocean from Land Based Sources and Activities (LBSA Protocol)[217] The LBSA Protocol was added to the Nairobi Convention by the UNEP in 2010. It applies to activities that cause pollution in ports and harbors that contribute to marine and coastal pollution and degradation. These can be point-sources, diffuse sources, and transboundary sources of pollution and harmful activities. Countries under this agreement have yet to ratify the instrument, however, there are present efforts both to ratify and implement the Protocol. It is expected that the LBSA Protocol will contribute to the regional and global efforts to protect the marine and coastal environment of the WIO region from land based sources and activities causing pollution and degradation.

[215] http://www.persga.org/inner.php?id=61
[216] http://maritimesafety.pmo.ir/marineenvironmentprotection-regionaltreaties-kuwaitconvention-en.html
[217] http://www.unep.org/NairobiConvention/LBSA_NCText_SAP_Workshop/index.asp

Locally Managed Marine Areas[218] Locally managed marine areas (LMMAs) are marine areas that are managed at a local level by the coastal communities, landowning groups, partner organizations, and/or collaborative government representatives for sustainable use. The way in which LMMAs are managed is extremely variable, and many of the more formally regulated LMMAs belong in the regulatory mechanism section of this report, and are listed in Appendix A. However, less formally regulated, and/or less known LMMAs, may be considered a type of conservation effort and are not included in Appendix A, thus are included in the Conservation Effort portion of this report. Most LMMAs restrict resource use, and many contain permanent, temporary, or seasonal fishery closures as well as other fisheries controls. Within the range of the bumphead parrotfish, LMMAs are prevalent in parts of Melanesia, including Fiji, the Solomon Islands, and Vanuatu, and appear to be effective at controlling overfishing. An additional advantage of such local management is that the concept can be rapidly transmitted between neighboring communities and islands (Burke *et al*. 2011).

Mangroves for the Future[219] This is a regional initiative coordinated between the UNDP and IUCN and local governments, non-governmental organizations, and community-based organizations in India, the Maldives, Indonesia, Sri Lanka, Seychelles, and Thailand promotes coastal ecosystem management of mangrove habitat, lagoons, estuary, and seagrass systems.

The Micronesia Challenge (launched in 2006)[220] This initiative is a commitment between Micronesian governments to balance the need to use their natural resources today between the the need to sustain those resources for future generations. The five Micronesian governments of the Republic of Palau, the Federated States of Micronesia, the Republic of the Marshall Islands, the U.S. Territory of Guam and the Commonwealth of the Northern Mariana Islands all committed to "effectively conserve at least 30 percent of the near-shore marine resources and 20 percent of the terrestrial resources across Micronesia by 2020." It is supported by a number of nationally and internationally recognized organizations including TNC, CI, MCT, NOAA, DOI, SPREP, SPC, USFWS, USFS, CCN, LMMA, RARE, SOPAC, and FORUM.

The Middle East Peace Park[221] This park originated from a special Research and Monitoring Workshop, hosted by the Aqaba Regional Authority and funded by the Middle East Regional Cooperation Program (MERC), held in Aqaba in December 1996. As a result of this workshop, Israel and Jordan have developed a project for coordinated management and monitoring of a Bi-national Marine Peace Park in the Gulf of Aqaba. This project involves collaboration between the Aqaba Regional Authority (ARA) and the Israel Nature Reserves Authority (NRA) with the participation of the Marine Science Station (MSS) in Aqaba and Israels Inter-university Institute (IUI) as research agencies. Two million dollars for this three-year program is being provided by MERC with contributions in kind from Israel and Jordan, and additional funding by the Jordan Global Environmental Facility sponsored by the World Bank. The project is being coordinated by the NOAA. Both Israel and Jordan look at this program as the basis for longer term collaboration in the future.

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[218] http://www.lmmanetwork.org/
[219] http://www.mangrovesforthefuture.org/index.html

[220] http://www.micronesiachallenge.org/
[221] http://celebrating200years.noaa.gov/magazine/mideast_peace_park/welcome.html

The Mtwara-Quirimbas Complex[222] A shared park between Tanzania and Mozambique was created to reduce pressure on near-shore fisheries and to assess, monitor, conserve and restore coral reefs, mangroves, and seagrass beds.

The Nairobi Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region (The Nairobi Convention) (signed in 1985; came into force in 1996; amended in 2010)[223] All ten Eastern African countries have ratified the convention and include: Comoros, France, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, Somalia, Tanzania, and the Republic of South Africa (Contracting Parties). The convention provides a mechanism for regional cooperation, coordination and collaborative actions, and enables the Contracting Parties to harness resources and expertise from a wide range of stakeholders and interest groups towards solving interlinked problems of the coastal and marine environment. Activities set out by the Nairobi Convention include: assessing pollution loads affecting the marine environment, and their harmful effects; setting up monitoring programs and development strategies; preparing and implementing a regional action plan; and strengthening capacity of coastal States to intervene in case of accidents and emergencies.

The Nature Conservancy's (TNC) Improving Resiliency to Climate Change project in Mozambique[224] This project is providing climate change technical assistance to partners in Mozambique by identifying coral reef communities that are more naturally resistant to bleaching events and stresses. The main goal of this project is that by intentionally identifying and protecting these species, the entire reef community has an increased ability to adapt to climate change, and continues to support spawning grounds for a fishery that feeds thousands of artisanal fishers.

Northwest Pacific Action Plan (NOWPAP)[225] This plan was adopted in 1994 by the four Member States, namely the People's Republic of China, Japan, the Republic of Korea and the Russian Federation as a part of the UNEP Regional Seas Programme. The origin of the Action Plan dates back to 1991 when a regional meeting of experts and national representatives from the four countries was held in Vladivostok to develop a regional seas action plan. The implementation of NOWPAP is financed mainly by contributions from the Members. Implemented activities of NOWPAP affecting coral reefs include long term biodiversity assessments, a review report for the state of the marine environment in the region, development of a regional action plan on marine litter and an overview of the protection and management of the marine and coastal environment of the Northwest Pacific Region.

The Convention for the Protection of Natural Resources and Environment of the South Pacific Region, 1986 (Noumea Convention)[226] This convention provides a broad framework for co-operation in preventing pollution of the marine and coastal environments. Each Party is committed to endeavor to participate in bilateral or multilateral agreements that protect, develop and manage the marine and coastal environments of the Convention Area. SPREP is the

222 http://eame.wiomsa.org/tanzania.html

223 http://www.unep.org/nairobiconvention/

224 http://www.nature.org/ourinitiatives/regions/africa/wherewework/mozambique.xml

225 http://www.nowpap.org/

226 http://seanet.org.nz/index.php?option=com_content&task=view&id=177&Itemid=75

Secretariat for this convention. It carries out institutional arrangements, calls meetings of Parties, and acts as an information clearing-house.

The Pacific Oceanscape Initiative This is a multi-national agreement to address all ocean issues from governance to climate change. It effectively represents the largest marine conservation initiative in history. This agreement specifically covers the management and conservation of coral reefs via addressing threats from climate change and the establishment of multiple use marine protected areas. The participating countries include: Australia, Cook Islands, Federated States of Micronesia, Republic of Kiribati, Nauru, New Zealand, Niue, Palau, Papua New Guinea, the Republic of the Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu (Pratt and Govan 2010).

Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA)[227] This is an intergovernmental body dedicated to the conservation of coastal and marine environments of the Red Sea, Gulf of Aqaba, Gulf of Suez, Suez Canal, and Gulf of Aden surrounding the Socotra archipelago. Countries who have joined PERSGA include Djibouti, Egypt, Jordan, Saudi Arabia, Somalia, Sudan, and Yemen. The mission of PERSGA is as follows: to perform the functions necessary for the implementation of the Jeddah Convention on a sustained and cost effective basis, aiming at rational use of living and non-living marine and coastal resources in a manner ensuring optimum benefit for the present generation while maintaining the potential of that environment to satisfy the needs and aspirations of future generations. PERSGA seeks to remedy destructive fishing practices and over-exploitation of fishery resources by implementing various management plans. Some applicable programs included in these plans are monitoring ornamental fish trade and conducting creel surveys. Parrotfish are specifically mentioned in creel surveys from the "Status of the Living Marine Resources in the Red Sea and Gulf of Aden and Their Management." A program instituted by this organization ameliorates the impacts on coastlines and mangrove areas from future development of shrimp and fish farms.

The Red Sea Regional Coral Nursery This nursery is managing reef restoration through the Gardening Concept. Due to many coral species' ability to reproduce via fragmentation, creating coral nurseries for the purpose of restoring degraded reefs has become a popular rehabilitation tool. In this project, large pools of farmed corals and spats are constructed within specially designed underwater coral nurseries. These nurseries are installed in sheltered zones where the different types of coral recruits are maricultured to sizes suitable for transplantation. This practice also makes use of minute size coral fragments that would have died in direct transplantation. Then, nursery-grown coral colonies, in different size and species combinations, are transplanted to degraded reef sites. Various coral nurseries are now being used in numerous countries around the world to help restore coral reefs (Rinkevich 2007).

Reef Check Australia[228] This is a not-for-profit environmental organization that engages the Australian community in coral reef conservation. Reef Check Australia recruits a global network of volunteers to regularly monitor and report on reef health. The aims of this organization are to protect and help to rehabilitate Australia's coral reefs through combination of community

[227] http://www.persga.org/index.php

[228] http://www.reefcheckaustralia.org/

education, to raise awareness of the key issues, and scientific research, to collect data that contributes to solutions. Reef Check Australia runs a number of conservation programs and projects including educational activities and monitoring programs. The Coral Trout Search program enables both recreational and commercial fishers, as well as snorkelers, to help monitor the populations of vital fish stocks that are essential to the sustainability of the reef. The EcoAction program includes material to help snorkelers and new divers, as well as casual reef visitors, to identify some of the vital species that find a home in our coral reefs. Reef Check Australia has a unique way of involving the general public in coral reef conservation via Scuba Monitoring Programs. Their volunteers are recreational scuba divers who monitor the health of reefs around Queensland (with future plans to spread the network to wider Australia and the Indo-Pacific). All volunteers complete one of PADI's accredited Training courses to qualify as Coral Reef Surveyors. The Great Barrier Reef Project is run with support of dive operators in Cairns, Port Douglas and Airlie Beach, conducts at least annual surveys at over 25 selected sites.

Regional Coastal Management Programme of Indian Ocean Countries (ReCoMap)[229] An agreement that came out of the Nairobi Convention between the Comoros, Madagascar, Mauritius, Kenya, the Seychelles, Somalia, and Tanzania that promotes sustainable use of marine and coastal resources with the goal of reducing the toll on coastal and marine resources. It also involves finding ways to adapt and implement national plans for Integrated Coastal Zone Management (ICZM).

Regional Commission for Fisheries (RECOFI) (1999)[230] This commission includes Bahrain, Iran, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates and its purpose is to promote the development, conservation, management, and best utilization of living marine resources and the development of aquaculture in the region. They also combat illegal, unreported, and unregulated (IUU) fishing.

Regional Organization for the Protection of the Marine Environment (ROPME)[231] The ROPME Sea Area covers eight states that joined forces in 1978 to adopt the Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution, otherwise known as the Kuwait Convention and four associated Protocols. These eight states include Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. In the same year, an Action Plan for the region was adopted to address activities relating to oil pollution, industrial wastes, sewage and marine resources. Projects under the Action Plan include coastal area management, fisheries, public health, land-based activities, sea-based pollution, biodiversity, oceanography, marine emergencies, GIS and remote sensing to environmental awareness and capacity building. The ROPME became the secretariat for the Kuwait Convention and Action Plan in 1982.

Secretariat of the Pacific Community (SPC)[232] The SPC provides technical and policy advice and assistance, training, and research services to 26 member countries in the Pacific. The member islands territories and countries are: American Samoa, Cook Islands, Federated States

229 http://www.recomap-io.org/

230 http://www.fao.org/world/regional/rne/statut/region/page57/page57_en.htm

231 http://www.ropme.com/

232 http://www.spc.int/

of Micronesia, Fiji Islands, French Polynesia, Guam, Kiribati, Marshall Islands, Nauru, New Caledonia, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Pitcairn Islands, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, Wallis and Futuna, Australia, France, New Zealand, and the United States of America. There are six technical divisions within the SPC that strive to help the Pacific community sustainably manage its resources. The SPC contains an Education, Training and Human Development Division; a Public Health Division; a Fisheries, Aquaculture and Marine Ecosystems Division; a Land Resources Division; an Economic Development Division; and an Applied Geoscience and Technology (SOPAC) Division. Other services the SPC provides are through the Strategic Engagement, Policy and Planning Facility and the Statistics for Development Programme. The Coastal Fisheries Programme within the Fisheries, Aquaculture and Marine Ecosystems Division ensures coastal fisheries, nearshore fisheries and aquaculture are managed and developed sustainably. They conduct workshops and produce media information available to fishers and managers. Coral Reef Initiative for the South Pacific (CRISP) (see above for more information) is hosted by the SPC.

South Asia Cooperative Environmental Programme (SACEP)[233] This organization is a coordinated program between Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka that is aimed protecting and managing the marine environment and related coastal ecosystems.

South Asia Seas Action Plan (SASP) (1995) A plan developed for Bangladesh, India, Maldives, Pakistan, and Sri Lanka to protect and manage the marine environment and related coastal ecosystems of the region, mainly focused on coral reef management. This plan includes integrated coastal zone management, developing national and regional oil spill contingency plans, human resources development, and protection of the marine environment from land based sources of marine pollution (SACEP 1983).

South Pacific Biodiversity Conservation Programme This program ran from 1992 to 2001 and was funded by the Global Environment Facility and the Australian Agency for International Development, and managed by the South Pacific Regional Environmental Programme and the United Nations Development Programme. It was designed help develop strategies for the conservation of biodiversity using the principle of sustainable use in the South Pacific. The program identified and initiated a series of strategic conservation projects in fourteen South Pacific countries. The implementing agency was the South Pacific Regional Environmental Programme, an independent, intergovernmental environmental agency. Specific objectives include establishing a series of conservation areas, protecting terrestrial and marine species that are threatened or endangered in the Pacific region, identifying new areas important to biodiversity conservation, improving awareness in Pacific Island countries of the importance of conserving biodiversity, and improving capabilities and cooperation among different sectors of society in the Pacific Islands (Baines *et al*. 2002).

South Pacific Regional Environment Programme (SPREP)[234] This regional organization was established by the governments and administrations of the Pacific region to serve as a conduit for environmental interests in this area. The SPBCP (see above) is funded through the SPREP. Other

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233 http://www.sacep.org/

234 http://www.sprep.org/sprep/about.htm

notable projects the SPREP is involved in include Climate Change, Coastal Management Programme, Coastal Systems Living Resources, Conservation Area Training, Community-based Conservation, Coral Reef Initiative, Mangrove Task Force, Marine Pollution, National Biodiversity Action Plans, and Wetlands Management.

US Coral Reef and Reef Fisheries Conservation Efforts As described in the Conservation Efforts portion of Appendix C, in the US there are numerous federal and non-federal government programs intended to address conservation of US coral reefs. Some of the non-federal programs also address management of coral reef fisheries. Together, these federal and non-federal conservation efforts addressing Harvest and Habitat threats to the bumphead parrotfish in the US. See Appendix C for more details.

World Wildlife Fund (WWF) Coastal East Africa Eco-region[235] This is one of the WWF's largest and most ambitious marine conservation initiatives covering the countries from Somalia to South Africa. Projects in this region focus on conservation to improve socioeconomic status, empowering local communities, creating sustainable fisheries, and protecting coastal forests. WWF and its partners work with communities to tackle illegal fishing, establish new national parks, educate children and others about conservation, and manage tourism to benefit communities and protect the resources upon which they rely.

World Wildlife Fund (WWF) Conservation of Coral Reefs in the Persian Gulf project[236] The aim of the project is to assist regional governments and NGOs in the development and implementation of a comprehensive conservation strategy for coral reefs in the Persian Gulf that takes into account the unique habitat and biodiversity and the, local community in this area. It also aims to increase regional awareness of the importance and uniqueness of coral reef habitats for this region. The project includes the development of published materials on coral reef habitat, distribution, and identification in the region. Additional objectives include mapping and inventorying reef habitats, investigating diversity, assessing reef fish and benthic life status, evaluating approaches to reef rehabilitation, building capacity for national research personnel, and increasing stakeholder awareness in the Persian Gulf.

World Wildlife Fund (WWF) Mafia-Kilwa-Rufiji Seascape Programme[237] The Mafia-Kilwa-Rufiji Seascape Programme promotes improved socio-economic well-being of coastal communities in Rufiji, Mafia, and Kilwa communities in Tanzania through sustainable fishing practices, protecting threatened habitats and species, and natural resource management of marine and coastal resources.

Summary for Conservation Efforts Addressing Harvest and Habitat Threats Conservation efforts with the potential to address the threats to bumphead parrotfish include fisheries management plans, coral reef monitoring, coral reef resilience research, coral reef education and/or outreach, marine debris removal projects, coral reef restoration, etc. These conservation efforts are often conducted by countries, states, local governments, individuals, NGOs, academic institutions,

[235] http://www.worldwildlife.org/what/wherewework/coastaleastafrica/projects.html
[236] http://wwf.panda.org/who_we_are/wwf_offices/united_arab_emirates/?uProjectID=AE0007
[237] http://wwf.panda.org/what_we_do/where_we_work/east_african_coast/publications/?21998/Rufiji-Mafia-Kilwa-Seascape-Programme-Tanzania

private companies, etc. They also include global conservation organizations that conduct coral reef and/or marine environment conservation projects, global coral reef monitoring networks and research projects, regional or global conventions, and education and outreach projects throughout the range of bumphead parrotfish. However, the overwhelming majority of these efforts receives a low effectiveness rating and do not contribute to the elimination or adequate reduction of the threats to the species.

3.2 Conservation Efforts Addressing Climate Change Threats

Conservation efforts to address climate change employ various approaches. This section includes a brief synthesis of some current efforts to mitigate climate change and reduce GHGs emissions on a global scale, as well as examples of smaller scale initiatives, such as bi-lateral and multinational agreements. These projects and/or agreements are undertaken voluntarily by participating nations and focus on various aspects of climate change mitigation and adaptation including GHG reductions, renewable energy, and others.

International Conservation Efforts:

Global Carbon Project[238] The Global Carbon Project (GCP) was formed in 2001 to assist the international scientific community in establishing a common, mutually agreed upon knowledge-base that would support policy debate and action to slow the increasing rate of GHG emissions into the atmosphere. The scientific goal of the project is to develop a complete picture of the global carbon cycle, including both its biophysical and human dimensions together with the interactions and feedbacks between them. The GCP is responding to this challenge through a shared partnership between the International Geosphere-Biosphere Programme, the International Human Dimensions Programme on Global Environmental Change, the World Climate Research Programme and Diversitas. This partnership constitutes the Earth Systems Science Partnership. The GCP has published the state of global carbon cycle annually since 2007. For a summary of accomplishments and scientific findings over the past 10 years, see http://www.globalcarbonproject.org/global/ppt/GCP_10years_med_res.pdf. (info and summary adapted from http://www.globalcarbonproject.org/)

Global Methane Initiative[239] The Global Methane Initiative is an action-oriented international initiative to reduce global methane emissions, enhance economic growth, promote energy security, improve the environment and reduce greenhouse gas emissions. It was launched as the Methane to Markets Partnership in 2004 with participation from the Departments of State, Energy, and Agriculture, and from the U.S. Trade and Development Agency and the Agency for International Development. The Global Methane Initiative targets three major methane sources: landfills, underground coal mines and natural gas and oil systems. The Initiative focuses on the development of strategies and markets for the recovery and use of methane through: technology development, demonstration, deployment and diffusion; implementation of effective policy frameworks; identification of ways and means to support investment; and removal of barriers to collaborative project development and implementation. Member countries will work in collaboration with the private sector, multilateral development banks, and other governmental and non-governmental organizations to achieve these objectives. More information can be found

[238] http://www.globalcarbonproject.org/
[239] http://epa.gov/climatechange/policy/international_multilateral.html

at EPA's Global Methane Initiative Site and the Global Methane Initiative Site (Info and summary adapted from http://epa.gov/climatechange/policy/international_multilateral.html)

Intergovernmental Panel on Climate Change[240] The Intergovernmental Panel on Climate Change (IPCC) is a leading international body for the assessment of climate change established by the United Nations Environment Program and the World Meteorological Organization in 1988. The goal of the IPCC is to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts. The IPCC is a scientific body that does not perform scientific research; rather, it reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change. Thousands of scientists from all over the world contribute to the IPCC on a voluntary basis. It is an intergovernmental body open to all member Countries of the United Nations and World Meteorological Organization. The work of the organization aims to be policy-relevant and yet policy-neutral, never policy-prescriptive. The IPCC has released four major publications to date known as the IPCC Assessment Reports (1990, 1995, 2001, 2007) as well as many other publications and reports. Information summarized and released in the assessment reports has been integral in informing major international negotiations and treaties to address climate change including the UNFCCC, Kyoto Protocol, and Copenhagen Accord (Info and summary adapted from http://www.ipcc.ch/).

International Energy Agency[241] The International Energy Agency (IEA) is an intergovernmental organization which acts as an energy policy advisor to 28 member countries in their efforts to ensure reliable, affordable, and clean energy for their citizens. Founded during the oil crisis of 1973-74, the IEA's initial role was to coordinate measures in times of oil supply emergencies. Energy security remains a key priority, but IEA's focus has expanded beyond concerns about oil supplies to include natural gas and electricity. The Agency's mandate has also broadened to incorporate the "Three E's" of balanced energy policy making: energy security, economic development, and environmental protection. Current work focuses on diversification of energy sources, renewable energy, climate change policies, market reform, energy efficiency, development and deployment of clean energy technologies, energy technology collaboration and outreach to the rest of the world, especially major consumers and producers of energy like China, India, Russia and the OPEC countries. The most recent meeting of the Governing Board of IEA member countries at Ministerial level was held on 14-15 October 2009 in Paris. With a staff of around 250, mainly energy experts and statisticians from its 28 member countries, the IEA conducts a broad program of energy research, data compilation, publications and public dissemination of the latest energy policy analysis and recommendations on good practices (info and summary adapted from www.iea.org).

International Renewable Energy Agency[242] The International Renewable Energy Agency (IRENA) was officially established in January 2009. To date, 148 states and the European Union have signed the Statute of the Agency including 48 African, 38 European, 35 Asian, 17 American and 10 Australia/Oceania States. Mandated by these governments worldwide, IRENA's mission is to promote the widespread and increased adoption and sustainable use of all

[240] http://www.ipcc.ch/
[241] www.iea.org
[242] http://www.irena.org/

forms of renewable energy. Acting as the global voice for renewable energies, IRENA will facilitate access to renewable energy information including technical data and renewable resource potential data, and will share experiences on best practices and lessons learned regarding policy frameworks, capacity-building projects, available finance mechanisms and renewable energy related energy efficiency measures. A Preparatory Commission was established to act as an interim body until the Statute entered into force with the 25th ratification instrument which occurred on June 8, 2010. They are currently in the process of establishing member representatives to form a Council to implement the 2010 Work Program (http://www.irena.org/pdf/IRENA_Work_Programme_2010.pdf) (info and summary adapted from http://www.irena.org/).

IUCN Climate Change and Coral Reefs Marine Working Group (CCCR)[243]. The main objective of the Working Group is to form a bridge between theoretical science and management in coral reef ecosystems. They address this by identifying information gaps and issues through workshops and research tracks to synthesis the most recent and relevant information, especially that pertaining to coral reefs and climate change. Projects under implementation of the CCCR include measuring resilience in coral reef monitoring programs and rapid resilience assessments of coral reefs around the world, improving bleaching early warning and response plans, measuring herbivory, and creating a resilience bibliography and coral reef resilience and resistance DVD.

Regional Conservation Efforts:

Asia-Pacific Partnership on Clean Development and Climate[244] The Asia-Pacific Partnership on Clean Development and Climate is an innovative new effort to accelerate the development and deployment of clean energy technologies. Participating countries include: Australia, Canada, China, India, Japan, Korea, and the United States. The seven partner countries collectively account for more than half of the world's economy, population and energy use, and they produce about 65 percent of the world's coal, 62 percent of the world's cement, 52 percent of world's aluminum, and more than 60 percent of the world's steel. These countries have agreed to work together and with private sector partners to meet goals for energy security, national air pollution reduction, and climate change in ways that promote sustainable economic growth and poverty reduction. The Partnership will focus on expanding investment and trade in cleaner energy technologies, goods and services in key market sectors. The Partners have approved eight public-private sector task forces for Aluminum, Buildings and Appliances, Cement, Cleaner Fossil Energy, Coal Mining, Power Generation and Transmission, Renewable Energy and Distributed Generation, and Steel.

Australia's Bilateral Climate Change Partnership Program[245] Under Australia's Bilateral Climate Change Partnership Program, Australia maintains partnerships with China, South Africa, New Zealand, the European Union, the United Kingdom, Japan, and the United States. These partnerships provide opportunities for building stronger political relationships and influencing

[243] http://www.iucn.org/cccr/
[244] http://www.asiapacificpartnership.org/english/default.aspx

[245] http://www.climatechange.gov.au/government/initiatives/bilateral-cc-partnership-program.aspx

other countries' climate change policies at the highest level. Through these partnerships, Australia supports practical activities that address climate change issues of mutual concern. The partnerships with developing countries aim to build their capacity to tackle climate change alongside sustainable development. Examples include collaboration with China and South Africa on projects involving capacity building on emissions reporting, renewable energy technology, energy efficiency, capture and use of methane, climate change and agriculture, climate change and biodiversity, land use, land use change and forestry, and adaptation and climate change science (DECC 2010).

Australia-China Bilateral Cooperation on Climate Change In 2003, officials from Australia and China agreed on a joint declaration of the Australia-China Bilateral Cooperation on Climate Change (Government of Australia 2003). This Memorandum of Understanding (MOU) between the two countries is a cooperative effort to combat climate change, focusing on several key themes including climate change policies, climate change impacts and adaptation, national communications (greenhouse gas inventories and projections), technology cooperation, and capacity building and public awareness. The MOU between Australia and China is expected to open up trade benefits in greenhouse technologies as well as exemplify both countries' willingness to cooperate on bilateral, multilateral, regional, and domestic levels in regards to the global issue of climate change (Government of Australia 2003).

Carbon Sequestration Leadership Forum The Carbon Sequestration Leadership Forum seeks to develop cost-effective technologies for the separation and capture of carbon dioxide for its transport and long-term storage. The purpose of the Carbon Sequestration Leadership Forum is to make these technologies available internationally, and to identify and address wider issues relating to carbon capture and storage. The forum, which now includes 21 countries as well as the European Commission, has approved 17 capture and storage projects as well as a Technology Roadmap to provide future directions for international cooperation (info and summary adapted from http://www.pi.energy.gov/usa_china_energy_cooperation.htm and http://www.cslforum.org/).

Caribbean Community (CARICOM) Climate Projects[246] CARICOM climate projects include the Caribbean Renewable Energy Development Programme and the Mainstreaming Adaptation to Climate Change. The mission of Caribbean Renewable Energy Development Programme is "to reduce barriers to the increased use of renewable energy thus reducing the dependence on fossil fuels while contributing to the reduction of greenhouse gas emissions." Caribbean Renewable Energy Development Programme is an initiative of the Energy Ministers of the Caribbean Community region established to change the market environment for Renewable Energy in the Region. Currently 13 Caribbean countries are participating, with another 4 countries pending.

Mainstreaming Adaptation to Climate Change[247] This is a program by CARICOM, and implemented by the World Bank with funding of USD $5 million from Global Environment Fund. The executing agency is the CARICOM Secretariat located in Georgetown, Guyana. In-kind participants include the Government of Canada and the Government of the United States of America through NOAA. The project's main objective is to mainstream climate change

[246] http://www.caricom.org/jsp/projects/macc%20project/cpacc.jsp
[247] http://www.caricom.org/jsp/projects/macc%20project/macc.jsp

adaptation strategies into the sustainable development agendas of the Small Island and low-lying states of CARICOM. Mainstreaming Adaptation to Climate Change will adopt a learning-by-doing approach to capacity building, consolidating the achievements of Caribbean Planning for Adaptation to Climate Change and Adapting to Climate Change in the Caribbean. It will build on the progress achieved in these past projects by furthering institutional capacity, strengthening the knowledge base, and deepening awareness and participation. The participating countries include: Antigua and Barbuda, the Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Saint Lucia, St. Kitts and Nevis, St. Vincent, and Trinidad and Tobago.

Caribbean Community Climate Change Center[248] The Center coordinates the Caribbean region's response to climate change. Officially opened in August 2005, the Centre is the key node for information on climate change issues and on the region's response to managing and adapting to climate change in the Caribbean. It is the official repository and clearing house for regional climate change data, providing climate change-related policy advice and guidelines to the CARICOM Member States through the CARICOM Secretariat. In this role, the Centre is recognised by the UNFCCC, UNEP, and other international agencies as the focal point for climate change issues in the Caribbean.

China-EU Climate Change Rolling Work Plan China and the EU issued the Joint Declaration on Climate Change which established the bilateral Partnership on Climate Change at the EU-China Summit in Beijing on 5 September 2005. The Partnership is to provide a mechanism for the EU and China to take a strategic view of shared climate change objectives, and to take an overview of, give direction to and develop bilateral cooperation activities that contribute to these objectives. Delegations have met at regular intervals since 2005 to exchange information and discuss ways to jointly address the sources and impacts of climate change (For more information see the following links: http://www.mfa.gov.cn/eng/wjb/zzjg/tyfls/tfsxw/t283051.htm, http://ec.europa.eu/clima/documentation/international/docs/minutes_6_meeting.pdf).

Energy Star[249] Energy Star is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy to help save consumers money and protect the environment through energy efficient products and practices. EPA has entered into agreements with the following foreign governments of Australia, Canada, European Union, European Free Trade Association, Japan, New Zealand, Switzerland, and Taiwan to promote specific Energy Star qualified products. These partnerships are intended to unify voluntary energy-efficiency labeling programs in major global markets and make it easier for partners to participate. These countries are using Energy Star products for offices, consumer electronic products, and home appliances.

India-China Bilateral Agreement on Climate In 2009, one month prior to high-profile climate talks in Copenhagen, India and China signed a bilateral agreement pledging partnership to tackle climate change (ICTSD[250] 2009). The memorandum of understanding was signed by India's environment minister, Jairam Ramesh, and minister and vice-chairman of China's National

[248] http://www.caricom.org/jsp/community/ccccc.jsp?menu=community
[249] http://www.energystar.gov/index.cfm?c=about.ab_index
[250] ICTSD stands for International Centre for Trade and Sustainable Development

Development and Reform Commission, Xie Zhenhua[251]. The agreement promises of continued cooperation on climate at the international level, and "seeks to broaden joint research and development into emissions-reducing technologies, in areas such as wind, solar, forestry and even 'clean coal'". Considering half of the world's population resides in one of these two countries, both India and China need to be on board to make any climate actions successful.

International Partnership for a Hydrogen Economy Established in 2003, the International Partnership for a Hydrogen Economy is comprised of 17 member countries and the European Union in a partnership to foster international cooperation on research, development and demonstration programs that advance the transition to a global hydrogen economy. The Partnership for a Hydrogen Economy organizes and coordinates national strategies for hydrogen and fuel cell research and development (info and summary adapted from http://www.iphe.net/ and http://www.pi.energy.gov/usa_china_energy_cooperation.htm).

International Thermonuclear Experimental Reactor The International Thermonuclear Experimental Reactor is an international research and development project that aims to demonstrate the scientific and technical feasibility of fusion power. The project's partners are the United States, China, Japan, India, Russia, the Republic of Korea, and the European Union (represented by EURATOM). The experimental fusion reactor will be constructed at Cadarache, France and is expected to be completed in 2015 (info and summary adapted from http://www.iter.org/default.aspx and http://www.pi.energy.gov/usa_china_energy_cooperation.htm).

Midwest Greenhouse Gas Reduction Accord[252] The North American Midwest has intensive manufacturing and agriculture sectors, making it the most coal-dependent region in North America. Realizing the unique and major impact that the Midwestern states plain the emissions of carbon, nine Midwestern governors and two Canadian premiers have signed on to participate or observe in the Midwestern Greenhouse Gas Reduction Accord (Accord). Through the Accord, these governors agreed to establish a Midwestern greenhouse gas reduction program to reduce greenhouse gas emissions in their states, as well as a working group to provide recommendations regarding the implementation of the Accord. The participating Midwestern states and Canadian provinces include: Iowa, Illinois, Kansas, Manitoba, Michigan, Minnesota and Wisconsin. Observing parties of the Accord include Indiana, Ohio, Ontario and South Dakota.

North American Declaration on Climate Change and Clean Energy[253] Leaders from the North American countries (U.S., Canada, and Mexico) made a Declaration on Climate Change and Clean Energy in August 2010. In the Declaration, the North American Leaders state their recognition of the broad scientific view that the increase in global average temperature above pre-industrial levels ought not to exceed 2 degrees C. Additionally, they declare their support of a global goal of reducing global emissions by at least 50% compared to 1990 or more recent years by 2050, with developed countries reducing emissions by at least 80% compared to 1990

[251] https://www.google.com/search?q=India-China+Bilateral+Agreement+on+Climate&ie=utf-8&oe=utf-8&aq=t&rls=org.mozilla:en-US:official&client=firefox-a
[252] http://www.midwesternaccord.org/midwesterngreenhousegasreductionaccord.pdf
[253] http://www.whitehouse.gov/the_press_office/North-American-Leaders-Declaration-on-Climate-Change-and-Clean-Energy/

or more recent years by 2050. The Declaration states the Parties' goals of working together to reduce GHG emissions from transport and oil and gas sectors, pursue a framework to align energy efficiency standards in the three countries, develop comparable approaches to measuring, reporting, and verifying emissions reductions, and collaborate on climate friendly and low-carbon technologies, among others. In order to facilitate these actions, the North American leaders aim to work cooperatively to develop and follow up on a Trilateral Working Plan and submit a report of results at the next North American Leaders Summit (White House Press Release 2010).

Regional Greenhouse Gas Initiative[254] The Regional Greenhouse Gas Initiative is the first greenhouse gas emissions reduction effort by the United States that is market-based and mandatory. This Initiaitive is represented by ten Northeastern and Mid-Atlantic States that have capped, and will continue to reduce CO_2 emissions from the power sector by 10% by 2018. In order to accomplish this goal, states sell nearly all emission allowances through auctions and invest proceeds in consumer benefits such as energy efficiency, renewable energy, and other clean energy technologies. The Regional Greenhouse Gas Initiative is thus able to spur innovation in the clean energy economy and create green jobs in each state. Participating states in the Regional Greenhouse Gas Initiative include: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont.

Transportation and Climate Initiative[255] Eleven Mid-Atlantic and Northeastern states, as well as the District of Columbia, announced a Declaration of Intent for the Transportation and Climate Initiative on June 16, 2010. The main goals of the Transporation and Climate Initiative include: reducing greenhouse gas emissions, minimizing the transportation system's reliance on high-carbon fuels, promoting sustainable growth, addressing the challenges of vehicle-miles traveled, and helping to build the clean energy economy. Included in this initiative are the ten Regional Greenhouse Gas Initiative members (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont), Pennsylvania, and the District of Columbia. Currently, transportation accounts for a total of 30 percent of greenhouse gas emissions in the Mid-Atlantic and Northeastern U.S. The states involved with the Transportation and Climate Initiative will establish and fund the Transportation, Energy, and Environment Staff Working Group to direct the initiative's planning and seek public and private funding for projects.

US-China Oil and Gas Industry Forum Launched in 1998, this bilateral forum provides opportunities for U.S. and Chinese government and industry leaders to conduct open discussions about their respective ventures in the oil and gas sector. The Departments of Energy and Commerce co-host the forum on the U.S. side and the National Development and Reform Commission is the lead agency for China. Additionally, a variety of industry representatives play an active role in formulating meeting agendas and delivering timely and informative presentations on private sector opportunities and issues **(**info and summary adapted from http://www.pi.energy.gov/usa_china_energy_cooperation.htm and http://www.uschinaogf.org/).

[254] http://www.rggi.org/home
[255] http://climatechange.transportation.org/pdf/markstout_trclimateinit.pdf

US-China Strategy for Clean Air and Energy Cooperation[256] The goal of the joint US-China Strategy for Clean Air and Energy Cooperation is to enhance the effectiveness of collaborative efforts to reduce the emissions intensity (air pollution and greenhouse gases) of China's rapidly growing economy. To achieve this goal, the U.S. EPA and the State Environmental Protection Agency of China plan to develop and implement a coordinated strategic framework for cooperation on matters related to air quality management, public health, clean energy and transportation.

US-India Green Partnership[257] In November 2009, President Barack Obama and Indian Prime Minister Manmohan Singh launched a "Green Partnership to Address Energy Security, Climate Change, and Food Security," reaffirming their countries' strong commitment to taking vigorous action to combat climate change, ensuring their mutual energy security, working towards global food security, and building a clean energy economy that will drive investment, job creation, and economic growth throughout the 21st century. Toward that end, Prime Minister Singh and President Obama agreed to strengthen U.S.-India cooperation on clean energy, climate change, and food security by launching various initiatives.

US-Indonesia Partnership on Climate Change and Clean Energy[258] In 2009, and Indonesian President Yudhoyono have committed to making combating climate change, including enhanced cooperation on clean energy, a key element of the new U.S.-Indonesia Comprehensive Partnership.

US-Korea Climate Technology Partnership To accelerate the implementation of methane recovery technologies in Korea, it was determined in 2001 by the Korean and U.S. governments that a new program approach was needed. This is when the Climate Technology Partnership was developed with considerable consultation among the U.S. Agency for International Development, the U.S. Environmental Protection Agency, the Department of Energy, and the National Renewable Energy Laboratory. Climate Technology Partnership is a follow-on from the Technology Cooperation Agreement Pilot Project which started in 1997 with the goal of developing an international process that assesses needs and fosters private sector development of climate friendly technologies in developing nations. To better focus resources under Climate Technology Partnership Korea, two of the three priority technologies that were identified by Technology Cooperation Agreement Pilot Project – energy management and methane recovery – were selected for further development. Climate Technology Partnership differed from Technology Cooperation Agreement Pilot Project in that it had the added feature of strategic activity to complement project activity. This bifurcation of tasks between strategic and project objectives sought to create a suitable environment for the formation of active new markets in energy service companies and landfill gas (LFG) development (summary and info adapted from Larney *et al.* 2006).

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[256] http://www.epa.gov/oia/regions/Asia/china/2004_sca_eng.pdf
[257] http://www.america.gov/st/texttrans-english/2009/November/20091124173218eaifas0.8567425.html#ixzz1823kF2JM
[258] http://www.america.gov/st/texttrans-english/2010/November/20101109180315su0.9502614.html#ixzz1827gyDGh

Western Climate Initiative[259] The Western Climate Initiative is a collaborative effort to reduce greenhouse gas emissions while spurring investment into clean-energy technologies that create green jobs and reduce dependence on imported oil. This initiative represents numerous independent jurisdictions that are working together to identify, evaluate, and implement policies to tackle climate change at a regional level. Regional partners include Arizona, British Colombia, California, Manitoba, Montana, New Mexico, Ontario, Oregon, Quebec, Utah, and Washington. Observers of the Initiative include: Alaska, Colorado, Kansas, Nevada, Idaho, Wyoming, Saskatchewan, New Brunswick, Nova Scotia, Yukon, and several Mexican states.

4. Overall Patterns and Summary

The purpose of this Management Report is to summarize existing regulatory mechanisms and conservation efforts relevant to the extinction risk of bumphead parrotfish. The information in this report will then be used in the Bumphead Parrotfish 12-month Finding to determine whether these existing regulatory mechanisms and conservation efforts contribute to the species' extinction risk. Several patterns have emerged from the above discussion of regulatory mechanisms and conservation efforts addressing threats to bumphead parrotfish throughout their range that are worth noting and summarizing.

A wide array of regulatory mechanisms exist within the 46 areas in bumphead parrotfish range that are intended to address threats of harvest and habitat loss/degradation for the species. These include fisheries regulations like bag limits, time/area closures, gear restrictions, and others as well as coastal zone management, prohibitions on coral and mangrove harvest, and more. A few particularly relevant categories of regulatory mechanisms are summarized in Table 6. Australia, Fiji, Maldives, Micronesia, Palau, and Samoa all have fisheries regulations pertaining specifically to parrotfish species, in some cases specifically bumphead parrotfish. These range from prohibition of take for all parrotfish, to size and bag limits, to seasonal restrictions, to listing as an Endangered Species (Fiji). These countries together represent 26% of total coral reef habitat and 13.1% of mangrove habitat in the 46 areas within bumphead parrotfish range.

Adult harvest is one of the two most severe threats to bumphead parrotfish according to the BRT and spearfishing is commonly the primary method used for harvest of adults and large juveniles. As such, it is worth noting which countries have regulations pertaining to spearfishing. Twenty-four out of the 46 areas have some sort of regulations on the books pertaining to spearfishing (Table 6). These include prohibiting spearfishing altogether, prohibiting fishing with SCUBA, prohibiting fishing with lights (limiting night spearfishing), area closures, permit requirements, or various combinations of those. Some regulations may only apply in some areas within a country or jurisdiction and some only within MPAs. Those 24 countries combined represent 63.6% of total coral reef habitat within the 46 areas in bumphead parrotfish range. They also represent 42.1% of mangrove habitat within the 46 areas but spearfishing is generally employed to harvest adults and large juveniles in coral reef habitat and not in mangroves. Spearfishing regulations exist in a majority (17 out of 24) of the areas within a significant portion of the species range (SPOIR) as determined by the BRT.

[259] http://www.westernclimateinitiative.org/

Table 6. Summary of selected relevant regulatory mechanisms for the 46 areas within bumphead parrotfish range. Countries in **BOLD** are included in SPOIR.

	% coral reefs	% mangroves	Parrotfish-specific laws (* = specific to bumpheads)	Spearfishing Regs (* = only in MPAs)	Mangrove Protection	Traditional Governance (* = recognized by gov't)	Notes
Australia	**19.8**	**12.4**	**X**	**X**	**X**		**Size and bag limits (5) on "regulated parrotfish" in QLD, bag limit of 8 parrotfish in Cocos-Keeling Islands**
Cambodia	**0.1**	**0.9**		**X**	**X**		
China	**0.3**	**0.3**		**X***	**X**		
Comoro Islands	**0.2**	**0**			**X**		
Disputed Areas	**1.8**	**0**					
Djibouti	0.1	0		X[1]			[1]it is noted that although banned, spearfishing is still widely practiced
Egypt	1.5	0					
Eritrea	0.9	0.1					
Fiji	3.1	0.5	X*		X	X*	Bumpheads listed under Endangered Species Act of 2002 which regulates trade, possession, and transport.
France	6.8	0.3		X			
India	**1.6**	**5.4**			**X**	**X**	
Indonesia	**18.5**	**40**			**X**	**X***	
Iran	0.1	0.2					
Israel	0	0.2					
Japan	0.8	0					
Kenya	**0.3**	**0.8**		**X***	**X**		
Kiribati	1.4	0		X*		X	
Madagascar	**1.8**	**3.8**		**X**	**X**	**X**	
Malaysia	**1.4**	**8.9**		**X***	**X**		
Maldives	**2.5**	**0**	**X**	**X**			**Harvest of all parrotfishes is prohibited**
Marshall Islands	1.7	0			X		
Mauritius	0.5	0		X			
Micronesia	**2.3**	**0.1**	**X[2]**	**X[3]**		**X***	**[2] Sale of bumpheads is prohibited in Pohnpei; [3]Some spearfishing bans in Yap only**
Mozambique	**1.1**	**3.6**		**X**			
Myanmar	**0.6**	**6.3**			**X**		
Niue	0	0				X	
Palau	**0.5**	**0.1**	**X***	**X**	**X**		**Minimum size limit for juveniles and time restrictions on take of bumphead parrotfish for Palauans; all take prohibited for non-Palauans**
Papua New Guinea	**6.8**	**5.3**		**X***	**X**	**X***	
Philippines	**10.5**	**3.2**		**X**	**X**	**X***	
Samoa	0.2	0	X*	X	X	X*	Minimum size limit for bumphead parrotfish
Saudi Arabia	2.5	0.3					
Seychelles	**0.9**	**0**		**X**			
Solomon Islands	**3.2**	**0.8**		**X**	**X**	**X***	
Somalia	0.3	0.1					
Sri Lanka	**0.1**	**0.1**			**X**	**X***	
Sudan	0.5	0		X			
Taiwan	**0.3**	**0**					
Tanzania	**1.4**	**1.6**		**X**	**X**		
Thailand	**0.2**	**3.1**			**X**		
Timor-Leste	**0.1**	**0**		**X**		**X**	
Tonga	0.8	0		X	X		
Tuvalu	0.6	0				X*	
United States	**0.3**	**0**		**X**	**X**		**Spearfishing regs only in American Samoa, CNMI, and PRIAs**
Vanuatu	0.8	0			X	X*	
Viet Nam	**0.4**	**1.3**			**X**	**X***	
Yemen	0.4	0					

Color codes:
No SCUBA
Prohibited
No lights
No lights, no SCUBA, area closures
Prohibited within some MPAs
Permit required
Area Closures

Juvenile habitat loss and degradation was also identified by the BRT as a threat with the highest severity for bumphead parrotfish. As such, it is worth noting which countries have regulations specifically protecting mangroves. Again, 24 out of the 46 areas within the species range have some sort of regulatory mechanisms in place that offer some protection to mangrove habitat. These regulations include prohibition on mangrove harvest and/or sale, inclusion of mangroves in protected areas, and sustainable harvest and/or restoration requirements. Combined, these 24 countries account for 94.8% of mangrove habitat in the 46 areas within the range of bumphead parrotfish. Regulations providing some level of protection for mangrove habitat exist in a majority (19 out of 24) of areas within SPOIR.

We recognize that the existence of regulatory mechanisms does not necessarily equate to their effectiveness in achieving their intended purpose. Issues related to community awareness, compliance, enforcement, regional priorities, and complex political climates within many countries in which bumphead parrotfish occur can limit the effectiveness of well-intended statutes and legislation. However, to fulfill consideration of Factor D in the bumphead parrotfish 12-month Finding, we determine whether the inadequacy of existing regulatory mechanisms is contributing to the species' extinction risk. For example, inadequate regulatory mechanisms would be a contributing factor to the species' extinction risk if not enough of them existed, or those in place were not stringent enough to address threats to the species. That is, the primary consideration for Factor D is whether inadequate regulatory mechanisms are making things worse for the species, not whether existing regulatory mechanisms are effective in achieving their intended purpose.

There has been recent rapid growth in coral reef and coastal MPAs. As human pressure on the coastal and marine environments intensifies, MPAs are increasingly recognized as critical management tools to protect, maintain, and restore natural resources. In 2000, there were 660 protected areas world-wide that included coral reefs (Spalding *et al.* 2001). The Reefs at Risk Revisited report (Burke *et al.* 2011) (Appendix A-1) indicates that now over 1,800 marine protected areas that include coral reefs are established, just within the range of bumphead parrotfish; a nearly three-fold increase in one decade. An estimated 25% of coral reef area within bumphead parrotfish range is within those MPAs. Additionally, over 650 protected areas have been established throughout the range that include mangrove habitat (Spalding *et al*. 2010) (Appendix B).

Because MPA establishment is growing, there is also a growing body of research investigating their effectiveness at achieving various biodiversity conservation goals. On a global scale, Selig and Bruno (2010) found that MPAs can be a useful tool for maintaining coral cover and that benefits resulting from MPA establishment increase over time. The results of 89 separate studies show that, on average, values for four biological measures are significantly higher inside reserves compared to outside (or after reserve establishment vs. before) when evaluated for both the overall communities and by each functional group within these communities (carnivorous fishes, herbivorous fishes, planktivorous fishes/invertebrate eaters, and invertebrates) (Halpern 2003). These results also show that relative impacts of reserves, such as the proportional differences in density or biomass, are independent of reserve size. After 14 years of MPA implementation in Belize, McClanahan et al (2011) reported that the abundance of large herbivores including parrotfish was on average higher in the Conservation zone than the General Use zone and had increased significantly (~28%) by 2008 but parrotfish showed a 60% decrease

overall in both management zones, which was largely attributable to a decrease in the small parrotfishes. Parrotfish response to the closure was difficult to detect because of complex trophic interactions with other trophic groups within the system. The results of one study on Guam demonstrate that a reduction in fishing pressure had a positive effect on the demography of *Lethrinus harak* through the significant accumulation of older individuals in certain areas (Taylor and McIlwain 2010). *L. harak* is a reef fish with similar life history characteristics to bumphead parrotfish making it easily targeted by fishers and heavily exploited. On Saipan, the abundance of *L. harak* increased 4-fold (on average) from 2000 to 2005 (Starmer *et al*. 2008); Taylor and McIlwain (2010) attribute this increase not only to the recent ban on certain fishing methods (SCUBA spearfishing and gill, drag, and surround nets) but also the presence of well-enforced MPAs. In Western Australia, contrasting effects of MPAs were observed on the abundance of two exploited reef fishes; a species of wrasse did not appear to respond to protection while the coral trout showed a significant increase in abundance after eight years of protection at both sites (Nardi *et al*. 2004). The authors note that, while MPAs are clearly an effective tool for increasing the local abundance of some reef fishes, the spatial and temporal scales required for their success may vary among species. McClanahan *et al*. (2007) studied the recovery of coral reef fishes through 37 years of protection at four marine parks in Kenya and found that scarid biomass (parrotfishes) initially recovered rapidly, but then exhibited some decline, primarily due to competition with more steadily increasing taxonomic groups and a decline in smaller individuals.

MPA is a broad term that can apply to a wide range of regulatory structures within designated protected areas; MPAs referred to in this report certainly represent different levels of protection from no-take zones to limited restrictions on fishing and other activities. Effectiveness of protected areas depends not only on implementation and enforcement of regulations, but also on reserve design; reserves are not always created or designed with an understanding of how they will affect biological factors or how they can be designed to meet biological goals more effectively (Halpern 2003). Even results from the same regulatory scheme can differ between species within the protected ecosystem. A detailed evaluation of MPAs within the range of bumphead parrotfish is beyond the scope of this report. In many cases, protections have only recently been established so benefits to biodiversity and particularly to bumphead parrotfish have not yet manifested. Regardless, the large number of established MPAs that include bumphead parrotfish habitat provides evidence of regulatory mechanisms intended to address threats to the species.

Customary governance and management remain important and effective in many areas. Implementation, enforcement and compliance issues represent a considerable challenge for some countries, given limited human and financial resources along with structural, operational, and cultural obstacles that are often present within regulatory entities responsible for environmental laws. Factors that have been identified that reduce the degree of compliance include a lack of awareness of rules and regulations and difficulty of implementation due to remoteness and geographic spread of many island regions (D. Fenner per. Comm.; De Young 2006; FAO 2002b). Along with intent, a country must also possess the capacity to enforce regulatory mechanisms in order for them to be effective. After intensive efforts by governments in the past to centrally manage coastal fisheries, there has been a shift in government policies from a centralized or "top-down" approach to restore resources to a "bottom-up" or community-based approach. This community-based management approach is more widespread in Oceania today

than any other tropical region in the world (Johannes 2002). Regardless of legislation or enforcement, especially in Oceania, the responsible management of marine resources is greatly improved when fishing communities see it as their responsibility (Fa'asili and Kelokolo 1999).

Customary governance and management systems are traditional, cultural, and historical practices designed to regulate the use of, access to, and transfer of resources locally, and are informed by indigenous ecological knowledge and embedded in customary land- and sea-tenure institutions (Cinner and Aswani 2007). Customary governance and management systems are being revitalized in countries throughout bumphead parrotfish range. Throughout the previous discussion of regulatory mechanisms, 16 of the 46 areas within bumphead parrotfish range employ traditional governance systems based on customary and traditional resource management practices, most of which are explicitly recognized and supported by their national governments. Notably, the national government in Indonesia recognizes that customary law and/or traditional management is adapted to local areas and therefore more effective than a homogeneous national law. As such, coral reef fisheries management is decentralized and delegated to the 503 Districts where District laws and regulations are based on customary law and/or traditional management. Indonesia accounts for 40% of mangrove habitat and 18.5% of coral reef habitat in the 46 areas within bumphead parrotfish range. Aswani (2010) suggests that community-based management and customary styles of management offer the only viable and socially just context for meaningful resource management and can provide management strategies that are more adaptive and effective.

Many island communities in the south and west Pacific have had a long tradition of managing their own resources; in fact, a locally managed approach to protected areas is virtually the only approach to Marine Managed Areas actively pursued in most of the independent countries of the Pacific Islands Region (Govan 2009b). Today, community-based marine resource management is becoming increasingly effective and there are many examples throughout Oceania that show traditional non-Western attitudes can provide a sound foundation for contemporary natural resource management (Johannes 2002). Alcala and Russ (2006) point out that Sumilon Island and Apo Island no-take marine reserves have produced some of the best evidence available that no-take reserves, protected and managed by local communities, can play a key role in biodiversity conservation and fisheries management. Similarly, Bonham *et al*. (2008) assert that protected areas management developing nations possessing unique cultural and natural histories, must be rooted in the local context. This increasingly effective approach is helping address some of the limitations of enforcement agencies throughout the range.

Climate change threats will continue. It is clear that most regulatory mechanisms and conservation efforts targeting climate change impacts have not yet shown to be effective. This is evident judging from continued increases in global greenhouse gas emissions, despite all efforts that have been initiated to implement reductions in emissions throughout the world. However, the BRT Report states that climate change threats are not thought to be plausible drivers of bumphead parrotfish population dynamics, either now or in the foreseeable future of 40-100 years (Kobayashi *et al*. 2011).

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Cover: Bumphead parrotfish weighing >30 kg in Indonesia market, caught by unidentified method near Aceh, Indonesia, in 2010. Photo provided by Crispen Wilson.

Figure 2: Bumphead parrotfish (*Bolbometopon muricatum***).**
Photo A: Group of fish resting at night, Malaysia. Photo by Steve Turek. Photo downloaded from http://www.coral.org/ and used in compliance with instructions on the website.
Photo B: Fish at night with diver, Sudan. Photo by Bob and Carol Cox.
Photo C: A pair of fish on Osprey Reef, Coral Sea, Australia. Photo by Richard Ling. Photo downloaded from http://en.wikipedia.org/wiki/Green_humphead_parrotfish and used in compliance with instructions on the website.
Photo D: School of fish on the Great Barrier Reef, Australia. Photo by David Burdick. Photo downloaded from http://www.marinephotobank.org/home.php and used in compliance with instructions on the website.
Photo E: Fish at night, Sudan. Photo by Bob and Carol Cox.
Photo F: Jaws and hard coral. Jaws collected from a fish purchased in New Caledonia. Photo by Malo Hosken. Photo downloaded from http://www.marinephotobank.org/home.php and used in compliance with instructions on the website.

Figure 3: Captured bumphead parrotfish.
Photo A: Fish caught on fly and released unharmed, Farquhar Atoll, Seychelles. Photo provided by Ricko Cronje – owner, FlyFishers Unlimited & Fly Travel – Unlimited Fishing,
Photo B: Fish speared at Tabuaeran, Kiribati. Photo provided by David Janikowski – C2T Sea to Tee Sports, Honolulu, HI.
Photo C: International Underwater Spearfishing Association's world record fish (58.9 kg) speared by Marc Alexander, Australia, 2003. Photo provided by Marc Alexander.
Photo D: Marc Alexander's world record fish from underwater before being brought on board, Australia, 2003. Photo provided by Marc Alexander.
Photo E: Group of fish, each weighing >30 kg, caught by unidentified method near Aceh, Indonesia, in 2010. Photo provided by Crispen Wilson.

Figure 4: Fishing gears and methods I.
Photo A: Fish speared off of Tutuila, American Samoa in 1970s. Photo by John Naughton, NOAA Photo Library.
Photo B: Bottom-set gillnet illegally set on Big Island, Hawaii. Photo provided by Bo Pardau.

Photo C: Shallow lagoon drive netting on Ofu Island, American Samoa – the men herded fish towards a net to the left, resulting in the catch of several dozen large reef fish. Photo by Lance Smith, NOAA Fisheries.
Photo D: A bottom-set gillnet on seagrass, Kenya. Photo provided by Adam Tuller.
Photo E: Beach seine netting in northwestern Madagascar (photo provided by Simon Harding).

Figure 5: Fishing gears and methods II.
Photo A: Hand-line fishing in Kenya. Photo provided by Jay Berkley, http://www.flickr.com/photos/jay_berkley/240915352/
Photo B: Fish traps in the Philippines. Photo provided by Phil McGuire, http://southernleyteenquirer.blogspot.com/2010/09/fish-traps-bobos.html
Photo C: Decrepit fish trap Koh Lipe, Thailand. Photo provided by Erika Antoniazzo, info@naturalscenes.net
Photo D: Fish trap in Indonesia. Photo provided by Bruce Yates, www.UnderwaterReflections.com
Photo E: Blast fishing in the Philippines. Photo taken by Lida Pet-Soede and provided by Reef Check Philippines.
Photo F: Cyanide fishing in the Philippines. Photo provided by Reef Check Philippines.

Appendix B: Summary of mangrove area and protected areas with mangroves for the 46 areas (45 countries and Disputed Areas) in which bumphead parrotfish occur.

COUNTRY	Mangrove Area (sq km)	% Total Mangrove Area	# of Protected Areas with Mangroves
Australia	9910.0	12.4	158
Cambodia	728.4	0.9	4
China	207.6	0.3	29
Comoro Islands	1.2	0.0	1
Disputed Areas		0.0	
Djibouti	10.0	0.0	1
Egypt	5.1	0.0	4
Eritrea	101.9	0.1	
Fiji	424.6	0.5	1
France	234.5	0.3	3
India	4325.9	5.4	33
Indonesia	31893.6	40.0	91
Iran	192.3	0.2	8
Israel	192.3	0.2	8
Japan	7.4	0.0	8
Kenya	609.5	0.8	11
Kiribati	2.6	0.0	
Madagascar	2991.1	3.8	6
Malaysia	7097.3	8.9	88
Maldives		0.0	
Marshall Islands		0.0	1
Mauritius	1.2	0.0	6
Micronesia	87.0	0.1	6
Mozambique	2909.0	3.6	6
Myanmar	5029.1	6.3	4
Niue	30.0	0.0	
Palau	48.5	0.1	7
Papua New Guinea	4264.8	5.3	12
Philippines	2564.8	3.2	52
Samoa	3.7	0.0	2
Saudi Arabia	204.0	0.3	4
Seychelles	32.3	0.0	5
Solomon Islands	602.5	0.8	10
Somalia	48.0	0.1	1
Sri Lanka	88.8	0.1	9
Sudan	9.8	0.0	
Taiwan		0.0	
Tanzania	1286.8	1.6	24
Thailand	2483.6	3.1	23
Timor-Leste	18.0	0.0	
Tonga	3.4	0.0	3
Tuvalu	0.4	0.0	

United States	1.6	0.0	5
Vanuatu	20.5	0.0	5
Viet Nam	1056.1	1.3	17
Yemen	9.3	0.0	1
TOTAL:	**79738.6**	**100.00**	**657**

Notes:

Numbers presented are for all mangrove area in the 46 areas in which bumphead parrotfish occur and are not limited to the extent of bumphead range in cases where they do not range throughout a country's entire EEZ. Information does not exist on a precise enough scale to determine specific spatial boundaries of bumphead parrotfish range. For countries with territories in multiple ocean basins, numbers are limited to mangrove areas in the Indo-Pacific region. All mangrove area statistics and information on the number of protected areas with mangroves are derived from the source below. Empty cells in the above table reflect missing information in the source data.

Source:

Spalding, M. D., Kainuma, M., and Collins, L., 2010, *World Atlas of Mangroves*, London, Earthscan, with International Society for Mangrove Ecosystems, Food and Agriculture Organization of the United Nations, The Nature Conservancy, UNEP World Conservation Monitoring Centre, United Nations Scientific and Cultural Organisation, United Nations University.

Appendix A-2: List of MPAs containing coral reefs in countries in which bumphead parrotfish occur

Note: MPAs listed include all coral reef MPAs within countries where bumphead parrotfish occur; they are not limited to the extent of bumphead range in cases where they do not range throughout a country's entire EEZ. Information does not exist on a precise enough scale to determine specific spatial boundaries of bumphead parrotfish range. For countries with territories in multiple ocean basins, MPAs listed are limited to those in the Indo-Pacific region.

Source: Reefs at Risk Revisited, World Resources Institute, 2011

Acknowledgement: Special thanks to K. Reytar of the World Resources Institute (WRI) for compiling and providing data.

COUNTRY	MPA ENGLISH NAME	AREA (SQ KM)	REGION
Australia	Adele Island	2.71	Australia
Australia	Airlie Island	0.31	Australia
Australia	Annan River	8.75	Australia
Australia	Annan River	8.78	Australia
Australia	Archer Point	0.06	Australia
Australia	Ashmore Reef	583.47	Australia
Australia	Baffle Creek	23.22	Australia
Australia	Bakers Creek	5.56	Australia
Australia	Ball Bay - Sand Bay	74.27	Australia
Australia	Barr Creek	0.64	Australia
Australia	Barrow Island	250.82	Australia
Australia	Bassett Basin	6.68	Australia
Australia	Bedout Island	0.41	Australia
Australia	Bernier And Dorre Islands	91.01	Australia
Australia	Bessieres Island	0.56	Australia
Australia	Bohle River	13.09	Australia
Australia	Boodie, Double Middle Islands	8.25	Australia
Australia	Bowling Green Bay	686.67	Australia
Australia	Brampton Islands	9.92	Australia
Australia	Broad Sound	1610.59	Australia
Australia	Browse Island	3.57	Australia
Australia	Bundegi Coastal Park	4.90	Australia
Australia	Burdekin	922.06	Australia
Australia	Burnside And Simpson Island	1.31	Australia
Australia	Cairns	6985.83	Australia
Australia	Cape Palmerston	87.91	Australia
Australia	Cape Range	499.58	Australia
Australia	Capricornia Cays	1.07	Australia
Australia	Carmila	15.13	Australia
Australia	Cartier Island	172.37	Australia
Australia	Casuarina	13.66	Australia
Australia	Cattle Creek	31.37	Australia
Australia	Causeway Lake	0.65	Australia
Australia	Cawarral Creek	28.45	Australia
Australia	Charles Darwin	13.03	Australia
Australia	Charlie Island	0.00	Australia
Australia	Clairview Bluff - Carmilla Creek	257.70	Australia
Australia	Cleveland Bay - Magnetic Island	410.92	Australia
Australia	Colosseum Inlet	98.88	Australia
Australia	Colosseum Inlet	19.30	Australia
Australia	Coringa-Herald	8852.50	Australia
Australia	Corio Bay	39.81	Australia

Australia	Coulomb Point	281.75	Australia
Australia	Dallachy Creek	17.14	Australia
Australia	Dhimurru	1243.81	Australia
Australia	Dolphin Island	33.03	Australia
Australia	Edgecumbe Bay - Bowen	413.11	Australia
Australia	Eight Mile Creek	52.23	Australia
Australia	Elizabeth and Middleton Reefs	1877.26	Australia
Australia	Elliott River	8.04	Australia
Australia	Escape River	248.80	Australia
Australia	Eurimbula	6.06	Australia
Australia	Far Northern	13852.47	Australia
Australia	Francois Peron	531.45	Australia
Australia	Fraser Island	96.93	Australia
Australia	Freycinet, Double Islands Etc	2.03	Australia
Australia	Friday Island	0.00	Australia
Australia	Garig Gunak Barlu	2236.13	Australia
Australia	Garig Gunak Barlu	2264.84	Australia
Australia	GBR- B-COMBINED	9882.20	Australia
Australia	GBR- CI-COMBINED	108.05	Australia
Australia	GBR- CP-COMBINED	5141.79	Australia
Australia	GBR- GU-COMBINED	116516.04	Australia
Australia	GBR- HP-COMBINED	97252.99	Australia
Australia	GBR- MNP-COMBINED	114214.44	Australia
Australia	GBR- P-COMBINED	706.42	Australia
Australia	GBR- SR-COMBINED	152.96	Australia
Australia	Gnandaroo Island	0.01	Australia
Australia	Great Sandy	2238.92	Australia
Australia	Great Sandy Island	40.46	Australia
Australia	Half Moon Creek	2.10	Australia
Australia	Halifax	52.73	Australia
Australia	Hamelin Pool	1145.40	Australia
Australia	Hervey Bay	1977.96	Australia
Australia	Hervey Bay - Tin Can Bay	1735.04	Australia
Australia	Hinchinbrook	122.75	Australia
Australia	Hinchinbrook Island area	593.90	Australia
Australia	Hull River	14.99	Australia
Australia	Ince Bay (Cape Palmerston - Allom Point)	69.52	Australia
Australia	Jurabi Coastal Park	12.61	Australia
Australia	Kalbarri	1832.62	Australia
Australia	Keppel Bay Islands	1.05	Australia
Australia	Koks Island	0.04	Australia
Australia	Kolan River	18.97	Australia
Australia	Lacepede Islands	1.64	Australia
Australia	Lesueur Island	0.60	Australia
Australia	Lihou Reef	8436.71	Australia
Australia	Little Rocky Island	0.02	Australia
Australia	Llewellyn Bay	126.53	Australia
Australia	Locker Island	0.29	Australia
Australia	Lord Howe Island	465.60	Australia
Australia	Lord Howe Island (Commonwealth Waters)	3002.87	Australia
Australia	Low Rocks	0.05	Australia
Australia	Lowendal	1.62	Australia
Australia	Lucinda to Allingham - Halifax Bay	113.16	Australia
Australia	Mackay / Capricorn	33910.17	Australia
Australia	Marion	16.83	Australia

Australia	Mermaid Reef	539.87	Australia
Australia	Meunga Creek	4.41	Australia
Australia	Michaelmas and Upolu Cays	0.00	Australia
Australia	Midge	82.01	Australia
Australia	Monkey Mia	4.88	Australia
Australia	Montebello Islands	35.49	Australia
Australia	Moreton Banks	63.23	Australia
Australia	Moreton Bay	3428.58	Australia
Australia	Muiron Islands	9.84	Australia
Australia	Murray River	15.79	Australia
Australia	Myora - Amity Banks	71.56	Australia
Australia	Ningaloo	2244.96	Australia
Australia	Ningaloo (Commonwealth Waters)	2435.21	Australia
Australia	North Sandy Island	0.54	Australia
Australia	North Turtle Island	0.66	Australia
Australia	One Tree Point	4.84	Australia
Australia	Palm Creek	14.45	Australia
Australia	Port Clinton (Reef Point - Cape Clinton)	174.60	Australia
Australia	Port of Gladstone - Rodds Bay	509.55	Australia
Australia	Prince Regent	5748.14	Australia
Australia	Princess Charlotte Bay	571.17	Australia
Australia	Repulse	694.90	Australia
Australia	Repulse Bay	30.47	Australia
Australia	Rocky Dam	29.35	Australia
Australia	Rocky Island	0.01	Australia
Australia	Rodds Bay	114.32	Australia
Australia	Round Island	0.03	Australia
Australia	Round Island	0.24	Australia
Australia	Sand Bay	114.27	Australia
Australia	Scott Reef	33.80	Australia
Australia	Sedimentary Deposits Reserve	630.59	Australia
Australia	Serrurier Island	2.91	Australia
Australia	Seventeen Seventy-Round Hill	4.59	Australia
Australia	Seventeen Seventy-Round Hill	10.22	Australia
Australia	Shark Bay	7118.63	Australia
Australia	Shell Beach	4.02	Australia
Australia	Shoalwater Bay	806.44	Australia
Australia	Silver Plains	125.90	Australia
Australia	Solitary Islands	719.65	Australia
Australia	Solitary Islands (Commonwealth Waters)	152.32	Australia
Australia	Stewart Peninsula - Newry Island - Ball Bay	162.20	Australia
Australia	Swan Island	0.22	Australia
Australia	Tanner Island	0.02	Australia
Australia	Temple Bay	39.06	Australia
Australia	Tent Island	18.87	Australia
Australia	Thevenard Island	19.22	Australia
Australia	Three Islands Group	0.70	Australia
Australia	Townsville / Whitsunday	7630.70	Australia
Australia	Trinity Inlet - Fish habitat area A	60.44	Australia
Australia	Trinity Inlet - Fish habitat area B	11.71	Australia
Australia	Trinity Inlet / Marlin Coast	385.65	Australia
Australia	Tully River	6.52	Australia
Australia	Un-named (No. 36907)	12.96	Australia
Australia	Un-named (No. 36909)	24.80	Australia
Australia	Un-named (No. 36910)	0.71	Australia

Australia	Un-named (No. 36913)	155.58	Australia
Australia	Un-named (No. 36915)	83.40	Australia
Australia	Un-named (No. 37500)	0.05	Australia
Australia	Un-named (No. 39202)	0.12	Australia
Australia	Upstart Bay	192.46	Australia
Australia	Victor Island	0.19	Australia
Australia	Warul Kawa (Deliverance Island)	0.46	Pacific
Australia	Weld Island	0.30	Australia
Australia	West Hill	48.18	Australia
Australia	Whalebone Island	0.01	Australia
Australia	Whitmore,Roberts,Doole Islands And Sandalwood Landing Nature	5.70	Australia
Australia	Woongarra	107.13	Australia
Australia	Wreck Creek	12.53	Australia
Australia	Y Island	0.34	Australia
Australia	Yorkeys Creek	0.67	Australia
Australia	Zuytdorp	649.84	Australia
Australia (Christmas Island)	Christmas Island	87.26	Australia
Australia (Cocos (Keeling) Islands)	Emden (1914)	0.79	Australia
Australia (Cocos (Keeling) Islands)	Pulu Keeling	26.02	Australia
Australia (Rowley Shoals)	Rowley Shoals	223.39	Australia
Cambodia	Botum-Sakor	1758.36	Southeast Asia
Cambodia	Ream	287.98	Southeast Asia
China	Dadonghaishanhujiao	0.13	Southeast Asia
China	Danxianbaidiebei	284.86	Southeast Asia
China	Dayawanshuichanziyuan	26.55	Southeast Asia
China	Dazhoudao	7.59	Southeast Asia
China	Dongdaobaijianniao	3.77	Southeast Asia
China	Dongzhaiganghongshulin	113.43	Southeast Asia
China	Lingaojiao	34.67	Southeast Asia
China	Qinglanhongshulin	54.24	Southeast Asia
China	Sanya baoyu	0.67	Southeast Asia
China	Sanyahe hongshulin	4.76	Southeast Asia
China	Sanyashanhujiao	42.57	Southeast Asia
China	Tongguling	2.32	Southeast Asia
China	Weizhoudao	27.67	Southeast Asia
China	Wenchangqilincai	39.37	Southeast Asia
China	Wenlanjiang	151.97	Southeast Asia
China	Xinyinghongshulin	17.58	Southeast Asia
China	Xuwen Large Yellow Croaker	178.33	Southeast Asia
China	Yalongwanqingmeiganghongshulin	1.56	Southeast Asia
Comoros	Bambao Mtsanga (Anjouan Island)		Indian Ocean
Comoros	Chindini (Grande Comore Island)		Indian Ocean
Comoros	Chiroroni (Anjouan Island)		Indian Ocean
Comoros	Itsandra (Grande Comore Island)		Indian Ocean
Comoros	Large Platier de Bimbini (Anjouan Island)		Indian Ocean
Comoros	Le Moroni (Grande Comore Island)		Indian Ocean
Comoros	Mitsamiouli (Grande Comore Island)		Indian Ocean
Comoros	Moheli	404.00	Indian Ocean
Comoros	Moya (Anjouan Island)		Indian Ocean
Comoros	Ouani (Anjouan Island)		Indian Ocean
Djibouti	Maskali Sud	2.23	Middle East
Djibouti	Musha	10.07	Middle East
Egypt	Abu Gallum	417.29	Middle East
Egypt	Elba	30362.79	Middle East

Egypt	Nabq	500.80	Middle East
Egypt	Ras Mohammed	785.53	Middle East
Egypt	Taba	2709.14	Middle East
Egypt	Tourism Development Area I	26.28	Middle East
Egypt	Tourism Development Area II	47.79	Middle East
Egypt	Wadi El Gemal - Hamata	6868.74	Middle East
Federated States of Micronesia	Kehpera Marine Sanctuary	2.63	Pacific
Federated States of Micronesia	Kisin Nahmw en Nangih Stingray Sanctuary	0.30	Pacific
Federated States of Micronesia	Lenger Island	1.54	Pacific
Federated States of Micronesia	Nahmwen Na Stingray Sanctuary	0.53	Pacific
Federated States of Micronesia	Nahtik Marine Sanctuary	0.77	Pacific
Federated States of Micronesia	Palipohn Depehk Marine Sanctuary	3.03	Pacific
Federated States of Micronesia	Chuuk State Lagoon	0.01	Pacific
Federated States of Micronesia	Chuuk State Underwater	0.01	Pacific
Federated States of Micronesia	Enipein Marine Park and Mangrove Sanctuary	0.01	Pacific
Federated States of Micronesia	Giant Clam	0.01	Pacific
Federated States of Micronesia	Kosrae Island	0.01	Pacific
Federated States of Micronesia	Mwahnd Pass Conservation Area	8.34	Pacific
Federated States of Micronesia	Okat Trochus Marine	0.01	Pacific
Federated States of Micronesia	Oroluk	0.50	Pacific
Federated States of Micronesia	Pwudoi Sanctuary	0.01	Pacific
Federated States of Micronesia	Ringe Te Suh	0.01	Pacific
Federated States of Micronesia	Senpehn-Lehdau Mangrove Forest	10.32	Pacific
Federated States of Micronesia	Trochus Santuaries	0.01	Pacific
Federated States of Micronesia	Utwa-Walung Conservation Area	22.73	Pacific
Federated States of Micronesia	Yela-Okat Terminalia Swamp/Mangrove Forest	5.80	Pacific
Fiji	Batiki-Manuku	5.52	Pacific
Fiji	Batiki-Mua	5.52	Pacific
Fiji	Batiki-Naigani	5.52	Pacific
Fiji	Batiki-Yavu	5.52	Pacific
Fiji	Biaugunu/Lakeba/Natuvu/Vuniwai	65.31	Pacific
Fiji	Biausevu	4.86	Pacific
Fiji	Bukatatanoa Barrier Reef	35.00	Pacific
Fiji	Bulia Village	40.94	Pacific
Fiji	Cevai village	2.83	Pacific
Fiji	Cuvu	9.67	Pacific
Fiji	Cuvu Tikina	1.70	Pacific
Fiji	Daku village	5.90	Pacific
Fiji	Daviqele village	21.75	Pacific
Fiji	Dawasamu	149.17	Pacific
Fiji	Dawato-Malake	34.33	Pacific
Fiji	Dawato-Navetau	34.33	Pacific
Fiji	Dawato-Yasawa	34.33	Pacific
Fiji	Draunibota and Labiko Island	0.86	Pacific
Fiji	Drue village	22.29	Pacific
Fiji	Fulaga	0.01	Pacific

Fiji	Galoa/Soso villages	53.42	Pacific
Fiji	Gasele	1.64	Pacific
Fiji	Gunu village	172.47	Pacific
Fiji	Joma village	8.46	Pacific
Fiji	Kabariki	21.75	Pacific
Fiji	Kadavu village	22.00	Pacific
Fiji	Kiuva	324.80	Pacific
Fiji	Kumi	89.46	Pacific
Fiji	Lavena Coastal Walk	0.01	Pacific
Fiji	Lawaki village	87.58	Pacific
Fiji	Levuka	4.76	Pacific
Fiji	Macuata/Dreketi/Sasa/Mali Districts	1341.37	Pacific
Fiji	Makogai Island	8.40	Pacific
Fiji	Malolo (Mamanuca Group)-Solevu	1127.40	Pacific
Fiji	Malolo (Mamanuca Group)-Yaro	1091.07	Pacific
Fiji	Malomalo	2.18	Pacific
Fiji	Manava Island	0.01	Pacific
Fiji	Matanuku village	9.77	Pacific
Fiji	Matasawalevu village	87.58	Pacific
Fiji	Mokoisa	53.42	Pacific
Fiji	Mositi Vanuaso-Lamiti-Malawai	14.92	Pacific
Fiji	Mositi Vanuaso-Lekanai	14.92	Pacific
Fiji	Mositi Vanuaso-Nacavanadi	14.92	Pacific
Fiji	Mositi Vanuaso-Naovuka	14.92	Pacific
Fiji	Mositi Vanuaso-Vanuaso	14.92	Pacific
Fiji	Moturiki	0.01	Pacific
Fiji	Moturiki-Daku	82.48	Pacific
Fiji	Moturiki-Niubasaga	82.48	Pacific
Fiji	Moturiki-Uluibau	82.48	Pacific
Fiji	Muainuku	4.76	Pacific
Fiji	Muani	6.87	Pacific
Fiji	Naboutini village (Saqani district)	67.06	Pacific
Fiji	Nabukelevu	21.75	Pacific
Fiji	Nacomoto village	7.63	Pacific
Fiji	Naevuevu	9.67	Pacific
Fiji	Naigani	660.58	Pacific
Fiji	Naikorokoro	4.71	Pacific
Fiji	Naioconivonu	4.04	Pacific
Fiji	Nairai-Lawaki	125.92	Pacific
Fiji	Nairai-Natoloa	125.92	Pacific
Fiji	Nairai-Tovu lailai	125.92	Pacific
Fiji	Nairai-Vutuna	125.92	Pacific
Fiji	Nairai-Waitoga	125.92	Pacific
Fiji	Naivakarauniniu village	6.78	Pacific
Fiji	Naivuruvuru	89.46	Pacific
Fiji	Nakorotubu	536.08	Pacific
Fiji	Naloto	89.46	Pacific
Fiji	Namada	8.93	Pacific
Fiji	Namalata/Namuana	3.17	Pacific
Fiji	Namaqumaqua village	4.37	Pacific
Fiji	Namatakula	4.86	Pacific
Fiji	Namenalala Island Resort	1.08	Pacific
Fiji	Namuana village	18.42	Pacific
Fiji	Namuka/ Dogotuki districts-Druadrua Island	230.42	Pacific
Fiji	Namuka/ Dogotuki districts-Gevo Island	230.42	Pacific
Fiji	Namuka/ Dogotuki districtsi-Qelewara, Naur	230.42	Pacific

Fiji	Namuka/ Dogotuki districts-Kedra, Lagi	230.42	Pacific
Fiji	Namuka/ Dogotuki districts-Nabubu, Lakeba, Nasovivi	230.42	Pacific
Fiji	Namuka/ Dogotuki districts-Naduru	230.42	Pacific
Fiji	Namuka/ Dogotuki districts-Rauriko	230.42	Pacific
Fiji	Namuka/ Dogotuki districts-Visoqo, Ravuka, Cawadevo	230.42	Pacific
Fiji	Nanuku Islet	0.01	Pacific
Fiji	Narikoso Village	271.81	Pacific
Fiji	Nasegai village	4.06	Pacific
Fiji	Nasinu	149.17	Pacific
Fiji	Natacileka	149.17	Pacific
Fiji	Natale-i-ra village	149.17	Pacific
Fiji	Natumua village/Baidamudamu	22.21	Pacific
Fiji	Navola	4.86	Pacific
Fiji	Navolau District	736.34	Pacific
Fiji	Navukailagi village/Qarani (Gau Is.)	14.37	Pacific
Fiji	Navunimono	89.46	Pacific
Fiji	Navutulevu village	2.17	Pacific
Fiji	Nuku	1.06	Pacific
Fiji	Nukutolu Islets	0.01	Pacific
Fiji	Nukuvou village	87.58	Pacific
Fiji	Ogea Levu	0.01	Pacific
Fiji	Qaliira	21.75	Pacific
Fiji	Rakiraki	4.17	Pacific
Fiji	Rakiraki District	736.34	Pacific
Fiji	Raviravi District	63.08	Pacific
Fiji	Ravitaki	7.81	Pacific
Fiji	Rukurukulevu	9.67	Pacific
Fiji	Saqani	33.53	Pacific
Fiji	Sawa	89.46	Pacific
Fiji	Sawaieke district-Nukuloa	148.85	Pacific
Fiji	Sawau District	29.31	Pacific
Fiji	Serua	11.26	Pacific
Fiji	Sila	9.67	Pacific
Fiji	Silana	149.17	Pacific
Fiji	Snake island (Labuco)	0.01	Pacific
Fiji	Solodamu village	22.21	Pacific
Fiji	Solovola	3.44	Pacific
Fiji	Soso	14.90	Pacific
Fiji	Susui	6.50	Pacific
Fiji	Tagaqe	8.93	Pacific
Fiji	Tavarua Island	0.01	Pacific
Fiji	Tavua District	688.27	Pacific
Fiji	Tavuki village	22.21	Pacific
Fiji	Tawake district	57.66	Pacific
Fiji	Tikina Levuka (Ovalau)-Arovudi	108.44	Pacific
Fiji	Tikina Levuka (Ovalau)-Levuka Vakaviti	108.44	Pacific
Fiji	Tikina Levuka (Ovalau)-Naqaliduna	108.44	Pacific
Fiji	Tikina Levuka (Ovalau)-Nauouo	108.44	Pacific
Fiji	Tikina Levuka (Ovalau)-Rukuruku	108.44	Pacific
Fiji	Tikina Levuka (Ovalau)-Taviya	108.44	Pacific
Fiji	Tikina Levuka (Ovalau)-Vagadaci	108.44	Pacific
Fiji	Tikina Levuka (Ovalau)-Vatukalo	108.44	Pacific
Fiji	Tikina Levuka (Ovalau)-Vuna	9.88	Pacific
Fiji	Tikina Levuka (Ovalau)-Waitovu	108.44	Pacific
Fiji	Tikina Nasinu (Ovalau)-Draiba	21.62	Pacific

Fiji	Tikina Nasinu (Ovalau)i-Nasinu	21.62	Pacific
Fiji	Tikina Nasinu (Ovalau)-Nabobo/Levuka	21.62	Pacific
Fiji	Tikina Nasinu (Ovalau)-Naikorokoro	21.62	Pacific
Fiji	Tikina Nasinu (Ovalau)-Natokalau	21.62	Pacific
Fiji	Tikina Nasinu (Ovalau)-Tokou	21.62	Pacific
Fiji	Tikina Nasinu (Ovalau)-Visoto	21.62	Pacific
Fiji	Tikina Ovalau/Lovoni-Nukutocia	108.44	Pacific
Fiji	Tikina Ovalau/Nasinu	5.83	Pacific
Fiji	Tikina Wai	52.43	Pacific
Fiji	Tiliva village	87.58	Pacific
Fiji	Tore	9.67	Pacific
Fiji	Turtle Island MPA	0.01	Pacific
Fiji	Ucunivanua	89.46	Pacific
Fiji	Uluiloli	13.57	Pacific
Fiji	Ulunikoro Marine Reserve	271.81	Pacific
Fiji	Vabea Village	271.81	Pacific
Fiji	Vacalea village	87.58	Pacific
Fiji	Vanua Balavu-Boitaci	21.55	Pacific
Fiji	Vanua Balavu-Dakuilomaloma	114.47	Pacific
Fiji	Vanua Balavu-Daliconi	65.75	Pacific
Fiji	Vanua Balavu-Muamua	17.36	Pacific
Fiji	Vanua Balavu-Namuana	2.60	Pacific
Fiji	Vanua Conua	7.02	Pacific
Fiji	Vanua Komave-Komave	4.86	Pacific
Fiji	Vanua Kubulau	259.04	Pacific
Fiji	Vanua Naboutini	2.20	Pacific
Fiji	Vanua Nasavusavu-Nagigi	56.48	Pacific
Fiji	Vanua Nasavusavu-Nukubalavu	56.48	Pacific
Fiji	Vanua Nasavusavu-Vivili	56.48	Pacific
Fiji	Vanua Nasavusavu-Waivunia	56.48	Pacific
Fiji	Vanua Nasavusavu-Yaroi	56.48	Pacific
Fiji	Vanua Navatu-Leya	86.61	Pacific
Fiji	Vanua Navatu-Navakaka	39.02	Pacific
Fiji	Vanua Naweni-Dromoninuku	16.53	Pacific
Fiji	Vanua Naweni-Naweni	16.53	Pacific
Fiji	Vanua Naweni-Tacilevu	16.53	Pacific
Fiji	Vanua Tabanivonolevu	51.99	Pacific
Fiji	Vanua Vanuavou	17.04	Pacific
Fiji	Vanua Vaturova	81.67	Pacific
Fiji	Vanua Yanuca	61.12	Pacific
Fiji	Vatuolalai	8.93	Pacific
Fiji	Vione	14.37	Pacific
Fiji	Votua	8.93	Pacific
Fiji	Votua village	1520.97	Pacific
Fiji	Vuata Ono	7.90	Pacific
Fiji	Vueti Navakavu	18.59	Pacific
Fiji	Vuna (Taveuni)	15.52	Pacific
Fiji	Vuna (Waitabu)	0.01	Pacific
Fiji	Vuo Island	0.50	Pacific
Fiji	Wailevu	53.42	Pacific
Fiji	Wailevu	0.01	Pacific
Fiji	Waitabu village	147.88	Pacific
Fiji	Wakaya Island	8.00	Pacific
Fiji	Yadua	9.67	Pacific
Fiji	Yadua Taba Island	1963.85	Pacific

Fiji	Yadua Taba Island Crested Iguana Reserve	0.76	Pacific
Fiji	Yanuca	1091.07	Pacific
Fiji	Yauwe	8.14	Pacific
Fiji	Yavusa Bucabuca	2.21	Pacific
Fiji	Yavusa Cawalevu	0.91	Pacific
Fiji	Yavusa Cibaciba	1.11	Pacific
Fiji	Yavusa Kade	3.71	Pacific
Fiji	Yavusa Loto	5.47	Pacific
Fiji	Yavusa Matanimudu	10.62	Pacific
Fiji	Yavusa Nabuna	20.65	Pacific
Fiji	Yavusa Nakaukilagi	1.04	Pacific
Fiji	Yavusa Nakodu/Qalitu/Wailevu	4.76	Pacific
Fiji	Yavusa Nasau	5.91	Pacific
Fiji	Yavusa Natusara (Bulia, Dravuni village)	40.94	Pacific
Fiji	Yavusa Ulunivuaka	1.69	Pacific
Fiji	Yavusa Werelevu and Nagusu	7.91	Pacific
France	╬les Glorieuses	0.01	Indian Ocean
France	Ilot de Bassas da India	0.01	Indian Ocean
France	Ilot d'Europa	0.01	Indian Ocean
France	Juan de Nova	0.01	Indian Ocean
France (French Polynesia)	Aratika	0.01	Pacific
France (French Polynesia)	Aroa	0.48	Pacific
France (French Polynesia)	Atoll de Taiaro	9.30	Pacific
France (French Polynesia)	Bellinghausen (Motu One)	12.40	Pacific
France (French Polynesia)	Eiao Island	43.80	Pacific
France (French Polynesia)	Fakarava	0.01	Pacific
France (French Polynesia)	Hatutu Island Reserve Integrale	18.10	Pacific
France (French Polynesia)	Il ⌠t de Sable	0.01	Pacific
France (French Polynesia)	Kauehi	0.01	Pacific
France (French Polynesia)	Maatea	2.09	Pacific
France (French Polynesia)	Maiao	10.00	Pacific
France (French Polynesia)	Mohotani Reserve Integrale	15.50	Pacific
France (French Polynesia)	Motu Ahi	1.27	Pacific
France (French Polynesia)	Niau	0.01	Pacific
France (French Polynesia)	Nuarei	0.64	Pacific
France (French Polynesia)	Pihaena	0.62	Pacific
France (French Polynesia)	Rapa	40.00	Pacific
France (French Polynesia)	Raraka	0.01	Pacific
France (French Polynesia)	Scilly Atoll Reserve	113.00	Pacific
France (French Polynesia)	Taiaro Atoll Nature Reserve	20.00	Pacific
France (French Polynesia)	Taotaha	2.34	Pacific
France (French Polynesia)	Tetaiuo	1.08	Pacific
France (French Polynesia)	Tiahura	2.98	Pacific
France (French	Toau	0.01	Pacific

Polynesia)			
France (Mayotte)	Ilot M'Bouzi		Indian Ocean
France (Mayotte)	îlots		Indian Ocean
France (Mayotte)	Karahani		Indian Ocean
France (Mayotte)	Mangrove de Dzoumonyé et Longoni		Indian Ocean
France (Mayotte)	Mangrove d'Hajangoua		Indian Ocean
France (Mayotte)	Mangroves de Bouéni		Indian Ocean
France (Mayotte)	Moya		Indian Ocean
France (Mayotte)	Passe de Longogori	4.50	Indian Ocean
France (Mayotte)	Pointes du Nord		Indian Ocean
France (Mayotte)	Saziley	41.80	Indian Ocean
France (Mayotte)	Saziley		Indian Ocean
France (Mayotte)	Vasière des badamiers		Indian Ocean
France (New Caledonia)	Baie de Prony: Aiguille	0.12	Pacific
France (New Caledonia)	Baie de Prony: Ilot Casy	1.45	Pacific
France (New Caledonia)	Casy Islet	145.00	Pacific
France (New Caledonia)	Ile Pam	4.60	Pacific
France (New Caledonia)	Ilot GoΘland	0.00	Pacific
France (New Caledonia)	Ilot LeprΘdour	6.71	Pacific
France (New Caledonia)	La Dieppoisse Special Marine Reserve	0.78	Pacific
France (New Caledonia)	Nekoro MPA	1259.99	Pacific
France (New Caledonia)	Parc du lagon de Bourail: Ile Verte	0.84	Pacific
France (New Caledonia)	Parc du lagon de Bourail: PoΘ	28.00	Pacific
France (New Caledonia)	Parc du lagon de Bourail: Roche Percee and Baie des tortues	120.00	Pacific
France (New Caledonia)	Parc du lagon sud: Humboldt	0.01	Pacific
France (New Caledonia)	Parc du lagon sud: Ile aux Canards	0.78	Pacific
France (New Caledonia)	Parc du lagon sud: Ilot Amedee et Grand Recif Abore	0.78	Pacific
France (New Caledonia)	Parc du lagon sud: Ilot Bailly	3.32	Pacific
France (New Caledonia)	Parc du lagon sud: Ilot LarΘgnΦre	2.97	Pacific
France (New Caledonia)	Parc du lagon sud: Ilot Maitre	10.34	Pacific
France (New Caledonia)	Parc du lagon sud: Ilot Signal	2.23	Pacific
France (New Caledonia)	Pointe Kuendu	0.55	Pacific
France (New Caledonia)	RΘserve de la passe AmΘdΘe	27.80	Pacific
France (New Caledonia)	RΘserve spΘciale de Ouano, commune de La Foa	0.01	Pacific
France (New Caledonia)	RΘserve spΘciale marine de lÆɛlot TΘnia	150.00	Pacific
France (New Caledonia)	Special Reserve Cap N'Dua	11.68	Pacific
France (New Caledonia)	SΦche-Croissant	0.10	Pacific
France (New Caledonia)	Yves Merlet Special Marine Reserve	172.76	Pacific
France (Reunion)	Anse des Cascades	0.47	Indian Ocean
France (Reunion)	Bois Blanc	3.61	Indian Ocean
France (Reunion)	Cap de la Houssaye	0.02	Indian Ocean
France (Reunion)	Cap la Houssaye - grand fond		Indian Ocean
France (Reunion)	Cap la Houssaye-Ravine Trois Bassins	0.01	Indian Ocean
France (Reunion)	Cayenne		Indian Ocean
France (Reunion)	Grande Anse	0.15	Indian Ocean
France (Reunion)	Ile Tromelin	0.01	Indian Ocean
France (Reunion)	La grande chaloupe		Indian Ocean
France (Reunion)	La grande ravine		Indian Ocean
France (Reunion)	La Pointe de trois bassins et le littoral Sud de 3 Bassins		Indian Ocean
France (Reunion)	Le Chaudron	0.04	Indian Ocean
France (Reunion)	le littoral Sud de St leu		Indian Ocean
France (Reunion)	les colimaçons de St leu		Indian Ocean
France (Reunion)	L'Etang	0.01	Indian Ocean

France (Reunion)	l'Etang du Gol		Indian Ocean
France (Reunion)	Marine de Vincendo		Indian Ocean
France (Reunion)	Pointe au Sel	0.17	Indian Ocean
France (Reunion)	Réserve Naturelle Marine de La Réunion (Saint-Paul, Trois-Bassins, Saint-Leu, Les Avirons et Etang-Salé)		Indian Ocean
France (Reunion)	Saint-Leu	0.01	Indian Ocean
France (Reunion)	Saint-Pierre	0.01	Indian Ocean
France (Reunion)	Saline l'Hermitage (lagoon)	0.01	Indian Ocean
France (Reunion)	Saline l'Hermitage (Reef)	0.01	Indian Ocean
France (Reunion)	Terre rouge		Indian Ocean
India	Arial Island	0.05	Indian Ocean
India	Bamboo Island	0.05	Indian Ocean
India	Barren Island	11.81	Indian Ocean
India	Battimalv Island	4.20	Indian Ocean
India	Belle Island	0.08	Indian Ocean
India	Bennett Island	3.46	Indian Ocean
India	Bingham Island	0.08	Indian Ocean
India	Blister Island	0.26	Indian Ocean
India	Bluff Island	1.14	Indian Ocean
India	Bondoville Island	2.55	Indian Ocean
India	Brush Island	0.23	Indian Ocean
India	Buchanan Island	9.33	Indian Ocean
India	Chanel Island	0.13	Indian Ocean
India	Cinque Islands	9.51	Indian Ocean
India	Clyde Island	0.54	Indian Ocean
India	Cone Island	0.65	Indian Ocean
India	Curlew (B.P.) Island	0.16	Indian Ocean
India	Curlew Island	0.03	Indian Ocean
India	Defence Island	10.49	Indian Ocean
India	Dot Island	0.13	Indian Ocean
India	Dottrell Island	0.13	Indian Ocean
India	Duncan Island	0.73	Indian Ocean
India	East Island	6.11	Indian Ocean
India	East Of Inglis Island	3.55	Indian Ocean
India	Egg Island	0.05	Indian Ocean
India	Elat (Flat) Island	9.36	Indian Ocean
India	Entrance Island	0.96	Indian Ocean
India	Gander Island	0.05	Indian Ocean
India	Girjan Island	0.16	Indian Ocean
India	Goose Island	0.01	Indian Ocean
India	Great Nicobar	884.99	Indian Ocean
India	Gulf of Kutch	820.13	Indian Ocean
India	Gulf of Mannar	375.08	Indian Ocean
India	Gulf Of Mannar	375.07	Indian Ocean
India	Hump Island	0.47	Indian Ocean
India	Interview Island	115.06	Indian Ocean
India	James Island	2.10	Indian Ocean
India	Jungle Island	0.52	Indian Ocean
India	Kyd Island	8.00	Indian Ocean
India	Landfall Island	29.48	Indian Ocean
India	Latouche Island	0.96	Indian Ocean
India	Lohabarrack	22.21	Indian Ocean
India	Mahatma Gandhi	311.38	Indian Ocean
India	Mangrove Island	0.39	Indian Ocean
India	Marine	295.03	Indian Ocean
India	Marine (Gujarat)	162.89	Indian Ocean
India	Mask Island	0.78	Indian Ocean

India	Mayo Island	0.10	Indian Ocean
India	Megapode Island	0.12	Indian Ocean
India	Middle Button Island	0.64	Indian Ocean
India	Montogemery Island	0.21	Indian Ocean
India	Mount Harriett	55.67	Indian Ocean
India	Narcondam Island	6.81	Indian Ocean
India	North Brother Island	0.75	Indian Ocean
India	North Button Island	0.44	Indian Ocean
India	North Island	0.49	Indian Ocean
India	North Reef Island	3.48	Indian Ocean
India	Oliver Island	0.16	Indian Ocean
India	Orchid Island	0.10	Indian Ocean
India	Ox Island	0.13	Indian Ocean
India	Oyster Island-I	0.08	Indian Ocean
India	Oyster Island-II	0.21	Indian Ocean
India	Paget Island	7.36	Indian Ocean
India	Passage Island	0.62	Indian Ocean
India	Patric Island	0.13	Indian Ocean
India	Peacock Island	0.62	Indian Ocean
India	Pichavaram	15.38	Indian Ocean
India	Pitman Island	1.37	Indian Ocean
India	Point Calimere	220.66	Indian Ocean
India	Point Island	3.07	Indian Ocean
India	Potanma Islands	0.16	Indian Ocean
India	Ranger Island	4.26	Indian Ocean
India	Rani Jhansi Marine	256.14	Indian Ocean
India	Reef Island	1.74	Indian Ocean
India	Roper Island	1.46	Indian Ocean
India	Ross Island	1.01	Indian Ocean
India	Rowe Island	0.01	Indian Ocean
India	Sandy Island	1.58	Indian Ocean
India	Sea Serpent Island	0.78	Indian Ocean
India	Shark Island	0.60	Indian Ocean
India	Shearme Island	7.85	Indian Ocean
India	Sir Hugh Rose Island	1.06	Indian Ocean
India	Sisters Island	0.36	Indian Ocean
India	Snake Island-I	0.73	Indian Ocean
India	Snake Island-II	0.03	Indian Ocean
India	South Brother Island	1.24	Indian Ocean
India	South Button Island	0.03	Indian Ocean
India	South Reef Island	1.17	Indian Ocean
India	South Sentinel Island	1.61	Indian Ocean
India	Spike Island-I	0.42	Indian Ocean
India	Spike Island-II	11.70	Indian Ocean
India	Stoat Island	0.44	Indian Ocean
India	Surat Island	0.31	Indian Ocean
India	Swamp Island	4.09	Indian Ocean
India	Table (Delgarno) Island	2.29	Indian Ocean
India	Table (Excelsior) Island	1.69	Indian Ocean
India	Talabaicha Island	3.21	Indian Ocean
India	Temple Island	1.04	Indian Ocean
India	Tillongchang Island	33.45	Indian Ocean
India	Tree Island	0.03	Indian Ocean
India	Trilby Island	0.96	Indian Ocean
India	Tuft Island	0.29	Indian Ocean
India	Turtle Islands	0.39	Indian Ocean
India	West Island	6.40	Indian Ocean
India	Wharf Island	0.11	Indian Ocean

India	White Cliff Island	0.47	Indian Ocean
Indonesia	Alas Purwo	404.71	Southeast Asia
Indonesia	Ayau-Asia Island	1012.20	Southeast Asia
Indonesia	Bakau Perhatu	16.17	Southeast Asia
Indonesia	Bali Barat	846.39	Southeast Asia
Indonesia	Baluran	199.32	Southeast Asia
Indonesia	Bangkiriang	126.60	Southeast Asia
Indonesia	Bangko-bangko	23.95	Southeast Asia
Indonesia	Bawean	194.39	Southeast Asia
Indonesia	Bengkayang	187.37	Southeast Asia
Indonesia	Biak Numfor	343.01	Southeast Asia
Indonesia	Biak Utara	452.16	Southeast Asia
Indonesia	Bonto Bahari	46.40	Southeast Asia
Indonesia	Bukit Barisan Selatan	3364.00	Southeast Asia
Indonesia	Bukit Soeharto	632.00	Southeast Asia
Indonesia	Bunaken	748.19	Southeast Asia
Indonesia	Buton Utara	1026.68	Southeast Asia
Indonesia	Cibanteng	15.70	Southeast Asia
Indonesia	Cikepuh	139.46	Southeast Asia
Indonesia	Danau Tuadale (RTK.191)	8.67	Southeast Asia
Indonesia	Dataran Bena	97.03	Southeast Asia
Indonesia	Derawan (Berau)	12365.05	Southeast Asia
Indonesia	Desa Olele	0.24	Southeast Asia
Indonesia	Dolangan	0.61	Southeast Asia
Indonesia	Gili Banta	66.49	Southeast Asia
Indonesia	Gili Meno, Gili Anyer, Gili Trawangan	68.65	Southeast Asia
Indonesia	Gili Sulat, Gili Lawang	6.86	Southeast Asia
Indonesia	Gili Sulat, Gili Lawang	10.70	Southeast Asia
Indonesia	Gugus Pulau Teluk Maumere	513.71	Southeast Asia
Indonesia	Gunung Api	1.17	Southeast Asia
Indonesia	Gunung Api Banda	7.34	Southeast Asia
Indonesia	Gunung Dua Sudara	120.67	Southeast Asia
Indonesia	Gunung Nanu'ua	74.94	Southeast Asia
Indonesia	Gunung Selok	29.53	Southeast Asia
Indonesia	Jorongmaligi	881.89	Indian Ocean
Indonesia	Kab Bintan	1814.72	Southeast Asia
Indonesia	Kab Bintan / Prop Kep Riau	10338.34	Southeast Asia
Indonesia	Kab Ciamis	47.14	Southeast Asia
Indonesia	Kab Kaur	466.20	Southeast Asia
Indonesia	Kab kep Mentawai	436.14	Indian Ocean
Indonesia	Kab kep Mentawai	220.55	Indian Ocean
Indonesia	Kab Lampung Barat	47.93	Southeast Asia
Indonesia	Kab Natuna	524.98	Southeast Asia
Indonesia	Kab Natuna	532.06	Southeast Asia
Indonesia	Kab Natuna	361.05	Southeast Asia
Indonesia	Kab Nias	291.86	Indian Ocean
Indonesia	Kab Serdang Bedagai	2.00	Southeast Asia
Indonesia	Kab Simuelue	534.65	Indian Ocean
Indonesia	Kai Besar	291.53	Southeast Asia
Indonesia	Kaimana	5408.41	Southeast Asia
Indonesia	Karang Bolong	0.01	Southeast Asia
Indonesia	Karimun Jawa	1790.85	Southeast Asia
Indonesia	Kawe / Kep. Wayag Sayang / Kep. Panjang	1545.61	Southeast Asia
Indonesia	Kelompok Hutan Bakau Pantai Timur	422.93	Southeast Asia
Indonesia	Kepulauan Aru Tenggara	2474.06	Southeast Asia
Indonesia	Kepulauan Banyak	2266.85	Indian Ocean
Indonesia	Kepulauan Kapoposang	217.39	Southeast Asia
Indonesia	Kepulauan Karimata	904.09	Southeast Asia

Indonesia	Kepulauan Padaido	848.19	Southeast Asia
Indonesia	Kepulauan Padamarang	36.91	Southeast Asia
Indonesia	Kepulauan Raja Empat	356.85	Southeast Asia
Indonesia	Kepulauan Seribu	1133.26	Southeast Asia
Indonesia	Kepulauan Togean	3989.05	Southeast Asia
Indonesia	Kepulauan Wakatobi (Laut)	12687.98	Southeast Asia
Indonesia	Kioyo I/II	9.53	Southeast Asia
Indonesia	Kofiau and Boo Islands	1578.32	Southeast Asia
Indonesia	Komodo	1765.82	Southeast Asia
Indonesia	Kota Batam	1172.48	Southeast Asia
Indonesia	Kutai	2243.53	Southeast Asia
Indonesia	Kwangtung Island	0.57	Indian Ocean
Indonesia	Lampoko Mampie	33.17	Southeast Asia
Indonesia	Leuweung Sancang	19.80	Southeast Asia
Indonesia	Lewotobi	79.42	Southeast Asia
Indonesia	Manepeu -Tanah Daru	569.24	Southeast Asia
Indonesia	Manusela	1571.24	Southeast Asia
Indonesia	Mas Popaya Raja	37.31	Southeast Asia
Indonesia	Maubesi	82.15	Southeast Asia
Indonesia	Meru Betiri	618.74	Southeast Asia
Indonesia	Morowali	2240.03	Southeast Asia
Indonesia	Muara Angke	33.02	Southeast Asia
Indonesia	Mubrani-Kaironi	24.87	Southeast Asia
Indonesia	Napabalano	13.80	Southeast Asia
Indonesia	Ngurah Rai	19.93	Southeast Asia
Indonesia	Nusa Barung	79.12	Southeast Asia
Indonesia	Nusa Kambagan Timur	2.77	Southeast Asia
Indonesia	Nusakambangan	205.80	Southeast Asia
Indonesia	P. Ujung, P. Tengah, P. Angsa, P. Kasiak	0.27	Indian Ocean
Indonesia	P. Ujung, P. Tengah, P. Angsa, P. Kasiak	0.48	Indian Ocean
Indonesia	P. Ujung, P. Tengah, P. Angsa, P. Kasiak	0.31	Indian Ocean
Indonesia	P. Ujung, P. Tengah, P. Angsa, P. Kasiak	0.24	Indian Ocean
Indonesia	P. Ujung, P. Tengah, P. Angsa, P. Kasiak	23.51	Indian Ocean
Indonesia	Pananjung Pangandaran	21.45	Southeast Asia
Indonesia	Pangi Binanga	60.00	Southeast Asia
Indonesia	Pangumbahan, Kec Ciracap, kab Sukabumi	27.91	Southeast Asia
Indonesia	Pantai Jamursba Medi	3940.81	Southeast Asia
Indonesia	Pantai Sausapor	407.15	Southeast Asia
Indonesia	Panua	496.01	Southeast Asia
Indonesia	Pati Pati	21.44	Southeast Asia
Indonesia	Pati-Pati - Game Reserve	18.21	Southeast Asia
Indonesia	Pegunungan Cycloop	328.86	Southeast Asia
Indonesia	Perhatu	4.57	Southeast Asia
Indonesia	Pinjam/Tanjung Mantop	5.86	Southeast Asia
Indonesia	Pulau Anak Krakatau	116.53	Southeast Asia
Indonesia	Pulau Anggrameos	23.07	Southeast Asia
Indonesia	Pulau Angwarmase	5.19	Southeast Asia
Indonesia	Pulau Batanta Barat	171.61	Southeast Asia
Indonesia	Pulau Baun	659.94	Southeast Asia
Indonesia	Pulau Besar	68.23	Southeast Asia
Indonesia	Pulau Biawak	1221.25	Southeast Asia
Indonesia	Pulau Bokor	0.19	Southeast Asia
Indonesia	Pulau Dua	0.52	Southeast Asia
Indonesia	Pulau Kassa	0.74	Southeast Asia
Indonesia	Pulau Kayu Adi / Kab Selayar	10.19	Southeast Asia
Indonesia	Pulau Kobror	82.34	Southeast Asia
Indonesia	Pulau Kofiau	128.40	Southeast Asia
Indonesia	Pulau Lapang	2.38	Southeast Asia

Indonesia	Pulau Larat	36.90	Southeast Asia
Indonesia	Pulau Laut	4.00	Southeast Asia
Indonesia	Pulau Manuk	1.00	Southeast Asia
Indonesia	Pulau Manuk Woha	15.84	Southeast Asia
Indonesia	Pulau Marsegu	101.37	Southeast Asia
Indonesia	Pulau Menipo (RTK.188)	39.27	Southeast Asia
Indonesia	Pulau Misool	1111.08	Southeast Asia
Indonesia	Pulau Moyo	157.92	Southeast Asia
Indonesia	Pulau Moyo	75.49	Southeast Asia
Indonesia	Pulau Noko-Nusa	0.07	Southeast Asia
Indonesia	Pulau Nustaram	650.69	Southeast Asia
Indonesia	Pulau Nuswotar	35.08	Southeast Asia
Indonesia	Pulau Panjang	128.55	Southeast Asia
Indonesia	Pulau Penyu	219.20	Indian Ocean
Indonesia	Pulau Penyu	1051.36	Indian Ocean
Indonesia	Pulau Pieh dan perariran	349.81	Indian Ocean
Indonesia	Pulau Pini	97.63	Indian Ocean
Indonesia	Pulau Pombo	17.12	Southeast Asia
Indonesia	Pulau Pombo	8.66	Southeast Asia
Indonesia	Pulau Rambut	0.18	Southeast Asia
Indonesia	Pulau Rambut dan Perairan	0.88	Southeast Asia
Indonesia	Pulau Rempang	156.45	Southeast Asia
Indonesia	Pulau Rusa	11.83	Southeast Asia
Indonesia	Pulau Sabuda dan Pulau Tataruga	166.17	Southeast Asia
Indonesia	Pulau Salawati Utara	675.29	Southeast Asia
Indonesia	Pulau Sangalaki	0.93	Southeast Asia
Indonesia	Pulau Sangiang	8.30	Southeast Asia
Indonesia	Pulau Saobi (Kangean)	11.87	Southeast Asia
Indonesia	Pulau Satonda	10.98	Southeast Asia
Indonesia	Pulau Seho	19.61	Southeast Asia
Indonesia	Pulau Selayar, Kab Selayar	16.65	Southeast Asia
Indonesia	Pulau Semama	0.78	Southeast Asia
Indonesia	Pulau Sempu	8.11	Southeast Asia
Indonesia	Pulau Waigeo	1312.33	Southeast Asia
Indonesia	Pulau Weh	63.58	Indian Ocean
Indonesia	Pulau Yapen Tengah	775.25	Southeast Asia
Indonesia	Raja Ampat	1661.68	Southeast Asia
Indonesia	Rawa Aopa Watumohai	1031.30	Southeast Asia
Indonesia	Riung	4.20	Southeast Asia
Indonesia	Sabuda Tataruga	11.59	Southeast Asia
Indonesia	Selah Legium Complex PrFo (Sumbawa Is.)	320.64	Southeast Asia
Indonesia	Selat Dampier	2999.98	Southeast Asia
Indonesia	Selat Pantar / Alor	3989.42	Southeast Asia
Indonesia	Selat Tiworo	294.23	Southeast Asia
Indonesia	Senayang Lingga	24980.75	Southeast Asia
Indonesia	Sepanjang	339.00	Southeast Asia
Indonesia	Sidei-Wibain	27.02	Southeast Asia
Indonesia	Sindangkerta	2.01	Southeast Asia
Indonesia	Southeast Misool	3324.16	Southeast Asia
Indonesia	Sumba Strait Marine Area	5527.87	Southeast Asia
Indonesia	Sungai Bahewo Reg.57	5.87	Southeast Asia
Indonesia	Sungai Bulan dan Sungai Lulan	23.60	Southeast Asia
Indonesia	Tafermaar	30.05	Southeast Asia
Indonesia	Taka Bonerate	5348.75	Southeast Asia
Indonesia	Taman Laut Banda	26.56	Southeast Asia
Indonesia	Tanah Pedauh	5.44	Southeast Asia
Indonesia	Tangkoko Batu Angus	31.96	Southeast Asia
Indonesia	Tanjung Amelengo	12.54	Southeast Asia

Indonesia	Tanjung Api	50.44	Southeast Asia
Indonesia	Tanjung Batikolo	30.35	Southeast Asia
Indonesia	Tanjung Batikolo	43.36	Southeast Asia
Indonesia	Tanjung Laksaha Reg.98	4.06	Southeast Asia
Indonesia	Tanjung Oisina Mangrove Swamp	5.00	Southeast Asia
Indonesia	Tanjung Panjang	73.00	Southeast Asia
Indonesia	Tanjung Peropa	304.08	Southeast Asia
Indonesia	Tanjung Santigi	15.91	Southeast Asia
Indonesia	Tapanuli Tengah	843.59	Indian Ocean
Indonesia	Teluk Adang	572.55	Southeast Asia
Indonesia	Teluk Apar	462.51	Southeast Asia
Indonesia	Teluk Baron	25.85	Southeast Asia
Indonesia	Teluk Bintuni	941.48	Southeast Asia
Indonesia	Teluk Cendrawasih	15379.63	Southeast Asia
Indonesia	Teluk Kelumpang; Selat Laut; Selat Sebuku	609.51	Southeast Asia
Indonesia	Teluk Klowe Reg.96	1.53	Southeast Asia
Indonesia	Teluk Kupang	648.30	Southeast Asia
Indonesia	Teluk Lasolo-Teluk Dalam	1550.57	Southeast Asia
Indonesia	Teluk Mayalibit	489.75	Southeast Asia
Indonesia	Teluk Pamukan	207.84	Southeast Asia
Indonesia	Teluk Yotefa	9.06	Southeast Asia
Indonesia	Tirosa Batek Marine Area	28570.41	Southeast Asia
Indonesia	Toffo Kota Lambu	39.77	Southeast Asia
Indonesia	Tujuh Belas Pulau Riung	83.52	Southeast Asia
Indonesia	Tuti Adagae	55.82	Southeast Asia
Indonesia	Ujung Kulon	1131.65	Southeast Asia
Indonesia	Wae Wuul/ Mburak	13.37	Southeast Asia
Indonesia	Wijaya Kusuma	0.01	Southeast Asia
Iran, Islamic Republic of	Faror	28.94	Middle East
Iran, Islamic Republic of	Hara	857.45	Middle East
Iran, Islamic Republic of	Hara-e Khoran	27.73	Middle East
Iran, Islamic Republic of	Kharko	3.01	Middle East
Iran, Islamic Republic of	Khuran Straits	781.94	Middle East
Iran, Islamic Republic of	Mond	491.04	Middle East
Iran, Islamic Republic of	Nayband	186.25	Middle East
Iran, Islamic Republic of	Sheedvar Island	2.57	Middle East
Iran, Islamic Republic of	Shidvar	2.57	Middle East
Israel	HaYam HaDeromi BeElat	0.33	Middle East
Israel	Maßiv Elat	391.23	Middle East
Japan	Amami - Gunto	565.81	Southeast Asia
Japan	Aragusuku-jima Maibishi	0.47	Southeast Asia
Japan	Iriomote	701.38	Southeast Asia
Japan	Kametoku	0.70	Southeast Asia
Japan	Kasari Hanto Higashi Kaigan	0.87	Southeast Asia
Japan	Kirishima -Yaku	1138.48	Southeast Asia
Japan	Kiyanguchi	0.46	Southeast Asia
Japan	Kurio	1.14	Southeast Asia
Japan	Kuroshima Kyanguch	0.42	Southeast Asia
Japan	Maibishi	0.48	Southeast Asia
Japan	Manko	2.02	Southeast Asia
Japan	Miyakejima	0.50	Southeast Asia
Japan	Ogasawara - Marine Park	4.51	Pacific
Japan	Ogasawara - National Park	261.47	Pacific
Japan	Okinawa Kaigan - Marine Park	1.39	Southeast Asia
Japan	Okinawa Kaigan - Quasi National Park	689.19	Southeast Asia
Japan	Okinawa Senseki	430.11	Southeast Asia
Japan	Sakiyamawan	20.83	Southeast Asia
Japan	Sata Misaki	0.18	Southeast Asia

Japan	Setouchi	0.78	Southeast Asia
Japan	Shimobishi	0.83	Southeast Asia
Japan	Surikozaki	0.61	Southeast Asia
Japan	Taketomi-jima Shimobishi	0.87	Southeast Asia
Japan	Taketomi-jima Takedonguchi	0.34	Southeast Asia
Japan	Takidunguchi	0.37	Southeast Asia
Japan	Tokashiki	2.15	Southeast Asia
Japan	Yoronto	1.64	Southeast Asia
Japan	Zamami	1.72	Southeast Asia
Kenya	Boni	1345.70	Indian Ocean
Kenya	Diani	106.91	Indian Ocean
Kenya	Dodori	729.47	Indian Ocean
Kenya	Kisite	34.00	Indian Ocean
Kenya	Kiunga	242.27	Indian Ocean
Kenya	Malindi	6.29	Indian Ocean
Kenya	Malindi-Watamu	245.00	Indian Ocean
Kenya	Mombasa - National Reserve	194.44	Indian Ocean
Kenya	Mombasa - National Park	9.98	Indian Ocean
Kenya	Mpunguti	12.87	Indian Ocean
Kenya	Watamu	206.16	Indian Ocean
Kiribati	Birnie Island	0.20	Pacific
Kiribati	Bonriki Island Water Reserve	0.01	Pacific
Kiribati	Cook Islet	0.22	Pacific
Kiribati	Kiritimati Atoll (Christmas Island)	523.69	Pacific
Kiribati	Malden Island	39.30	Pacific
Kiribati	McKean Island	0.57	Pacific
Kiribati	Motu Tabu	0.04	Pacific
Kiribati	Motu Upua	0.19	Pacific
Kiribati	Ngaon te Taake	0.26	Pacific
Kiribati	North Tarawa	12.70	Pacific
Kiribati	Phoenix Islands	408397.07	Pacific
Kiribati	Rawaki (Phoenix) Island	65.00	Pacific
Kiribati	Starbuck Island	162.00	Pacific
Kiribati	Vostok Island	0.24	Pacific
Madagascar	Ambodilaitry Masoala	38.86	Indian Ocean
Madagascar	Andavadoaka		Indian Ocean
Madagascar	Baie d'Ambodivahibe		Indian Ocean
Madagascar	Baie de Baly	652.87	Indian Ocean
Madagascar	Baie de Ranobe		Indian Ocean
Madagascar	Cap Sainte-Marie	29.12	Indian Ocean
Madagascar	Ifaho	36.09	Indian Ocean
Madagascar	Lokobe	15.84	Indian Ocean
Madagascar	Mananara-Nord	11.96	Indian Ocean
Madagascar	Masoala	2094.96	Indian Ocean
Madagascar	Nosy Hara		Indian Ocean
Madagascar	Nosy Mangabe	6.06	Indian Ocean
Madagascar	Sahamalaza - Iles Radama		Indian Ocean
Madagascar	Salary Nord		Indian Ocean
Madagascar	Tampolo	32.54	Indian Ocean
Malaysia	Abai	13.96	Southeast Asia
Malaysia	Bako	36.32	Southeast Asia
Malaysia	Banggi Island	112.06	Southeast Asia
Malaysia	Bengkoka	63.56	Southeast Asia
Malaysia	Benkoka Penninsular	132.83	Southeast Asia
Malaysia	Elopura	246.74	Southeast Asia
Malaysia	Gum Gum	0.48	Southeast Asia
Malaysia	Gum Gum	30.86	Southeast Asia
Malaysia	Kabili Sepilok	42.75	Southeast Asia

Malaysia	Karakit	0.28	Southeast Asia
Malaysia	Kota Belud	8.72	Southeast Asia
Malaysia	Kuala Sedili	4.33	Southeast Asia
Malaysia	Kuala Tingkaya	47.45	Southeast Asia
Malaysia	Kudat and Marudu	136.36	Southeast Asia
Malaysia	Kulamba	225.93	Southeast Asia
Malaysia	Lahad Datu	110.66	Southeast Asia
Malaysia	Menumbok	57.10	Southeast Asia
Malaysia	Padas Damit	90.27	Southeast Asia
Malaysia	Paitan	711.09	Southeast Asia
Malaysia	Pulau Aur	16.85	Southeast Asia
Malaysia	Pulau Babi Besar	5.20	Southeast Asia
Malaysia	Pulau Babi Hujung	0.41	Southeast Asia
Malaysia	Pulau Babi Tengah	0.80	Southeast Asia
Malaysia	Pulau Banggi	115.04	Southeast Asia
Malaysia	Pulau Batik	3.47	Southeast Asia
Malaysia	Pulau Berhala	1.71	Southeast Asia
Malaysia	Pulau Besar	84.14	Southeast Asia
Malaysia	Pulau Chebeh	0.23	Southeast Asia
Malaysia	Pulau Ekor Tebu	0.10	Southeast Asia
Malaysia	Pulau Goal	0.19	Southeast Asia
Malaysia	Pulau Harimau	0.54	Southeast Asia
Malaysia	Pulau Hujung	52.36	Southeast Asia
Malaysia	Pulau Jahat	45.20	Southeast Asia
Malaysia	Pulau Kaca	0.34	Indian Ocean
Malaysia	Pulau Kapas	1.99	Southeast Asia
Malaysia	Pulau Kuraman	66.95	Southeast Asia
Malaysia	Pulau Labas	0.33	Southeast Asia
Malaysia	Pulau Lang Tengah	1.53	Southeast Asia
Malaysia	Pulau Lembu	0.51	Indian Ocean
Malaysia	Pulau Lima	0.34	Southeast Asia
Malaysia	Pulau Mantanani	3.00	Southeast Asia
Malaysia	Pulau Mensirip	46.60	Southeast Asia
Malaysia	Pulau Mentinggi	43.99	Southeast Asia
Malaysia	Pulau Nyireh	14.40	Southeast Asia
Malaysia	Pulau Payar	0.54	Indian Ocean
Malaysia	Pulau Pemanggil	9.33	Southeast Asia
Malaysia	Pulau Penyu (Turtle Islands)	17.57	Southeast Asia
Malaysia	Pulau Perhentian Besar	9.82	Southeast Asia
Malaysia	Pulau Perhentian Kecil	6.35	Southeast Asia
Malaysia	Pulau Pinang	1.07	Southeast Asia
Malaysia	Pulau Rawa	0.29	Southeast Asia
Malaysia	Pulau Redang	27.68	Southeast Asia
Malaysia	Pulau Rusukan Besar	44.70	Southeast Asia
Malaysia	Pulau Rusukan Kecil	48.50	Southeast Asia
Malaysia	Pulau Sakar	7.92	Southeast Asia
Malaysia	Pulau Segantang	0.41	Indian Ocean
Malaysia	Pulau Sembilang	2.42	Southeast Asia
Malaysia	Pulau Sepoi	0.28	Southeast Asia
Malaysia	Pulau Seri Buat	5.42	Southeast Asia
Malaysia	Pulau Sibu	4.76	Southeast Asia
Malaysia	Pulau Sibu Hujung	11.83	Southeast Asia
Malaysia	Pulau Singa	6.28	Indian Ocean
Malaysia	Pulau Sipadan	11.08	Southeast Asia
Malaysia	Pulau Sri Buat	77.20	Southeast Asia
Malaysia	Pulau Susu Dara	0.32	Southeast Asia
Malaysia	Pulau Tengah	51.49	Southeast Asia
Malaysia	Pulau Tenggol	24.00	Southeast Asia

Malaysia	Pulau Tiga	37.00	Southeast Asia
Malaysia	Pulau Timun	8.21	Indian Ocean
Malaysia	Pulau Tinggi	15.84	Southeast Asia
Malaysia	Pulau Tioman	134.51	Southeast Asia
Malaysia	Pulau Tioman	251.15	Southeast Asia
Malaysia	Pulau Tokong Bahara	1.01	Southeast Asia
Malaysia	Pulau Tuba	4.98	Indian Ocean
Malaysia	Pulau Tukong Ara-Banun	6.98	Southeast Asia
Malaysia	Pulau Tulai	1.75	Southeast Asia
Malaysia	Samunsam	95.99	Southeast Asia
Malaysia	Selangan Island	1.61	Southeast Asia
Malaysia	Selat Panchor	13.35	Indian Ocean
Malaysia	Semporna	11.08	Southeast Asia
Malaysia	Semporna	234.00	Southeast Asia
Malaysia	Sepilok (Mangrove)	12.46	Southeast Asia
Malaysia	Sibyte	23.64	Southeast Asia
Malaysia	Similajau	145.94	Southeast Asia
Malaysia	Sulaman Lake	26.35	Southeast Asia
Malaysia	Sungai Sugut,Paitan,Pulau Jambongan	385.64	Southeast Asia
Malaysia	Tabawan,Bohayan,Maganting,Silumpat Islands	1.77	Southeast Asia
Malaysia	Talang Satang	206.60	Southeast Asia
Malaysia	Tanjong Nagas	10.91	Southeast Asia
Malaysia	Tanjung Dagu	7.28	Indian Ocean
Malaysia	Tunku Abdul Rahman	2.70	Southeast Asia
Malaysia	Turtle Islands Heritage	2847.87	Southeast Asia
Malaysia	Ulu Kalumpang	513.33	Southeast Asia
Maldives	Anemone City	0.01	Indian Ocean
Maldives	Banana Reef	0.01	Indian Ocean
Maldives	Devana Kandu	0.01	Indian Ocean
Maldives	Dhigali haa	0.01	Indian Ocean
Maldives	Embudu Channel	0.01	Indian Ocean
Maldives	Filitheyo Kandu	0.01	Indian Ocean
Maldives	Fish Head	0.01	Indian Ocean
Maldives	Fushi Kandu	0.01	Indian Ocean
Maldives	Fushivaru Thila	0.01	Indian Ocean
Maldives	Guraidhoo Channel	0.01	Indian Ocean
Maldives	H.P Reef	0.01	Indian Ocean
Maldives	Hakura Thila	0.01	Indian Ocean
Maldives	Hans Place	0.01	Indian Ocean
Maldives	Kadu Rah Thila	0.01	Indian Ocean
Maldives	Kari Beyru Thila	0.01	Indian Ocean
Maldives	Kuda Haa	0.01	Indian Ocean
Maldives	Kuredhu Express	0.01	Indian Ocean
Maldives	Lions Head	0.01	Indian Ocean
Maldives	Maaya Thila	0.01	Indian Ocean
Maldives	Madivaru	0.01	Indian Ocean
Maldives	Makundhoo kandu	0.01	Indian Ocean
Maldives	Nasimo Thila	0.01	Indian Ocean
Maldives	Orimas Thila	0.01	Indian Ocean
Maldives	Rasfari	0.01	Indian Ocean
Maldives	Vattaru Kandu	0.01	Indian Ocean
Marshall Islands	Bikar Atoll	56.31	Pacific
Marshall Islands	Bokaak (Taongi) Atoll	106.97	Pacific
Marshall Islands	Jaluit Atoll	700.99	Pacific
Mauritius	Anse aux Anglais Marine Reserve		Indian Ocean
Mauritius	Anse Quitor	0.10	Indian Ocean
Mauritius	Balaclava Marine Park		Indian Ocean

Mauritius	Black River	2.70	Indian Ocean
Mauritius	Blue Bay/Le Chaland Marine Nature Reserve	3.53	Indian Ocean
Mauritius	Coin de Mire (Gunner's Quoin)	0.74	Indian Ocean
Mauritius	Flacq	5.24	Indian Ocean
Mauritius	Grand Bassin Marine Reserve		Indian Ocean
Mauritius	Grand Port - Mahebourg	22.00	Indian Ocean
Mauritius	Grande Montagne	0.14	Indian Ocean
Mauritius	Ile aux Aigrettes	0.25	Indian Ocean
Mauritius	Ile aux Cocos	0.15	Indian Ocean
Mauritius	Ile aux Sables	0.08	Indian Ocean
Mauritius	Ile aux Serpents	0.31	Indian Ocean
Mauritius	Ile Plate (Flat Island)	2.54	Indian Ocean
Mauritius	Ile Ronde (Round Island)	2.21	Indian Ocean
Mauritius	Ilot Gabriel	0.40	Indian Ocean
Mauritius	Ilot Marianne	0.02	Indian Ocean
Mauritius	Passe Demie Marine Reserve		Indian Ocean
Mauritius	Port Louis	7.68	Indian Ocean
Mauritius	Riviere Banane Marine Reserve		Indian Ocean
Mauritius	Riviere du Rampart - Poudre d'Or	28.13	Indian Ocean
Mauritius	South East Marine Protected Area		Indian Ocean
Mauritius	Trou d'Eau Douce Fir	5.53	Indian Ocean
Mozambique	Bazaruto	1359.33	Indian Ocean
Mozambique	Quirimbas	9030.11	Indian Ocean
Myanmar	Lampi Island	184.25	Indian Ocean
Myanmar	Moscos Island	171.16	Indian Ocean
Myanmar	Natma Taung	722.60	Indian Ocean
Myanmar	Thamihla Kyun GS (Diamond Island)	9.20	Indian Ocean
Myanmar	Wunbaik	227.32	Indian Ocean
Niue	Anono (Namoui)	0.28	Pacific
Niue	Hakupu Cultural and Heritage Park	0.05	Pacific
Niue	Huvalu Forest	60.29	Pacific
Niue	Makefu and Alofi North	0.01	Pacific
Palau	Airai Reef	4.00	Pacific
Palau	Angaur	0.40	Pacific
Palau	Bkulengriil	0.70	Pacific
Palau	Ebiil	37.94	Pacific
Palau	Helen Reef	189.66	Pacific
Palau	Imul Mangrove	0.40	Pacific
Palau	Lake Ngardok	4.93	Pacific
Palau	Melekeok	0.01	Pacific
Palau	Ngaraard Beach	12.10	Pacific
Palau	Ngaraard Mangrove	1.40	Pacific
Palau	Ngatpang	0.50	Pacific
Palau	Ngchesechang Mangrove	1.00	Pacific
Palau	Ngederrak Reef	5.89	Pacific
Palau	Ngelukes	1.00	Pacific
Palau	Ngemai	1.00	Pacific
Palau	Ngemelis Conservation Area	40.31	Pacific
Palau	Ngerameduu	167.95	Pacific
Palau	Ngeran Clam Area	1.00	Pacific
Palau	Ngeream	1.60	Pacific
Palau	Ngerheba Island Wildlife	1.00	Pacific
Palau	Ngerkebesang	0.10	Pacific
Palau	Ngermasech	7.00	Pacific
Palau	Ngeruangel	56.59	Pacific
Palau	Ngerukuid (Ngerukewid) Islands Preserve	11.40	Pacific
Palau	Ngerumekoal Spawning Area	3.52	Pacific

Palau	Ngkisaol Sardines	1.13	Pacific
Palau	Reef of Ileyakl Beluu (Ileakelbeluu)	0.50	Pacific
Palau	Rock Islands Southern Lagoon	840.59	Pacific
Palau	Tululeu Seagrass	0.40	Pacific
Papua New Guinea	Ae/Gugumi	0.01	Pacific
Papua New Guinea	Aronai	0.01	Pacific
Papua New Guinea	Bagiai	168.93	Pacific
Papua New Guinea	Baia Managed Area	237.97	Pacific
Papua New Guinea	Baniara Island	0.37	Pacific
Papua New Guinea	Bialla Managed Area	52.47	Pacific
Papua New Guinea	Boma	0.01	Pacific
Papua New Guinea	Bosadi	0.01	Pacific
Papua New Guinea	Buakap	0.01	Pacific
Papua New Guinea	Buludawa Managed Area	24.19	Pacific
Papua New Guinea	Cape Hoskin/Wulai Managed Area	425.44	Pacific
Papua New Guinea	Cape Torkoro Managed Area	84.38	Pacific
Papua New Guinea	Cape Wom Memorial Park	0.02	Pacific
Papua New Guinea	Crown Island Wildlife Sanctuary	25.81	Pacific
Papua New Guinea	Dagi Managed Area	24.25	Pacific
Papua New Guinea	Eware	0.01	Pacific
Papua New Guinea	Galuse	0.01	Pacific
Papua New Guinea	Garu	75.17	Pacific
Papua New Guinea	Garua Island Managed Area	25.86	Pacific
Papua New Guinea	Gingala	0.01	Pacific
Papua New Guinea	Hercules Bay	0.01	Pacific
Papua New Guinea	Heusner Managed Area	123.95	Pacific
Papua New Guinea	Kalama/Sulu Managed Area	3.76	Pacific
Papua New Guinea	Kalaven LMMA	0.05	Pacific
Papua New Guinea	Kamiali	450.75	Pacific
Papua New Guinea	Kapiuru Managed Area	19.75	Pacific
Papua New Guinea	Kilu-Tamare	0.01	Pacific
Papua New Guinea	Kimbe Island Managed Area	21.37	Pacific
Papua New Guinea	Klampun	45.59	Pacific
Papua New Guinea	Kulungi	0.01	Pacific
Papua New Guinea	Labu	0.01	Pacific
Papua New Guinea	Lavongai	0.00	Pacific
Papua New Guinea	Lemus	0.01	Pacific
Papua New Guinea	Lissenung	0.01	Pacific
Papua New Guinea	Locha LMMA	0.17	Pacific
Papua New Guinea	Lolobau Managed Area	419.24	Pacific
Papua New Guinea	Long Island (III)	414.24	Pacific
Papua New Guinea	Machomuna	0.00	Pacific
Papua New Guinea	Mait LMMA	3.21	Pacific
Papua New Guinea	Malai	0.01	Pacific
Papua New Guinea	Malasangai	0.01	Pacific
Papua New Guinea	Maza	2334.01	Pacific
Papua New Guinea	M'Buke	1.02	Pacific
Papua New Guinea	Mou	0.01	Pacific
Papua New Guinea	Nago Island	0.01	Pacific
Papua New Guinea	Namanatabu	0.55	Pacific
Papua New Guinea	Nanuk Island District Park	0.03	Pacific
Papua New Guinea	Ndrolowa (I)	60.46	Pacific
Papua New Guinea	Ngoto	0.00	Pacific
Papua New Guinea	Nono	0.01	Pacific
Papua New Guinea	Nonovaul	0.11	Pacific
Papua New Guinea	Numundo Managed Area	15.23	Pacific
Papua New Guinea	Nusaum	0.01	Pacific
Papua New Guinea	Pakanavaul LMMA	0.11	Pacific

Papua New Guinea	Panachais	0.00	Pacific
Papua New Guinea	Pananaru	0.00	Pacific
Papua New Guinea	Paramana	0.01	Pacific
Papua New Guinea	Pasiloke	0.01	Pacific
Papua New Guinea	Patanga	0.01	Pacific
Papua New Guinea	Patio	0.01	Pacific
Papua New Guinea	Pere Community Zone Area	46.34	Pacific
Papua New Guinea	Pere LMMA	0.24	Pacific
Papua New Guinea	Pere Village LMMA	0.80	Pacific
Papua New Guinea	Pirung	542.12	Pacific
Papua New Guinea	Ruango	0.01	Pacific
Papua New Guinea	Sapa	0.01	Pacific
Papua New Guinea	Sawasawaga LMMA	0.10	Pacific
Papua New Guinea	Sawataitai	7.08	Pacific
Papua New Guinea	Sicahccui	0.01	Pacific
Papua New Guinea	Silom	0.92	Pacific
Papua New Guinea	Simbine Coast	0.72	Pacific
Papua New Guinea	Singirokai	0.01	Pacific
Papua New Guinea	Sinub Island WMA	0.12	Pacific
Papua New Guinea	Tab Island WMA	0.05	Pacific
Papua New Guinea	Tabad Island WMA	0.16	Pacific
Papua New Guinea	Taipo LMMA	0.73	Pacific
Papua New Guinea	Talele Island	0.31	Pacific
Papua New Guinea	Tami	0.01	Southeast Asia
Papua New Guinea	Tarobi Managed Area	320.82	Pacific
Papua New Guinea	Tavalo	22.99	Pacific
Papua New Guinea	Tioputuk	0.00	Pacific
Papua New Guinea	Tuam	0.01	Pacific
Papua New Guinea	Ungakum	0.96	Pacific
Papua New Guinea	Wewak Peace Memorial Park	198.77	Pacific
Papua New Guinea	Whal Island	0.07	Pacific
Philippines	Agan-an	0.06	Southeast Asia
Philippines	Agoo - Damortis	105.88	Southeast Asia
Philippines	Alang-alang	0.07	Southeast Asia
Philippines	Alburquerque - Loay - Loboc	11.61	Southeast Asia
Philippines	Aliguay	12.15	Southeast Asia
Philippines	Aliguay Island Buffer Zone	12.53	Southeast Asia
Philippines	Anas	0.15	Southeast Asia
Philippines	Anibong	0.07	Southeast Asia
Philippines	Antipolo	0.40	Southeast Asia
Philippines	Apalan	0.53	Southeast Asia
Philippines	Apo Island	0.78	Southeast Asia
Philippines	Apo Reef	158.56	Southeast Asia
Philippines	Apo Reef Buffer Zone	117.03	Southeast Asia
Philippines	Arbor	0.09	Southeast Asia
Philippines	Arthur's Rock	0.27	Southeast Asia
Philippines	Asinan Reef	0.60	Southeast Asia
Philippines	Aurora	16.48	Southeast Asia
Philippines	Awaan	0.15	Southeast Asia
Philippines	Babuyan	0.48	Southeast Asia
Philippines	Bacon	1.68	Southeast Asia
Philippines	Bagasawe	0.40	Southeast Asia
Philippines	Balasinon	0.28	Southeast Asia
Philippines	Baliangao	2.95	Southeast Asia
Philippines	Balicasag Island	0.03	Southeast Asia
Philippines	Balud-Consolacion	0.12	Southeast Asia
Philippines	Banacon Island	0.42	Southeast Asia
Philippines	Banban	0.09	Southeast Asia

Philippines	Bantayan Island	114.51	Southeast Asia
Philippines	Bantigue	0.10	Southeast Asia
Philippines	Barili	0.15	Southeast Asia
Philippines	Basdiot	0.04	Southeast Asia
Philippines	Bataan	256.47	Southeast Asia
Philippines	Batalang-Bato	0.03	Southeast Asia
Philippines	Batanes	2108.91	Southeast Asia
Philippines	Batasan	0.19	Southeast Asia
Philippines	Bato	0.25	Southeast Asia
Philippines	Baybay Kawas	0.15	Southeast Asia
Philippines	Biasong	0.10	Southeast Asia
Philippines	Bilangbilangan	0.15	Southeast Asia
Philippines	Bilang-bilangan	0.05	Southeast Asia
Philippines	Bil-isan	0.13	Southeast Asia
Philippines	Binlanan	0.01	Southeast Asia
Philippines	Binlod	0.12	Southeast Asia
Philippines	Biri Larosa	356.68	Southeast Asia
Philippines	Bitoon	0.33	Southeast Asia
Philippines	Bogo	0.12	Southeast Asia
Philippines	Bolod	0.05	Southeast Asia
Philippines	Bonbon	0.34	Southeast Asia
Philippines	Bongsalay	6.28	Southeast Asia
Philippines	Botigues	0.25	Southeast Asia
Philippines	Bulasa	0.12	Southeast Asia
Philippines	Bunga Mar	0.12	Southeast Asia
Philippines	Buntis	0.06	Southeast Asia
Philippines	Busin Island	4.76	Southeast Asia
Philippines	Busogon	0.32	Southeast Asia
Philippines	Cabacongan	0.04	Southeast Asia
Philippines	Cabantian	0.21	Southeast Asia
Philippines	Cabungan	0.18	Southeast Asia
Philippines	Cagawasan	0.17	Southeast Asia
Philippines	Calag-Calag	0.15	Southeast Asia
Philippines	Calauit Island	34.87	Southeast Asia
Philippines	Camboang	0.05	Southeast Asia
Philippines	Campao Occidental	0.18	Southeast Asia
Philippines	Campuyo	0.51	Southeast Asia
Philippines	Cangmating	0.02	Southeast Asia
Philippines	Canhabagat	0.25	Southeast Asia
Philippines	Cantagay	0.05	Southeast Asia
Philippines	Caramoan	3.16	Southeast Asia
Philippines	Carot	0.21	Southeast Asia
Philippines	Casay	0.05	Southeast Asia
Philippines	Casay	0.11	Southeast Asia
Philippines	Catanduanes	427.94	Southeast Asia
Philippines	Catarman	0.02	Southeast Asia
Philippines	Cathedral Rock	0.11	Southeast Asia
Philippines	Caticugan	0.09	Southeast Asia
Philippines	Chico Island	0.08	Southeast Asia
Philippines	Colase	0.13	Southeast Asia
Philippines	Corte-Baud	0.53	Southeast Asia
Philippines	Cuaming	0.14	Southeast Asia
Philippines	Cuatro Islas	115.08	Southeast Asia
Philippines	Daan-Lungsod and Guiwang	0.23	Southeast Asia
Philippines	Danao	0.08	Southeast Asia
Philippines	Doljo	0.08	Southeast Asia
Philippines	Doong	0.10	Southeast Asia
Philippines	Dumanquilas Bay	268.64	Southeast Asia

Philippines	Dumaquilas Buffer Zone	39.16	Southeast Asia
Philippines	El Nido	917.57	Southeast Asia
Philippines	Gasan Community	18.83	Southeast Asia
Philippines	Gilutongan Island	0.15	Southeast Asia
Philippines	Great and Little Sta. Cruz Islands	12.95	Southeast Asia
Philippines	Great and Little Sta. Cruz Islands Buffer Zone	10.47	Southeast Asia
Philippines	Guinacot	0.15	Southeast Asia
Philippines	Gui-ob Reef	0.28	Southeast Asia
Philippines	Guiwanon	0.12	Southeast Asia
Philippines	Hagonoy	0.50	Southeast Asia
Philippines	Hambongan	0.14	Southeast Asia
Philippines	Handumon	0.43	Southeast Asia
Philippines	Hayaan, Inanuran and Badlaan	1.37	Southeast Asia
Philippines	Hilaitan	0.06	Southeast Asia
Philippines	Hilantagaan	0.08	Southeast Asia
Philippines	Hinablan	0.12	Southeast Asia
Philippines	Hundred Islands	1.94	Southeast Asia
Philippines	Iniban	0.08	Southeast Asia
Philippines	Initao	0.33	Southeast Asia
Philippines	Ipil	0.07	Southeast Asia
Philippines	Jagoliao	0.17	Southeast Asia
Philippines	Jandayan Norte	0.25	Southeast Asia
Philippines	Jandayan Sur	0.24	Southeast Asia
Philippines	Kinawahan	0.24	Southeast Asia
Philippines	Lajog	0.29	Southeast Asia
Philippines	Lambog	0.25	Southeast Asia
Philippines	Langtad	0.12	Southeast Asia
Philippines	Larapan	0.09	Southeast Asia
Philippines	Lawis	0.18	Southeast Asia
Philippines	Lawis	0.10	Southeast Asia
Philippines	Legaspi	0.10	Southeast Asia
Philippines	Liboron	0.23	Southeast Asia
Philippines	Lomboy-Kahayag	0.43	Southeast Asia
Philippines	Looc	0.03	Southeast Asia
Philippines	Lumayag Islet	0.76	Southeast Asia
Philippines	Luyang	0.23	Southeast Asia
Philippines	Luyong-baybay	0.13	Southeast Asia
Philippines	Mabini	61.38	Southeast Asia
Philippines	Macaas	0.34	Southeast Asia
Philippines	Madangog	0.07	Southeast Asia
Philippines	Madridejos	0.10	Southeast Asia
Philippines	Magkalagom	0.06	Southeast Asia
Philippines	Magtongtong	0.33	Southeast Asia
Philippines	Majigpit	0.29	Southeast Asia
Philippines	Malabungot	1.19	Southeast Asia
Philippines	Malalag	0.28	Southeast Asia
Philippines	Malampaya Sound	2001.51	Southeast Asia
Philippines	Manalo	0.74	Southeast Asia
Philippines	Mantatao	0.32	Southeast Asia
Philippines	Manyukos Island	2.22	Southeast Asia
Philippines	Masaplod Norte	0.06	Southeast Asia
Philippines	Masinloc and Oyon Bay	73.15	Southeast Asia
Philippines	Maslog	0.09	Southeast Asia
Philippines	Matutinao	0.14	Southeast Asia
Philippines	Murcielagos Island	2.71	Southeast Asia
Philippines	Murcielagos Island Buffer Zone	1.05	Southeast Asia
Philippines	Naatang	0.05	Southeast Asia
Philippines	Nagolon Island	0.05	Southeast Asia

Philippines	Nahawan	0.16	Southeast Asia
Philippines	Nalayag Point	0.01	Southeast Asia
Philippines	Nalusuan	0.82	Southeast Asia
Philippines	Naro Island	1.04	Southeast Asia
Philippines	Naujan Lake	130.11	Southeast Asia
Philippines	Nausak	0.05	Southeast Asia
Philippines	North Granada	0.10	Southeast Asia
Philippines	Northern Luzon Heroes Hill	12.61	Southeast Asia
Philippines	Northern Sierra Madre Mountain Range	3568.37	Southeast Asia
Philippines	Olang	0.21	Southeast Asia
Philippines	Padada	0.30	Southeast Asia
Philippines	Palaui Island	85.13	Southeast Asia
Philippines	Palawan	11773.67	Southeast Asia
Philippines	Pamilacan Island	0.29	Southeast Asia
Philippines	Pandanon	0.20	Southeast Asia
Philippines	Pangdan	0.15	Southeast Asia
Philippines	Pantudlan	0.13	Southeast Asia
Philippines	Pasil	0.09	Southeast Asia
Philippines	Pasil Reef	0.18	Southeast Asia
Philippines	Patao	0.60	Southeast Asia
Philippines	Pinamgo	0.48	Southeast Asia
Philippines	Poblacion	0.06	Southeast Asia
Philippines	Poblacion	0.06	Southeast Asia
Philippines	Poblacion	0.05	Southeast Asia
Philippines	Poblacion	0.17	Southeast Asia
Philippines	Poblacion District 1	0.09	Southeast Asia
Philippines	Polo	0.02	Southeast Asia
Philippines	Port Barton	744.82	Southeast Asia
Philippines	Puerto Princesa Subterranean River	55.57	Southeast Asia
Philippines	Pujada Bay	212.00	Southeast Asia
Philippines	Pulang Yuta	0.18	Southeast Asia
Philippines	Pulong Bato	0.02	Southeast Asia
Philippines	Saavedra	0.09	Southeast Asia
Philippines	Sagay	323.42	Southeast Asia
Philippines	San Isidro	0.52	Southeast Asia
Philippines	San Salvador	1.34	Southeast Asia
Philippines	Sandugan	0.10	Southeast Asia
Philippines	Sarangani Bay	2159.49	Southeast Asia
Philippines	Selinog Island	13.14	Southeast Asia
Philippines	Siargao	1550.61	Southeast Asia
Philippines	Sibuyan Island	457.94	Southeast Asia
Philippines	Siocon	0.13	Southeast Asia
Philippines	Siocon Buffer Zone	2.47	Southeast Asia
Philippines	Sta Cruz	0.72	Southeast Asia
Philippines	Sta. Cruz	0.13	Southeast Asia
Philippines	Sta. Filomena	0.11	Southeast Asia
Philippines	Sta. Filomena	0.05	Southeast Asia
Philippines	Sto. Ni±o	0.09	Southeast Asia
Philippines	Sto. Ni±o-Basiawan	0.52	Southeast Asia
Philippines	Subic	62.52	Southeast Asia
Philippines	Sulangan	0.13	Southeast Asia
Philippines	Sumilon Island	0.08	Southeast Asia
Philippines	Ta±on Strait	5397.26	Southeast Asia
Philippines	Taklong Island	11.16	Southeast Asia
Philippines	Talibon	67.57	Southeast Asia
Philippines	Talisay	0.11	Southeast Asia
Philippines	Talo-ot	0.12	Southeast Asia
Philippines	Tambobo	0.09	Southeast Asia

Philippines	Tambongon	0.31	Southeast Asia
Philippines	Tandayag	0.05	Southeast Asia
Philippines	Taongon Can-andam	0.26	Southeast Asia
Philippines	Tawala	0.09	Southeast Asia
Philippines	Tayong Occidental	0.24	Southeast Asia
Philippines	Tayong Oriental	0.33	Southeast Asia
Philippines	Tindog	0.30	Southeast Asia
Philippines	Torrijos	1.12	Southeast Asia
Philippines	Tubbataha Reefs	1001.30	Southeast Asia
Philippines	Tubod	0.24	Southeast Asia
Philippines	Tubod Mar	0.12	Southeast Asia
Philippines	Tugas	0.10	Southeast Asia
Philippines	Tuka	0.11	Southeast Asia
Philippines	Tulapos	0.24	Southeast Asia
Philippines	Tulic	0.11	Southeast Asia
Philippines	Turtle Islands	2265.54	Southeast Asia
Philippines	Twin Rocks	0.23	Southeast Asia
Philippines	Victoria	0.44	Southeast Asia
Samoa	afaga tele	1.43	Pacific
Samoa	Aleipata	45.59	Pacific
Samoa	amaile	0.01	Pacific
Samoa	Apai Manono-tai	0.96	Pacific
Samoa	Apolima-uta (e)	0.18	Pacific
Samoa	Asaga	0.20	Pacific
Samoa	Asau	2.37	Pacific
Samoa	Auala	0.79	Pacific
Samoa	Aufaga Lepa (e)	0.04	Pacific
Samoa	ava o sina	0.07	Pacific
Samoa	Eva Anoama'a	0.20	Pacific
Samoa	Faala Palauli	1.33	Pacific
Samoa	faaofi laulu	0.34	Pacific
Samoa	Fagae'e	0.27	Pacific
Samoa	Fagali'i Vaimauga	0.04	Pacific
Samoa	Fagamalo	0.56	Pacific
Samoa	Fagasa	0.17	Pacific
Samoa	Falealupo	1.96	Pacific
Samoa	Falealupo Forest Preserve	12.15	Pacific
Samoa	faleasiu	1.82	Pacific
Samoa	Faleu Manono-uta	0.24	Pacific
Samoa	Faleula	5.53	Pacific
Samoa	fanuatapu	0.01	Pacific
Samoa	Fasito'o-tai	1.67	Pacific
Samoa	Fatuvalu	0.03	Pacific
Samoa	fausaga	0.73	Pacific
Samoa	Foailalo	0.59	Pacific
Samoa	Fogatuli	0.49	Pacific
Samoa	Fuailolo'o Mulifanua (e)	0.05	Pacific
Samoa	gaga o suluie	0.01	Pacific
Samoa	Gagaifo Lefaga	0.62	Pacific
Samoa	lalomanu	0.01	Pacific
Samoa	Lalovi Mulifanua (e)	0.89	Pacific
Samoa	le niu	0.01	Pacific
Samoa	Lelepa	0.16	Pacific
Samoa	Lepa (e)	0.20	Pacific
Samoa	Lepuiai Manono-tai	1.81	Pacific
Samoa	Leusoalii Anoama'a	0.11	Pacific
Samoa	Lu'ua Faga	0.23	Pacific
Samoa	malaetuli	0.01	Pacific

Samoa	Manase	0.48	Pacific
Samoa	Matafa'a Lefaga	0.01	Pacific
Samoa	Matatufu (e)	0.01	Pacific
Samoa	Matautu Falelatai	0.20	Pacific
Samoa	Matautu- uta lefaga	0.01	Pacific
Samoa	Matautu-Faleapuna	0.01	Pacific
Samoa	namua	0.01	Pacific
Samoa	Neiafu (e)	1.01	Pacific
Samoa	Nofoalii Aana	2.93	Pacific
Samoa	nuulua	0.01	Pacific
Samoa	nuutele	0.01	Pacific
Samoa	palolo deep	0.57	Pacific
Samoa	Papa Palauli	0.30	Pacific
Samoa	Papa Sataua	0.01	Pacific
Samoa	Papaloa, Falefia & Malaeta (Salelologa)	0.01	Pacific
Samoa	Poutasi Falealili	2.25	Pacific
Samoa	Pu'apu'a	1.23	Pacific
Samoa	punaoa	0.30	Pacific
Samoa	Sa'anapu-Sataoa	0.75	Pacific
Samoa	Safaatoa Lefaga (e)	0.01	Pacific
Samoa	Safa'i	0.01	Pacific
Samoa	Safata	55.41	Pacific
Samoa	Safua lalomalava	0.12	Pacific
Samoa	Salani Falealili	0.01	Pacific
Samoa	salea aumua	0.01	Pacific
Samoa	Saleapaga Lepa (e)	0.05	Pacific
Samoa	Saleaula	0.01	Pacific
Samoa	Saleilua Falealili	0.01	Pacific
Samoa	Salesatele	0.58	Pacific
Samoa	Saletagaloa & Foua (Salelologa)	0.24	Pacific
Samoa	Salimu Faga (e)	0.51	Pacific
Samoa	Salua Manono-tai (e)	1.67	Pacific
Samoa	Salua Manono-uta	0.01	Pacific
Samoa	Samatau Falelatai (e)	1.09	Pacific
Samoa	samusu	0.01	Pacific
Samoa	Saoluafata Anoama'a	1.04	Pacific
Samoa	Sapapalii	1.77	Pacific
Samoa	Sapini Faga (e)	0.36	Pacific
Samoa	Sasina	5.00	Pacific
Samoa	Satalafai & Sapulu (Salelologa)	0.12	Pacific
Samoa	Satapuala Aana	2.46	Pacific
Samoa	Sataua (e)	0.54	Pacific
Samoa	satitioa	0.01	Pacific
Samoa	Sato'alepai	0.31	Pacific
Samoa	Satui Fasito'o-uta	0.01	Pacific
Samoa	Savaia Lefaga (e)	0.05	Pacific
Samoa	Siufaga Faga	0.26	Pacific
Samoa	Siufaga Falelatai (e)	0.08	Pacific
Samoa	Solosolo Anoama'a	0.57	Pacific
Samoa	Tafagamanu Lefaga (e)	0.05	Pacific
Samoa	Tafatafa Falealili (e)	0.12	Pacific
Samoa	Tafua Rainforest Reserve	60.00	Pacific
Samoa	tafuna	0.01	Pacific
Samoa	Tauao'o Faleasiu	0.01	Pacific
Samoa	tiavea	0.01	Pacific
Samoa	Tuanai Tuamasaga	0.01	Pacific
Samoa	Uafato	14.00	Pacific
Samoa	ulutogia	0.01	Pacific

Samoa	utufa alalafa	0.01	Pacific
Samoa	vaiee	10.26	Pacific
Samoa	vailea	0.01	Pacific
Samoa	Vailuutai Aana	0.93	Pacific
Samoa	Vaisala	0.37	Pacific
Samoa	Vaitoomuli	0.34	Pacific
Samoa	Vaiusu Faleata	0.53	Pacific
Samoa	Vaovai Falealili (e)	0.92	Pacific
Samoa	Vasaulu Iva	0.01	Pacific
Samoa	Vavau Lepa (e)	0.03	Pacific
Saudi Arabia	Dawat Ad-Dafl, Dawat Al-Musallamiyah and Coral Islands	2099.99	Middle East
Saudi Arabia	Farasan Islands	715.53	Middle East
Saudi Arabia	Umm al-Qamari Islands	0.41	Middle East
Seychelles	African Banks	8.22	Indian Ocean
Seychelles	Aldabra	351.57	Indian Ocean
Seychelles	Aride Island	0.70	Indian Ocean
Seychelles	Baie Ternaie	0.87	Indian Ocean
Seychelles	Cousin Island	1.70	Indian Ocean
Seychelles	Curieuse	16.15	Indian Ocean
Seychelles	Ile aux Vache Marine	0.04	Indian Ocean
Seychelles	Ile Cocos, Ile La Fouche, Ilot Platte	0.86	Indian Ocean
Seychelles	Port Launay	1.63	Indian Ocean
Seychelles	Silhouette Marine	21.32	Indian Ocean
Seychelles	Ste. Anne	9.68	Indian Ocean
Solomon Islands	Abalolo, Gwaedalo, Ailau (AGA)	1.00	Pacific
Solomon Islands	Alale, Grant Island MPA	2.78	Pacific
Solomon Islands	Alite	0.59	Pacific
Solomon Islands	Arnavon Islands	153.53	Pacific
Solomon Islands	Babanga Reef MPA	0.86	Pacific
Solomon Islands	Baghafu Tabu	0.01	Pacific
Solomon Islands	Bakiha Reef MPA	0.38	Pacific
Solomon Islands	Barasipo	3.56	Pacific
Solomon Islands	Baraulu/Bule Lavata	1.64	Pacific
Solomon Islands	Bareho (Marovo)	0.01	Pacific
Solomon Islands	Barivuto	1.62	Pacific
Solomon Islands	Bebea	0.63	Pacific
Solomon Islands	Buni	1.67	Pacific
Solomon Islands	Chivoko MCA	0.89	Pacific
Solomon Islands	Duduli Rereghana	0.35	Pacific
Solomon Islands	Dunde	1.05	Pacific
Solomon Islands	Dunde Shark Point	0.29	Pacific
Solomon Islands	Ghanitapi tabu	0.01	Pacific
Solomon Islands	Grant Island,Patuparoana MPA	14.74	Pacific
Solomon Islands	Ha'apai	0.47	Pacific
Solomon Islands	Hatare (Tariairaro)	0.22	Pacific
Solomon Islands	Hetaheta tabu	0.01	Pacific
Solomon Islands	Hot Spot Reef MPA	0.05	Pacific
Solomon Islands	Inuzaru Island MPA	0.13	Pacific
Solomon Islands	Jericho Reef MPA	0.14	Pacific
Solomon Islands	Jorio Marine Resource Management Plan	170.00	Pacific
Solomon Islands	Kapina Tabu	0.01	Pacific
Solomon Islands	Karikasi Reef MPA	0.06	Pacific
Solomon Islands	Kekehe	0.41	Pacific
Solomon Islands	Kere hira	0.00	Pacific
Solomon Islands	Kia District Marine Resource Management Plan	802.94	Pacific
Solomon Islands	Kibelifolu	0.73	Pacific

Solomon Islands	Kida	0.96	Pacific
Solomon Islands	Kinamara	1.58	Pacific
Solomon Islands	Kindu	0.76	Pacific
Solomon Islands	Kogulavata Reef MPA	0.73	Pacific
Solomon Islands	Koqu Rua	0.36	Pacific
Solomon Islands	Kozou	0.41	Pacific
Solomon Islands	Kuaboka to Lollua	0.01	Pacific
Solomon Islands	Ladosama Reef MPA	3.13	Pacific
Solomon Islands	Langa Langa Lagoon	0.01	Pacific
Solomon Islands	Leva Point MPA	0.15	Pacific
Solomon Islands	Lodu Hokata	0.14	Pacific
Solomon Islands	Loreto, Lalana, SuÆu,	0.02	Pacific
Solomon Islands	Malole Tabu	0.01	Pacific
Solomon Islands	Mamarava tabu	0.01	Pacific
Solomon Islands	Marapa-Niu	2.63	Pacific
Solomon Islands	Maravaghi	0.15	Pacific
Solomon Islands	Modiudu	0.01	Pacific
Solomon Islands	Naro	10.00	Pacific
Solomon Islands	Naru Reef MPA	1.28	Pacific
Solomon Islands	Nazareth (Marovo)	0.54	Pacific
Solomon Islands	Nazareti	2.12	Pacific
Solomon Islands	Niami Reef MPA	0.02	Pacific
Solomon Islands	Niuhoa	0.07	Pacific
Solomon Islands	Niumala	2.37	Pacific
Solomon Islands	Njari Island MPA	1.06	Pacific
Solomon Islands	Nusa Hope Mangrove	0.50	Pacific
Solomon Islands	Nusa Hope/Heloro	0.82	Pacific
Solomon Islands	Nusa Roviana	0.15	Pacific
Solomon Islands	Nusatupe Reef MPA	0.40	Pacific
Solomon Islands	Nu'u Marere	0.16	Pacific
Solomon Islands	Olive	1.05	Pacific
Solomon Islands	Omavua	0.01	Pacific
Solomon Islands	Ontong Java Atoll	0.01	Pacific
Solomon Islands	Opele	1.50	Pacific
Solomon Islands	Paipai	1.04	Pacific
Solomon Islands	Parama MCA	3.19	Pacific
Solomon Islands	Peanaha Tabu	0.01	Pacific
Solomon Islands	Penjapenja Reef MPA	0.15	Pacific
Solomon Islands	Petu Island MPA	1.20	Pacific
Solomon Islands	Pezokombukombu	0.01	Pacific
Solomon Islands	Pipa/Kororo (Marovo)	5.00	Pacific
Solomon Islands	Poro	0.01	Pacific
Solomon Islands	Pusinau Reef MPA	0.12	Pacific
Solomon Islands	Putuo Tabu	0.01	Pacific
Solomon Islands	Rabakela MCA	0.10	Pacific
Solomon Islands	Rapita Tabu	0.01	Pacific
Solomon Islands	Redman MCA	0.87	Pacific
Solomon Islands	Rendova Harbor	4.00	Pacific
Solomon Islands	Renjo Reef MPA	0.08	Pacific
Solomon Islands	Reva	0.01	Pacific
Solomon Islands	Roderic bay	0.20	Pacific
Solomon Islands	Rosiamati	0.01	Pacific
Solomon Islands	Saeraghi Reef MPA	24.45	Pacific
Solomon Islands	Saika	1.88	Pacific
Solomon Islands	Salavo	0.36	Pacific
Solomon Islands	Sasakola	5.30	Pacific
Solomon Islands	Sasarauru	0.01	Pacific
Solomon Islands	Sasavele/NB	3.00	Pacific

Solomon Islands	Sauka	0.01	Pacific
Solomon Islands	Simeruka	0.48	Pacific
Solomon Islands	Sisili	0.07	Pacific
Solomon Islands	Suvania Reef MPA	0.25	Pacific
Solomon Islands	Tabezaru	0.01	Pacific
Solomon Islands	Taburu	0.07	Pacific
Solomon Islands	Tebono MPA	0.29	Pacific
Solomon Islands	Tetepare	141.77	Pacific
Solomon Islands	Tetepare Marine Protected Area	16.79	Pacific
Solomon Islands	Tibitibi	0.01	Pacific
Solomon Islands	Tiraranju Reef MPA	2.81	Pacific
Solomon Islands	Tobe Tabu	0.01	Pacific
Solomon Islands	Tobo	1.50	Pacific
Solomon Islands	Tokekolo	0.01	Pacific
Solomon Islands	Tulagi Island	0.11	Pacific
Solomon Islands	Vaininoturu Island VMPA	1.50	Pacific
Solomon Islands	Variparui Island VMPA	1.60	Pacific
Solomon Islands	Varu North Reef MPA	0.22	Pacific
Solomon Islands	Vasigoro Tabu	0.01	Pacific
Solomon Islands	Vena Island VMPA	2.60	Pacific
Solomon Islands	Vonga Pondala MPA	0.10	Pacific
Solomon Islands	Wahere	0.03	Pacific
Solomon Islands	Waimamauru	0.05	Pacific
Solomon Islands	Zaosodu Tabu	0.01	Pacific
Solomon Islands	Zinoa MCA	0.09	Pacific
Solomon Islands		0.07	Pacific
Somalia	Bushbush	3339.99	Indian Ocean
Sri Lanka	Bar Reef Marine	301.09	Indian Ocean
Sri Lanka	Big Sorber Island	0.76	Indian Ocean
Sri Lanka	Bundala	70.50	Indian Ocean
Sri Lanka	Hikkaduwa	1.02	Indian Ocean
Sri Lanka	Kalametiya Lagoon	10.55	Indian Ocean
Sri Lanka	Pigeon Island		Indian Ocean
Sri Lanka	Rumassala Marine Sanctuary		Indian Ocean
Sri Lanka	Seruwavila	138.39	Indian Ocean
Sri Lanka	Wilpattu Block 1	1287.90	Indian Ocean
Sri Lanka	Yala (Ruhuna)	1025.73	Indian Ocean
Sudan	Sanganeb Atoll	12.00	Middle East
Taiwan, Province of China	Bei-Men Coast	29.80	Southeast Asia
Taiwan, Province of China	Cat-Islet	3.80	Southeast Asia
Taiwan, Province of China	Hua-Tung Coast	584.37	Southeast Asia
Taiwan, Province of China	Jeou-Perng Coast	5.30	Southeast Asia
Taiwan, Province of China	Jian-Shan Coast	23.92	Southeast Asia
Taiwan, Province of China	Kenting	317.68	Southeast Asia
Taiwan, Province of China	Kenting Uplifted Coral Reef	1.38	Southeast Asia
Taiwan, Province of China	Kinmen	37.80	Southeast Asia
Taiwan, Province of China	Kuantu	5.35	Southeast Asia
Taiwan, Province of China	Lanyang River Mouth	2.06	Southeast Asia
Taiwan, Province of China	Mienhua Huaping Islet	2.26	Southeast Asia
Taiwan, Province of China	North Coast	108.90	Southeast Asia
Taiwan, Province of	Northeast Coast	130.45	Southeast Asia

China			
Taiwan, Province of China	Penghu Columnar Basalt	18.02	Southeast Asia
Taiwan, Province of China	Penghu Wangan Island	0.23	Southeast Asia
Taiwan, Province of China	Sue-Hua Coast	71.45	Southeast Asia
Taiwan, Province of China	Tanshui River Mangrove	4.19	Southeast Asia
Taiwan, Province of China	Tan-Shui River Mouth	26.10	Southeast Asia
Taiwan, Province of China	Taroko	1032.43	Southeast Asia
Taiwan, Province of China	Watzuwei	0.30	Southeast Asia
Tanzania, United Republic of	Chumbe Island Coral Park (CHICOP)	0.63	Indian Ocean
Tanzania, United Republic of	Dar es Salaam	31.99	Indian Ocean
Tanzania, United Republic of	Forest Reserve Name Unknown (TZA) (Mangrove) No.10	56.67	Indian Ocean
Tanzania, United Republic of	Forest Reserve Name Unknown (TZA) (Mangrove) No.37	62.62	Indian Ocean
Tanzania, United Republic of	Mafia Island	894.76	Indian Ocean
Tanzania, United Republic of	Maziwe Island	2.59	Indian Ocean
Tanzania, United Republic of	Menai Bay	492.62	Indian Ocean
Tanzania, United Republic of	Misali Island	22.68	Indian Ocean
Tanzania, United Republic of	Mnazi Bay-Ruvuma Estuary	550.46	Indian Ocean
Tanzania, United Republic of	Mnemba Island	0.15	Indian Ocean
Tanzania, United Republic of	Ngezi-Vumawimbi	19.19	Indian Ocean
Tanzania, United Republic of	Pemba Channel Conservation Area	931.68	Indian Ocean
Tanzania, United Republic of	Rufiji-Mafia-Kilwa Marine	5158.24	Indian Ocean
Tanzania, United Republic of	Saadani	1174.47	Indian Ocean
Tanzania, United Republic of	Tanga	1913.99	Indian Ocean
Thailand	Ao Phangaga	417.08	Indian Ocean
Thailand	Had Chao Mai	246.72	Indian Ocean
Thailand	Had Kanom - Moo Koh Taletai	309.02	Southeast Asia
Thailand	Had Noparatthara - Mu Ko Phi Phi	396.32	Indian Ocean
Thailand	Had Vanakorn	31.00	Southeast Asia
Thailand	Khao Laem Ya - Mu Ko Samed	126.38	Southeast Asia
Thailand	Khao Lak-Lam Ru	133.84	Indian Ocean
Thailand	Khao Lam Pi - Hat Thai Muang	70.96	Indian Ocean
Thailand	Khao Sam Roi Yot	158.92	Southeast Asia
Thailand	Laemson	278.02	Indian Ocean
Thailand	Lam Nam Kraburi	165.12	Indian Ocean
Thailand	Mu Ko Ang Thong	104.35	Southeast Asia
Thailand	Mu Ko Chang	677.70	Southeast Asia
Thailand	Mu Ko Chumphon	321.65	Southeast Asia
Thailand	Mu Ko Lanta	135.24	Indian Ocean
Thailand	Mu Ko Libong	447.48	Indian Ocean
Thailand	Mu Ko Payam	335.42	Indian Ocean
Thailand	Mu Ko Preta	513.83	Indian Ocean
Thailand	Mu Ko Similan	125.63	Indian Ocean
Thailand	Mu Ko Surin	157.99	Indian Ocean
Thailand	Sirinath	91.50	Indian Ocean

Thailand	Tarn Boke Koranee	98.72	Indian Ocean
Thailand	Tarutao	1254.71	Indian Ocean
Thailand	Thaleban	199.88	Indian Ocean
Tonga	Atata	0.01	Pacific
Tonga	'Eua	4.50	Pacific
Tonga	Eueiki	0.01	Pacific
Tonga	Falevai	5.00	Pacific
Tonga	Fanga'uta and Fanga Kakau Lagoons	30.91	Pacific
Tonga	Felemea	0.01	Pacific
Tonga	Ha'afeva	0.01	Pacific
Tonga	Ha'apai	9999.98	Pacific
Tonga	Ha'atafu Beach	0.71	Pacific
Tonga	Hakaumama'o Reef	1.59	Pacific
Tonga	Kao	0.01	Pacific
Tonga	Malinoa Island Park and Reef	0.90	Pacific
Tonga	Monuafe Island Park and Reef	0.50	Pacific
Tonga	Mounu Reef	0.20	Pacific
Tonga	Mui Hopo Hoponga Coastal Reserve	0.88	Pacific
Tonga	Nukuhetulu	3.00	Pacific
Tonga	O'ua	48.75	Pacific
Tonga	Ovaka	0.01	Pacific
Tonga	Pangaimotu Reef	0.35	Pacific
Tonga	Vaomopa	0.01	Pacific
Tuvalu	Funafuti Conservation Area	39.85	Pacific
Tuvalu	Momea tapu	2.51	Pacific
Tuvalu	Nanumaga lagoon	0.02	Pacific
Tuvalu	Nanumaga reef	1.13	Pacific
Tuvalu	Niulakita	8.01	Pacific
Tuvalu	Niutao	0.52	Pacific
Tuvalu	Nui	6.68	Pacific
Tuvalu	Nukufetau	11.75	Pacific
Tuvalu	Nukulaelae	1.72	Pacific
Tuvalu	Vaitupu Tapu Area	0.21	Pacific
United States	Baker Island	129.22	Pacific
United States	Howland Island	138.99	Pacific
United States	Jarvis Island	151.78	Pacific
United States	Mariana Trench	247191.62	Pacific
United States	Pacific Remote Islands	213143.65	Pacific
United States	Palmyra Atoll	2038.29	Pacific
United States (American Samoa)	Alofau	0.34	Pacific
United States (American Samoa)	Amaua & Auto	0.48	Pacific
United States (American Samoa)	Aoa	0.01	Pacific
United States (American Samoa)	Aua	0.23	Pacific
United States (American Samoa)	Aunu'u Island	1.23	Pacific
United States (American Samoa)	Fagamalo	0.30	Pacific
United States (American Samoa)	Fagatele Bay National Marine Sanctuary	0.71	Pacific
United States (American Samoa)	Leone Pala	0.09	Pacific

United States (American Samoa)	Masausi	0.20	Pacific
United States (American Samoa)	Matu'u & Faganeanea	0.01	Pacific
United States (American Samoa)	National Park of American Samoa	3.67	Pacific
United States (American Samoa)	Nu'uuli Pala	0.50	Pacific
United States (American Samoa)	Ofu Vaoto Marine Park	1.79	Pacific
United States (American Samoa)	Pago Pago Harbor	0.01	Pacific
United States (American Samoa)	Poloa	0.35	Pacific
United States (American Samoa)	Rose Atoll	157.73	Pacific
United States (American Samoa)	Rose Atoll	34783.89	Pacific
United States (American Samoa)	Sa'ilele	0.01	Pacific
United States (American Samoa)	Vaiava Strait	1.42	Pacific
United States (American Samoa)	Vatia	6.83	Pacific
United States (American Samoa)		0.15	Pacific
United States (Guam)	Achang Reef Flat	4.50	Pacific
United States (Guam)	Anao Conservation Reserve	2.63	Pacific
United States (Guam)	Guam	121.03	Pacific
United States (Guam)	Guam National Wildlife Refuge	0.01	Pacific
United States (Guam)	Haputo	1.02	Pacific
United States (Guam)	Masso River Reservoir Area	0.67	Pacific
United States (Guam)	Orote Peninsula	0.66	Pacific
United States (Guam)	Pati Point	19.50	Pacific
United States (Guam)	Piti Bomb Holes	3.57	Pacific
United States (Guam)	Sasa Bay	1.02	Pacific
United States (Guam)	Tumon Bay	4.09	Pacific
United States (Guam)	War in the Pacific	7.79	Pacific
United states (Northern Marianas)	Asuncion Island	0.01	Pacific
United states (Northern Marianas)	Bird Island Sanctuary	2.17	Pacific
United states (Northern Marianas)	Bird Island Sea Cucumber Reserve	0.79	Pacific
United states (Northern Marianas)	Forbidden Island Sanctuary	2.49	Pacific
United states (Northern Marianas)	Guguan Island	0.01	Pacific
United states (Northern Marianas)	Lau Lau Bay Sea Cucumber Sanctuary	1.96	Pacific
United states (Northern Marianas)	Lighthouse Reef Trochus Reserve	1.10	Pacific
United states (Northern Marianas)	Managaha Marine Conservation Area	5.03	Pacific
United states (Northern Marianas)	Maug Island Preserve	0.01	Pacific
United states (Northern Marianas)	Sarigan	0.01	Pacific
United states (Northern Marianas)	Sasanhaya Bay Fish Reserve	0.84	Pacific
United states (Northern Marianas)	Tank Beach Trochus Reserve	0.17	Pacific
United states (Northern Marianas)	Uracas Island	0.01	Pacific
Vanuatu	Ambrym Megapode Reserve	36.10	Pacific
Vanuatu	Aore Recreation Park	2.13	Pacific
Vanuatu	Avunatari Tabu	0.01	Pacific
Vanuatu	Baboo Bay Turtle conservation	0.01	Pacific
Vanuatu	Bucaro Aore Recreation Park	2.13	Pacific

Vanuatu	Denemeus	0.01	Pacific
Vanuatu	Dickson Reef Protected area-	0.01	Pacific
Vanuatu	Emua	0.01	Pacific
Vanuatu	Epao	0.01	Pacific
Vanuatu	Erakor and Empten Lagoon	0.01	Pacific
Vanuatu	Eton	0.01	Pacific
Vanuatu	Hideaway Island	0.01	Pacific
Vanuatu	Hiu Island Reserve	0.01	Pacific
Vanuatu	Lapo	0.01	Pacific
Vanuatu	Lekavik	0.01	Pacific
Vanuatu	Lelepa Marine Conservation	2.00	Pacific
Vanuatu	Loohbahkalo	0.01	Pacific
Vanuatu	Loohormoil	0.01	Pacific
Vanuatu	Loru Protected Area	2.20	Pacific
Vanuatu	Mangalilu	0.01	Pacific
Vanuatu	Marae	0.01	Pacific
Vanuatu	Marou	0.12	Pacific
Vanuatu	Marou Lagoon	0.01	Pacific
Vanuatu	Mele marine sanctuary	0.01	Pacific
Vanuatu	Mystery Island	4.34	Pacific
Vanuatu	Nagha mo Pineia Protected Area	10.50	Pacific
Vanuatu	Naomebaravu-Malo	2.13	Pacific
Vanuatu	Narong Marine	1.60	Pacific
Vanuatu	Nguna-Pele Marine Protected Area	0.17	Pacific
Vanuatu	Nguna-Pele Marine Protected Area	0.01	Pacific
Vanuatu	Nguna-Pele Marine Protected Area1	0.07	Pacific
Vanuatu	Nguna-Pele Marine Protected Area2	0.12	Pacific
Vanuatu	Nguna-Pele Marine Protected Area3	0.09	Pacific
Vanuatu	Nguna-Pele Marine Protected Area3	0.09	Pacific
Vanuatu	Nguna-Pele Marine Protected Area5	0.05	Pacific
Vanuatu	Nguna-Pele Marine Protected Area6	0.19	Pacific
Vanuatu	Nguna-Pele Marine Protected Area8	0.28	Pacific
Vanuatu	Pango MPA	8.00	Pacific
Vanuatu	Paunagisu Village	7.54	Pacific
Vanuatu	Ponkovio	0.01	Pacific
Vanuatu	President Coolidge and Million Dollar Reef	2.14	Pacific
Vanuatu	Rano Island	1.24	Pacific
Vanuatu	Ringi te Extension Reserve	0.01	Pacific
Vanuatu	Ringi Te Suh Marine Conservation Reserve	1.00	Pacific
Vanuatu	Saama	2.00	Pacific
Vanuatu	Siviri Tabu area	0.18	Pacific
Vanuatu	Takara MPA	0.29	Pacific
Vanuatu	Takara2 MPA	1.24	Pacific
Vanuatu	Tanolio	0.01	Pacific
Vanuatu	Tenstik	0.01	Pacific
Vanuatu	Uri Marine Park	0.01	Pacific
Vanuatu	Vatthe	34.65	Pacific
Vanuatu	Vendik Protected Area	0.01	Pacific
Vanuatu	Wala Island	0.01	Pacific
Vanuatu	Whitesands Reserve	2.13	Pacific
Viet Nam	Ba Mun	23.15	Southeast Asia
Viet Nam	Ban Dao Son Tra	43.83	Southeast Asia
Viet Nam	Binh Chau Phuoc Buu	105.76	Southeast Asia
Viet Nam	Cac Dao Vinh Ha Long	370.87	Southeast Asia
Viet Nam	Cat Ba	149.09	Southeast Asia
Viet Nam	Con Dao (Marine protected area)	450.24	Southeast Asia
Viet Nam	Con Dao (National park)	74.30	Southeast Asia

Viet Nam	Cu Lao Cham	15.87	Southeast Asia
Viet Nam	Cu Lao Cham (marine)	65.30	Southeast Asia
Viet Nam	Cu Mong	26.81	Southeast Asia
Viet Nam	Dao Bach Long Vi	906.27	Southeast Asia
Viet Nam	Dao Cat Ba	387.05	Southeast Asia
Viet Nam	Dao Co To	100.57	Southeast Asia
Viet Nam	Dao Con Co	78.33	Southeast Asia
Viet Nam	Dao Ly Son	77.38	Southeast Asia
Viet Nam	Dao Phu Quy	194.94	Southeast Asia
Viet Nam	Dao Tran	41.12	Southeast Asia
Viet Nam	Ha Long Bay	402.23	Southeast Asia
Viet Nam	Hai Van-Hon Son Tra	272.38	Southeast Asia
Viet Nam	Hon Cau-Vinh Hao	123.66	Southeast Asia
Viet Nam	Hon Me (marine)	59.22	Southeast Asia
Viet Nam	Hon Mun	153.06	Southeast Asia
Viet Nam	Nam Du	99.91	Southeast Asia
Viet Nam	Nha Phu-Hon Heo	108.05	Southeast Asia
Viet Nam	O Loan	24.76	Southeast Asia
Viet Nam	Phu Quoc - Marine Protected Area	411.01	Southeast Asia
Viet Nam	Phu Quoc - Nature Reserve	145.35	Southeast Asia
Viet Nam	Quy Nhon	60.07	Southeast Asia
Viet Nam	Thuy Trieu	96.81	Southeast Asia
Yemen	Socotra island	3624.99	Middle East

Appendix A-1: Summary of Coral Reef Area and Marine Protected Areas (MPAs) for 46 areas (45 countries + Disputed Areas) in which bumphead parrotfish occur

COUNTRY	Coral Reef Area (sq km)	% of Total Coral Reef Area	# of MPAs	Coral Reef Area within MPAs (sq km)	% of Coral Reef Area within MPAs
Australia	42315	19.8	172	31736	75
Cambodia	119	0.1	2	0	0
China	602	0.3	18	36	6
Comoro Islands	399	0.2	10	0	0
Disputed Areas	3843	1.8	0	0	0
Djibouti	231	0.1	2	7	3
Egypt	3151	1.5	8	1544	49
Eritrea	1878	0.9	0	0	0
Fiji	6704	3.1	202	2145	32
France	14616	6.8	89	292	2
India	3496	1.6	106	420	12
Indonesia	39538	18.5	201	9885	25
Iran	242	0.1	9	5	2
Israel	1	0.0	2	0	15
Japan	1786	0.8	28	339	19
Kenya	698	0.3	11	181	26
Kiribati	3041	1.4	14	182	6
Madagascar	3934	1.8	15	79	2
Malaysia	2935	1.4	93	205	7
Maldives	5281	2.5	25	0	0
Marshall Islands	3558	1.7	3	142	4
Mauritius	976	0.5	24	39	4
Micronesia	4925	2.3	20	0	0
Mozambique	2435	1.1	2	365	15
Myanmar	1347	0.6	5	54	4
Niue	45	0.0	4	2	4
Palau	966	0.5	29	261	27
Papua New Guinea	14535	6.8	85	581	4
Philippines	22484	10.5	219	1574	7
Samoa	402	0.2	108	80	20
Saudi Arabia	5273	2.5	3	53	1
Seychelles	1904	0.9	11	95	5
Solomon Islands	6743	3.2	116	405	6
Somalia	591	0.3	1	0	0
Sri Lanka	235	0.1	10	0	0
Sudan	1074	0.5	1	0	0
Taiwan	629	0.3	20	57	9

Tanzania	3008	1.4	15	1414	47
Thailand	522	0.2	24	193	37
Timor-Leste	146	0.1	0	0	0
Tonga	1662	0.8	20	499	30
Tuvalu	1210	0.6	10	36	3
United States	685	0.3	52	204	30
Vanuatu	1803	0.8	55	36	2
Viet Nam	777	0.4	29	233	30
Yemen	930	0.4	1	0	0
TOTAL:	**213673**	**100**	**1874**	**53380**	**25**

Notes:

Numbers presented are for all coral reefs in the 46 areas in which bumphead parrtofish occur and are not limited to the extent of bumphead range in cases where they do not range throughout a country's entire EEZ. Information does not exist on a precise enough scale to determine specific spatial boundaries of bumphead parrotfish range. For countries with territories in multiple ocean basins, numbers are limited to coral reef areas and MPAs in the Indo-Pacific region.

Source and Method information (provided by WRI):

Reef area estimates: Calculated at WRI based on 500-m resolution gridded data assembled under the Reefs at Risk Revisited project from Institute for Marine Remote Sensing, University of South Florida (IMaRS/USF), Institut de Recherche pour le Developpement (IRD), UNEP-WCMC, The World Fish Center, and WRI (2011).

MPAs: Compiled at the World Resources Institute from the World Database of Protected Areas (WDPA), ReefBase Pacific, The Nature Conservancy, and the Great Barrier Reef Marine Park Authority. The primary source for this information is the World Database of Protected Areas (WDPA), which provided the majority of sites. Reef Base provided information on over 600 LMMAs for Pacific Islands and the Phillipines. The Nature Conservancy provided data on over 100 additional sites in Indonesia, while reviewers provided about 50 additional sites. For the analysis, we differentiated the nine different management zones within the Great Barrier Reef Marine Park. The combined areas in each zone are substantial, and each zone offers strikingly different levels of protection. The final total is 2,679 sites in coral reef areas globally.

Note about MPA map (and therefore estimates of protected reef area): We lacked accurate boundary information for some MPAs, while reef maps themselves are also missing some areas of reef (notably small isolated patches or coral communities that are too small or deep to be properly mapped). The primary source for this information is the World Database of Protected Areas (WDPA) polygon and point shapefiles, which provided the majority of sites. For WDPA point data, the points were buffered to the documented area of the MPA as listed in WDPA. If the documented area was blank or unknown, the MPA received a default area of 1 ha. Therefore,

estimates of protected reef area should be treated as approximations due to assumptions made about boundaries for some MPAs and mapped reef areas.

Methodology for calculating reef area protected by country: These estimates were calculated using the 500-m resolution map of reefs and the shapefile of MPAs converted to a 500-m resolution grid. The MPAs were gridded because some MPAs in the shapefile overlap, and we did not want to count the same reefs multiples times if they happened to be protected under multiple sites. The country designations were assigned using a 500-m grid of EEZs for each country.

Acknowledgement:

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Appendix C – United States Existing Regulatory Mechanisms and Conservation Efforts Within Range of Bumphead Parrotfish

Regulatory Mechanisms

Within the U.S., bumphead parrotfish distribution is limited to the Territory of American Samoa, Territory of Guam, Commonwealth of the Northern Mariana Islands (CNMI), and Jarvis Atoll, Wake Island, Palmyra Atoll, and Howland and Baker Islands within the Pacific Remote Island Areas (PRIAs). This description of regulatory mechanisms is limited to federal, territorial, commonwealth, and other regulatory mechanisms that apply in this area, and that are relevant to the 2 x 4 assessment approach used for each of the 45 countries described in Section 1.3 of the Bumphead Parrotfish Management Report (i.e., fishery and coastal management, and MPA regulations). In American Samoa and Guam, the territories have jurisdiction from the shoreline to 3 nautical miles (nm) from shore, and the federal government generally has management authority over fishery resources between 3 and 200 nm from shore. In CNMI and PRIA, federal jurisdiction extends from the shoreline to 200 nautical miles seaward. However, under the Fishery Ecosystem Plan for the Marianas Archipelago, fisheries management in waters 0-3 nautical miles of the CNMI is generally left to the CNMI government. In PRIA, the federal government exercises exclusive jurisdiction.

The Regulatory Mechanisms portion of this appendix is organized to support the 2 x 4 assessment approach used for each of the 45 countries described in Section 1.3 of the Bumphead Parrotfish Management Report:

1. Fisheries and Coastal Management Regulatory Mechanisms (description of relevant federal and non-federal regulatory mechanisms).
    - 1.1. Federal
        - 1.1.1. Federal Laws
        - 1.1.2. Federal Executive Orders
    - 1.2. Non-federal
        - 1.2.1. American Samoa
        - 1.2.2. Guam
        - 1.2.3. CNMI
    - 1.3. Summary of Fisheries and Coastal Management Regulatory Mechanisms for Bumphead Parrotfish:
        - 1.3.1. Harvest Threats.
        - 1.3.2. Habitat Threats
2. MPA Regulations (description of federal and non-federal MPAs and other relevant protected areas).
    - 2.1. Federal
    - 2.2. Non-federal
        - 2.2.1. American Samoa
        - 2.2.2. Guam
        - 2.2.3. CNMI

2.3. Summary of MPA Regulations for Bumphead Parrotfish:
2.3.1. Harvest Threats.
2.3.2. Habitat Threats

Detailed descriptions of federal and non-federal fisheries and coastal management regulatory mechanisms are provided in Sections 1.1 and 1.2, while MPA/protected area regulations are provided in Sections 2.1 and 2.2. Sections 1.3 and 2.3 summarize regulatory mechanisms with regard to the eight categories used to rate each country's regulatory mechanisms, as described in Section 1.3 of the report.

1. Fisheries and Coastal Management Regulatory Mechanisms

1.1 Federal

This section describes federal laws, federal executive orders, and federal MPAs covering American Samoa, Guam, Commonwealth of Northern Marianas Islands (CNMI), and the Pacific Remote Island Areas (PRIA), consisting of Jarvis Atoll, Wake Island, Palmyra Atoll, and Howland and Baker Islands.

1.1.1 Federal Laws

Clean Water Act[1]. The 1977 amendments to the Federal Water Pollution Control Act of 1948 and 1972 (PL 92-500) are commonly known as the Clean Water Act (CWA), due to a parenthetical revision in Section 518. Congress stated that the objective of the CWA was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (33 U.S.C. §1251(A)).

Clean Water Act of 1987 Section 404 Program. Section 404 (a) of the CWA gives the authority to the Secretary of the Army (through the Corps) to issue permits, after notice and opportunity for public hearings, for the discharge of dredged or fill material. Section 404 (b) states that disposal sites shall be specified through the application of guidelines developed by the Administrator of the U.S. Environmental Protection Agency (USEPA), in conjunction with the Secretary. These "Guidelines for Specification of Disposal Sites for Dredged or Fill Material" (40 CFR 230) have become known as the "Section 404 (b)(1) Guidelines" (Guidelines); these were finalized on December 24, 1980, and remain in effect. Section 404 (c) authorizes the USEPA to prohibit, restrict, or deny (veto) any defined areas as a disposal site if it is determined that discharges of materials into such areas will have "an unacceptable adverse effect on municipal water supplies, shellfish beds and fisheries areas (including spawning and breeding areas), wildlife, or recreational areas." Issuance of a Section 404 permit requires water quality certification by the appropriate State agency (33 U.S.C.1341, Section 401).

The above-described protections apply to "navigable waters," which it defines as "waters of the United States" (33 U.S.C. §1362(7)). The Corps' regulations (33 CFR 328 (a)) and the Section 404 (b)(1) Guidelines (40 CFR 230.3 (s)) define "waters of the United States to include seven categories:

[1] http://cfpub.epa.gov/npdes/cwa.cfm?program_id=45

- All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
- All interstate waters including interstate wetlands;
- All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, slough, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including and such waters:
    - which are or could be used by interstate of foreign travelers for recreational or other purposes; or
    - which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
    - which are used or could be used for industrial purpose by industries in interstate commerce.
- All impoundments of waters otherwise defined as waters of the United States under the definition;
- Tributaries of waters identified in paragraphs 1-4 of this section;
    - The territorial sea;
    - Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs 1-6 of this section; waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA (other than cooling ponds as defined in 40 CFR §423.11(m)) which also meet the criteria of this definition) are not waters of the United States.

The purpose of the Section 404 (b)(1) Guidelines is to restore and maintain the chemical, physical, and biological integrity of waters of the U.S. through the control of discharges of dredged or fill material (40 CFR 230.1). Fundamental to the Guidelines is the precept that dredged or fill material should not be discharged into the aquatic ecosystem, "unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact either individually or in combination with known and/or probable impacts of other activities affecting the ecosystems of concern." The Guidelines further state that: "From a national perspective, the degradation or destruction of special aquatic sites, such as filling operations in wetlands, is considered to be among the most severe environmental impacts covered by these Guidelines. The guiding principle should be that degradation or destruction of special sites may represent an irreversible loss of valuable aquatic resources."

Special aquatic sites are defined as geographical areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values. 40 CFR § 230.3(q-1). These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region. The Guidelines lists the following communities to represent "Special Aquatic Sites": sanctuaries and refuges;

wetlands; mudflats; vegetated shallows; coral reefs; riffle and pool complexes. Thus, coral reefs are afforded special protection under the Guidelines.

Dredging and filling activities can adversely affect colonies of reef-building organisms by burying them, by releasing contaminants such as hydrocarbons into the water column, by reducing light penetration through the water, and by increasing the level of suspended particles in the water column. The Guidelines recognize that coral organisms are "extremely sensitive to even slight reductions in light penetration or increases in suspended particulates." These adverse effects will cause a loss of productive colonies that in turn provide habitat for many species of highly specialized aquatic organisms.

Clean Water Act; Comprehensive Environmental Response, Compensation, and Liability Act and Oil Pollution Act of 1990. The CWA, as amended by the Oil Pollution Act of 1990 (33 USC §§ 2701 et seq.), and the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC §§ 9601 et seq.), mandate that parties that release oil or hazardous substances, pollutants, or contaminants into the environment are responsible not only for the cost of removing (cleaning up) the release, but they are also responsible for restoring (remediating) any injury to natural resources that results from the actual or threatened release, or from response actions. These provisions are applied to address impacts to coral reefs from release incidents.

Advanced Identification of Disposal Areas Under Section 404. A potential mechanism for providing additional protection to coral communities is through the use of Advanced Identification of Disposal Areas (ADID) (40 CFR 230.80). Under this action, the USEPA and the permitting authority, (e.g., the Corps or State in the case of a state-delegated program) on their own initiative or at the request of any other party after consultation with any affected State that is not the permitting authority, may identify sites which are considered as:

- Possible future disposal sites, including existing disposal sites and non-sensitive areas; or
- Areas generally unsuitable for disposal site specification.

To provide the basis for ADID of disposal areas and areas unsuitable for disposal, the USEPA and the permitting authority shall consider the likelihood that use of the area in question for dredge or fill material disposal will comply with the Guidelines. Thus, it is possible that coral reef sites may be determined through the ADID process as areas generally unsuitable for disposal of dredged or fill material.

Coastal Zone Management Act[2]. The Federal Coastal Zone Management Act (CZMA) of 1972 encourages coastal states to develop comprehensive management programs that ensure the beneficial use, protection and management of the Nation's coastal resources. To encourage the adoption and implementation of these management programs, coastal states whose programs receive approval from the U.S. Department of Commerce, NOAA

2 http://coastalmanagement.noaa.gov/czm/czm act.html

are empowered to review federal activities that affect the state's approved management program. This authority to review federal activities is called "federal consistency." The process allows states to review the following activities for compliance with their approved management program:

- Activities conducted by or on behalf of a federal government agency;
- Federally funded activities;
- Activities that require a federal license or permit; and
- Activities conducted pursuant to the Outer Continental Shelf Lands Act minerals exploration plan or lease.

If a state with an approved management program objects to a negative or consistency determination on the basis that the proposed federal activity is "inconsistent" with the requirements of the state's approved program, the state may request mediation through NOAA's Office of Ocean and Coastal Resource Management, and may appeal the determination to the Secretary of Commerce. . As a general matter, state coastal management plans for areas that include coral reefs include specific provisions to ensure that these valuable ecosystems are not harmed. Consistent with the provisions of the CZMA, the ACOE will not issue any permits or authorizations under CWA Section 404, MPRSA Section 103, or RHA Section 10 that do not have a State CZMA consistency determination. Similarly, EPA will not designate an ocean dumping site under MPRSA Section 102 without meeting the requirements of the CZMA.

Table 1. Summary of states and territories with federally approved Coastal Management Programs (CMP) enacted pursuant to the Coastal Zone Management Act.

State/ Territory	Year CMP approved	URL
American Samoa	1980	http://coastalmanagement.noaa.gov/mystate/american_samoa.html
CNMI	1980	http://www.crm.gov.mp/
Guam	1979	http://www.bsp.guam.gov/content/category/6/15/37/

In an effort to develop a more comprehensive solution to the problem of polluted runoff in coastal areas, the U.S. Congress expanded the CZMA in 1990 to include a new section 6217 entitled "Protecting Coastal Waters." Section 6217 requires that states with approved coastal zone management programs develop Coastal Nonpoint Pollution Programs wherein state programs incorporate management measures to address land-based sources of run-off from agriculture, forestry, urban development, marinas, hydromodification (e.g., stream channelization), and the loss of wetlands and riparian areas. In keeping with the successful state-federal partnership to manage and protect coastal resources achieved by the CZMA, section 6217 envisioned that nonpoint source

programs developed under section 319 of the Clean Water Act (CWA) would be combined with existing coastal management programs. By combining the water quality expertise of state 319 agencies with the land management expertise of coastal zone agencies, section 6217 was designed to more effectively manage nonpoint source pollution in coastal areas. To facilitate development of state coastal nonpoint programs and ensure coordination between states, administration of section 6217 at the federal level was assigned to NOAA and the Environmental Protection Agency.

Coral Reef Conservation Act[3]. The Coral Reef Conservation Act (CRCCA) (16 U.S.C. 6401 et seq.) was passed in 2000. The CRCCA recognizes the unique nature of coral reef communities and has three main goals:

- The creation of a National Coral Reef Action Strategy;
- The financial promotion of governmental, educational, and non-governmental conservation programs; and
- Granting of additional power to the Secretary of Commerce to protect coral reef ecosystems.

The CRCCA charges NOAA with the development and periodic review of a National Coral Reef Action Strategy that addresses sustainable uses, monitoring, mapping, and public education of coral reef resources. Under the CRCCA, NOAA can provide grants to governmental, education, and non-governmental entities with expertise in coral reef conservation, and to fund monitoring, mapping, and education programs of coral reefs.

Endangered Species Act[4]. The Endangered Species Act (ESA)(16 U.S.C. § 1531, et.seq.) provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. The lead federal agencies for implementing ESA are the U.S. Fish and Wildlife Service (FWS) and the U.S. National Oceanic and Atmospheric Administration (NOAA) Fisheries Service. The law requires federal agencies, in consultation with the U.S. Fish and Wildlife Service and/or the NOAA Fisheries Service, to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species. The law also prohibits any action that causes an unauthorized "taking" of any listed species of endangered fish or wildlife. Likewise, import, export, interstate, and foreign commerce of listed species are all generally prohibited.

Section 7 requires federal agencies to ensure that actions they fund, authorize, or carry out will not jeopardize the continued existence of listed species or adversely modify designated critical habitat. "Action," in this case, is defined broadly to include federal grants, permitting, licensing, or other regulatory actions (16 USC 1536(a)(2)). In general, if a listed species may be present in an action area, the Federal action agency must conduct a biological assessment (or evaluation) to determine whether the proposed action

[3] http://coris.noaa.gov/activities/actionstrategy/08_cons_act.pdf
[4] http://www.nmfs.noaa.gov/pr/laws/esa/

may affect listed species. If the action agency's assessment shows, and NMFS concurs, that the proposed action is not likely to adversely affect any listed species or designated critical habitat, then the consultation is concluded.

If the Federal action agency's biological assessment shows that a proposed action may adversely affect a listed species or designated critical habitat, formal consultation and issuance of a biological opinion is required. During the formal consultation process, the action agency supplies NMFS with information that includes descriptions of the proposed action, action area, listed species that may be affected, and how the species may be affected by that action. NMFS has up to 135 days to complete consultation and prepare a biological opinion that contains the analysis of whether the proposed action would be likely to jeopardize the continued existence of the species or adversely modify designated critical habitat. If a jeopardy or adverse modification determination is made, the biological opinion must identify reasonable and prudent alternatives (RPAs), if any, that would not jeopardize the continued existence of the listed species or adversely modify designated critical habitat and are economically and technologically feasible. The action agency may choose to implement an RPA, modify the proposed action and consult with NMFS again, decide not to authorize, fund or otherwise proceed with the action or apply for an exception.

A biological opinion includes an incidental take statement (ITS) to authorize take resulting from the action. Incidental take is take that is incidental to, and not the purpose of, an otherwise lawful activity. The ITS also specifies reasonable and prudent measures (RPMs) considered necessary or appropriate to minimize the impact of the anticipated incidental take on the species.

Magnuson-Stevens Act[5]. The Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. § 1801 et.seq.) is the primary law governing marine fisheries conservation and management in waters under U.S. jurisdiction. The Act was first enacted in 1976, amended in 1996, and reauthorized by the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 on January 12, 2007. Eight regional fishery management councils were created under the MSA to manage fisheries and promote conservation. Among the goals of the MSA are to: achieve optimum yield in each U.S. fishery while preventing overfishing, rebuild overfished stocks, minimize bycatch and bycatch mortality, promote the safety of human life at sea, promote market-based management approaches, improve data collection and processing (including improvements in recreational data collection) giving it a larger role in the decision-making process, and enhance international cooperation by addressing IUU fishing and bycatch of protected living marine resources (NOAA, 2007).

One provision established under the MSA is to establish and maintain essential fish habitat (EFH). EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" (16 USC § 1802(10)). MSA requires that EFH be identified for all species which are federally managed. NMFS has

[5] http://www.nmfs.noaa.gov/msa2005/

designated coral substrate as EFH. MSA requires any Federal agency to consult with NMFS with respect to any action authorized, funded or undertaken, or proposed to be authorized, funded or undertaken by such agency that may adversely affect EFH. After receipt of a completed EFH Assessment, NMFS will provide EFH Conservation Recommendations to the federal agency detailing measures that can be taken by that agency to conserve EFH. Within 30 days of receiving NMFS recommendations, the federal agency must provide a detailed written response to NMFS. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case where a response is inconsistent with NMFS recommendations, the federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the proposed action and the measures needed to minimize, mitigate or offset such effects.

The Western Pacific Fishery Management Council and Fisheries Ecosystem Plans

The Western Pacific Fishery Management Council (WPFMC), established under the Magnuson-Stevens Act, manages the U.S. EEZ waters of the American Samoa Archipelago, the Mariana Archipelago (Guam and CNMI), and the Pacific Remote Islands Areas (PRIA). Fishery ecosystem plans (FEPs) prepared by the WPFMC (herein referred to as the Council) and approved by the Secretary outline ecosystem-based approaches for fishery management. Beginning in 1980, the Council had prepared the precursor to FEPs, fishery management plans (FMPs), to govern commercial fishing throughout the EEZ, regulate harvests by annual catch quotas, close seasonal fisheries, place restrictions on gear, and establish minimum catch sizes (*Acropora* Biological Review Team, 2005), all based on species-level management. FEPs, on the other hand, restructure fishery management using a place-based ecosystem approach. For these plans to be successful, trophic and biological relationships, ecosystem indicators and models, and ecological effects of non-fishing activities must all be understood (WPRFMC, 2005).

Both FMPs and FEP cover federal waters in the US EEZs. Around CNMI and the PRIA, these boundaries extend from the shoreline to 200 nautical miles seaward (although CNMI generally manages fisheries conducted by its citizens within 3 nautical miles). The Territories of Guam and American Samoa manage fisheries from the shoreline to three nautical miles seaward. The remaining waters within their EEZs are managed under FEPs to 200 nautical miles seaward (71 FR 53605).

Coral management began in 1983 when the Council established the Precious Corals Fishery Management Plan banning bottom trawling and other potentially destructive and non-selective gear in the federally managed EEZ around Hawaii, American Samoa, the Mariana Archipelago, and the PRIA. The FMP also established minimum sizes and quotas as well as no-take MPAs in the PRIAs (*Acropora* Biological Review Team, 2005). The management objectives addressed in the Coral FMPs are: 1) develop scientific information necessary to determine feasibility and advisability of harvesting coral; 2) minimize, as appropriate, adverse human impacts on coral and coral reefs; 3) provide, where appropriate, special management for Coral Habitat Area of Particular Concern; and

4) increase public awareness of the importance of sensitivity of coral and coral reefs (49 FR 29607, July 23, 1984). Since 1983, the FMP has been amended several times to include previsions to harvest for certain species of coral identified as Precious Coral Management Unit Species in the FMP with the most up-to-date amendment being in 2008[6]. Presently, NMFS defines "prohibited coral" in the Caribbean to include all coral belonging to the orders Gorgonacea, Scleractinia (stony corals), and Antipatharia (black corals) or of the Class Hydrozoa (fire corals and hydrocorals) (50 CFR 622.2). No person may fish for, harvest, or possess prohibited coral without a Federal permit in the Caribbean, Gulf of Mexico, South Atlantic, Central or Western Pacific Exclusive Economic Zones (EEZ). Moreover, no person may sell or purchase Scleractinia corals if taken from the EEZ; and if the corals are sold in Puerto Rico or U.S.V.I., it is presumed to have been harvested in the EEZ unless it is accompanied by documentation showing that it was harvested elsewhere (50 CFR 622.45(a)). A person harvesting live rock under a Federal permit is exempt from the prohibition on taking prohibited coral, however, if such coral settles on live rock (50 CFR 622.41(a)(1)). In the Western Pacific, regulations set forth for American Samoa, Hawaii, the Marianas, and PRIA define precious coral management unit species as any coral of the genus *Corallium* in addition to pink (aka red), gold, black, and bamboo corals (50 CFR 665.161, 665.261, 665.461, and 665.661). Federal regulations in 50 CFR 665 also set forth specific prohibitions and regulations for the permitting and take of precious coral management unit species within US jurisdiction in the Western Pacific.

Bumphead parrotfish, considered "currently harvested management unit species", are managed in the most current FEPs for American Samoa, the Mariana Archipelago, and the PRIA. In the American Samoa FEP, provisions exist for certain gear types within marine protected areas applicable to bumphead parrotfish harvest (WPRFMC, 2009b). Bumphead parrotfish are considered heavily over-harvested in shallow water within the Mariana Archipelago, specifically in the Territorial waters of Guam (WPRFMC, 2009a). The PRIA FEP outlines gear and harvest restrictions applicable to bumphead parrotfish in all federally managed waters (WPRFMC, 2005). Federal regulations for specific gear requirements in American Samoa, the Marianas, and PRIA are set forth in 50 CFR 665.127, 665.427, and 665.627. See sections Federal MPAs, American Samoa Territorial Laws, and Guam Territorial Laws for further details within each area.

National Marine Sanctuaries Act[7]. The National Marine Sanctuaries Act of 1972 authorizes the Secretary of Commerce, with significant public input, to designate and manage national marine sanctuaries based on specific standards. It provides for supervision by the Secretary over any permitted private or federal action that is likely to destroy or injure a sanctuary resource, and requires periodic evaluation of implementation of management plans and goals for each sanctuary. The Act also specifies prohibited activities, penalties and enforcement.

[6] http://www.wpcouncil.org/precious/Precious%20Corals%20FMP.html
[7] http://sanctuaries.noaa.gov/about/legislation/

The Act prohibits the following activities: destroying, causing the loss of, injuring a sanctuary resource managed under law or regulations for that sanctuary; possessing, selling, delivering, carrying, transporting, or shipping a sanctuary resource taken in violation of the Act; interfering with enforcement of the Act; and violating a provision of the Act or regulations of permits issued under it. Furthermore, the Secretary must conduct enforcement activities to carry out the Act. A person authorized to enforce the Act may board, search, inspect or seize a vessel, equipment, stores and cargo suspected of being used to violate the Act, and seize unlawfully taken sanctuary resources. The Act requires the Secretary to promote the use of national marine sanctuaries for research, monitoring, evaluation and educational programs as are necessary and reasonable to carryout the purposes and policies of the Act.

Rivers and Harbors Act[8]. The main purpose of the Rivers and Harbors Act (RHA) is to maintain navigation and prevent the obstruction or alteration of navigable waters of the U.S including its Territories and possessions (RHA; 33 USC §§ 401 et seq.). The RHA authorizes the U.S. Army Corps of Engineers (USACE) to issue permits to perform a variety of activities, including dredging, filling, or placement of structures in navigable waters. Section 9 prohibits the construction of bridges, causeways, dams, or dikes over any navigable water of the United States without the consent of Congress. In addition, a permit must be obtained from the U.S. Coast Guard for bridges and causeways, and from the Corps for dams and dikes (bridges and causeways 33 C.F.R. §114.01 *et seq.*; dams and dikes (33 C.F.R. §321 *et seq.*). Permit applications are evaluated for their impedance to navigation; however, dredging and filling activities that impede navigation can also adversely affect aquatic organisms, including corals.

Section 10 of the RHA prohibits any unauthorized obstruction of the navigability of any waters of the U.S. and prohibits dredging or filling in navigable waters without the approval of the Corps. Permits are required under this section for wharfs, piers, breakwaters, jetties, and other obstructions to the "navigable capacity" of waters, and for activities that may "alter or modify the course, location, condition, or capacity" of any navigable water. Section 10 has consistently been given a broad interpretation by the Courts. Two examples of court rulings that show broad interpretation of what constitutes a dredging and/or filling activity include:

- United States v. M.C.C. of Florida, Inc. (772 F.2d 1501 (11th Cir. 1985)) found that repeatedly going back and forth across the same waters with tug equipment that is dredging a channel and dumping the spoil on the adjacent sea grass beds is illegal dredging and filling under Section 10.
- United States v. Republic Steel Corp. (362 U.S. 432 (1960) determined that discharges of solid industrial wastes that progressively decreased the depth of a water body constituted prohibited obstruction covered by Section 10.

In issuing these permits, USACE conducts a "public interest balancing," which can include evaluation of benefits and detriments of a project to fish and wildlife values, such

[8] http://www.fws.gov/laws/lawsdigest/riv1899.html

as corals. As a general matter, adverse impacts to coral reefs and coral reef systems are considered to be detrimental to the public interest, and the USACE findings for Section 10 permits should document how these impacts have been avoided. Through this evaluation, USACE requires applicants to avoid and minimize impacts to corals by altering the design of a project or by imposing mitigation actions (e.g., relocation and monitoring of corals).

The Rivers and Harbors Act also authorizes the U.S. Coast Guard (USCG) to protect U.S. navigable waters. The Corps has defined "navigable waters of the Unites States" to include:

- All intrastate waterways capable of carrying interstate commerce (33 C.F.R. §329.9;
- Artificially created water bodies, including canals (33 C.F.R.§ 329.8 (a));
- Inland marina basins (Kaiser Aetna v. Unites States, 444 U.S. 164 (1979); and
- Formally navigable waters (33 C.F.R. §329.7).

Under 14 USC § 81, the USCG is charged with establishing, maintaining, and operating aids to navigation to serve the needs of U.S. armed forces and maritime commerce, and when those aids are electronic, air commerce as well when requested by the Federal Aviation Administration. Some of these aids to navigation are found in areas scleractinian corals occur. For example, the USCG maintains navigational aids in the Florida Keys National Marine Sanctuary (FKNMS) that are intended to help ships avoid grounding on coral reefs. Protection of navigable waters also includes regulating bridge-related activities. In general, a bridge cannot be constructed across any navigable water(s) until USCG has approved the location and construction plans.

Under the Rivers and Harbors Act, there is a "no net loss" policy that applies to wetland in US states and territories. Permits and mitigation plans are needed for construction in wetlands, including mangrove habitat.

Act to Prevent Pollution From Ships (APPS) As Amended by the Marine Plastic Pollution Research and Control Act (MPPRCA)[9]. The APPS, as amended by the MPPRCA, protects coral reefs by requiring all U.S. ships and all ships in U.S. navigable waters or the EEZ to comply with the International Convention for the Prevention of Pollution from Ships (33 USC §§ 1901 et seq.). Under the regulations implementing APPS as amended by MPPRCA, the discharge of plastics, including synthetic ropes, fishing nets, plastic bags, and a biodegradable plastic, into the water is prohibited. Discharge of floating dunnage, lining, and packing materials is prohibited in the navigable waters, and in areas offshore less than 25 nautical miles from the nearest land. Finally, food waste or paper, rags, glass, metal, bottles, crockery and similar refuse cannot be discharged in the navigable waters or in waters offshore inside 12 nautical miles from the nearest land. USCG has the primary responsibility of enforcing

[9] http://wildlifelaw.unm.edu/fedbook/shippoll.html

regulations under the APPS, and the APPS applies to all vessels, including cruise ships, regardless of flag, operating in U.S. navigable waters and the EEZ.

International Convention for the Prevention of Pollution from Ships (MARPOL)[10]. The MARPOL Convention is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. It combines two treaties adopted in 1973 and 1978 respectively and includes the Protocol of 1997 (outlined in Annex VI).The Convention currently includes a total of six technical Annexes described below:

- Annex I are the Regulations for the Prevention of Pollution by Oil (entered into force 2 October 1983). It covers the prevention of pollution by oil from operational measures and accidental discharges. Amendments to Annex I in 1992 made it mandatory for new oil tankers to have double hulls and bringing in measures for existing tankers to be fit with double hulls. Annex I was subsequently revised again in 2001 and 2003.
- Annex II are the Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk (entered into force 2 October 1983). Annex II outlines the discharge criteria and measures for the control of pollution by noxious liquid substances carried in bulk. There are 250 substances evaluated and included in the list appended to the Convention. The discharge of their residues is allowed only to reception facilities until certain concentrations and conditions (which vary with the category of substances) are complied with. In any case, no discharge of residues containing noxious substances is permitted within 12 miles of the nearest land.
- Annex III is the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form (entered into force 1 July 1992). Annex III contains general requirements for standards on packing, marking, labeling, documentation, stowage, quantity limitations, exceptions and notifications for preventing pollution by harmful substances. Since 1991, the International Maritime Dangerous Goods (IMDG) Code has also included marine pollutants.
- Annex IV is the Prevention of Pollution by Sewage from Ships (entered into force 27 September 2003). It contains requires to control pollution of the sea by sewage.
- Annex V is the Prevention of Pollution by Garbage from Ships (entered into force 31 December 1988). It specifies the distance from land, manner of disposal, and type of garbage allowed to be disposed of at sea. The requirements are much stricter in a number of "special areas" but perhaps the most important feature of this Annex is the complete ban on dumping all forms of plastic into the sea.
- Annex VI is the Prevention of Air Pollution from Ships (entered into force 19 May 2005). The regulations in this annex set limits on sulphur oxide and nitrogen oxide emissions from ship exhausts as well as particulate matter and prohibit deliberate emissions of ozone depleting substances

[10] http://www.imo.org/about/conventions/listofconventions/pages/international-convention-for-the-prevention-of-pollution-from-ships-(marpol).aspx

Antiquities Act[11]. The Antiquities Act authorizes the President of the United States to withdraw lands in order to provide for the "proper care and management" of "historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest." 16 U.S.C. § 431. The President is to reserve "the smallest area compatible with the proper care and management of the objects to be protected." The Antiquities Act establishes penalties for destroying, injuring, removing, or excavating any historic or prehistoric object of antiquity or object of scientific interest located on federal lands identified for protection with the monument. Reference in the Act to objects of "scientific interest" has resulted in the identification of natural geological features and wildlife for protection within Monument boundaries.

National Environmental Policy Act (NEPA)[12]. Title I contains the Declaration of National Environmental Policy requiring the federal government to "use all practicable means to create and maintain conditions under which man and nature can exist in productive harmony". Section 102 requires all federal agencies to incorporate environmental considerations in planning and decision-making. Under this act, the impacts of construction or changes to a fishery management plan must be considered by conducting an appropriate environmental analysis, which may consist of an Environmental Assessment (EA) or Environmental Impact Statement (EIS). Federal agencies are also required to lend appropriate support to initiatives and programs designed to "anticipate and prevent a decline in the quality of mankind's world environment". Title II establishes the Council on Environmental Quality to oversee NEPA by gathering information on conditions and trends in environmental quality; evaluating federal programs with respect to the goals of Title I, develop and promote national policies to improve environmental quality; and conduct studies, surveys, research, and analyses related to the ecosystems and environmental quality.

National Park Service Organic Act[13] of 1916. The National Park Service Organic Act, or the Organic Act, establishes the National Park Service within the Department of the Interior. The Organic Act promotes and regulates the use of national parks, monuments, and reservations "to conserve the scenery and the natural and historic objects and the wildlife therein, and to provide for the enjoyment…leaving them unimpaired for the enjoyment of future generations

National Wildlife Refuge System Administration Act of 1966[14]. The purpose of the National Wildlife Refuge System is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. § 668dd(a)(2). The law also provides that compatible wildlife-dependent recreational uses are allowable activities on refuges. According to the Act, "no person shall knowingly disturb, injure, cut, burn, remove,

[11] http://www.cr.nps.gov/history/hisnps/npshistory/antiq.htm
12 http://www.epa.gov/compliance/nepa/

[13] http://www.nps.gov/dena/upload/NPS%20Organic%20Act.pdf
[14] http://www.fws.gov/laws/lawsdigest/nwrsact.html

destroy, or possess any real or personal property of the United States, including natural growth, in any area of the System; or take or possess any fish, bird, mammal, or other wild *vertebrate* or *invertebrate animals* or part or nest or egg thereof within any such area; or enter, use, or otherwise occupy any such area for any purpose; unless such activities are performed by persons authorized to manage such area, or unless such activities are permitted". Accordingly, vertebrate and invertebrate species (i.e. corals and bumphead parrotfish) are protected within National Wildlife Refuges.

Ocean Dumping Ban Act[15]. The Ocean Dumping Ban Act of 1988 (also called the Ocean Dumping Act; formerly called the Marine Protection, Research, and Sanctuaries Act) prohibits any person from dumping, or transporting for the purpose of dumping, sewage sludge, medical or industrial waste into ocean waters without a permit after December 31, 1991 (16 USC §1411b). Permits can not be issued to dump radiological, chemical, and biological warfare agents, high-level radioactive waste, and medical waste (16 USC §1412). The EPA has responsibility for regulating the dumping of all material except dredged material.

Refuge Recreation Act[16]. The Refuge Recreation Act was passed in recognition of mounting public demands for recreational opportunities on areas within the National Wildlife Refuge System, national fish hatcheries, and other conservation areas administered by the Secretary of the Interior for fish and wildlife purposes. Additionally, this act is instituted to assure that any present or future recreational use will be compatible with the primary purposes for which the conservation areas were acquired or established.

The Lacey Act[17]. The Lacey Act, as amended in 1981 (16 USC §§ 3372 et seq.), prohibits the trade of fish, wildlife, or plants taken in violation of any foreign, state, tribal or other U.S. law.

The Sikes Act[18]. The Sikes Act (16 U.S.C. § 670), requires the U.S. Department of Defense to provide for conservation and rehabilitation of natural resources on military installations, which in some locations include corals.

Water Resources Development Act[19]. The Water Resources Development Act (33 USC §§ 2201 et seq.) authorizes the construction or study of United States Army Corps of Engineers (USACE) projects and applies to all features of water resources development and planning, including environmental assessment and mitigation requirements.

1.1.2 Federal Executive Orders

Following are descriptions of US Executive Orders that protect bumphead parrotfish, mangroves, and coral reefs in the Pacific Territories.

[15] http://www.epa.gov/history/topics/mprsa/02.htm
[16] http://www.fws.gov/laws/lawsdigest/refrecr.html
[17] http://www.fws.gov/le/pdffiles/lacey.pdf
[18] http://www.fws.gov/endangered/esa-library/pdf/2004SikesAct%20NMFWA.pdf
[19] http://www.fas.org/sgp/crs/natsec/IB10133.pdf

Executive Order 12962[20]. This Executive Order mandates that Federal agencies, to the extent permitted by law and where practicable, improve the quality, function, and sustainable productivity and distribution of U.S. aquatic resources for increased recreational fishing opportunities. It also established the National Recreational Fisheries Coordination Council. This order is applicable in the Pacific Remote Island Area National Monument (Proclamation No. 8336). The main provisions of this Executive Order are:

- Federal Agencies shall, to the extent permitted by law and where practicable, and in cooperation with States and Tribes, improve the quantity, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities.
- A National Recreational Fisheries Coordination Council is established, consisting of seven members from the Departments of the Interior, Commerce, Agriculture, Energy, Transportation and Defense and the Environmental Protection Agency. The representatives from the Departments of Commerce and the Interior will co-chair the Coordination Council.
- The Coordination Council, in cooperation and consultation with others, will develop a comprehensive Recreational Fishery Resources Conservation Plan setting forth a 5-year agenda for Federal agencies.
- All Federal agencies will aggressively work to identify and minimize conflicts between recreational fisheries and their respective responsibilities under the Endangered Species Act. The Fish and Wildlife Service and the National Marine Fisheries Service will develop a joint agency policy towards this end.
- The role of the Sport Fishing and Boating Partnership Council will be expanded to assist in the implementation of the Order.

Executive Order 12996[21]. Executive Order 12996 for "Management and General Public Use of the National Wildlife Refuge System" declares the National Wildlife Refuge System main purposes are to "preserve a national network of lands and waters for the conservation and management of fish, wildlife, and plant resources of the United States for the benefit of present and future generations". The Order also defines six compatible wildlife-dependent recreational activities (involving fishing, hunting, wildlife observation and photography, and environmental education and interpretation); defines four guiding principles for management; directs the Secretary to undertake several actions in support of management and public use; directs the Secretary to ensure the maintenance of the biological integrity and environmental health;and provides for the identification of existing wildlife-dependent uses that will continue to occur as lands are added.

Executive Order 13089[22]. Executive Order 13089, "Coral Reef Protection", issued by President William J. Clinton on 11 June 1998, established the U.S. Coral Reef Task Force (USCRTF) with a central goal of preserving and protecting the biodiversity, health,

20 http://www.fedcenter.gov/Bookmarks/index.cfm?id=691

21 http://teeic.anl.gov/lr/dsp_statute.cfm?topic=3&statute=149

22 http://www.coralreef.gov/execorder.cfm

heritage, and social and economic value of U.S. coral reef ecosystems and the marine environment. In 2000, the USCRTF published "The National Action Plan to Conserve Coral Reefs[23]" identifying two fundamental themes for immediate and sustained national action. These include: 1) understanding coral reef ecosystems and the natural and anthropogenic processes that determine their health and viability and 2) quickly reducing the adverse impacts of human activities on coral reefs and associated ecosystems. The action plan also identified marine protected areas (MPAs) as a promising conservation tool and proposed a critical conservation goals. The goals were to 1) strengthen protection within existing MPAs; 2) establish no-take ecological reserves in 20 percent of all representative U.S. coral reefs and associated habitats by 2010; 3) conduct a national assessment of the remaining gaps in coverage; and 4) strengthen support for international cooperation to conserve global biodiversity.

Executive Order 13158[24]. President Clinton issued Executive Order 13158 on Marine Protected Areas on May 26, 2000 to strengthen the management, protection, and conservation of existing marine protected areas and establish new or expanded MPAs; to develop a scientifically based, comprehensive national system of MPAs representing diverse U.S. marine ecosystems, and the Nation's natural and cultural resources; and to avoid causing harm to MPAs through federally conducted, approved, or funded activities (65 FR 34909). The Department of Commerce and the Department of the Interior are the lead agencies charged with carrying out the Executive Order; however, other pertinent agencies must be consulted to develop the national system of MPAs, ensuring agencies coordinate and share information, tools, and strategies. To aid in coordination effors, the Order called for the creation of a MPA Center within NOAA. Furthermore, a Federal Advisory Committee, consisting of non-Federal scientists, resource managers, and other interested persons, was established to provide advice and guidance for developing the national system of MPAs.

1.2 Non-Federal

The following section describes non-federal regulatory mechanisms for the three administrative units that have local governments (American Samoa, Guam, CNMI) within the range of the bumphead parrotfish. Bumphead parrotfish also occur on Jarvis Atoll, Wake Island, Palmyra Atoll, and Howland and Baker Islands of the Pacific Remote Island Areas (PRIA). However, PRIA does not have a local government, and is thus controlled entirely by the federal government. Therefore, there are no non-federal regulatory mechanisms in PRIA.

1.2.1 American Samoa

The coral reef fishery in American Samoa is dominated by subsistence and small-scale commercial fishing operations mainly using hook-and-line, spear guns, and gillnets. The parrotfish family, Scaridae, represents about six percent of the coral reef fish catch composition (WPRFMC 2009a). Bumphead parrotfish have been mainly harvested by spearfishers, and occasionally using gillnets (D. Fenner pers. comm.).

[23] http://www.coralreef.gov/CRTFAxnPlan9.pdf
[24] http://www.mpa.gov

Nighttime SCUBA spearfishing is thought to have led to overfishing of this species (Green 2003). SCUBA spearfishing was banned in American Samoa in April 2001 by Executive Order from the governor of American Samoa based on the interest of maintaining healthy parrotfish populations (Green 2003; Gillett and Moy 2006). A report by Mike Page, Fishery Biologist with American Samoa's Department of Marine and Wildlife Resources, noted sharp increases in parrotfish catch from SCUBA spearfishing, and other researchers and managers attested to overfishing and the importance of banning SCUBA spearfishing. Also, many local villagers were in favor of a ban on SCUBA spearfishing because they were concerned about their ability to use traditional methods in controlling fishing activities from boats in their villages and thought a government ban would have a greater effect (Green 2003). More recently, in August of 2012, the Governor issued another Executive Order 002-2012 banning the catch of all species of sharks, humphead wrasse, and bumphead parrotfish within territorial waters so American Samoa is now effectively a no-take zone for bumpheads (Office of the Governor 2012).

American Samoa Code Annotated Title 24 Ecosystem Protection and Development[25]

Chapter 1 Environmental Quality Act (A.S.C.A. §§ 24.0101 et seq). The two main objectives of this policy are: (a) to achieve and maintain levels of air and water quality as will protect human health and safety, prevent injury to plant and animal life and property, foster the comfort and convenience of the people, promote the economic and social development, and facilitate the enjoyment of the natural attractions; and (b) to provide for a coordinated Territory-wide program of air and water pollution prevention, abatement, and control; and provide a framework within which all values may be balanced in the public interest.

The Act defines "water pollution" as "the presence in the water of visible floating materials, oil, grease, scum, foam or other materials which produce visible turbidity or settle to form deposits; or materials which produce color, odor or taste, either of themselves or in combination, or in the biota; or materials which induce undesirable aquatic life; or materials which are toxic or an irritant to humans, animals, plants, or aquatic life". The Act pertains to all "waters of American Samoa" of which include all streams, lakes, ponds, rivers, bays, lagoons, navigable water, groundwaters, underground waters, and coastal waters.

Chapter 2 Water Quality Standards (A.S.C.A. §§ 24.0201 et seq). This chapter confers with the Federal Water Pollution Control Act and asserts that existing water uses and water quality standards must be maintained in such as way as is consistent with the Clean Water Act.

Chapter 9 Fishing (A.S.C.A. §§ 24.0901 et seq).

Section 24.0907 of these regulations outlines activities regulated in Fagatele Bay National Marine Sanctuary. In zones A and B, it is prohibited to gather, take, break, cut,

[25] http://www.asbar.org/

damage, destroy, or possess any invert, shellfish, coral, bottom formation, or marine plant; prohibited to possess or use spearguns (Hawaiian slings, pole slings, arbalettes, pneumatic and spring loaded spearguns), blow and arrows, bang sticks, or similar taking device; no person shall possess seines, trammel nets, or any fixed net; no vessel anchor in living coral or anchor in any manner that causes damage to living coral; and no vessel shall discharge, or cause to be discharged, in the marine environment any substance that may damage fish habitat (this includes but is not limited to garbage, human waste, or oily bilge). Within subzone A no person shall possess or use fishing poles, hand lines, or trawls and commercial fishing is prohibited.

Section 24.0909 of these regulations describe activities regulated at Rose Atoll National Wildlife Refuge (operates in conjunction with Federal Regulations). The boundaries include all lands within extreme low water line of the outside perimeter reef except at the entrance to the channel where the boundary line is a line extended between extreme low waterlines on each side of the entrance channel. It is prohibited to gather, take, break, cut, damage, destroy, or possess any invert, shellfish, coral, bottom formation, or marine plant; prohibited to take or attempt to take fish; and no person shall enter without a special use permit from DMWR.

Section 24.0910 states it is unlawful to use or possess in a fishing area any gear prohibited by annual proclamation.

Section 24.0911 states it is unlawful to take or attempt to take fish or shellfish with dynamite or any explosive.

Section 24.0912 states it is unlawful to place or explode dynamite or any explosive, or cause to be placed or explode dynamite or any explosive in the waters of American Samoa for any reason except as may be authorized by the American Samoa Government pursuant to all applicable regulations and permits

Section 24.0913 states it is unlawful to take or attempt to take fish or shellfish using any substance that has a poisonous or intoxicating effect on fish or shellfish. Includes bleach, quinaldine, insecticides, herbicides, and traditional fish poisons derived from plant and animal materials such as Barrintonia (futu) and Derris (Ava niu kini).

Section 24.0914 states it is unlawful to take or attempt to take fish or shellfish with electric device that operates by shocking with an electrical current

Section 24.0915 states it is unlawful to take, attempt to take, or assist in taking fish or shellfish (or both) using SCUBA or any underwater breathing apparatus, except with a permit issued by the director under 24.0938.

Section 24.0916 states it is unlawful to possess SCUBA or any underwater breathing apparatus and spear on any vehicle, vessel, or along the shoreline, unless the person in possession holds a permit issued by the director under 24.0938.

Section 24.0917 states it is unlawful to be in possession of explosives, poisonous substances, or electrical devices.

Section 24.0918 states frame for hand or scoop nets shall not exceed three feet in diameter.

Section 24.0919 states it is unlawful to possess, use or attempt to take fish or shellfish with a cast or throw net with a stretched mesh size less than three quarters of an inch.

Section 24.0920 states it is unlawful to possess, use or attempt to take fish with a gillnet with stretched mesh size of less than one and one half inches. Unlawful to deploy a gillnet or series of continuous gillnets with a combined length in excess of 700 feet. Unlawful to abandon gillnets. Unlawful to deploy a gillnet that will cause hazard to navigation. Unlawful to deploy a drift gillnet. Unlawful to deploy a gillnet in water greater than 60 ft deep. Gillnets must be checked at least every three hours and cleared of fish and debris.

Section 24.0921 states seines, surround nets and drag nets must have a stretched mesh size of one and one half inches. Does not apply to traditional surround nets (lau) made from natural materials.

Section 24.0926 states it is unlawful to willfully damage coral during fishing operations.

Section 24.0927 states it is unlawful to willfully damage or destroy fish habitat at any time unless authorized by the American Samoan Government pursuant to all applicable permits and regulations.

Section 24.0929 states it is unlawful to collect any living coral in water less than 60 feet deep. No commercial harvest of coral is permitted without a valid permit from the department.

Section 24.0937 states a permit is needed to collect aquarium fish, coral harvesting, or scientific collection.

Section 24.0938 states a license is needed for commercial fishing. Applicants must be a resident of American Samoa for one year to obtain a license.

Section 24.0943 states laws are fully enforceable by ASG department of Public Safety Officers and other authorized persons. Primary enforcement is from agents of the DMWR staff.

Chapter 10 Community-Base Fisheries Management Program (A.S.C.A. §§ 24.1001 et seq.). These regulations govern the Community-based Fisheries Management Program in an effort to protect traditionally valuable resources; such as traditional fishing gear, fishing methods, and Village Marine Protected Areas; in the waters surrounding American Samoa. Designation of Village Marine Protected Areas and Village Bylaws are

recognized under Sections 24.1005 and 24.1006. According to Section 24.1009, prohibits the use of poisons, explosives, and other noxious substances.

Section 24.1008 addresses Fishing or Taking Fish in a Village Marine Protected Area. The following methods are approved within Village Marine Protected Areas: rod and reel, bamboo pole, hand line, Gleaning, hand thrown pole spear, throw net, Fish or Shellfish Trap, traditional use of Lau and the enu and spear, and spear gun. All other methods are illegal. The village has the right to ban certain types of fishing gear, methods, or declare no take areas within the Village Marine Protected Area.

American Samoa Code Annotated Title 26 Environmental Safety and Land Management[26]

Chapter 2 Coastal Management (A.S.C.A. §§ 26.0201 et seq.). The American Samoa Coastal Management Program Administrative Rules were adopted from the American Samoa Coastal Management Act of 1990 with the purpose of establishing a system of environmental review that includes economic and technical guidance for land-use decisions. These regulations develop standards, procedures for designating, planning, and managing Special Management Areas that are consistent with the Coastal Zone Management Act of 1972. Some specific regulations within this chapter are:

Section 26.0221 declares Special Management Areas in mangrove habitat that are "unique and irreplaceable habitat". The two areas specifically mentioned are Leone Pala Lagoon and Nuuuli Pala Lagoon.

Section 26.0222 states that wetlands management must include delination of boundaries, policy, jurisdictional limits, bufferzones, permitted and prohibited activities, and permissible uses and violations.

Other Legislation

American Samoa Coastal Management Program Administrative Rules 1997[27]. These rules developed the Project Notification and Review System, which is a system of environmental review that is used when making land-use decisions.

1.2.2 Guam

Nearshore fisheries in Guam are divided into commercial, subsistence, and recreational fisheries. Most coral reef fish are harvested via shore-based fishing methods (WPRFMC, 2009b). Historically, bumphead parrotfish are thought to be harvested in reef flat channels using harpoons and a torch at night. In more recent times, SCUBA spearfishing is considered the primary method of harvest (J. McIlwain pers. comm.), while bang-sticks have also been used (G. Davis pers. comm.). Currently, there are no regulations for SCUBA spearfishing or the use of bang-sticks on Guam (A. Torres pers. comm.) and no traditional laws (J. McIlwain pers. comm.), therefore bumphead parrotfish are still

[26] http://www.asbar.org/
[27] http://www.asbar.org/Regs/asac26_02.htm

vulnerable to these methods of harvest. There are five no-take marine reserves, which could offer protection for bumphead parrotfish. These no-take reserves are Pati Point, Tumon Bay, Piti Bomb Holes, Sasa Bay, and Achang Reef Flat Preserves[28].

Guam Code Annotated (GCA), Organic Act of Guam[29],

Title 5 Government Operations, Chapter 63 (Fish, Game, Forestry, and Conservation). Bumphead parrotfish take is regulated and coral species are protected under this act. There are four Articles within this Chapter that specifically pertain to threats for bumphead parrotfish:

Article 1 (Game and Fish).

Section 63104 states it is unlawful to take any fish using dynamite or explosive.

Section 63105 states it is unlawful to explosives to be thrown, dropped, or exploded in any waters of the Territory of Guam.

Section 63106 states taking fish by means of poisons or intoxicant substances is unlawful.

Section 63107 states the use of poison or intoxicant substances are unlawful.

Section 63108 states the use of electric devices is unlawful.

Section 63113 states it is unlawful to willfully destroy coral for purposed of flushing fish from their habitat or for clearing an area for net fishing.

Section 63115 requires a license for placing or maintaining a fish weir. The wing of a main weir cannot exceed 300 feet in length and a leader cannot exceed 500 feet in length. The wing of an auxiliary weir cannot exceed 150 feet in length and a leader cannot exceed 250 feet in length. Mesh size must not be less than one inch in diameter or one inch square.

Section 63116.1 states the purpose of marine preserves are to protect, preserve, manage and conserve aquatic life, habitat, and marine communities and ecosystems. Ensure the health, welfare and integrity of marine resources and qualities for current and future generations by managing, regulating, restricting or prohibiting activities to include but not limited to fishing, development, or human uses (Amended by Bill 228, in 2005).

Section 63116.2 gives information related to activities within marine preserves. All forms of fishing and the taking or altering of aquatic life including living or dead coral is unlawful except as specifically identified as allowable by the Department of Agriculture through regulations (Amended by Bill 228, in 2005).

28 http://coris.noaa.gov/portals/pdfs/status_coralreef_guam.pdf

29 http://www.justice.gov.gu/compileroflaws/GCA/title5.html

Section 63129 states anyone violating sections 63104, 63105, 63106, 63107, or 63108 is guilty of felony punishable by imprisonment or fine (Amended by Bill 228, in 2005).

Article 4 (Conservation Reserves). The Department of Agriculture, Department of Parks and Recreation, and other agencies of the government of Guam are in charge of managing land and waters set aside as Conservation Reserves.

Article 6 (Live Coral and Fish Nets)

Section 63601 states the take of coral unlawful. Unlawful to remove coral from the area surrounding the Island of Guam extending ten meters inland from the main high tide line then seaward within the waters of Guam, except in accordance with the Article (Amended by Bill 228, in 2005).

Section 63602 gives regulations for harvesting of coral. Need a license for commercial harvest. The Director of Agriculture can limit the maximum time of the permit to 5 days and may restrict the amount of coral taken to insure conservation.

Section 63603 authorizes commercial permits. Permits can be limited to a specific amount of coral.

Section 63609 authorizes the use of poisons, electric devices, and mesh nets for scientific purposes. Permits are issued by the Department of Agriculture for bona fide scientific research.

Article 9 (The Guam Coral Reef Protection Act). Under the Coral Reef Protection Act, the responsible party that has run aground, struck, released pollutants, or otherwise damaged coral reefs must notify the Department of Agriculture 24 hours after the occurrence. They are responsible for a damage assessment and primary restoration in a timely fashion. The vessel must be removed, without causing additional damage, within 72 hours of the initial grounding, weather permitting. If there is a pollutant release, they must begin clean-up within 72 hours. They are financially responsible up to 3 years after the incident and fines vary with the size of the site impacted. The act also creates the Coral Reef Restoration Fund used exclusively for purposes of this Article and proceeds from fines are added to the fund (Cruz, 2010).

Title 10 Health and Safety, Chapter 45 (Guam Environmental Protection Agency Act)[30]. The purpose of this Act is to "provide a united, integrated and comprehensive territory-wide program of environmental protection and to provide a framework to fulfill that task". The Guam Environmental Protection Agency is responsible for implementing the Water Resources Conservation Act, the Water Pollution Control Act, Toilet Facilities and Sewage Disposal Act, the Air Pollution Control Act, the Guam Pesticides Act, and Solid Waste regulations.

Other Acts, Legislation, and Executive Orders

[30] http://www.guamcourts.org/CompilerofLaws/GCA/title10.html

Bill 397 (proposed in 2009): The Prohibition of Spearfishing with the use of a Self Contained Underwater Breathing Apparatus (SCUBA). This bill proposes a ban on the use of SCUBA spearfishing in Guam waters or in any vessel Guam waters Chapter 63 of Title 5 Guam Code Annotated (§ 63116.3). It recognizes that despite the establishment of marine preserves, the fishing stock of certain species, particularly stocks of bumphead parrotfish (Atuhong), are declining in Guam waters. The authors acknowledge that fish stocks within marine preserves thrive with continued sediment and pollution into these areas. Declining populations is due to SCUBA fishing with all recorded landings of bumphead parrotfish by the Guam Department of Agriculture's Division of Aquatic and Wildlife Resources. A ban on SCUBA spearfishing is proposed to allow for repopulation of bumphead parrotfish, revitalize dive tourism, enable residents to see a fish that once thrived in Guam waters, and preserve vital marine resources for future generations. It would be unlawful to take any fish with a spear or other device while using SCUBA within Guam waters.

Guam Comprehensive Planning Enabling legislation (1989). These laws have to do with land-use planning, zoning, and adapting and planning for growth.

Guam Seashore Protection Act of 1974. The Seashore Reserve is the land and water area of Guam extending seaward to the 10 fathom contour line, including all islands within government jurisdiction except Cabras Island and those Villages where residences are constructed on the shoreline prior to the effective date of this act. The Guam Territorial Seashore Reserve is seen as a distinct and valuable resource and must be preserved and protected for the resources of the shoreline. Under this act, this area can be studied and development must be consistent with the objectives of this chapter.

Mangrove legislation. This section is a set of executive orders that can be applied to mangrove habitat management.

Executive order 78-21 allows the Territorial Land Use Commission to designate wetlands as Areas of Particular Concern and to promulgate a set of Wetland Rule and Regulations.

Executive order 78-23 establishes conservation districts to protect wetlands and other natural resources.

Executive order 78-20 establishes flood hazard zones.

Executive order 90-13 requires several local agencies to update wetland regulations.

Executive order 90-10 requires an EIA for new developments.

Programs and Plans

Guam Coastal Zone Management Program (1979)[31]. This program guides the use, protection, and development of land and ocean resources within Guam's coastal zone, which is the entire Territory of Guam. The program was developed under the Federal Coastal Zone Management Act of 1972 and is overseen by the Bureau of Statistics.

Guam's Comprehensive Development Plan and Master Plan. This Bureau of Statistics and Plans is comprised of the Administrative Office of the Director, the Guam Coastal Management Program, the Socio-Economic Planning Program, the Business and Economic Statistics Program, the Planning Information Program and Land Use Planning, and has the authority to oversee this plan. This plan takes into account proposed future military expansion, federal regulations, and environmental impacts while focusing on sustainable and well-planned development efforts (Bureau of Statistics and Plans, 2010). A portion of the plan relative to threats to bumphead parrotfish is the Guam Compensatory Mitigation Policy:

Guam Compensatory Mitigation Policy (revised in 2010) provides guidance for developing and evaluating aquatic and terrestrial compensatory mitigation proposals. The goal is to have no net loss of habitat function by offsetting losses at the impact site though gains in other locations. This policy will assist Guam in issuing permits or reviewing actions under Section 401 of the Clean Water Act; Guam Coastal Management Program Federal Consistency review; Seashore Protection Act of 1974; Water Pollution Control Act; Fish, Game, Forestry, and Conservation (5 GCA Ch 63); and Wetland Areas.

Guam Comprehensive Wildlife Conservation Strategy (2006). Under Guam's Comprehensive Wildlife Conservation Strategy, bumphead parrotfish are considered a species of concern. The main threat identified is overfishing, particularly from SCUBA spearfishing. The overall goal is to return populations to historic levels. Other goals are to assess the current population structure and size by determining the baseline population size, demography, genetic, and distributional information; protect habitat in the Army Corps of Engineers and Guam Seashore Clearance permit conditions; and to reduce take through education and outreach by highlighting this species slow growth and including sustainable fishing strategies in fisheries management plans.

Hard corals are also considered species of concern. Threats identified by the Strategy include pollution, development, sedimentation, and climate change. Some abatement measures given in the plan are to assess the current population structure and size by the in situ surveys by determining the percent cover and species; to protect the habitat by restoring vegetation in watersheds and monitoring water quality; and to reduce take by educating local residents and outreach to recreational users (GDAWR, 2006).

[31] http://coastalmanagement.noaa.gov/mystate/guam.html

1.2.3 Commonwealth of the Northern Mariana Islands

Coral reef fisheries in Commonwealth of the Northern Mariana Islands (CNMI) are divided into commercial, subsistence, or recreational fisheries and are mostly limited to the islands of Saipan, Rota, and Tinian (WPRFMC, 2009b).

Reports of sighting vary from most of CNMI being outside of the range of bumphead parrotfish (S. McKagan pers. comm.) to reports of low abundances at Pagan Island (Kobayashi et al., 2011). Methods of harvest can include free-dive spearfishing (S. McKagan pers. comm.), but SCUBA spearfishing is banned (see below). There are no species-specific regulations for bumphead parrotfish, although the ban on SCUBA spearfishing is very helpful in this regard. There are no traditional regulations for bumphead parrotfish (M. Tenorio pers. comm.).

The ban on SCUBA fishing in certain areas is discussed below in five different national and local regulations: Title 85 § 85-30.1-401 (2004), Public Law 12-87 (2001), Public Law No. 17-13 (2010), Saipan Local Law No. 13-13 (2002), and Tinian Local Law No. 13-1 (2002).

Division of Fish and Wildlife, Northern Mariana Islands Administrative Codes, Title 85:

§ 85-30.1-201 (2004) states a license required to fish regulated fish. Unprotected wildlife may be taken year-round without a license. Precious corals (Corallium spp., hermatypic and other hard corals, soft corals and stony hydrozoans) are regulated. Also, any species of fish or marine invertebrate taken by a method or for a purpose is regulated by part 400.

§ 85-30.1-401 (2004) prohibits the use of explosives, poisons, electric shocking devices, SCUBA or hookah and use of certain nets, including drag nets/beach seines (Chenchulun and lagua), trap net (Chenchulun managam), surround nets (Chenchulun umesugon) or gill nets (Tekken). Permitted use of explosives, poisons, electric shocking devices, SCUBA or hookah by Division employee for scientific collection is allowed with a permit.

§ 85-30.1-405 (2004) states cast nets (talaya) are permitted with a license.

§ 85-30.1-410 (2004) states collection and/or removal from the water of CNMI of any and all species of hard Hermatypic reef building corals, soft corals, or stony hydrozoans is prohibited, but an exception can be granted and a license issued by the Director for the collection of dead coral from the beach above the lower low water mark for the purpose of manufacturing “afuk” (calcium carbonate).

§ 85-30.1-445 (2004) prohibits the sale or export of marine aquarium fish. A license is required by any person who captures aquarium fish for personal use or enjoyment. No poisons may be used to collect aquarium fish, except for scientific research.

§ 85-30.1-450 (2004) states the Director may acquire and designate aquatic habitats or easements as marine reserves, which are created to protect important fish and aquatic

species populations and their habitats. The marine reserves managed by the department are Sasanhaya Fish Reserve and Managaha Conservation Area. It is prohibited to kill or remove, or attempt to kill or remove, any marine animal or plants, including but not limited to any fishes, coral (live or dead), lobster, shellfish, clams, or octopus. It is prohibited to anchor unless emergency or scientific research. Also, it is prohibited to dump or deposit rubbish, waste material or substance that would degrade or alter the quality of the environment.

The Commonwealth Constitution[32]

Article XIV: Natural Resources. The waters off the coast of the CNMI are managed by the local government and have jurisdiction under United States law to be managed, controlled, protected, and preserved by the legislature for the people. The islands of Managaha, Maug, Uracas, Asuncion, and Guguan are maintained as uninhabited places for either cultural or recreational purposes or for the preservation and protection of natural resources.

Executive Orders

Executive Directive 235[33]. This directive established CNMI's Coral Reef Initiative Program under the Office of the Governor, with an interagency structure to coordinate coral reef issues. The Coral Reef Initiate Program includes the following agencies: the Coastal Resources Management Office, the Division of Fish and Wildlife and the Division of Environmental Quality. The interagency group is tasked with protecting coral reefs and implementation of Local Action Strategies projects.

Local Laws[34]

Saipan Local Law No. 13-13 (2002). It is unlawful for any commercial or non-commercial fishermen to use SCUBA and other related devices when fishing for reef fish, other types of fish, or harvesting other marine life within the lagoon and coastal waters of the island of Saipan and the Northern Islands. Enforcement is the responsibility of the Secretary of the Department of Lands and Natural Resources in consultation with the Director of Fish and Wildlife.

Tinian Local Law No. 13-1 (2002). It is unlawful for any commercial or non-commercial fisherman to use scuba tanks and other related device when fishing for reef fish and harvesting other marine life within the lagoon and coastal waters of the municipality of Tinian and Aguiguan.

Public Laws[35]

[32] http://www.cnmilaw.org/constitution_article14.htm
[33] http://www.deq.gov.mp/section.aspx?secID=9
[34] http://www.cnmilaw.org/publicandlocallaws.htm
[35] http://www.cnmilaw.org/publicandlocallaws.htm

Public Law No. 3-23 Commonwealth Environmental Protection Act. Some of the objectives of this Act affecting the marine environment and coral reefs include:

- Establishing and enforcing environmental standards to protect and preserve the marine resources, in implementation of Section 1 of Article XIV of the Constitution;
- Protecting vigorously the environment of uninhabited islands, thus furthering the purpose of Section 2, Article XIV of the Constitution, which requires that they be maintained as uninhabited places and used for cultural and recreational purposes, and for preservation of bird, fish, wildlife, and plant species;
- Affording special consideration to the environmental quality of places and things of cultural and historical significance to contribute to the protection and preservation thereof, in implementation of Section 3 of Article XIV of the Constitution;
- Maintaining optimal levels of air, land, and water quality in order to protect and preserve the public health and general welfare;
- Assuring that necessary or desirable economic and social development proceeds in an environmentally responsible manner in order to promote the highest attainable quality of life for present and future generations; and
- Preserving, protecting, and improving the aesthetic quality of the land, water, and natural resources in order to promote the beauty of the CNMI for the enjoyment of its residents and visitors.

The provisions of this Act and regulations issued pursuant to this Act shall apply to the air, land, water, wetlands, and submerged lands, including the Exclusive Economic Zone and other areas established by the Marine Sovereignty Act of 1980 (P.L. 2-7).

Public Law No. 3-47 Coastal Resources Management Act 1983. This Act establishes the Coastal Resources Management (CRM) Program and Policy. The CRM Program was established on February 11, 1983, with the implementation of Public Law 3-47 within the Office of the Governor. It was established in order to promote the conservation and wise development of coastal resources. The goals of the Coastal Resources Management Policy are to:

- Encourage land-use master planning, floodplain management, and the development of zoning and building code legislation;
- Promote, through a program of public education and public participation, concepts of resource management, conservation and wise development of coastal resources;
- Promote more efficient resources management through the coordination and development of resource management laws and regulations into a readily identifiable program by revising existing unclear laws and regulations, improving coordination among local agencies, improving coordination between local and federal agencies, and establish of educational and training programs for local government personnel and refinement of supporting technical data;

- Plan for and manage any use or activity with the potential for causing a direct and significant impact on coastal, significant adverse impacts shall be mitigated to the extent practicable;
- Give priority for water-dependent development and consider the need for water-related and water-oriented locations in its siting decisions;
- Provide for adequate consideration of the national interest, including that involved in planning for, and in the siting of, facilities(including energy facilities in, or which significantly affect, the coastal zone) which are necessary to meet requirements which are other than local in nature;
- Not to permit to the extent practicable, development of identifiable hazardous lands, including floodplains, erosion-prone areas, storm wave inundation areas, air installation crash and sound zones and major fault lines, unless it can be demonstrated that such development does not pose unreasonable risks to the health, safety or welfare of the people, and complies with applicable laws;
- Mitigate, to the extent practicable adverse environmental impacts, including those aquifers, beaches, estuaries and other coastal resources while developing an efficient and safe transportation system;
- Require any development to strictly comply with erosion, sedimentation, and related land and water use districting guidelines, as well as other related land and water use policies for such areas;
- Maintain or improve coastal water quality through control of erosion, sedimentation, runoff, siltation, sewage and other discharges;
- Recognize and respect locations and properties of historical significance, and ensure that development which would disrupt, alter, or destroy these, is subject to local laws and regulations;
- Recognize areas of cultural significance, the development which would disrupt the cultural practices associated with such areas, which shall be subject to a consultation process with concerned ethnic groups and any applicable laws and regulations;
- Require compliance with all local air and water quality laws and regulations and any applicable federal air and water quality standards;
- Not permit, to the extent practicable, development with the potential for causing significant adverse impact in fragile areas such as designated and potential historic and archaeological sites, critical wildlife habitats, beaches, designated and potential pristine marine and terrestrial communities, limestone and volcanic forests, designated and potential mangrove stands and other wetlands;
- Manage ecologically significant resource areas for their contribution to marine productivity and value as wildlife habitats, and preserve the functions and integrity of reefs, marine meadows, salt ponds, mangroves and other significant natural areas;
- Manage the development of the local subsistence, sport and commercial fisheries, consistent with other policies;
- Protect all coastal resources, particularly sand, coral and fish from taking beyond sustainable levels and in the case of marine mammals and any species on the CNMI Endangered Species List, from any taking whatsoever;

- Encourage preservation and enhancement of and respect for scenic resources through the development of, increased enforcement of, and compliance with, sign, litter, zoning, building codes, and related land use laws;
- Discourage, to the maximum extent practicable, visually objectionable uses so as not to significantly degrade scenic views;
- Encourage the development of recreation facilities which are compatible with the surrounding environment and land uses;
- Encourage the preservation of traditional rights of public access to and along the shorelines consistent with the rights of private property owners;
- Pursue agreements for the acquisition of use of any lands necessary to guarantee traditional public access to and along the shorelines; and
- Encourage agricultural development and the preservation and maintenance of critical agricultural lands for agricultural uses.

Public Law No. 11-112 H. B. No. 11-492 Cyanide Fishing Act of 1999. The Cyanide Fishing Act prohibits use of cyanide in water of CNMI and defines Cyanide Fishing as: "… a method in which fishermen harvest marine life by spraying such poisonous material into the coral reefs to stunt fishes and crustaceans, extract them by breaking apart the coral rocks, and finally, selling them in aquarium and live food markets around world. Although cyanide does not kill the marine life harvested, it kills and destroys the other life forms that inhabit and make up the coral reef." This Act designates the Division of Fish and Wildlife to promulgate rules and regulations to enforce its intent.

Public Law No. 12-87 (2001). It is unlawful for any commercial or non-commercial fisherman to use explosives, poison, or electric shocking devices when fishing for reef fish and harvesting other marine life within the waters of the CNMI. It is also unlawful to for any commercial or non-commercial fisherman to fish with SCUBA or hookah within the lagoon or reef or outside the lagoon or reef on the coastal waters of Saipan from Puntan Agingan to Puntan Sabaneta. Fishing with SCUBA or hookah by commercial or non-commercial fisherman in the First and Second Senatorial Districts is defined as a subject of local law as permitted by Article II, Section 6 of NMI Constitution, may enact laws prohibiting fishing with SCUBA or hookah within the lagoon or reef or outside the lagoon or reef on the coastal waters of their respective districts.

Public Law No. 12-66 (Phosphate Detergent Ban). The Legislature finds that detergent products containing phosphates are causing nutrient overloading, leading to potential eutrophication of the coastal waters of the CNMI, which in turn leads to destruction of the coral reefs and the habitat they provide for many marine organisms. Public Law 12-66 is an act prohibiting the sale, manufacturing, distribution or use of certain cleaning agents containing phosphates; conferring powers and duties on the Division of Environmental Quality; and providing penalties; and for other purposes.

Public Law No. 15-90 An Act To Create A Marine Reserve Area On Tinian From Southwest Carolinas Point And to Puntan Diablo, And For Other Purposes. This Act created a marine reserve area, located from the Southwest Carolinas Point to Puntan Diablo Point, specifically encompassing all the areas from Tachogna Beach, Taga Beach,

YCC Beach, Kammer Beach, Tinian Harbor, Breakwater area to Leprosarium Beach (aka Nasarinu) and Barcinas Bay, from the high-tide mark on shore to one-half mile out to the reef. The Department of Lands and Natural Resources, in consultation with the Tinian Resident Director of the Department of Lands and Natural Resources, were the designated authorities to delineate the boundaries of said areas by installing buoys to ensure that the boundaries are visible to the general public. Regulations of the Reserve Area are as follows:

- The removal, disturbance, damage, or destruction of any marine life or habitat, including any fish, coral, lobster, shellfish, clams, octopus or any shellfish, shall be prohibited within the Marine Reserve Area, except that seasonal fish may be removed only during their respective seasons.

- Any other activities which are exploitative or destructive to the marine life or to any historical value of this Area are strictly prohibited, except that aquaculture and marine studies conducted in the area shall not be considered a violation of this Act.

Public Law No. 17-13 (2010). It is unlawful for any commercial and non-commercial fishermen to use explosives, poisons, electric shocking devices, scuba tank or hookah when fishing for reef fish and harvesting other marine life within water of the CNMI. The use of throw nets (talaya) or the use of the following types of nets must have mesh sizes no smaller than two inches, drag nets (chenchulun lagua), surround nets (chenchulun umesugon) or trap nets (chenchulun managam), shall be legal in waters surrounding the First Senatorial District when used for non-commercial purposes only.

1.3 Summary of Fisheries and Coastal Management Regulatory Mechanisms for Bumphead Parrotfish

This section summarizes fisheries and coastal management regulatory mechanisms within the US where bumphead parrotfish occur. The summary is for federal and non-federal regulatory mechanisms jurisdiction-wide, not for MPAs or other protected areas, which are covered separately in Section 2 below. PRIA is entirely some type of MPA or protected area, and so is not covered here. The regulatory mechanism summary below is provided in terms of Harvest Threats (adult and juvenile harvest) and Habitat Threats (juvenile habitat loss/ degradation, adult habitat loss/degradation, pollution) to the species.

1.3.1 Harvest Threats

As described in Section 1.2.1 above, in American Samoa, scuba spearfishing and bottom-set gillnets are banned by territorial law, and other gears are closely regulated by territorial law. As described in Section 1.2.2 above, in Guam, although a bill was proposed in 2010 to ban scuba spearfishing in the territory, it did not pass, and spearfishing is otherwise little regulated. In Guam, other gears are closely regulated by territorial law. As described in Section 1.2.3 above, in CNMI, fishing while on scuba (i.e., using any gear, including spears) is banned by commonwealth law, and other gears are banned or closely regulated by commonwealth law.

1.3.2 Habitat Threats

As described in Sections 1.2.1 – 1.2.3 above, federal, territorial, and commonwealth laws regulate and restrict loss of mangroves, corals and coral reefs, and other coastal habitats throughout American Samoa, Guam, and CNMI. Likewise, federal, territorial, and commonwealth laws also strictly prohibit or restrict the release of pollutants into mangroves, coral reefs, and other coastal habitats throughout American Samoa, Guam, and CNMI.

2. MPA Regulations

2.1 Federal

Following are descriptions of US Federal Marine Protected Areas (MPAs) that protect bumphead parrotfish adult habitat (coral reefs) and juvenile habitat (mangroves, shallow seagrass areas, coral reef lagoons) in the Indo-Pacific Region.

American Samoa. Fagatele Bay National Marine Sanctuary(FBNMS) [36] in American Samoa was designated in 1986 in response to a proposal from the American Samoa Government. Recently, the sanctuary has been expanded to include five new discrete geographic units and renamed the National Marine Sanctuary of American Samoa. The Fagatele Bay unit is located in an eroded volcanic crater on the island of Tutuila and encompasses the 0.25 square miles of the bay. In the new regulations, harvest of any sanctuary resources is now prohibited in this unit. Prohibited or otherwise regulated activities within the other five units (Fagalua/Fogama`a, Aunu`u, Ta`u, Swains, and Rose Atoll) are listed in 77 FR 144 (July 26, 2012). In general, the other units of the sanctuary allow some level of resource extraction with varied specific regulations.

The National Park of American Samoa[37] was established by Congress "to preserve and protect the tropical forest and archeological and cultural resources of American Samoa, and of associated reefs, to maintain the habitat of flying foxes, preserve the ecological balance of the Samoan tropical forest, and, consistent with the preservation of these resources, to provide for the enjoyment of the unique resources of the Samoan tropical forest by visitors from around the world" (16USC410qq). The National Park of American Samoa has jurisdiction over 2,550 acres of coral reefs along 17 miles of coastline within park units on Tutuila, Ofu, and Ta'u Islands in American Samoa. The park is part of the Pacific West Region of the National Park Service and allows fishing or gathering for subsistence purposes only in the marine areas of the park. Traditional agriculture is also permitted.

Rose Atoll is located approximately 130 nautical miles east-southeast of Pago Pago Harbor, American Samoa, is the easternmost Samoan island, and the only atoll in the Samoan Archipelago. It is part of the Territory of American Samoa and is both a National Wildlife Refuge and part of a Marine National Monument. The National Wildlife Refuge was established by cooperative agreement between the Government of American Samoa

36 http://fagatelebay.noaa.gov/

37 http://www.nps.gov/npsa/naturescience/coral-reef-studies-and-products.htm

and the Bureau of Sport Fisheries and Wildlife (a predecessor of the U.S. Fish & Wildlife Service) on August 24, 1973. Rose Atoll National Wildlife Refuge[38] managed by the U.S. Fish and Wildlife Service and is the southernmost unit of the National Wildlife Refuge System sharing the distinction of being the only National Wildlife Refuges located south of the equator with Jarvis Island. The Wildlife Refuge includes Rose Atoll itself which is about 1 mile in length and consists of two low sandy islets, Rose and Sand Islands, each covering areas of about 14 and 7 acres, respectively. A coralline algal reef rim encloses the lagoon within Rose Atoll. A single, natural pass with a minimum depth of 8 to 48 feet deep links the lagoon to the sea. The lagoon is a maximum of 1.2 miles wide and up to about 65 feet deep, and includes 1,575 acres.

On January 6, 2009, President George W. Bush established Rose Atoll Marine National Monument[39] under the authority of the Antiquities Act of 1906 by Presidential Proclamation 8337 (74 fr 1577; 12 January 2009). The Marine National Monument surrounds Rose Atoll National Wildlife Refuge extending from the mean low water line of Rose Atoll out 50 nautical miles. The Fish & Wildlife Service has management responsibility for the Monument, including Rose Atoll National Wildlife Refuge, in consultation with the Secretary of Commerce, except that NOAA has primary management authority over fishery related activities seaward of the mean low water mark. The total area of the Marine National Monument is approximately 13,451 square miles. Within the Marine National Monument, all commercial fishing is prohibited. The Secretaries may permit non-commercial and sustenance fishing, and after consultation with the American Samoa government, traditional indigenous fishing as sustainable activities. The Western Pacific Fishery Management Council also has taken action to recommend the establishment of no-take zones from 0-12 nautical miles around Rose Atoll. Consistent with the Proclamation, NOAA has initiated the process to add the marine areas of the monument to the Fagatele Bay National Marine Sanctuary in accordance with the National Marine Sanctuaries Act.

Guam and CNMI. Guam National Wildlife Refuge[40] was established in 1993, to protect and recover endangered and threatened species, protect habitat, control non-native species, protect cultural resources, and provide recreational and educational opportunities to the public. The refuge is composed of 1,203 acres (371 acres of coral reefs and 832 acres of terrestrial habitat) owned by the U.S. Fish and Wildlife Service, and 22,456 acres (mostly forest) of refuge overlay owned by the Department of Defense in Air Force and Navy installations. According to the Guam National Wildlife Refuge Comprehensive Conservation Plan (2009), recreational fishing, including using gears such as rod-and-reel, throw net, hand spears and Hawaiian slings are allowed within the boundaries. The harvest of bumphead parrotfish, though, has been prohibited.

38 http://www.fws.gov/roseatoll/

39 http://www.fws.gov/roseatollmarinemonument/

40 http://www.fws.gov/refuges/profiles/index.cfm?id=12518

The War in the Pacific National Historical Park[41], authorized on August 18, 1978, was established to commemorate those participating in the campaigns of the Pacific Theater of World War II, and to conserve and interpret outstanding natural, scenic, and historic values and objects on the Island of Guam. The park itself has seven separate units located in or near the villages of Asan, Piti, and Agat, on the west side of the island facing the Philippine Sea. The park contains over 3,500 marine species and 200 species of coral. Scientific activities within the park include inventories of flora and fauna and long-term monitoring of the coral reefs. It is unlawful to disturb or remove artifacts from public lands; therefore, underwater natural objects (such as corals) are protected within the park.

On January 6, 2009, President George W. Bush established the Marianas Trench Marine National Monument under the authority of the Antiquities Act of 1906 by Presidental Proclamation 8335 (74 fr 1557; 12 January 2009). The Marianas Trench Marine National Monument (Northern Mariana Islands and Guam)[42] is approximately 940 nautical miles long and 38 nautical miles wide within the United States Exclusive Economic Zone and incorporates waters below the mean low water line of three islands of the Mariana Archipelago, Farallon de Pajaros or Uracas, Maug, and Asuncion. The waters of the archipelago's northern islands are biologically diverse surrounded by coral reef ecosystems and the deep waters are inhabited by seamount and hydrothermal communities. The monument consists of two units the Mariana Trench and the Volcanic Unit. The Mariana Trench Unit is almost 1,100 miles long and 44 miles wide and includes only the submerged lands. The Volcanic Unit consists of small circles (2.3 miles in diameter) around 21 undersea mud volcanoes and thermal vents along the Mariana Arc, again only the submerged lands. Fisheries related activities are managed by the National Oceanic and Atmospheric Administration, in consultation with the Fish & Wildlife Service. Commercial fishing is prohibited within the waters around the islands, but subsistence, recreational, and traditional fishing are allowed under sustainable management via Executive Order 12962 for recreational fisheries. Other agencies involved with management activities within the monument are the Secretary of Defense, the U.S. Coast Guard, and the Government of the Commonwealth of the Northern Mariana Islands. The U.S. Fish and Wildlife Service also has management responsibilities with the Mariana Trench and Volcanic Units as they are within the Mariana Trench and Mariana Arc of Fire National Wildlife Refuges.

Pacific Remote Island Area. The U.S. Pacific Remote Island Area (PRIA) includes seven islands, atolls and reefs in the Central Pacific that are under the jurisdiction of the United States. Baker, Howland, and Jarvis Islands; Johnston and Palmyra Atolls; and Kingman Reef all lie between Hawaii and American Samoa. Wake Island is located between the Northwestern Hawaiian Islands and Guam. Terrestrial activities on each of the islands are managed by different agencies. All islands expect Wake Island and Johnston Atoll are managed by the U.S. Fish and Wildlife Service. Johnston Atoll is managed by the Department of Defense (DOD). Also, both Johnston and Palmyra are owned by the

41 http://www.nps.gov/wapa/index.htm

42 http://www.fws.gov/marianastrenchmarinemonument/

Nature Conservancy. Wake Island is an unincorporated territory of the U.S. that is administered by the DOI and the U.S. Air Force (part of the DOD). Inland waters surrounding the islands are administered by the U.S. Fish and Wildlife Service as the Pacific Remote Islands National Wildlife Refuge Complex[43].

The Pacific Remote Islands National Marine Monument[44] was established by President George W. Bush on January 6, 2009 under the authority of the Antiquities Act of 1906 by Presidential Proclamation 8336 (74 fr 1565; 12 January 2009). The Monument includes the waters and submerged and emergent lands of the Pacific Remote Islands from the mean low water lines of Wake, Baker, Howland, and Jarvis Islands, Johnston Atoll, Kingman Reef, and Palmyra Atoll seaward to approximately 50 nautical miles. The National Oceanic and Atmospheric Administration has primary management authority over fishery-related activities. Resource destruction or extraction, waste dumping, and commercial fishing are prohibited in the PRIA. Scientific research, innocent passage, and recreational fishing on a sustainable basis are allowed.

WPFMC-developed no-take MPAs within the PRIA include Baker, Howland, and Jarvis Islands, and Kingman Reef from 0 to 50 fathoms (fm); and low-use MPAs are Johnston and Palmyra Atolls, and Wake Island from 0 to 50 fm. 50 C.F.R. § 665.599. Fishers may not fish within a low-use MPA without a special permit. 50 C.F.R. § 665.625. Within low-use MPAs, fishers may hand harvest and/or use spear, slurp gun, hand/dip net, hoop net for Kona crab, throw net, barrier net, surround/purse net that is attended at all times, hook-and-line, traps affixed with a vessel ID number, and/or remote operating vehicles/submersibles to harvest species within waters less than or equal to 50 fm, including bumphead parrotfish. 50 C.F.R. § 665.627. Poisons, explosives, or intoxicating substances may not be used to harvest this species. 50 C.F.R. § 665.605. At Wake, Howland, Baker, and Jarvis Islands, and at Johnston and Palmyra Atolls, there is no SCUBA spearfishing from 6pm to 6am in the EEZ (WPRFMC, 2005; NOAA, 2009). Within Palmyra Atoll National Wildlife Refuge, the Secretary shall ensure that recreational fishing is managed sustainably in accordance with the purposes of the monument (Executive Order 12962)[45].

2.2 Non-Federal

2.2.1 American Samoa Territorial MPAs

American Samoa only has one Territorial MPA. Ofu Vaoto Territorial Marine Park was established in 1994 by Territorial legislation and encompasses a small area (less than one mile in width). The main purpose of establishing the park was to protect unique coral habitats while allowing public access and enjoyment. Only residents of Ofu Island may

43 http://www.fws.gov/pacificislandsrefuges/

44 http://www.fws.gov/pacificremoteislandsmarinemonument/

45 http://www.fws.gov/pacificremoteislandsmarinemonument/PP%20PRIMNM.pdf

fish and/or harvest shellfish in the boundaries of the park, while all others are restricted from such activities. The terrestrial part of the park is to remain unimproved[46].

Additionally, within 7 villages, a Community-based Fisheries Management Program is installed via the Department of Marine and Wildlife Resources. Replenishing resources through no-take areas is the main proponent of this program, where villages manage their own local MPAs. Notably, Fagamalo Village recently established a long-term no-take marine protected area via this program, the first on Tutuila.[47]

2.2.2 Guam Territorial MPAs

In 1997, Public Law 24-21 was implemented creating 5 marine preserves and making changes to Guam's fishing regulations. The names of the preserves are the Pati Point Preserve, the Tumon Bay Preserve, the Piti Bomb Holes Preserve, the Sasa Bay Preserve, and the Achang Reef Flat Preserve. Within a marine preserve, the taking of aquatic animals is restricted. Unless specifically authorized, all types of fishing, shell collecting, the use of gaffs, and the removal of sand and rocks are prohibited in a preserve. Violators of these regulations are subject to fines up to $500 and/or imprisonment up to 90 days. The exceptions are: hook-and-line fishing from shore is permitted for all species in Pati Point Preserve; hook-and-line and cast net fishing from shore are permitted for rabbitfish, juvenile goatfish, juvenile jacks, and convict tangs in Tumon Bay; cast net fishing along the reef margin is permitted in Tumon Bay along with bottom fishing from 100 ft depth seaward; and trolling is permitted for pelagic fish in all preserves from the reef margin seaward[48].

2.2.3 Commonwealth of Northern Mariana Islands MPAs

The CNMI has several marine protected areas with varying levels of restricted activities[49]. No-take reserves prohibit the fishing or harvesting of any marine species of plant or animal, including prohibiting the take of coral (live or dead), and ban all exploitive or destructive activities to marine life. In Saipan, there are three no-take reserves Managaha Marine Conservation Area, Forbidden Island Marine Sanctuary, and Bird Island Marine Sanctuary. The island of Rota has a no-take reserve called Sasanhaya Fish Reserve. The island of Tinian has a marine reserve which extends from the Southwest Carolinas Point to Puntan Diablo that is primarily a no-take reserve allowing for the seasonal fishing of atulai, i'i, and ti'ao only and prohibiting destruction of marine habitat (Public Law 15-90).

Conservation Efforts

The following sections describe US federal and US non-federal conservation efforts addressing Harvest and Habitat threats to the bumphead parrotfish. Federal conservation

46 http://faolex.fao.org/cgi-bin/faolex.exe?database=faolex&search_type=query&table=result&query=LEX-FAOC050989&format_name=@ERALL&lang=eng

47 http://ip-208-109-238-104.ip.secureserver.net/viewstory.php?storyid=30819&edition=1317459600

48 http://www.guamdawr.org/aquatics/mpa/

49 http://www.dfw.gov.mp/Fisheries/Marine%20Protected%20Areas.html

efforts are in the form of national programs and initiatives for coral reef conservation while non-federal conservation efforts include State and Territorial conservation programs, initiatives and local action plans.

1. US Federal

The United States has numerous federal programs in place aimed at the conservation of coral reefs. Below is a brief description of these different programs and their aims. Some programs may not be listed below; however it is recognized that the United States make a valiant effort at conserving coral reefs within federal waters.

Marine Protected Areas Inventory[50]. This is a geospatial database that catalogs and classifies marine protected areas within US waters.

National Coral Reef Institute (NCRI)[51]. NCRI was started in 1998 after a Congressional mandate. The primary goal of the NCRI is the protection and preservation of coral reefs through applied and basic research on coral reef assessment, monitoring, restoration, and biodiversity, as well as via training and education. This goal is addressed through multidisciplinary scientific research on coral reef assessment, mitigation, monitoring, and restoration as directed by Congress, as well as through applied engineering, operations, and public education.

NOAA Species of Concern Program[52]. "Species of Concern" are species or vertebrate populations for which there is concern or uncertainty about their status. Species of Concern are not protected by the Endangered Species Act (ESA). As resources permit, NOAA Fisheries conducts a review of the status of each Species of Concern. NOAA Fisheries believes it is important to highlight species for which additional information and management may be warranted so that Federal and state agencies, Native American tribes, and the private sector are aware of which species could benefit from proactive conservation efforts. NOAA has external and internal grant programs to fund such efforts. Funding for projects in CNMI, Guam, and Wake atoll was made available through this program for projects implementing research and conservation measures to improve the status of bumphead parrotfish.

NOAA Coral Reef Conservation Program (CRCP)[53]. The NOAA CRCP is a partnership between the NOAA Line Offices that work on coral reef issues: the National Ocean Service, the National Marine Fisheries Service, the Office of Oceanic and Atmospheric Research, and the National Environmental Satellite, Data and Information Service. The CRCP brings together expertise from across NOAA for a multidisciplinary, ecosystem based approach to managing and understanding coral reef ecosystems. Themes of conservation include: appropriately placed and well managed MPAs; research,

50 http://www.mpa.gov/dataanalysis/mpainventory/

51 http://www.nova.edu/ncri/

52 http://www.nmfs.noaa.gov/pr/species/concern/

53 http://coralreef.noaa.gov/

restoration, and/or monitoring expeditions; coral reef ecosystem monitoring, mapping and assessment. Conservation methods of CRCP include the following programs:

National Coral Reef Ecosystem Monitoring Program (NCREMP). NCREMP supports local shallow-water coral reef ecosystem monitoring activities. The goal of NCREMP is a nationally-coordinated, comprehensive, long-term monitoring program to assess the condition of US shallow-water coral reef ecosystems, evaluate the efficacy of coral reef ecosystem management, and communicate progress toward conservation of coral reef ecosystems.

NOAA Coral Reef Watch (CRW). The Coral Reef Watch program uses satellite sea surface temperature data to alert managers and scientists around the world of the risk of coral bleaching. CRW has also recently developed a new system, which uses NOAA experimental sea surface temperature forecasts, to predict coral bleaching events. The prediction system uses forecast models to develop bleaching outlooks up to three months in advance. To continue addressing the threat of coral bleaching, reef managers are provided with tools to understand climate change and coral bleaching and information about how to take action in response to alerts of potential bleaching conditions.

NOAA Coral Reef Management Fellowship Program. The NOAA Coral Reef Management Fellowship Program was established to respond to the need for additional coral reef management capacity in the U.S. Flag Pacific and Caribbean islands. The program has been expanded to include Florida in the 2010-2012 cycle. The program provides the state and territorial coral reef management agencies with highly qualified candidates whose education and work experience meet each island's specific needs, while providing the individual fellows with professional experience in coastal and coral reef resources management. Each jurisdiction develops a separate Statement of Work which contains project descriptions, goals and objectives, minimum and desired qualifications, and salary, among other information. The Statements of Work uniquely reflect each jurisdiction's particular needs, complementing other ongoing local projects and management activities. Successful candidates will meet these needs.

NOAA Coral Health and Monitoring Program (CHAMP)[54]. The mission of CHAMP is to provide services to help improve and sustain coral reef health throughout the world.

Long term goals of CHAMP include:

- Establish an international network of coral reef researchers for the purpose of sharing knowledge and information on coral health and monitoring.
- Provide near real-time data products derived from satellite images and monitoring stations at coral reef areas.
- Provide a data repository for historical data collected from coral reef areas.
- Add to the general fund of coral reef knowledge.

[54] http://www.coral.noaa.gov/

NOAA Coral Reef Information System (CoRIS)[55]. NOAA's CoRIS is designed to be a single point of access to NOAA coral reef information and data products, especially those derived from NOAA's Coral Reef Conservation Program. CoRIS is a web-based information portal that provides access to products from NOAA coral reef research, monitoring, and management activities, with emphasis on the U.S. states, territories, and remote island areas. NOAA activities include coral reef mapping, monitoring and assessment; natural and socioeconomic research and modeling; outreach and education; and management and stewardship.

Coral Reef Conservation Fund[56]. Responding to an alarming decline in both the quantity and productive quality of the world's coral reef ecosystems, the National Fish and Wildlife Foundation partnered with NOAA to establish the Coral Reef Conservation Fund. Through this Fund, the Foundation supports local to ecosystem level projects that restore damaged reef systems and prevent further negative impacts through both on-the-water and up-the-watershed projects by focusing on specific areas of human impact such as anchor damage and sedimentation.

Pacific Reef Assessment and Monitoring Program (Pacific RAMP)[57]. Pacific RAMP institutes principles of ecosystem management through development of an ecosystem observing system to map, assess, and monitor coral reef ecosystems in the Pacific. There are 50 islands and atolls that are monitored in the Hawaiian and Mariana Archipelagos, American Samoa, and U.S. Line and Phoenix Islands monitored by NOAA's Coral Reef Ecosystem Division (CRED). In 2010, the 5th biennial Pacific Ramp expedition took place in American Samoa. The strategic goal of this research is to improve scientific understanding of coral reef ecosystems throughout the Pacific, and serve as the basis for improved conservation and resource management.

U.S. Coral Reef Initiative (USCRI)[58]. The United States is one of the first countries with coral reefs to launch a national Coral Reef Initiative. Announced in 1996, the USCRI is designed to be a platform of U.S. support for domestic and international coral conservation efforts. The goal is to strengthen and fill the gaps in existing efforts to conserve and sustainably manage coral reefs and related ecosystems (sea grass beds and mangrove forests) in U.S. waters. USCRI is a partnership of federal, state, territorial and commonwealth governments, the scientific community, the private sector and other organizations. The primary objective of USCRI is to foster innovative partnerships and cross-disciplinary approaches that reduce the threats to U.S. coral ecosystems.

[55] http://coris.noaa.gov/

[56] http://www.nfwf.org/AM/Template.cfm?Section=Charter_Programs_List&Template=/TaggedPage/TaggedPageDisplay.cfm&TPLID=60&ContentID=18269

[57] http://www.nova.edu/ncri/11icrs/abstract_files/icrs2008-002024.pdf

[58] http://oceanservice.noaa.gov/aa/ia/cri.html

U.S. All Islands Coral Reef Committee (AIC)[59]. The AIC was created in 1999 by governor-appointed Points of Contact (POCs) to represent each coral reef jurisdiction in the United States. The creation of the AIC formally recognized the U.S. island jurisdictions of Guam, American Samoa, Commonwealth of the Northern Marianas, Hawaii, Puerto Rico, and the U.S. Virgin Islands who had been meeting informally since 1993 after the U.S. Department of State proposed creating the Coral Reef Initiative to ameliorate future global degradation of coral reef ecosystems. The State of Florida became a full member of the Committee in 2007. The Committee works closely with the Coral Reef Conservation Program, NOAA, U.S. Department of Commerce, and the U.S. Department of the Interior, Office of Insular Affairs. The AIC also actively collaborates with other federal agencies who are members of the U.S. Coral Reef Task Force. The AIC is a made up of marine resource managers from state, commonwealth, territorial agencies and freely associated states working collaboratively with federal agencies to conserve and protect coral reefs in the United States.

U.S. Coral Reef Task Force (USCRTF)[60]. The USCRTF was established in 1998 by Presidential Executive Order #13089 to lead U.S. efforts to preserve and protect coral reef ecosystems. The USCRTF includes leaders of twelve federal agencies, seven U.S. states and territories, and three freely associated states. The USCRTF has been instrumental in building partnerships and strategies for on-the-ground action to conserve coral reefs. NOAA as a partner in the USCRTF submitted *A National Coral Reef Action Strategy*[61] to Congress to help track implementation of *The National Action Plan to Conserve Coral Reefs* developed by the USCRTF in 2000. The National Action Plan: (1) identified key threats and issues driving the loss and degradation of coral reefs, (2) established thirteen major goals to address these threats, and (3) outlined objectives and priority actions needed to achieve each goal. Additionally, in 2002 the U.S. Coral Reef Task Force identified the need for more focused action at the local level to reduce key threats to coral reefs and called for the development of Local Action Strategies (LAS) in each of the seven states and territories that possess significant coral reef resources. These LASs are locally-driven roadmaps for collaborative and cooperative action among federal, state, territory and non-governmental partners which identify and implement priority actions needed to reduce key threats to valuable coral reef resources. The goals and objectives of the LASs are linked to those found in the U.S. National Action Plan to Conserve Coral Reefs, adopted by the U.S. Coral Reef Task Force in 2000. Nationally, there are 13 goals and LASs prioritize six areas for immediate local action that contain projects to ameliorate stressors. The six areas are over-fishing, land-based sources of pollution, recreational overuse and misuse, lack of public awareness, climate change and coral bleaching, and disease. Plans are instituted for three years. The LASs for Guam, CNMI and American Samoa are summarized below in section 3.2 about conservation efforts in States and Territories.

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[59] ftp://ftp.nodc.noaa.gov/pub/data.nodc/coris/library/NOAA/CRCP/project/1204/us_islands_coral_reef_comm_strategic_plan_2008-13.pdf

[60] http://www.coralreef.gov/

[61] http://coris.noaa.gov/activities/actionstrategy/action_reef_final.pdf

U.S. Department of Agriculture Coral Reef Initiative[62]. The U.S. Department of Agriculture (USDA) will provide $1 million from the Environmental Quality Incentives Program (EQIP) in Fiscal Year 2010 to reduce sediment and nutrient run-off from the watershed to help protect near shore coral reef ecosystems in the Guánica Bay Watershed in southwest Puerto Rico. The pilot project will protect coastal and stream water quality, improve wildlife habitat, and enhance near shore coastal and coral reef health through land-based management. USDA's Natural Resources Conservation Service (NRCS) will assist producers in voluntarily establishing systems of conservation practices specifically tailored to their operations. These practices, designed to avoid, control and trap sediment and nutrient runoff, include nutrient management, cover crops, grassed waterways, and field borders. The $1 million dedicated to improving coral reef health in the watershed in Fiscal Year 2010 will come from funds NRCS allocates to Puerto Rico, and NRCS is planning to fund similar projects in Florida, U.S. Virgin Islands, Hawaii and the Pacific Islands area in the future.

2. US Non-Federal

For each US territory or commonwealth within bumphead parrotfish range (American Samoa, Guam, CNMI, PRIA), information on non-federal programs for coral reef conservation as well as Coral Reef Local Action Strategies (LASs) was summarized. Numerous other projects in each state and territory are conducted every year through grants funded by the Coral Reef Conservation Fund. These projects and their descriptions and can be found in the online grants library[63]. It is also recognized that other smaller coral reef conservation projects conducted by various organizations, academic institutions and/or NGOs are conducted frequently, signifying an increase in public awareness on coral reef issues.

2.1 American Samoa

Summary of American Samoa Coral Reef Conservation Projects. Conservation of coral reefs in American Samoa is a joint effort of government agencies (i.e. CRAG) and community-based management. American Samoa has 11 Village Marine Protected Areas which rely on management by the local communities in coordination with local governments. Like other states and territories, American Samoa's reef conservation efforts include monitoring, education and outreach, as well as community participation in management. The most relevant conservation programs instituted by the local government in American Samoa are summarized below.

American Samoa Coral Reef Initiative (ASCRI)[64]. American Samoa's Coral Reef Initiative is administered by the Governor's Coral Reef Advisory Group (CRAG), an inter-agency task force established to provide the Government of American Samoa with advice, guidance and project management regarding coral reef related issues. Instrumental to its success is the direct and active role that each of the five agencies play

[62] http://www.coralreef.gov/

63 http://www.nfwf.org/AM/Template.cfm?Section=Library_Search&Template=/customsource/ProjectSearch/cindex.cfm.

[64] http://crag.as/?nav=Home&cont=home

in collaborative project development and implementation. Important projects implemented under the ASCRI include:

American Samoa Coral Reef Monitoring Plan. This plan was designed by the Coral Reef Monitoring Coordinator and CRAG Monitoring Working Group to create a management driven program that is achievable with on-island staff and resources and resilient to staff turnover. American Samoa began implementing the integrated coral reef monitoring plan in early 2005. This program consists of 11 core sites, distributed geographically around the island. It will also assist individual agency monitoring efforts, as well as the Community-based Fisheries Management Program at the DMWR. For the first time, the Territory will have a single point of reference and contact for monitoring activities, as well as a centralized database.

Education and Outreach. The main objective of CRAG's Education and Outreach Coordinator is to increase public awareness of issues affecting American Samoa's coral reefs. The Education and Outreach Coordinator conducts regular visits to schools, develops educational equipment, and disseminates information via newspaper articles, slides and brochures relevant to coral reef issues. One notable project is the distribution of grants from awarding the American Samoa Teachers' Challenge Awards to teachers in American Samoa. Le Tausagi, an interagency working group consisting of environmental educators who collaborate on conservation programs and community outreach, administers this program.

American Samoa Marine Protected Area (MPA) Network Strategy. The American Samoa MPA Network Strategy was developed to link the Territory's MPA programs and agencies together to be more effective in protecting and managing the marine resources. The goal of the MPA Network Strategy is to effectively coordinate existing and future MPAs to ensure the long-term health and sustainable use of the Territory's coral reef resources. Collaboration and integration among agencies through existing programs in education, research, monitoring, enforcement, and administration are emphasized.

American Samoa's Local Action Strategy[65]. In American Samoa, the Coral Reef Advisory Group (CRAG) is responsible for implementing the Local Action Strategies (LAS) via initiatives developed by the U.S. Coral Reef Task Force. LASs are the result of a continuing process incorporating input from territorial agencies, non-profit groups, interested individuals, stakeholder groups, and federal agency partners. American Samoa has LASs addressing population pressure, overfishing, land-based sources of pollution, public outreach and awareness, and local response to global climate change.

2.2 Guam

Summary of Guam's Coral Reef Conservation Efforts. A broad network of agencies, educational/research institutions and non-governmental organizations continue to carry out a range of activities aimed at mitigating the threats to Guam's coral reefs, improving public awareness of coral reef issues and monitoring the vitality of Guam's coral reef

[65] http://www.coralreef.gov/las/lasfactsheets2009/las09/lasas.pdf

resources. Progress towards short- and long-term increases in human capacity to effectively carry out these activities has been made with the establishment of two scholarship programs for graduate study in marine biology/natural resource management, the NOAA Coral Management Fellowship, the Pacific Islands Technical Assistantship program, the NOAA Pacific Islands Regional Office (PIRO) Guam Field Office and various training opportunities for managers, technicians and teachers. Many of the goals and objective of coral reef management projects in Guam are directly linked to the U.S. National Action Plan to Conserve Coral Reefs through Local Action Strategies developed locally (Waddell et al., 2008). The most relevant conservation programs instituted by the government of Guam are summarized below.

Guam Coastal Management Program (GCMP)[66]. The Guam Coastal Management Program, instituted in 1979, is responsible for coordinating and assisting the development and implementation of plans, policies and programs which affect the management, use and preservation of Guam's land and ocean resources. The objectives of the GCMP are to ensure consistency amongst the plans, policies and programs such that Guam's resources are effectively used for the benefit of present and future generations. It is overseen by the Bureau of Statistics and Plans, and guides the use, protection, and development of land and ocean resources within Guam's coastal zone. Because Guam is a small island, the entire land area is included within this coastal zone. The Coastal Program provides overall coordination and direction to a network of government agencies to ensure a balanced approach to coastal management. Some of the most prominent coastal management issues for Guam are coral reef and watershed habitat degradation, water quality degradation, coastal hazards, and cultural and historic resource preservation.

Guam Coral Reef Initiative (CRI) and Local Action Strategy (LAS)[67]. In 1997, the Government of Guam established the CRI and instituted a LAS to address threats to the reefs via initiatives developed by the U.S. Coral Reef Task Force. The Bureau of Statistics and Plans, Guam Coastal Management Program, Department of Agriculture, Division of Aquatics and Wildlife Resources, and Guam Environmental Protection Agency lead most of the efforts of the CRI. Guam LASs on land-based sources of pollution, fishery management, public outreach and awareness, recreational use and misuse, and coral bleaching and global climate change.

Guam Fisherman's Cooperative Association (GFCA). The GFCA collects fisheries data, trains fishers, provides demonstrations, and is involved in fisheries management. It was originally organized under Guam law and represents all fishermen in Guam, including traditional fishers (Stewart and Bartram, 2008).

2.3 Commonwealth of the Northern Mariana Islands

Summary of the CNMI Coral Reef Conservation Efforts. Many coral research and monitoring programs have been funded in recent years by the U.S. Coral Reef Initiative

[66] http://coastalmanagement.noaa.gov/mystate/guam.html
[67] http://www.coralreef.gov/las/lasfactsheets2009/las09/lasguam.pdf

(CRI) increasing the CNMI's capacity to manage its coral reef ecosystem resources. This has enabled the CNMI's capacity to assess, monitor, educate and enforce coral reef management policy to grow substantially through an increase in both personnel and the development of locally applicable management tools (Waddell et al., 2008). The most relevant conservation programs instituted by the government of the CNMI are summarized below.

Coastal Resources Management (CRM) Office Marine Monitoring Program[68]. The CRM Marine Monitoring Program is funded by a grant from NOAA that supports the Coral Reef Ecosystem Monitoring Program in the CNMI. This program is a long-term interagency project between local and national agencies including the CNMI Coastal Resources Management Office, the Division of Environmental Quality, the Division of Fish and Wildlife, NOAA, US EPA, and ACOE. The main goal of this program is to provide the information necessary for the wise management of reef resources. It provides a means to document how reef communities change over time in response to natural fluctuations, acute disturbances (e.g. typhoons), and chronic disturbances (e.g. NPS pollution). Following changes over time allows for assessing the impacts of land-based pollution and if management actions are needed, or working. Monitoring activities also provide information as to what organisms live on the coral reefs in the CNMI. This provides knowledge of what areas are most precious and endangered so prioritization of limited management funding and resources to these regions can be made.

CNMI's Mooring Buoy Program[69]. In order to protect coral reefs and fisheries habitats from anchor damage at frequently visited sites, while assuring public access to marine resources, CNMI's Coastal Resources Management Office (CRM) and the Northern Mariana Dive Operators Association (NMDOA) worked together to install and maintain public marker and mooring buoys.

CNMI's Nonpoint Source Pollution, Marine Monitoring, and Coral Reef Program[70]. This branch of the Department of Environmental Quality (DEQ) is responsible for keeping CNMI waters clean and healthy for beneficial uses. It was established from the CNMI Coral Reef Initiative. Through this program, the DEQ provides demonstrations for best management practices and education and outreach campaigns concerning water quality issues through fairs and festivals such as the Environmental Symposium and Expo during Earth Day and the EcoArts Festival.

CNMI's Local Action Strategy[71]. The Local Action Strategies (LAS) the CNMI were developed through a coordinated effort among three natural resources management agencies: the Coastal Resources Management Office, the Division of Fish and Wildlife and the Division of Environmental Quality. Stakeholder meetings and input also contributed to the development of the strategies. LAS serve as tools to encourage stewardship towards coastal resource protection and restoration. CNMI has LASs on

[68] http://www.crm.gov.mp/programs/monitoring/how.asp
[69] http://cnmibouymooring.blogspot.com/
[70] http://www.deq.gov.mp/section.aspx?secID=9
[71] http://www.coralreef.gov/las/lasfactsheets2009/las09/lascnmi.pdf

land- based sources of pollution, fishery management, recreational use, public outreach and awareness, and coral resources management.