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HOW TO PROTECT A CORAL REEF: THE PUBLIC TRUST DOCTRINE AND THE LAW OF THE SEA

by J.C. Sylvan*

INTRODUCTION

Reef ecosystems are an invaluable biological resource — the “species factories” of the world’s seas.¹ Though they occupy less than one percent of the ocean floor, reefs are home to 25 percent of all marine species and 32 of the 33 animal phyla.² Among these reefs ecosystems, ten “Coral Reef Hotspots” comprise just one hundredth of a percent of the ocean floor in terms of area and harbor more than half of the world’s restricted-range marine species.³ For the sheer concentration of biodiversity they support, only tropical rainforests can compare, and rainforests occupy 20 times the area.⁴

Coral reefs also rank among the most endangered marine ecosystems on earth.⁵ The same unique biology that enables reef-building corals to create and maintain vital habitat also makes them particularly vulnerable to the cumulative and interactive effects of local and global environmental stressors, primarily overfishing, pollution, and coral bleaching. In every place they are found, reefs are now reported to be “in crisis.” Of the coral reefs that remain, nearly a third worldwide are degraded,⁶ and more than half are considered to be at risk.⁷ By 2030, 60 percent of the world’s coral reefs are predicted to disappear.⁸

Properly managed, healthy, and intact reefs could potentially provide a sustainable livelihood for coastal communities. As our knowledge of the risks to coral reefs grows, so too does the need to adapt our international legal regimes to ensure their sustainable use. This article argues that there are significant economic benefits to adapting existing legal regimes, notably the public trust doctrine, to protect the long-term sustainability of coral reefs. The first part delineates the benefits that healthy coral reefs provide as well as the primary threats they face today. The second part surveys the legal regimes most relevant to their sustainable use.

CHARACTERISTICS OF CORAL REEFS

THE BENEFITS OF CORAL REEFS

Coral reefs provide two kinds of benefits: “economic benefits,” which are tangible and immediate, and “ecosystem services,” which are less apparent perhaps, but no less important. Worldwide, coral reefs have a net present value of almost \$800 billion, and every year, they generate \$30 billion in net economic benefits.⁹ One square kilometer of healthy reef habitat can feed

up to 300 people; nearly ten percent of all the fish consumed worldwide is caught on a reef.¹⁰ Sustainable managed reefs can become a financially lucrative for both the marine aquarium and the live fish trades.¹¹ The annual dockside value of commercial U.S. fisheries that depend on coral reefs exceeds \$100 million; “the annual value of reef-dependent recreational fisheries probably exceeds that.”¹²

The pharmaceutical industry has found dozens of substances with antimicrobial, anti-inflammatory, and anti-coagulating properties in reef species.¹³ AZT, a drug doctors have used to treat HIV, is derived in part from compounds found in a Caribbean reef sponge.¹⁴ Moreover, with potentially eight million more reef species still to be identified, reefs may represent an “untapped wealth of biochemical resources.”¹⁵ The aesthetic value of healthy and intact coral reefs generates another source of tourism-related income for coastal communities to the tune of \$9.6 billion in net benefits annually.¹⁶ Finally, healthy reefs may

also translate into a “politically actionable existence value... [P]eople derive satisfaction from just knowing that coral reefs still exist.”¹⁷

In addition to their economic benefits, reefs also provide valuable ecosystem services that are difficult to quantify because they are provided at no cost. Healthy and intact reefs absorb as much as 90 percent of the impact of wind-

generated waves, protecting ports, shipping, coastal development, and mangroves from storms and erosion.¹⁸ Replacing these services can be expensive: in the Maldives, an artificial substitute for a coral reef cost \$12 million to construct.¹⁹ Reef-dependent animals also provide valuable ecosystem services. Green turtles, for example, maintain seagrass beds, ecosystems in themselves worth an estimated \$3.8 trillion.²⁰ Finally, from an aesthetic perspective, healthy reefs also keep white sand beaches clean. In the aftermath of Hurricane Allen, the combination of disease, pollution from coastal development, and historic overfishing of algae-eating reef fish, “flipped” Jamaica’s coastal ecosystem from an array of pristine coral reefs to a massive algae bloom.²¹

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Sound environmental policies do not easily translate into conventional measures of economic health, such as gross national product. Nonetheless, “[i]nvesting in environmentally sustainable management and development of [coral reefs today] will be more cost effective than restoring human livelihoods and ecosystems after a catastrophe.”²² While any attempt to put a price on ecosystem services should be viewed with caution, valuations can guide us in weighing the costs and benefits of sustainable reef management. A healthy and intact coral reef may be worth as much as \$600,000 per square kilometer — well worth the \$775 per square kilometer it costs to maintain a marine protected area around them, especially considering that doing nothing will also have costs.²³ Harder still is to calculate the value of unknown opportunities lost when a biologically diverse reef is destroyed. Used sustainably, coral reefs will continue to provide immediate benefits. Preserved for the future, coral reefs may pay unforeseen dividends. Left undefended, their loss may deprive many development countries of their principle livelihood and a potential source of wealth.

THREATS FACING CORAL REEFS

The trends are not encouraging. Reefs are disappearing faster than they can be counted. By one estimate, 40 percent of the world’s remaining coral reefs may be gone by 2010, 60 percent by 2030 if nothing is done.²⁴ One reason for the precipitous decline is an accident of reef ecology. Nearly 40 percent of the world’s human population now lives within 100 kilometers of a coastline.²⁵ As a result, reef species become overexploited, habitat is destroyed, watersheds are altered, and runoff pours sediment, sewage, pollutants, hydrocarbons, litter, and pathogens into coastal waters. Invasive species, stowed away in ballast water of tankers, are discharged along with cargo in port. Air pollution carries heavy metals, persistent organic pollutants (“POPs”) and persistent toxic substances (“PTSs”) miles from shore. Even excess nutrients can generate harmful plankton blooms that stifle corals.²⁶

Another reason for the decline is a general failure of fisheries to account for the dynamic nature of reef ecosystems. Historic overharvesting of one species can have cascading effects on others. The pressure is compounded by the fact that many of the over-fished species play vital roles as “ecosystem engineers” and maintain the health of reef ecosystems.²⁷ When they are removed faster than their stocks can be replenished, reef ecosystems break down and lose their capacity to recover. Without a viable habitat, overexploited populations cannot recover. This entire process can happen quickly, but the effects endure. A reef discovered in Guam in 1957, for example, was fished down in six months and 40 years later the populations have yet to recover.²⁸

In the long run, some species of reef fish and some areas of reef habitat may be more valuable if left alone. However, even a complete moratorium on reef fishing will not address all the

threats reefs face today. When subjected to severe stress, corals release symbiotic microalgae that account for their vivid colors, resulting in “coral bleaching.” Bleaching seems to be occurring with increasing frequency, such that every coral reef region in the world has experienced some bleaching over the past decade.²⁹ In 2005, scientists witnessed the worst bleaching event on record in the Caribbean.³⁰ The interaction of local and global pressures has a cumulative effect on the long-term health of corals, reducing their reproductive capacity, and making them susceptible to diseases. Given that the recovery time of reefs can take decades, successive environmental stressors can kill a reef. Permanent damage comes at significant cost. Bleaching on the Great Barrier Reef in Australia could cost nearly \$300 million over the next 15 years.³¹ Globally, the economic losses over 50 years could approach \$83 billion.³²

LEGAL REGIMES FOR CONSERVATION AND SUSTAINABLE USE

Despite the benefits they provide, the risks they face, and the legal regimes created to manage them, coral reefs today remain largely unprotected. Like fisheries, reef conservation is a classic case of “the tragedy of the commons.” When access to a valuable resource is open, such that everyone can use it and no

one can bar or limit another’s use, exploitation will inevitably occur. Traditionally, oceans were like air, with benefits so abundant that reducing them to possession as private property was impracticable. This is not quite true for reefs. Limited in scope, fixed in location, they could arguably be reduced to private ownership.

While nearly 20 percent of the world’s coral reef habitat lies within one of 980 Marine Protected Areas (“MPAs”), less than 0.1 percent are protected by “no-take” rules that prohibit poaching, and none are protected from risks arising outside the MPA.³³ Even when reefs are officially “protected,” a mandate to regulate on behalf of a species, an area, a process or a habitat may not guarantee protection in an area subject to fractured jurisdiction or authority.³⁴ Divided authority engenders incoherent conservation goals for natural resources and undermines any opportunity for their sustainable use.

But even a regional approach to conservation will not work if it does not attend to the full range of risks facing a particular ecosystem. For example, The Magnuson-Stevens Fishery Conservation and Management Act (“Magnuson Act”) authorizes the drafting of a Fishery Management Plan for Coral and Coral Reefs of the Gulf of Mexico and South Atlantic to preserve “all corals on the seabed in U.S. federal waters (of the Gulf) from harvest, sale, and destruction from fishing related activities.”³⁵ Nevertheless, the National Marine Fisheries Service itself concluded that “[n]o regulatory mechanisms are currently in place, or expected to be in place in the foreseeable future, to control or prevent [the three principal threats to corals in the Gulf: elevated

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sea surface temperature, and hurricanes, and disease.] [T]he inadequacy of existing regulatory mechanisms is contributing to the threatened status of these species.”³⁶ Success of coral reef conservation depends on a unified authority with jurisdiction extending “from the inland extent of coastal watersheds to the offshore boundary of the nation’s exclusive economic zone,” and over “a wide range of ocean and coastal issues.”³⁷ Writ large, the gaps in United States ocean policy exemplify the problem of fragmentation facing coral reef conservation internationally.

THE GLOBAL: UNITED NATIONS CONVENTION ON THE LAW OF THE SEA³⁸

When they entered into force in 1994, the 320 articles and nine annexes of the United Nations Convention on the Law of the Sea (“UNCLOS”) became the most comprehensive international legal agreement for marine conservation to date.³⁹ Most importantly, UNCLOS shifted the legal assumption that the ocean was an inexhaustible commodity, and adopted a precautionary approach that treated the seas as a vulnerable resource worthy of human stewardship. This idea is implicit throughout UNCLOS. However, certain provisions of UNCLOS undermine its effectiveness as a tool for protecting coral reef ecosystems. Under UNCLOS, living resources do not belong to the “common heritage of mankind.”

Moreover, because most reef-building corals depend on photosynthesis, they are limited to a “sunlit zone,” part of the ocean where light penetrates (about 660 feet). Thus, by another accident of ecology, most of the world’s coral reefs are well within coastal states’ jurisdiction, entitling them to conserve or to exploit most of the world’s reefs as they see fit.

While a state may invoke its obligation to maintain or restore populations of marine life at levels that can produce the maximum sustainable yield to justify a conservation policy, nothing requires them to do so. A state need only “consider” the effects of its policies on the marine environment. Moreover, the state itself sets its own benchmark for what level of protection of the marine environment is appropriate. While UNCLOS does caution Parties against undertaking actions which jeopardize the marine environment of their neighbors, absent proof of transboundary damage, no state can challenge the policies or practices of its neighbors. Ultimately, the state decides the sustainable limits of the living resources within its EEZ and the degree to which it will enforce them leading to instances where enforcement is so lax as to be nonexistent.

All told, “the one international agreement theoretically most suited for marine biodiversity protection is at best only a decidedly incomplete response to the mass extinction bubbling under the surface of the planet’s waters.”⁴⁰ Unfortunately, UNCLOS falls prey to a false dichotomy. When food pressures are at odds with reef conservation, people come first, as they should. But sustainable economic development and environmental conserva-

tion need not be at odds; they may even be synonymous. What happens, for instance, when a state allows pollution to continue unabated in the name of economic development and its reefs are permanently destroyed as a result, taking with them one of the few resources that developing nations have to generate economic growth?

THE LOCAL: MPAS AND MARINE RESERVES

In their approach to coral reef management, coastal states have had to find a balance between conservation and economic development. This has meant picking a regulatory scheme that protects reefs by limiting the ways the public can use them. A more permissive scheme, the Marine Protected Area (“MPA”), allows some commercial and recreational activities. A more restrictive subset of MPA, the marine reserve, implements a “no-take” rule which prohibits all activities that upset the natural ecological functions of the area. “No-take” reserves tend to be the exception rather than the rule, and less than 0.1 percent of coral reefs worldwide are protected by these kinds of “no-take” provisions.⁴¹ Governments are reluctant to create marine reserves because “no-take” provisions fly in the face of the open access people associate with marine resources. In California, for example, a no-take reserve near Santa Barbara provoked a grass-

roots campaign to put a “Freedom to Fish Act” on the state and federal legislative agenda.⁴²

Today, federal and state governments in the United States have ample legislative authority to create no-take marine reserves. The Supreme Court did away with the notion of State title to fisheries as a 19th-century legal fiction, but it

40 percent of the world's remaining coral reefs may be gone by 2010.

kept state “sovereignty over lands covered by tide waters, [...] with the consequent right to use or dispose of any portion thereof, when that can be done without substantial impairment of the interest of the public in the waters[.]”⁴³ Legitimacy of protecting fisheries turns upon “whether the State has exercised its police power in conformity with the federal laws and Constitution.”⁴⁴ But this approach begs the question: who decides what “the interest of the public in the waters” is, precisely?⁴⁵

One view maintains that the legislature, as the ultimate representative of the public, is the final arbiter of the public interest. Another view elevates the public interest to an informal constitutional right — not even the legislature could assign a general benefit held in trust for the many to a privileged and well-connected few. Florida and Louisiana went so far as to include the public trust doctrine in their state constitutions.⁴⁶ A third approach views the public interest as a government defense against takings claims by private parties contesting conservation restrictions on private land. Under this view the public trust created a pseudo-easement on the land. If a private party bought tidal lands, it did so with constructive knowledge of the public’s traditional interests in fishing, or navigation thereon. Under this view, “the individual States have the authority to define the lim-

its of the lands held in public trust and to recognize private rights in such lands as they see fit.”⁴⁷

But if two equally legitimate public property rights — like recreational fishing and coral reef conservation — are at odds, which interest wins out? Absent enactment of a “Freedom to Fish” bill or the like, the courts are left to decide. While tradition limited the public trust to navigation, fishing and commerce, time has amended the list, adding recreation, conservation and aesthetic concerns, without necessarily creating a hierarchy among them. The Florida State constitution added to the list marine living resources which “should be conserved and managed for the benefit of the state, its people, and future generations.”⁴⁸ The Supreme Court of Washington upheld a ban on the use of jet-skis on county waters reasoning, “it would be an odd use of the public trust doctrine to sanction an activity that actually harms and damages the waters and wildlife.”⁴⁹ This seems to suggest that the vitality of the ecosystem in general is paramount to any particular use to which it can be put.

As MPAs become more pervasive, and their classification becomes more fixed, the question of no-take provisions becomes more salient. In 1999, California passed its Marine Life Protection Act to create a network of MPAs and marine reserves along its coast that would be “managed according to clear, conservation-based goals and guidelines that take full advantage of the multiple benefits that can be derived from the establishment of marine life reserves.”⁵⁰ In 2000, President Clinton signed Executive Order 13158 to bring 1,500 MMAs under one national system with individual areas classified according to a single set of criteria.⁵¹ Regionally, the United States, Mexico, and Canada are working on a North American MPA Network (“NAMPAN”).⁵²

To date there are approximately 400 MPAs which include coral reefs in more than 65 countries around the world.⁵³ As the number of MPAs worldwide continues to grow, coastal states will have to choose which rules will govern reef conservation; how many of these new protected areas will have no-take provisions remains to be seen.

The advantage of “no-take” reserves is that they promote a more holistic approach to conservation management by aiming to restore the vitality to an entire ecosystem rather than just a single species. Reserves protect habitat, conserve biological diversity, provide a sanctuary for sea life, establish a benchmark to measure changes elsewhere in the marine environment, and help rebuild depleted fisheries by cushioning crashes in local fish stocks from overfishing in adjacent areas. On the other hand, the benefits of reef reserves have their limits. Sanctuary status only reduces the risk of overharvesting; it does not address the damage that arises from pollution, shipping, or coral bleaching. These require the cooperation of local authorities with responsibility for regulating the source of these threats. Marine reserves may also be inappropriately situated. Creating reserves where none are needed while leaving essential habitat unprotected is not a strategy for sustainable coral reef conservation. Understandably, communities that depend on reefs for food or other resources may have a strong incentive not to establish marine reserves in those reefs’ most productive areas, regardless of whether they are fragile ecosystems susceptible to overexploitation.

Paradoxically, a more permissive approach to use within an area may do more to protect fragile habitat. So long as use occurs at a sustainable level, the trade-off for less stringent protections potentially creates greater community involvement and cooperation between managers and users. One way to accomplish this is through zoning. “Several zones can and generally should exist within a single MPA, contributing to the strength of MPAs in protecting the biodiversity of a location, rather than trying to address each individual human impact separately.”⁵⁴ The most successful MPAs have this in common. The Great Barrier Reef of Australia is exemplary “of integrated and multiple-use management, allowing sustainable utilization of the reef by a wide range of users with numerous and often conflicting needs.”⁵⁵ In the Philippines, the Apo Island Reserve “has allowed [fish] stocks to recover sufficiently so that local fishermen operating in the surrounding areas are reporting major increases in fish yields.”⁵⁶ This question of enforcement remains a crucial as many developing countries face real constraints in terms of the resources available to enforce even the most lenient provisions. Without resources MPAs risk becoming “paper tigers.” One global study of 383 MPAs found that conservation objectives were only enforced effectively in one third of them (117).⁵⁷

CONCLUSION

Increasingly, governments will be forced to choose between protecting their publics’ right to use marine resources today against its right to have them there to use tomorrow. While giving a coastal state exclusive jurisdiction over valuable marine habitat enables that state to manage it in a coherent manner and provides that state with an economic incentive to do so, the public trust doctrine also could serve as a check on any exploitative or unsustainable practices the state decides to permit.

Even so, the public trust doctrine cannot alone save reef ecosystems. For even though they could be reduced to private property, fragile reef ecosystems cannot be fenced off. They depend on fluid ocean currents for their survival. The boundaries of even the best protected marine reserves are permeable. Environmental stressors from around the world will continue to afflict them if we cannot find a way to hold ourselves in check. “It is no longer sufficient to talk of state responsibility for environmental damage. The context must change to reflect state responsibility for the preservation of global environmental well-being.”⁵⁸ This sentiment is especially apt for the world’s coral reefs, given their breakneck pace towards mass extinction.

Endnotes: How to Protect a Coral Reef

¹ Erika Kranz, *Scientists Confirm Bird’s Head Seascape Is Richest on Earth: CI-Led Survey Reveals Trove of Biodiversity Near ‘Lost World’ of Foja*, CONSERVATION INTERNATIONAL, Sept. 18, 2006, available at <http://www.conservation.org/xp/frontlines/2006/09180601.xml> (last visited Oct. 17, 2006).

² UNITED NATIONS ENVIRONMENT PROGRAMME (“UNEP”), Coral Reef Unit and WWF Coral Reefs Advocacy Initiative, *Conventions and Coral Reefs: Fourteen*

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Multilateral Environmental Agreements, Programmes, Partnerships and Networks Relevant to the Protection and Conservation of Coral Reefs and the World Summit on Sustainable Development Plan of Implementation (May 2003) available at http://www.unep.org/PDF/Conventions_CoralReefs_optimized.pdf (last visited October 17, 2006) [hereinafter Conventions and Coral Reefs].

³ See Callum M. Roberts et al., *Marine Biodiversity Hotspots and Conservation Priorities for Tropical Reefs*, 295 SCIENCE 1280 (2002); see also Press Release, Conservation International, *The Ocean's Top 10 Coral Reef Hotspots Identified For First Time: Study Sounds Alarm for Extinctions of Marine Species*, Feb. 14, 2002, available at http://www.conservation.org/xp/news/press_releases/2002/021402.xml (last visited Oct. 20, 2006).

⁴ Norman Myers et al., *Biodiversity Hotspots for Conservation Priorities*, 403 NATURE 853 (Feb. 24, 2004) (finding that 35 percent of four vertebrate groups are confined to 25 terrestrial hotspots comprising 1.4 percent of the world's land surface).

⁵ CLIVE WILKINSON, STATUS OF CORAL REEFS OF THE WORLD: 2004, Vol. 1 (Australian Institute of Marine Science 2004) available at <http://www.aims.gov.au/pages/research/coral-bleaching/scr2004/> (last visited Oct. 17, 2006).

⁶ Conventions and Coral Reefs, *supra* note 2, at foreword.

⁷ DIRK BRYANT ET AL., REEFS AT RISK: A MAP-BASED INDICATOR OF POTENTIAL THREATS TO THE WORLD'S CORAL REEFS 20 (World Resources Institute 1998), available at <http://pdf.wri.org/reefs.pdf> (last visited Oct. 20, 2006) [hereinafter REEFS AT RISK].

⁸ UNITED NATIONS ENVIRONMENT PROGRAMME WORLD CONSERVATION MONITORING CENTRE ("UNEP-WCMC"), IN THE FRONT LINE: SHORELINE PROTECTION AND OTHER ECOSYSTEM SERVICES FROM MANGROVES AND CORAL REEFS 5 (2006) available at http://sea.unep-wcmc.org/resources/publications/UNEP_WCMC_bio_series/24.cfm (last visited Oct. 20, 2006) [hereinafter IN THE FRONT LINE].

⁹ Assuming a three percent discount rate. WORLD WILDLIFE FUND, THE ECONOMICS OF WORLDWIDE CORAL REEF DEGRADATION (2003) available at (last visited Oct. 20, 2006) [hereinafter REEF ECONOMICS].

¹⁰ Fredrik Moberg & Carl Folke, *Ecological Goods and Services of Coral Reef Ecosystems*, 29 ECOLOGICAL ECONOMICS 215, 216 (1999).

¹¹ NOAA, U.S. CORAL REEF TASK FORCE, IMPLEMENTATION OF THE NATIONAL CORAL REEF ACTION STRATEGY: REPORT ON THE U.S. CORAL REEF TASK FORCE ACTIVITIES FROM 2002–2003 (July 2005), available at http://www.coris.noaa.gov/activities/reportcongress2005/Chap12_InternationalTrade.pdf (last visited Oct. 20, 2006) (finding that "trade in coral reef species could provide jobs in predominantly rural, low-income coastal communities, thereby providing strong economic incentives for coral reef conservation in regions with few alternative sources of revenue.").

¹² NOAA, WHAT ARE CORAL REEFS—AND WHY ARE THEY IN PERIL?, Dec. 3, 2001, <http://www.magazine.noaa.gov/stories/mag7.htm> (last visited Oct. 20, 2006).

¹³ Moberg & Folke, *supra* note 10, at 217.

¹⁴ Reef Economics, *supra* note 9, at 8.

¹⁵ GREAT BARRIER REEF MARINE PARK AUTHORITY, A REEF MANAGER'S GUIDE TO CORAL BLEACHING (2006) available at www.coris.noaa.gov/activities/reef_managers_guide/welcome.html (last visited Oct. 20, 2006) [hereinafter REEF MANAGER'S GUIDE].

¹⁶ REEF ECONOMICS, *supra* note 9, at 8.

¹⁷ Robin Kundis Craig, *Taking Steps Toward Marine Wilderness Protection? Fishing and Coral Reef Marine Reserves in Florida and Hawaii*, 34 MCGEORGE L. REV. 155, 160 (2003).

¹⁸ IN THE FRONT LINE *supra* note 8, at 5.

¹⁹ Moberg & Folke, *supra* note 10, at 220. 29 ECOLOGICAL ECONOMICS 215, 220 (1999).

²⁰ WORLD WILDLIFE FUND-INTERNATIONAL, MONEY TALKS: ECONOMIC ASPECTS OF MARINE TURTLE USE AND CONSERVATION (2004) available at <http://worldwildlife.org/turtles/pubs/turtlereport4.pdf> (last visited Oct. 20, 2006).

²¹ Moberg & Folke, *supra* note 10, at 228.

²² IN THE FRONT LINE, *supra* note 8, at 5.

²³ IN THE FRONT LINE, *supra* note 8, at 5–6.

²⁴ CLIVE WILKINSON, STATUS OF THE CORAL REEFS OF THE WORLD: 2000 (Australian Institute of Marine Science 2000), available at <http://www.aims.gov.au/pages/research/coral-bleaching/scr2000/scr-00gcrmn-report.html> (last visited Oct. 20, 2006). See generally *Altered Oceans, A Five Part Series on the Crisis in the Seas*, LOS ANGELES TIMES, July–Aug., 2006, available at <http://www.latimes.com/news/local/oceans/la-oceans-series,0,7842752.special> (last visited

Oct. 17, 2006); *see also* U.S. COMMISSION ON OCEAN POLICY, AN OCEAN BLUE-PRINT FOR THE 21ST CENTURY: FINAL REPORT OF THE U.S. COMMISSION ON OCEAN POLICY (Sept. 2004), *available at* http://oceancommission.gov/documents/full_color_rpt/000_ocean_full_report.pdf (last visited Oct. 20, 2006) [hereinafter OCEAN COMMISSION REPORT]; PEW OCEANS COMMISSION, AMERICA'S LIVING OCEANS: CHARTING A COURSE FOR SEA CHANGE (2003), *available at* http://www.pewtrusts.com/pdf/env_pew_oceans_final_report.pdf (last visited Oct. 20, 2006) [hereinafter PEW COMMISSION REPORT]; *see also* PEW CENTER ON GLOBAL CLIMATE CHANGE, CORAL REEFS AND GLOBAL CLIMATE CHANGE: POTENTIAL CONTRIBUTIONS OF CLIMATE CHANGE TO STRESSES ON CORAL REEF ECOSYSTEMS (2004).

²⁵ WORLD WILDLIFE FUND, THE ECONOMICS OF WORLDWIDE CORAL REEF DEGRADATION 5 (2003) *available at* <http://www.eldis.org/static/DOC12720.htm> (last visited Oct. 20, 2006).

²⁶ *See generally* JOINT GROUP OF EXPERTS ON THE SCIENTIFIC ASPECTS OF MARINE ENVIRONMENTAL PROTECTION ("GESAMP"), PROTECTING THE OCEANS FROM LAND-BASED ACTIVITIES (2001) 18-26 *available at* <http://gesamp.imo.org/no71/index.htm> (last visited Oct. 20, 2006). *See also* T. P. Hughes et al., *Climate Change, Human Impacts, and the Resilience of Coral Reefs*, 301 SCIENCE 929, 929 (2003).

²⁷ *See generally* Felicia C. Coleman & Susan L. Williams, *Overexploiting Marine Ecosystem Engineers: Potential Consequences for Biodiversity*, 17 TRENDS IN ECOLOGY AND EVOLUTION 40 (2002), *available at* <http://www.bio.fsu.edu/mote/colemanTREE 01.02.pdf> (last visited Oct. 20, 2006).

²⁸ GLOBAL TRADE AND CONSUMER CHOICES, at 15.

²⁹ REEF MANAGER'S GUIDE, *supra* note 15, at 5.

³⁰ Press Release, NOAA, U.S. *Coral Reef Task Force Announces New Conservation Initiatives*, NOAA06-052 May 4, 2005[sic] *available at* http://www.coralreef.gov/announcements/may_2006_press.pdf (last visited Oct. 12, 2006).

³¹ WORLD WILDLIFE FUND ("WWF"), THE IMPLICATIONS OF CLIMATE CHANGE FOR AUSTRALIA'S GREAT BARRIER REEF (2004).

³² H. CESAR ET AL., THE ECONOMICS OF WORLDWIDE CORAL REEF DEGRADATION, (Cesar Environmental Economics Consulting 2003), <http://www.icran.org/pdf/cesardegredationreport.pdf> (last visited Oct. 20, 2006).

³³ Camilo Mora et al., *Coral Reefs and the Global Network of Marine Protected Areas*, 312 SCIENCE 1750, 1750 (June 2006).

³⁴ *See* Josh Eagle, *Regional Ocean Governance: The Perils of Multiple-Use Management and the Promise of Agency Diversity*, 16 DUKE ENV L & POL'Y 143, 153 (2006).

³⁵ 71 FR 26852, 26858.

³⁶ 71 FR 26852, 26858.

³⁷ OCEAN COMMISSION REPORT, *supra* note 24, at 91.

³⁸ The U.N. Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397.

³⁹ *See generally* UNITED NATIONS ENVIRONMENTAL PROGRAMME ["UNEP"], CONVENTIONS AND CORAL REEFS: FOURTEEN MULTILATERAL ENVIRONMENTAL AGREEMENTS, PROGRAMMES, PARTNERSHIPS AND NETWORKS RELEVANT TO THE

PROTECTION AND CONSERVATION OF CORAL REEFS AND THE WORLD SUMMIT ON SUSTAINABLE DEVELOPMENT PLAN OF IMPLEMENTATION 12 (2003) [hereinafter CONVENTIONS AND CORAL REEFS].

⁴⁰ John Charles Kunich, *Losing Nemo: The Mass Extinction Now Threatening the World's Ocean Hotspots*, 30 COLUM. J. ENVTL. L. 1, 58 (2005).

⁴¹ Camilo Mora et al., *Coral Reefs and the Global Network of Marine Protected Areas*, 312 SCIENCE 1750, 1750 (June 2006).

⁴² *See* Doug Obegi, *Is There a Constitutional Right to Fish in a Marine Protected Area?*, 12 HASTINGS W—N.W. J. ENV. L. & POL'Y 103, 121 (2005).

⁴³ *Illinois Cent. R. Co. v. State of Illinois*, 146 U.S. 387, 435 (U.S. 1892).

⁴⁴ *Douglas v. Seacoast Products, Inc.*, 431 U.S. 265, 284-285 (U.S. 1977).

⁴⁵ *See generally* Carol M. Rose, *Joseph Sax and the Idea of the Public Trust*, 25 ECOLOGY L.Q. 351 (1998).

⁴⁶ Fla. Const., art. X, section 1 (1970) ("The title to lands under navigable waters...is held by the state ... in trust for all the people. ... Private use of portions lands may be authorized ... only when not contrary to the public interest."). Louisiana: ("The natural resources of the state, including air and water, and the healthful, scenic, historic, and aesthetic quality of the environment shall be protected, conserved, and replenished insofar as possible and consistent with the health, safety, and welfare of the people").

⁴⁷ *Phillips Petroleum Co. v. Miss.*, 484 U.S. 469, 475 (1988).

⁴⁸ Fla. Const., art. X, section 16(a) (1994).

⁴⁹ *Weden v. San Juan County*, 958 P.2d 273, 283-84 (Wash. 1998).

⁵⁰ Cal Fish & G Code § 2851.

⁵¹ Executive Order 13158 (May 2000). There six categories of protection are: "Uniform Multiple-Use," "Zoned Multiple-Use," "Zoned with No-Take Area(s)," "No Take," "No Impact," and "No Access." *See generally* NOAA, *The U.S. Classification System: An Objective Approach for Understanding the Purpose and Effects of MPAs as an Ecosystem Management Tool*, http://mpa.gov/pdf/helpful-resources/factsheets/class_system_0806.pdf (last visited Oct. 20, 2006).

⁵² NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION ("NOAA"), NATIONAL MARINE PROTECTED AREAS CENTER, NOAA PROGRESS REPORT: STATUS OF MPA EXECUTIVE ORDER 13158 ON MARINE PROTECTED AREAS, FISCAL YEAR 2006 (Sept. 2006) at 16, *available at* <http://mpa.gov/pdf/helpful-resources/mpa-prog-rpt-fy06.pdf> (last visited Oct. 20, 2006).

⁵³ REEFS AT RISK, *supra* note 7, at 44.

⁵⁴ Craig, *supra* note 17, at 168.

⁵⁵ REEFS AT RISK, *supra* note 7, at 44.

⁵⁶ REEFS AT RISK, *supra* note 7, at 44.

⁵⁷ REEFS AT RISK, *supra* note 7, at 44.

⁵⁸ Susan H. Bragdon, *National Sovereignty and Global Environmental Responsibility: Can the Tension Be Reconciled for the Conservation of Biological Diversity?*, 33 HARV. INT'L L.J. 381, 391 (1992).