# Managing Large Scale Marine Reserves:

## Policy Recommendations for the Global Ocean Legacy Campaign

Jackson School of International Studies

Task Force 2015

JACKSON SCHOOL OF INTERNATIONAL STUDIES

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**TASK FORCE 2015**

University of Washington
The Henry M. Jackson School of International Studies

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# Executive Summary

Over the course of just a few generations, man has gained for the first time the ability to change the oceans – harnessing technologies that allow intensive marine extraction and dramatically increasing anthropogenic activities, which are today altering the sea's chemistry, temperature, and even depth. At the same time, science is daily uncovering interconnections of increasing complexity between the health of the oceans and the health of life on land, from near-shore ecosystems and indigenous peoples, to inland crops and forests waiting for rain.

Large marine reserves (LMRs), marine protected areas 100,000 km² or greater, respond to the new paradigm of human-ocean interaction with a conservation tool of similar scope. Unsustainable fisheries, habitat degradation, sea-level changes, and global warming in general will inevitably stretch the adaptive capabilities of even well-protected sanctuaries. But far from a strike against reserves, acknowledging this reality is in fact one of the strongest arguments in their favor. As the closest tool available to whole-ecosystem preservation, reserves large enough to protect entire food chains and whole-life-cycle habitats are likely the best buffers against negative global anthropogenic change.

The Pew Charitable Trusts' Global Ocean Legacy (GOL) campaign has made significant strides in achieving its ambitious goal of securing 15 large reserves – each at least 200,000 $km^2$ – that protect the world's pristine oceans by prohibiting fishing and resource extraction. Their efforts have not only contributed to the doubling of protected marine area worldwide, but have also spurred institutional and project-level investments in developing best management practices for all stages of planning and implementation.

Under the umbrella of the University of Washington's Jackson School of International Studies, and aided by experts from both within the Pew Charitable Trusts itself and the broader world of LMR management, this Task Force has constructed a Strategic Action Plan pertinent to the Global Ocean Legacy campaign. In three parts, this report suggests feasible and strategic changes to existing practices in LMR management.

For the purposes of this report, an effective LMR incorporates interdisciplinary knowledge, broad stakeholder participation, and robust enforcement and research mechanisms, and displays measurable progress toward scientifically-grounded conservation goals. Based on these desired outcomes, authors conducted a gap analysis for the GOL program, taking into account the unique benefits and challenges presented by LMRs and defining common deficiencies in management practices.

From the gap analysis, five thematic foci were identified as important gaps in the GOL program: 1) Representation and Transparency in Design, Implementation, and Monitoring, 2) Enforcement, 3) Mitigating Negative Impacts, 4) Research and Monitoring, and 5) Communications and Outreach. In turn, three existing or proposed LMRs were examined as case studies, in New Caledonia, Palau, and the Northwestern Hawaiian Islands (NWHI). Based on the thematic interrogation of these case studies, major recommendations evolved that emphasized inclusive planning and implementation processes that actively enlist stakeholders as management and monitoring partners.

This Strategic Action Plan defines opportunities for the GOL program to make progress in the presented thematic areas by providing concrete recommendations crafted specifically for the Pew Charitable Trusts, including: developing more inclusive practices for integrating

stakeholders at all phases of LMR project cycles; leveraging both new technologies and existing communities to circumvent enforcement challenges; realistically and honestly defining not only ecological but also socioeconomic impacts of LMR creation, and communicating them through defined, open channels; developing robust monitoring strategies; and ultimately creating iterative management practices that provide reserves with adaptive, broadly-supported protection over time. Supported by literature review, expert opinion, and a gap analysis, these recommended actions each improve upon existing management practices. Below, major recommendations are grouped by theme.

| ***Themes*** | ***Major Recommendations*** |
|---|---|
| • Representation and Transparency | • Identify and involve stakeholders in processes<br>• Make processes transparent and publicly accessible<br>• Participate in learning networks |
| • Enforcement | • Implement satellite surveillance<br>• Encourage self-enforcement by local communities<br>• Invest in enforcement technologies |
| • Mitigating Negative Impacts | • Define and communicate impacts to stakeholders<br>• Mitigate negative impacts using a variety of compensation and incentive-based approaches |
| • Research and Monitoring | • Use interdisciplinary techniques to balance social science and environmental science<br>• Develop and implement a monitoring strategy |
| • Communications and Outreach | • Generate awareness of LMR |

The notion of successful conservation has gradually evolved toward the modern focus on responsive, stakeholder-inclusive management regimes. The Pew Charitable Trusts remains committed to fostering a sustainable relationship between humanity and the environment. The recommendations here guide the continuation and strategic extension of that commitment, and help set the standard for effective LMR implementation and management in years to come.

The following infographic encapsulates the main themes of this report and the Strategic Action Plan. This infographic is an integrated, visual model that highlights the interactions between the different parts of this report. It should serve as a simplified guide for LMR implementation.

# WELL-MANAGED LARGE MARINE RESERVES

**Representation:** Early and consistent participation can result in informed, invested users, who are more likely to support and adhere to rules they helped establish, potentially avoiding future conflict and delay

**Enforcement:** A comprehensive enforcement system is crucial for a LMR to maintain its social and ecological effectiveness.

## KEY PRINCIPLES FOR SUCCESS

- Representation
- Enforcement
- Negative Impact Mitigation
- Research & Monitoring
- Communications & Outreach

**Negative Impact Mitigation:** Being able to demonstrate tangibly the benefits and ensure that they are equitably distributed over a wide range of users can be the deciding factor for the acceptance and long-term success of a LMR

**Research & Monitoring:** A monitoring plan provides the necessary data required to evaluate a LMR's success

**Communications & Outreach:** Market LMR design and success to the general public, in order to raise awareness and garner political and financial support.

Each recommended action is based on the gaps addressed in case studies of the New Caledonia, Palau, and Papahānaumokuākea marine reserves

# Acknowledgements

Our Task Force is indebted to NOAA Director of Ocean Initiatives Aulani Wilhem, Dr. Rebecca Gruby, and Dr. Noah Idechong, for the expertise and time they shared with Task Force members during interviews. We would also like to thank Professor Patrick Christie and Dr. Todd Stevenson for donating their time and expertise to this project. We would like to thank them for their honest contributions to all stages of this report, and for their patience. Finally, we would also like to thank the Pew Charitable Trusts for their evaluation of our report. In particular, we are indebted to Dr. Kathryn Matthews, Manager of Ocean Science projects for the Pew Charitable Trusts, for her generous support throughout the entire endeavor. Lastly, we would like to thank the Henry M. Jackson School of International Studies for this opportunity.

# Introduction

## The State of the Ocean

In total, the ocean covers three-quarters of the earth and hosts around half of all known species; over 250 million people are dependent on its resources for their livelihoods, and over 2.6 billion people rely on fish for their daily protein.[1] Additionally, many indigenous communities rely on the ocean to uphold their ancestral traditions, which often include subsistence fishing. However, the health of the oceans, measured through a myriad of ecological indicators, is deteriorating. Before analyzing conservation efforts, it is imperative to acknowledge the current state of the ocean.

Firstly, unsustainable commercial fishing negatively affects the health of the ocean. The use of exploitative practices, such as bottom trawling, destroys habitat and decreases fish biomass and abundance.[2] Bycatch, "the incidental takes of other non-target species," further contributes to the depletion of fish stocks.[3] In 2001, the United Nations Food and Agriculture Organization estimated that almost 70 percent of fish stocks were fully exploited, overfished, or otherwise in urgent need of management (Figure 1).[4] For example, many predatory fish species have experienced up to a 75 percent population decrease in the North Atlantic since 1986.[5]

[1] "Global Ocean Legacy – About." *The Pew Charitable Trusts* (accessed January 28, 2015).
[2] Samuel Shephard et al., "Can Bottom Trawling Indirectly Diminish Carrying Capacity in a Marine Ecosystem?" *Marine Biology* 157, no. 11 (2010): 2375.
[3] Ashley McCrea-Strub et al., "Understanding the Cost of Establishing Marine Protected Areas." *Marine Policy* 35, no. 1 (2011): 598.
[4] Per Pinstrup-Andersen and Rajul Pandya-Lorch. *The Unfinished Agenda: Perspectives on Overcoming Poverty, Hunger, and Environmental Degradation*. International Food Policy Research Institute (2001): 96.
[5] Jeffrey A. Hutchings and John D. Reynolds, "Marine Fish Population Collapses: Consequences for Recovery and Extinction Risk." *BioScience* 54, no. 4 (2004): 297–309.

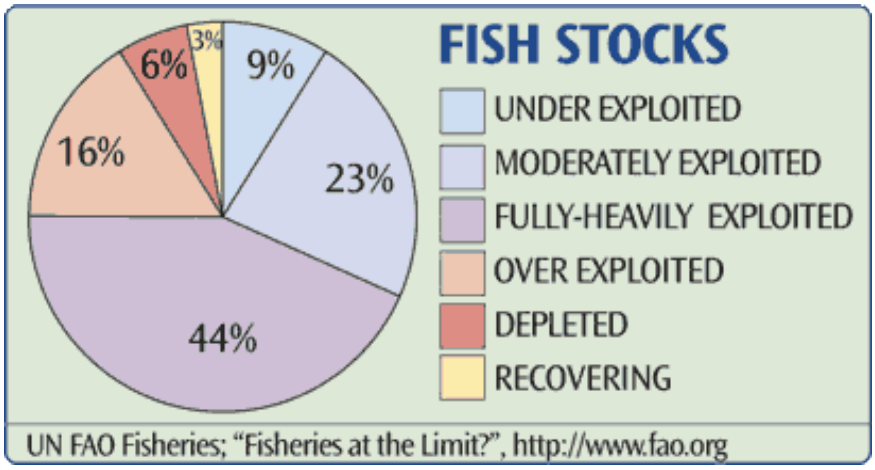


**Figure 1: Fish Stock Depletion**[6]

Marine habitat degradation also drives ocean change through direct and indirect human activities. These activities are divided into two categories – land-based activities, which include the run-off of pollutants into the water, and ocean-based activities, including resource extraction and the direct destruction of habitat.[7] Furthermore, coastal development is rapidly expanding globally. Poorly regulated development can result in large amounts of pollution seeping into the ocean.[8]

Many marine reserves protect coral reefs. A study from the World Resources Institute found that "more than 60 percent of the world's reefs are under immediate and direct threat from local sources."[9] These threats come from the previously mentioned human activities, specifically, "overfishing and destructive fishing, coastal development, watershed-based pollution, or marine-based pollution and damage."[10] 73 percent of coral reefs are unprotected by any type of marine

[6] "Decreasing Fish Stocks." *World Wildlife Fund* (accessed February 26, 2015).
[7] Benjamin S. Halpern, et al. "A Global Map of Human Impact on Marine Ecosystems." *Science* 319, no. 5865 (February 15, 2008): 949.
[8] Michael C. Hall. "Trends in Ocean and Coastal Tourism: The End of the Last Frontier?" *Ocean & Coastal Management*, *Trends in Ocean Industries* 44, no. 9–10 (2001): 601–18.
[9] Lauretta Burke et al., "Reefs at Risk Revisited." *World Resources Institute,* February 2011 (accessed February 26, 2015).
[10] Ibid.

conservation method, rendering them susceptible to various impacts.[11] Moreover, approximately 275 million people live within 16 kilometers from a coast and 48 kilometers from coral reefs, interacting with the ocean and marine life daily. A majority of these people also rely on the ocean for their livelihoods.[12] The destruction of marine habitat caused by human activities is amplified with the rise of atmospheric pollution and global climate change.

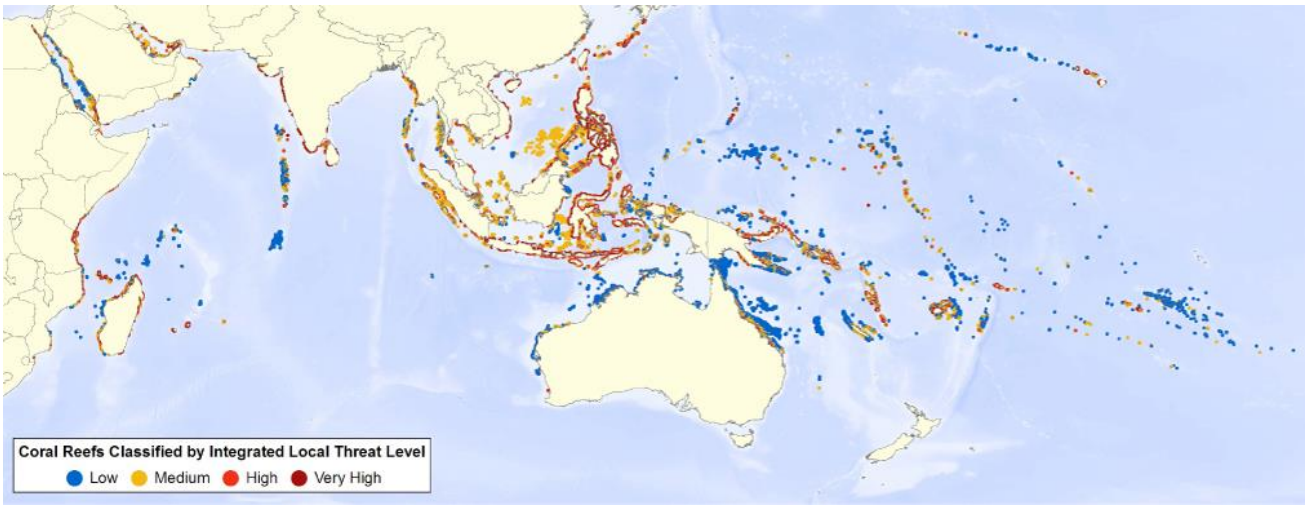


**Figure 2: Coral Reefs at Risk[13]**

Since the Industrial Revolution, there has been an increase in "human activities that emit heat-trapping carbon dioxide."[14] These various human activities release carbon dioxide ($CO_2$), and other heat-trapping gases, into the atmosphere at unprecedented and ever-increasing rates. The ocean subsequently absorbs much of this $CO_2$, resulting in ocean acidification. Over the last 250 years, the amount of $CO_2$ in the atmosphere has increased by 40 percent and the pH level of the ocean has decreased by around 0.1 units, from 8.2 to 8.1 (Figure 3).[15] The processes and implications of ocean acidification are complex, but there are indications that it will lead to coral

[11] Ibid.
[12] Halpern, "A Global Map", 952.
[13] Burke. "Reefs at Risk Revisited."
[14] "Sea Temperature Rise." *National Geographic* (accessed January 26, 2015).
[15] Scott Doney, et al., "Ocean Acidification: The Other CO $_2$ Problem." *Annual Review of Marine Science* 1, no. 1 (January 2009): 170.

bleaching, ecological shifts, and eventually reduced fish and shellfish biomass, in some contexts.[16]

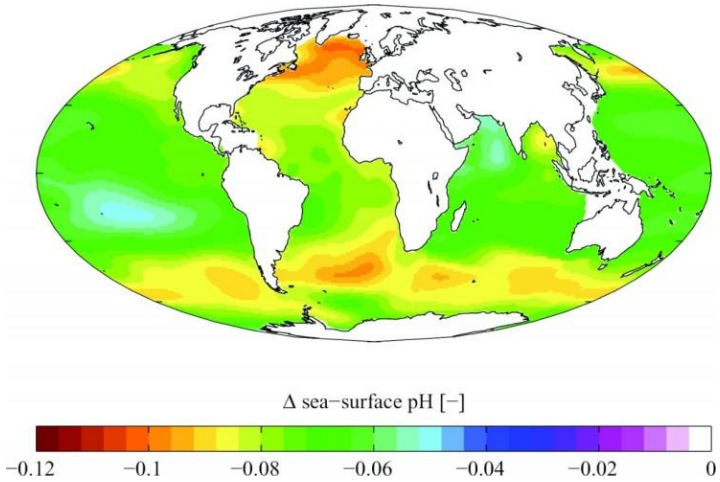


**Figure 3: Sea Surface pH Level[17]**

The increase in $CO_2$ also generates warmer ocean temperatures. Over the last century, the average ocean temperature has increased by approximately 0.7-0.8°C.[18] This rise in ocean temperature has serious implications for many fish species and key ocean habitats, such as coral reefs.[19] The impacts on higher latitude fish species are not fully known, but the life cycles of Northeast Atlantic fish species are very sensitive, meaning higher temperatures lead to a shorter lifespan, a reduced overall biomass, and a smaller number of offspring.[20]

Changes in the earth's climate have been observed in the past, but never so intensely in such a short period of time. The current projected rate of increase in world global temperatures is more than any period in the past 10,000 years.[21] Some models estimate that atmospheric $CO_2$ levels are likely to double in the next century, which is associated with a predicted 1.5-4.5°C

[16] Hedia Adelsman et al. "Ocean Acidification: From Knowledge to Action." *2012 Summary Report* (November 2012): 9-10.
[17] "Carbon Synthesis Project." Global Ocean Data Analysis Project (accessed February 9, 2015).
[18] Adelsman, "Ocean Acidification." 9-10
[19] Lauretta Marie Burke et al., "Reefs at Risk in Southeast Asia." *Word Resources Institute* (2002).
[20] Adriaan D. Rijnsdorp et al., "Resolving the Effect of Climate Change on Fish Populations." *ICES Journal of Marine Science: Journal Du Conseil* (2009).
[21] Ibid.

increase in global temperatures.[22] While this report will not assert that climate change is an issue on which the Pew Charitable Trusts or the Global Ocean Legacy campaign should focus, it is important to note that climate change will affect every marine reserve. Thus, this report will take the issue of climate change into consideration when evaluating the efficacy and challenges of marine reserves, as ignoring climate change entirely would provide an incomplete analysis.

## The Pew Charitable Trusts and the Global Ocean Legacy

The Pew Charitable Trusts is a global nongovernmental organization that is the beneficiary of seven different charitable trusts established by the sons and daughters of the founder of the Sun Oil Company, Joseph Newton Pew.[23] One campaign that the Pew Charitable Trusts funds is the Global Ocean Legacy (GOL), established in 2006 to protect and conserve some of the world's most important and unspoiled ocean environments through the establishment of large marine reserves (LMRs). The goal of the GOL campaign is to secure 15 large reserves – each at least 200,000 $km^2$ – that protect the world's pristine oceans by prohibiting fishing and resource extraction.[24] The following map (Figure 4) depicts completed and active GOL Reserve Projects.

[22] Ibid., 182
[23] "History." *The Pew Charitable Trusts* (accessed January 28, 2015).
[24] "Global Ocean Legacy - About." *Pew Charitable Trusts*.

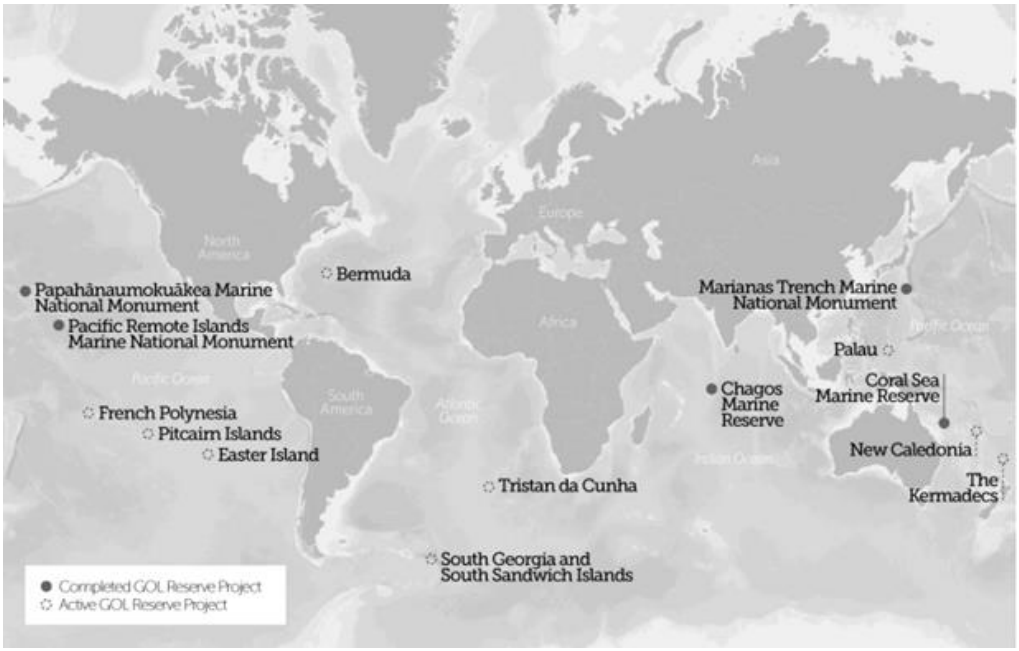


**Figure 4: GOL Reserve Projects**[25]

The Pew Charitable Trusts has been criticized by some opponents of its conservationist agenda, and others have expressed concern that the organization is inflexibly focused on predetermined outcomes.[26] The Pew Charitable Trusts' leadership has responded to the latter claim by maintaining that "there is no contradiction between our pursuit of conservation goals and sound science. We have a bias, but we never dictate results."[27] As marine conservation approaches are often highly contentious, critique and outside evaluation is unavoidable. Yet, the authors of this report take the position that the Pew Charitable Trusts' overall goals through GOL are laudable. The GOL has also made progress toward its targets – the efforts of GOL have contributed to the doubling of protected ocean habitat worldwide.[28] In fact, GOL has secured 676,000 m² (1,750,831 $km^2$) of ocean within reserve status, an area comparable to the size of Mexico (Figure 5).

[25] "Global Ocean Legacy Map." The Pew Charitable Trusts, November 6, 2014 (accessed February 27, 2015).
[26] David Malakoff, "Science Helps Pew Push Its Oceans Agenda." *Science* 296, no. 5567 (2002): 459.
[27] Ibid.
[28] "Global Ocean Legacy - About." *Pew Charitable Trusts*.


**Figure 5: Global Ocean Legacy Size**[29]

The work of GOL has been pivotal in the designation and establishment of some of the world's most expansive LMRs, some of which will be analyzed in the Case Studies section of this report. However, the funding allocated to any of the Pew Charitable Trusts' numerous campaigns is limited. With large ocean areas in need of protection, a finite amount of funding affects all aspects of the design, implementation, and monitoring of a marine reserve. This report will, therefore, provide concise and specific recommendations and priority strategies that should be implemented to produce the most effective and financially feasible results.

## The Case for Ocean Conservation: The Evolution to Large Marine Reserves

As a response to the declining state of the oceans, local and national governments, with the assistance of organizations such as the Pew Charitable Trusts, began to develop and establish marine protected areas (MPAs). As defined by the International Union for Conservation of

[29] "Global Ocean Legacy - About." *Pew Charitable Trusts*.

Nature (IUCN), an MPA is "*any area of intertidal or subtidal terrain together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment.*"[30] Design varies in size, duration, and extraction regulations, but ultimately MPAs are intended to mitigate unsustainable fishing practices and habitat decline in the ocean.[31] MPAs aim to improve fish population and marine ecosystem resilience, while, ideally, providing ecosystem services for local communities dependent on marine resources.[32] These reserves vary in size, from less than 1 km² to larger than 100,000 km², and currently make up 2.12 percent of the ocean.[33] Situated within the Exclusive Economic Zones (EEZs) of coastal countries, MPAs can be community-based, as observed in the Philippines and elsewhere, or they can be implemented and managed by a governmental entity or an NGO.[34] Regardless the management organization (i.e., community-based, governmental, or NGO administered), the importance of broad stakeholder involvement in MPA design and implementation is empirically grounded and widely recognized.[35]

With the proliferation of MPAs, international summits were organized to articulate universal policies that would govern and monitor the implementation of the protected areas. Notably, The Conference of the Parties to the Convention on Biological Diversity first convened in 1992 and continues to meet every two years. Marine conservation became a more prominent

[30] Graeme Kelleher. *Guidelines for Marine Protected Areas*. IUCN Report, (Gland, Switzerland, and Cambridge, UK, 1999), xi.
[31] Ibid., xv.
[32] Food and Agriculture Organization of the United Nations, *Fisheries management: Marine protected areas and fisheries* (Rome: *FAO Technical Guidelines for Responsible Fisheries*. No. 4, Suppl. 4, 2011), 14.
[33] "Global Marine Protected Areas." *MPAtlas* (accessed January 23, 2015).
[34] Chris Mason-Parker, "Community-Based Marine Protected Areas." *ROLE Foundation* (accessed February 2, 2015).
[35] Nicolás Gutiérrez, et al. "Leadership, Social Capital and Incentives Promote Successful Fisheries." *Nature* 470, no. 7334 (February 17, 2011): 386–89.

point of discussion at these assemblies.[36] At the 2010 Conference of Parties, participants set a target goal of protecting 10 percent of coastal and marine areas by the year 2020,[37] asserting that "efforts to establish and maintain systems of protected areas and areas where special measures need to be taken [are necessary] to conserve biological diversity."[38] In the most recent conferences, occurring in 2012 and 2014, the involvement of local stakeholders was discussed, as participants felt that the social implications of biodiversity conservation were as important as the biodiversity conservation outcomes. [39]

The most recent conference's final agreement stressed the importance of "enabling participation at all levels [of society] to foster the full and effective contributions of women, indigenous and local communities, civil society organizations, the private sector and stakeholders from all other sectors in the full implementation of the objectives of the Convention and the Strategic Plan for Biodiversity 2011-2020."[40] The agreement acknowledged that conservation measures are able to reach their full potential through the involvement of the people who play vital leadership roles in the communities near and impacted by protected areas. In other words, imposed marine reserves are unlikely to produce desired results if the people who interact daily with the reserve area are not vested in nor agree with LMR regulations by in large. Compliance with regulations will be low, and enforcement costs high, conclusions that agree with comparative research.[41]

The implementation of LMRs gained wide recognition when President Bush declared the Papahānaumokuākea Marine National Monument (PMNM), encompassing the Northwestern

[36] "COP Decisions." *Convention on Biological Diversity* (accessed January 23, 2015).
[37] Robert J. Toonen et al., "One Size Does Not Fit All: The Emerging Frontier in Large-Scale Marine Conservation." *Marine Pollution Bulletin* 77, no. 1-2 (2013): 7
[38] "COP Decisions." *Convention on Biological Diversity* (accessed January 23, 2015).
[39] Ibid.
[40] Ibid.
[41] Richard Pollnac, et al., "Marine Reserves as Linked Social–ecological Systems." *Proceedings of the National Academy of Sciences* 107, no. 43 (October 26, 2010): 18262.

Hawaiian Islands, under the Antiquities Act.[42] At the time, it was the largest marine reserve in the world and established President Bush's legacy for ocean conservation.[43] President Obama followed suit and extended the Pacific Remote Islands National Monument in 2009, topping the PMNM reserve and making it the largest marine reserve in the world. Creating LMRs is trending among wealthier countries because of the competition for recognition it has ignited.[44] For example, France declared the *Parc Naturel de la mer de Corail* in French Polynesia, the United Kingdom created the Chagos reserve in the British Indian Ocean, and Australia declared multiple reserves along its coast – in part to gain the international acknowledgement that comes from rapidly achieving set conservation goals.[45]

The number of LMRs in existence has greatly increased over the past decade.[46] However, the effectiveness and enforcement of these LMRs varies by site.[47] Thus, the peer-to-peer learning network Big Ocean was founded in 2010 and now includes LMR managers from 14 different sites (Figure 6). Big Ocean's primary goals are to build capacity, enhance communication, and create tools and services that improve management efforts.[48] Many of the advocated management techniques concern the relationship between the reserve and local human communities, as Big Ocean emphasizes creating inclusive and holistic management practices that take into consideration the well being of the marine ecosystems alongside the prosperity of local communities.

[42] Laurie Richmond and Dawn Kotowicz, "Equity and access in marine protected areas: The history and future of 'traditional indigenous fishing' in the Marianas Trench National Monument." *Applied Geography* (2014): 2.
[43] "Bush Creates World's Biggest Ocean Preserve." *NBC News*. June 16, 2006 (accessed February 2, 2015).
[44] Pierre Leenhardt et al., "The Rise of Large-Scale Marine Protected Areas: Conservation or Geopolitics?" *Ocean & Coastal Management* 85, (2013): 112–18.
[45] Ibid.
[46] Elizabeth M. De Santo, "Missing Marine Protected Area (MPA) Targets: How the Push for Quantity Over Quality Undermines Sustainability and Social Justice." *Journal of Environmental Management* 124 (2013): 138.
[47] Ibid., 144.
[48] "Purpose & Aims." *Big Ocean,* August 2, 2014 (accessed January 16, 2015).

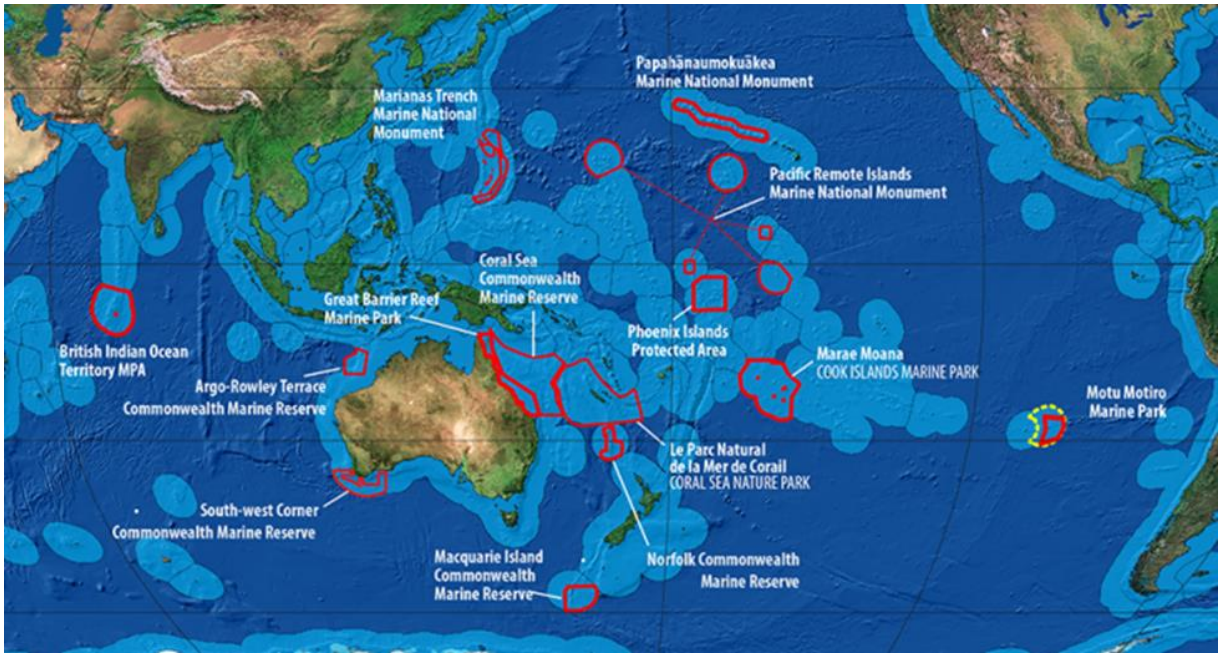


**Figure 6: Big Ocean Member Sites**[49]

## The Benefits of Large Marine Reserves

LMRs, protected marine areas that each cover 100,000 km² or greater, can mitigate many ecological challenges that small MPAs are unable to adequately address. One benefit of LMRs is that they can encompass whole ecosystems, interrelated ecosystems, and ecological processes within one protected area.[50] It is important to identify and protect "habitats necessary for successful recruitment, growth and reproduction;"[51] the latter task being easier to accomplish through an LMR due to its large size.[52] If a certain species is protected from unsustainable fishing and other anthropogenic activities throughout the majority of their life cycle, they will

[49] "About." *Big Ocean* (accessed February 26, 2015).
[50] T. 'Aulani Wilhelm et al., "Large Marine Protected Areas - Advantages and Challenges of Going Big," *Aquatic Conservation-Marine and Freshwater Ecosystems* 24 (2014): 26.
[51] Delisse M. Ortiz and Brian N. Tissot, "Ontogenetic Patterns of Habitat Use by Reef-Fish in a Marine Protected Area Network: A Multi-Scaled Remote Sensing and in Situ Approach." *Marine Ecology Progress Series* 365 (2008): 218.
[52] Jane Lubchenco et al., "Partnership for Interdisciplinary Studies of Coastal Oceans." *The Science of Marine Reserves* 2, (2007): 13.

grow larger, live longer, and reproduce more. In fact, one study found that fish biomass was six times greater in LMRs than in smaller MPAs.[53]

These beneficial outcomes are spread outside the reserve through the act of spillover, "the active movement of fish swimming out of MPAs into adjacent areas."[54] Various studies have found that fish biomass and abundance significantly increased in waters adjacent to an MPA (Figure 7).[55] This is especially notable in areas where fishing pressure is high outside a no-take MPA. Additionally, spillover has the potential to provide benefits to fishers, as it can compensate for the loss of fishing grounds that resulted from the establishment of a reserve.[56] In other words, while the establishment of marine reserves shrinks the size of available fishing grounds, it has been proven that the resulting spillover of marine species into adjacent waters can significantly increase the fish stock and offset this change,[57] especially when a reserve is embedded within sustainable fisheries policies. Spillover is an essential benefit of LMRs because it is "presently the only tangible index of potential fishery benefits" of marine reserves.[58]

[53] Nicholas Graham and Tim R. McClanahan. "The Last Call for Marine Wilderness?" *BioScience* 63, no. 5 (May 1, 2013): 397.
[54] Robert Brock and Carlos Mireles, "Do Fish Swim Out of Marine Protected Areas?" NOAA (accessed February 17, 2015).
[55] Ibid.
[56] Nathan James Bennett and Philip Dearden. "Why Local People Do Not Support Conservation: Community Perceptions of Marine Protected Area Livelihood Impacts, Governance and Management in Thailand." *Marine Policy* 44 (February 2014): 107.
[57] Ibid.
[58] Raquel Goni et al., "Net Contribution of Spillover from a Marine Reserve to Fishery Catches." *Marine Ecology Progress Series* 400 (2010): 234.

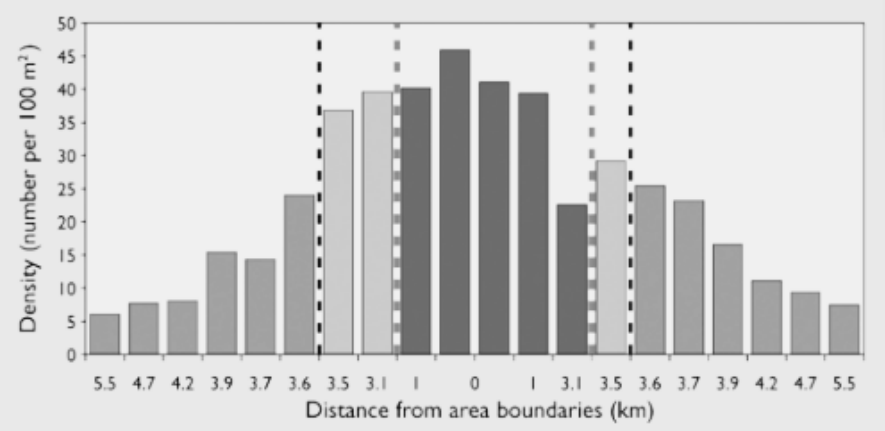


**Figure 7: Fish Stock in Proximity to Reserve Boundaries at Torre Guaceto Marine Reserve[59]**

LMRs can also offer protection against the negative impacts of natural disasters, such as hurricanes.[60] Protected waters are still susceptible to natural and man-made disasters, but not all examples of any one ecosystem will be susceptible if the LMR is large enough and contains replicates of each essential ecosystem. Although debated, ecosystem resilience may be enhanced as ecosystems become healthier.[61] This benefit of LMRs is amplified when the reserve is protecting an iconic marine structure, such as the Great Barrier Reef or the Marianas Trench.[62] They can protect the biodiversity of these large areas that display some of the most unique aspects of this planet.

This section has addressed the positive ecological impacts of LMRs. However, it is important to note that these benefits can positively affect local populations. In other words, the ecological benefits can produce socioeconomic benefits for coastal communities. For example, many coastal populations heavily rely on fish protein and have ancestral connections to fishing practices, and would thus benefit from the restoration or augmentation of fish stocks, in the long-

[59] Lubchenco et al., "Partnership for Interdisciplinary Studies of Coastal Oceans." 13.
[60] Gary W. Allison et al., "Ensuring Persistence of Marine Reserves: Catastrophes Require Adopting an Insurance Factor." *Ecological Applications* 13, (2003): S20.
[61] Lubchenco et al., "Partnership for Interdisciplinary Studies of Coastal Oceans." 12.
[62] Wilhelm et al., "Large Marine Protected Areas." 25.

term.[63] Notably, increased fish stocks and sustainability can enhance food security, as LMRs can increase these communities' ability to obtain fish protein, which is a staple of traditional, coastal diets.[64] Additionally, cleaner waters, heightened biodiversity, and habitat protection can have practical recreational purposes for coastal communities and recreation-related businesses. Therefore, these ecological benefits have the potential to augment food security and protect the traditional lifestyles of indigenous populations.[65]

## The Challenges of Large Marine Reserves

It is crucial to pay equal attention to the unique challenges that LMRs present. LMRs are not a panacea, as they do not provide a solution to all of the issues associated with ocean conservation and marine resource management.[66] Thus, while reading this report, it is imperative to view LMRs as only one of many conservation tools available, each with their own advantages and limitations. As stated by Wilhelm et al., LMRs "will not be the best approach in all cases or for all places … [and] are difficult in several respects, but due to the decline of the world oceans, initiatives of increased size, scope and scale are needed."[67] F

The sheer size of an LMR (>100,000 km$^2$) is itself a pressing challenge and produces significant limitations for the enforcement and monitoring of conservation sites. For example, in comparison to terrestrial reserves, LMRs generally occupy larger areas and have few, if any, observable boundaries.[68] It is consequently a difficult task to effectively manage and monitor such large areas, as demonstrated by the Papahānaumokuākea Marine National Monument

[63] Richmond and Kotowicz. "Equity and Access in Marine Protected Areas" 5, 7.
[64] Michael B Mascia, et al., "Impacts of Marine Protected Areas on Fishing Communities." *Conservation Biology* 24, no. 5 (October 1, 2010): 1428.
[65] Richmond and Kotowicz. "Equity and Access in Marine Protected Areas" 5.
[66] Michel J. Kaiser, "Are Marine Protected Areas a Red Herring or Fisheries Panacea?" *Canadian Journal of Fisheries and Aquatic Sciences* 62, (2005) 5: 1194.
[67] Wilhelm et al., "Large Marine Protected Areas." 28.
[68] De Santo, "Missing Marine Protected Areas." 138.

(PMNM) in the map below (Figure 8). While PMNM is relatively well enforced, its area is equivalent to the distance between Las Vegas and Louisiana, and represents a considerable enforcement challenge.

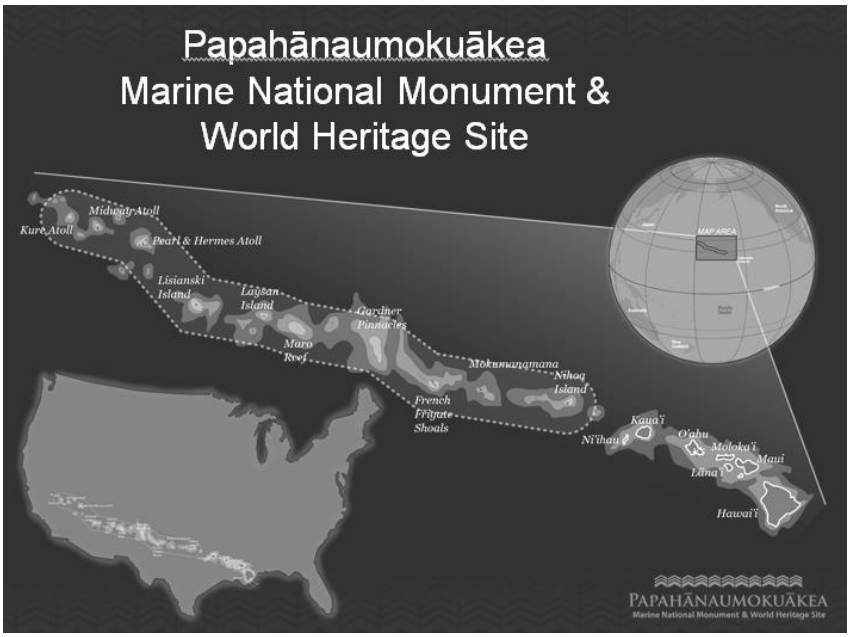


**Figure 8: Size of PMNM**[69]

Marine reserves in general can be attractive targets for illegal fishing activity, as they protect the habitats and populations of valuable and sometimes rare species. Illegal shark finning within shark sanctuaries, such as within the Galapagos UNESCO World Heritage site, has been a chronic challenge.[70] As long as there is a demand for illegal and valuable marine products, some fishers will attempt to violate LMR boundaries and regulations in order to provide the illegal goods. A reduction in illegal fishing is not likely to occur as a result of the establishment of an LMR if the benefits of violating regulations outweigh the chance of detection and penalty.

How LMRs affect local human communities is another challenge that has received much attention. For example, no-take reserves prohibit extractive activities, often banning all fisheries

[69]Aulani Wilhelm. "The Story of Large-Scale & Big Ocean: How a Crazy Idea Started a Movement." Skype Presentation, University of Washington, Seattle, WA, January 14, 2015.
[70] Lindsey A. Carr et al., "Illegal Shark Fishing in the Galápagos Marine Reserve." *Marine Policy* 39 (2013): 317.

from an area.[71] Thus, the sudden establishment of a no-take reserve has the potential to disrupt current fishing activities and force fishers to relocate to previously undisturbed or under-fished locations.[72]

Also, many LMRs are located in developing countries' EEZs. Such economically poorer nations have less diverse economies than economically developed countries, and rely heavily on their EEZs for income.[73] Unless such realities are considered in the design of LMRs, no-take reserves could produce devastating economic consequences for a country and its inhabitants. Additionally, artisanal fishers who use low-technology boats could have difficulty adjusting to the large-scale displacement of fishing activities,[74] disproportionately affecting "economically disadvantaged fishers."[75] Fisheries dislocation and increased costs, convenience, and impacts on the most marginal social groups (e.g., women, elderly) are consistent MPA management challenges. These circumstances demonstrate that each LMR presents its own unique conditions that must be taken into consideration when establishing and maintaining a reserve.

An LMR becomes a 'paper park' without sufficient enforcement and proper management – creating the illusion of protection.[76] However, proponents of LMRs argue that these complications cannot be attributed to the concept of LMRs, but rather highlight the lack of available enforcement resources that tend to be expensive.[77] Some LMR proponents also suggest that declaration is the key first step, and that management of areas can be improved in the future – even sometimes the distant future. This stance is risky, as vulnerable societies depend on these

[71] Carolyn K. Robb et al., "Commercial Fisheries Closures in Marine Protected Areas on Canada's Pacific Coast: The Exception, Not the Rule." *Marine Policy* 35, no. 3 (May 2011): 309.
[72] Kaiser, "Are Marine Protected Areas a Red Herring." 1195.
[73] Wilhelm et al., "Large Marine Protected Areas." 28.
[74] Serge M. Garcia et al., *Towards Integrated Assessment and Advice in Small-Scale Fisheries: Principles and Processes* (Rome: Food and Agriculture Organization, 2008).
[75] Joshua E. Cinner et al., "Winners and Losers in Marine Conservation: Fishers' Displacement and Livelihood Benefits from Marine Reserves." *Society & Natural Resources* 27, no. 9 (2014): 994–1005.
[76] De Santo et al., "Missing Marine Protected Areas." 144.
[77] Wilhelm et al., "Large Marine Protected Areas." 27.

resources and a backlash may arise against LMRs and marine conservation as a result of managed conflict.[78] Such a backlash could have serious consequences for marine biodiversity and societies.

Lastly, the cost of establishing and maintaining an LMR is a challenge. Since every protected area's design and context is unique, it is difficult to produce a 'fixed cost' model of required funding. However, there are estimates of marine reserve costs. One study of 13 different marine reserves recorded establishment costs and noted the large variance between sites.[79] Higher cost is associated with longer establishment timeframes (Figure 9).[80] The estimated total establishment cost (EC) and annual maintenance cost (MC) from this research estimates the amount of funding required for various sizes of marine reserves (Figure 10). Notably, while LMRs are generally more expensive to establish and maintain, they produce lower costs per km² relative to smaller MPAs.[81] While LMRs are more cost-effective to maintain per km², smaller and poorer nations may be limited by the steep initial costs.

| Site | Total establishment cost | |
|---|---|---|
| | (2005 USD) | (2005 USD· $km^{-2}$) |
| 1. Bibilik MPA | 20,518 | 102,591 |
| 2. Talisay MPA | 7,528 | 22,950 |
| 3. CHICOP | 1,583,455 | 3,192,450 |
| 4. Villahermosa MS | 8,179 | 11,802 |
| 5. Tambunan MPA | 18,198 | 17,668 |
| 6. MISSTA MPA | 16,040 | 10,025 |
| 7. Pilar MPA | 8,212 | 4,578 |
| 8. Saba MP | 557,237 | 64,050 |
| 9. Bonaire NMP | 1,145,058 | 42,410 |
| 10. Nha Trang Bay MPA | 2,370,832 | 14,818 |
| 11. Seaflower MPA | 14,795,169 | 228 |
| 12. Mariana Trench MNM | 10,000,000 | 41 |
| 13. PMNM | 34,800,000 | 96 |

**Figure 9: Understanding the Cost of Establishing MPAs[82]**

[78] Patrick Christie and Alan T. White. "Best practices for improved governance of coral reef marine protected areas." *Coral Reefs* 26, no. 4 (2007): 1047-1056
[79] Ashley McCrea-Strub et al., "Understanding the Cost of Establishing Marine Protected Areas." 1.
[80] Ibid., 4.
[81] Ibid.
[82] Ibid., 1

| MPA size ($km^2$) | $EC^a$ | | $MC^b$ | |
|---|---|---|---|---|
| | (2005 USD) | (2005 USD· $km^{-2}$) | (2005 USD· $year^{-1}$) | (2005 USD· $km^{-2}$· $year^{-1}$) |
| 0.5 | 31,876 | 63,752 | 146,819 | 293,639 |
| 5 | 105,551 | 21,110 | 238,113 | 47,623 |
| 50 | 349,514 | 6,990 | 386,175 | 7723 |
| 500 | 1,157,349 | 2,315 | 626,302 | 1,253 |
| 5000 | 3,832,343 | 766 | 1,015,743 | 203 |
| 50,000 | 12,690,081 | 254 | 1,647,342 | 33 |
| 500,000 | 42,020,808 | 84 | 2,671,675 | 5 |
| 1,000,000 | 60,255,959 | 60 | 3,090,295 | 3 |

**Figure 10: Establishment and Maintenance Costs[83]**

## Gap Analysis of Large Marine Reserves

This report assesses opportunities and challenges to improve LMR management effectiveness, as ineffective LMRs will not attain ecological or social goals.[84] For the purposes of this report, an effective LMR incorporates interdisciplinary knowledge, integrates participatory practices, establishes robust enforcement and research mechanisms, and exhibits progress towards achieving declared conservation goals.[85] Thus, effectiveness can be measured through the involvement of stakeholders, the explicit definition of ecological objectives, the inclusion of available ecological and social sciences, and the thorough evaluation of implementation methods.[86] Comprehensively, these indicators encourage a holistic approach to design, implementation, and monitoring processes.

[83] McCrea-Strub et al., "Understanding the Cost of Establishing Marine Protected Areas." 1
[84] Michael B. Mascia and Sharon Pailler. "Protected Area Downgrading, Downsizing, and Degazettement (PADDD) and Its Conservation Implications." *Conservation Letters* 4, no. 1 (February 1, 2011): 18.
[85] R.S. Pomeroy, et al., "How is your MPA doing? A Guidebook of Natural and Social Indicators for Evaluating Marine Protected Area Management Effectiveness". *IUCN*, (Gland, Switzerland and Cambridge, UK.) (2004): xvi-216.
[86] Carolyn J. Lundquist and Elise F. Granek, "Strategies for Successful Marine Conservation: Integrating Socioeconomic, Political, and Scientific Factors." *Conservation Biology* 19, no. 6 (2005): 1771–78.

As a first step toward the development of this report, authors conducted a gap analysis[87] of current LMR practices based on an assessment of key LMR and MPA studies[88] [89] [90] [91] [92] and expert opinion.[93] [94] Key gaps were identified that fell into five themes: 1) Representation and Transparency in Design, Implementation and Monitoring; 2) Mitigating Negative Impacts; 3) Enforcement; 4) Research and Monitoring; and 5) Communications and Outreach. Specific gaps within each of these themes are identified in this gap analysis and then discussed in relation to the LMRs of New Caledonia, Palau, and the Northwestern Hawaiian Islands.

The Strategic Action Plan will propose recommended actions in these thematic areas to address key gaps.[95] Strategic action plans are the foundation of most successful conservation initiatives,[96] but it is unclear whether GOL is operating with the benefit of a strategic plan. The following are key gaps.

<u>Representation and Transparency in Design, Implementation, and Monitoring</u>

- LMR processes are not adequately interdisciplinary, as ecology and environmental science considerations currently receive more attention and emphasis than socioeconomic

[87] "A Sample Gap Analysis Explained." *Brighthub Project Management*. (accessed February 25, 2015).
[88] Wilhelm, et al., "Large Marine Protected Areas."
[89] De Santo, "Missing Marine Protected Area (MPA) Targets."
[90] Lubchenco et al., "Partnership for Interdisciplinary Studies of Coastal Oceans."
[91] Todd Stevenson, et al. "Too Big to Fail: A Review of Social and Ecological Opportunities, Challenges and Paths Forward with Mega Marine Reserves (DRAFT)." *Environmental Conservation* in press (n.d.).
[92] Patrick Christie et al. "Toward Developing a Complete Understanding: A Social Science Research Agenda for Marine Protected Areas." *Fisheries* 28, no. 12 (2003): 22–25.
[93] Wilhelm. "The Story of Large-Scale & Big Ocean." Skype Presentation.
[94] Todd Stevenson. "Biological Concepts and Implications of Mega Marine Protected Areas." Lecture, University of Washington, Seattle, WA, January 12, 2015.
[95] John M Bryson. "A Strategic Planning Process for Public and Non-Profit Organizations." *Long Range Planning* 21, no. 1 (February 1988): 73–81.
[96] Coral Triangle Initiative. "Regional Plan of Action–Coral Triangle Initiative on coral reefs, fisheries and food security (CTI-CFF)." Interim Coral Triangle Initiative Secretariat (Jakarta, Indonesia 2009).

considerations. Overlooking the social dimensions of LMRs can produce negative consequences for local communities, resulting in LMR resistance and noncompliance.[97]

- Identification of stakeholders and their subsequent involvement rarely occurs during LMR design and implementation. Often, meetings or interactions with local communities are not conducted in their native language.[98]
- Information regarding all aspects of the design, implementation, and monitoring of LMRs is not made adequately transparent to both local communities and the general public.[99]
- There is a lack of cultural awareness at LMR sites. Each context is diverse and unique, and it is important to be fully aware of the traditions with which the reserve may interact.[100]
- The above points highlight the inadequate emphasis given to building two-way communication between local communities, the reserve, and GOL program management.

Mitigating Negative Impacts

- In general, current LMR reserve designs do not adequately account for potential and real negative impacts.
- The establishment of no-take LMRs can displace local fisheries into adjacent areas, amplifying fishing pressure in those regions.[101] [102]
- The displacement, reduction, or elimination of commercial fisheries decreases local and national incomes dependent on marine extraction.[103]

[97] Christie, et al. "Toward Developing a Complete Understanding." 23.
[98] Anthony Charles and Lisette Wilson. "Human Dimensions of Marine Protected Areas." *ICES Journal of Marine Science: Journal Du Conseil* 66, no. 1 (2009): 7
[99] Bennett and Philip, "Why Local People Do Not Support Conservation."110.
[100] Graham J. Edgar et al., "Global Conservation Outcomes Depend on Marine Protected Areas with Five Key Features." *Nature* 506, no. 7487 (2014): 216–20.
[101] Rebecca Gruby, Skype Interview by Emily Minge, University of Washington, February 5, 2015.
[102] Kaiser, "Are Marine Protected Areas a Red Herring." 1195.

- Excluding industrial fishing from an LMR can displace international corporations, generating political animosity from otherwise friendly nations.[104]
- The closure of waters to local fisheries may inhibit cultural traditions and may reduce local human population access to an important part of their diet, namely fish proteins.[105]

Enforcement

- The large spatial scale and remoteness of LMRs makes enforcement difficult.[106]
- Limited funding hinders adequate investment in enforcement methods, staffing, and monitoring technologies.[107]
- Lack of effective enforcement renders LMRs vulnerable to illegal, unreported, and unregulated (IUU) fishing.[108]
- There is not one technology or enforcement practice that will provide "full detection capability."[109] Instead, multiple tools must be used together. However, the necessary diversification is expensive.
- Enforcement deficits may lead to the development of 'paper parks' that do little to achieve their conservation goals.

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[103] Ussif Rashid Sumaila et al., "Addressing Ecosystem Effects of Fishing Using Marine Protected Areas." *ICES Journal of Marine Science: Journal Du Conseil* 57, no. 3 (June 1, 2000): 754.
[104] Haruka Teragaki and Akiko Inoue, "Japan Boats Face Palau Fishing Ban." *Asia News Network,* September 24, 2014 (accessed February 22, 2015).
[105] Richmond and Kotowicz, "Equity and Access in Marine Protected Areas." 5.
[106] De Santo, "Missing Marine Protected Areas." 138.
[107] Liliana Rodriguez Cortes, *Legal and Management Framework for the Sustainable Management of Marine Protected Areas in the Mesoamerican Barrier Reef System: An Analysis for the Mexican Approach*, Divison for Ocean Affairs and the Law of the Sea Office of Legal Affairs, The United Nations (2011): 11.
[108] Wilhelm et al., "Large Marine Protected Areas*."* 27.
[109] "Developing an Effective Enforcement System for a Marine Reserve in the Pitcairn Islands." *Pew Charitable Trusts* (2013): 5.

Research and Monitoring

- Limited funding hinders comprehensive ecological and socioeconomic LMR research and monitoring.[110]
- Ecological and socioeconomic benefits of LMRs are usually long-term and not immediately visible after the establishment of an LMR.[111]
- Ecological and socioeconomic conditions within an LMR are not static, but rather vary and evolve, thus requiring consistent monitoring and research.[112]
- Creating and maintaining research and monitoring partnerships takes time and requires extensive communication.[113]

Communications and Outreach

- The benefits and successes of LMRs are not sufficiently communicated to the general public.
- Marine conservation organizations, such as GOL, do not have a strong presence on social media, which forfeits opportunities to educate the public and recruit more conservation advocates.
- Through this lack of outreach, marine conservation forfeits increased public awareness, which reduces funding opportunities.

[110] Kelleher, *Guidelines for Marine Protected Areas*. 6.
[111] Patrick Christie, "Creating Space for Interdisciplinary Marine and Coastal Research: Five Dilemmas and Suggested Resolutions." *Environmental Conservation* 38, no. 02 (June 2011): 172-86.
[112] Lubchenco et al., "Partnership for Interdisciplinary Studies of Coastal Oceans." 18.
[113] Wilhelm et al., "Large Marine Protected Areas." 27.

## Conclusion

In sum thus far, the deteriorating health of the oceans has prompted an international conservational response in the form of MPAs. As ambitious marine conservation targets were introduced, LMRs became increasingly prevalent due to their unprecedented size and ability to maintain and recuperate ecosystems. Unique benefits and challenges accompany this shift to LMRs, manifesting in design, implementation, and monitoring processes. This section, as a prelude to the Case Studies and the Strategic Action Plan, examined these particularities and conducted a gap analysis of LMRs to showcase main themes and define deficiencies in management. The subsequent section will analyze current or proposed LMRs in New Caledonia, Palau, and the NWHI, to further examine the various themes and gaps presented in this Introduction. Finally, the Strategic Action Plan will evaluate these themes and selected case studies in order to recommend strategic actions.

# Case Studies

## Introduction

As discussed in the Introduction section, there are many reasons why large marine reserves (LMRs) are beneficial conservation tools. However, only approximately 2.1 percent of the ocean is currently included in either large or small marine reserves.[114] Here, the successes and challenges typifying LMR design and implementation will be explored through studies of three implemented or in-process reserves in New Caledonia, Palau, and the Northwestern Hawaiian Islands (NWHI). This Task Force chose to conduct case study analyses to provide details and examples that complement LMR literature review and the thematic framework established by the Introduction, consisting of: 1) Representation and Transparency in Design, Implementation, and Monitoring, 2) Enforcement, 3) Mitigating Negative Impacts, 4) Research and Monitoring, and 5) Communications and Outreach. The authors recognize the implications of their case study choices and acknowledge that these sites cannot fully capture the diversity of LMRs.

New Caledonia, Palau, and NWHI were carefully chosen to represent different stages of implementation within varying contexts of economic development and human settlement. For example, the Papahānaumokuākea Marine National Monument (PMNM) in the NWHI is a mature United States (U.S.) national monument without permanent human settlements and experiences restricted human activities within its jurisdiction. PMNM was primarily established to conserve biodiversity and was declared under the Antiques Act in the U.S., ultimately through a decision taken in 2006 by then-President George W. Bush. Palau, on the other hand, is a sovereign nation that relies heavily on its fisheries for income and food, and has yet to

[114] "Global Marine Protected Areas." *MPAtlas* (accessed January 23, 2015).

implement their proposed LMR. The proposed Palauan LMR has a bill in review by legislation and is focused mainly on changing how commercial, offshore fisheries are managed. New Caledonia is one of France's overseas territories, whose declaration was the product of a relatively bottom-up, multi-stakeholder planning process intended to balance sustainable fisheries and biodiversity conservation. Its specific policies are still being developed. In short, the cases present a diversity of contexts, processes, and goals.

These varying LMR contexts grant insight on ecological, political, and socioeconomic configurations that impact effectiveness. From these case studies, best management practices and recommended actions will be gleaned to inform a Strategic Action Plan, which will follow the presented case studies.

# New Caledonia

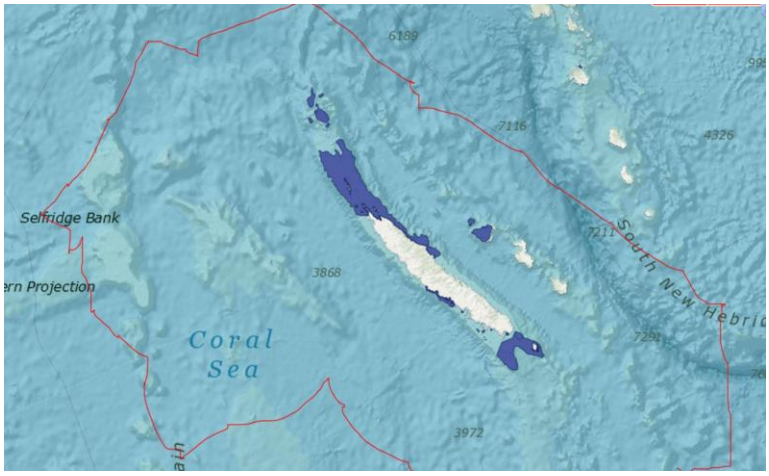


**Figure 11: *Parc Naturel de la mer de Corail*[115]**

## Introduction

New Caledonia is a French overseas territory located between Australia and the Cook Islands in the Pacific Ocean.[116] Along with the main island, Grande Terre, and the Isle of Pines, the territory also includes two smaller groups of islands and numerous outlying islets, and is divided into three provinces – the North, South and Loyalty Islands.[117] Each province is responsible for managing the portion of the LMR within its boundaries, and each imposes regulations that restrict activities to varying degrees, ranging from no-use areas to areas with few restrictions.[118] Although New Caledonia is a French territory, more governing responsibility has gradually been transferred to the islands' leaders, as the French and New Caledonian governments have worked together to create the reserve.

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[115] "Global Marine Protected Areas." *MPAtlas*.
[116] "New Caledonia Announces Intention to Create Large Marine Reserve in Their Waters." *The Pew Charitable Trusts* (accessed February 1, 2015).
[117] United Nations Environment Programme, eds. *Dugong: Status Report and Action Plans for Countries and Territories*. By Russell Marsh, Early Warning and Assessment Report Series 1. (Nairobi, Kenya: United Nations Environment Programme, 2002).
[118] Christophe Cleguer et al., "Spatial Mismatch between Marine Protected Areas and Dugongs in New Caledonia." *Biological Conservation* 184 (2015): 155.

Due to their biodiversity and cultural importance, the lagoons of New Caledonia were named a UNESCO World Heritage Site in 2008. In 2014, the *Parc Naturel de la mer de Corail* (Natural Park of the Coral Sea) was established to protect New Caledonia's elaborate system of coral reefs, increasing France's total area of protected waters from 4 percent to 16 percent.[119] The reserve contributes to France's marine conservation goal of protecting 20 percent of its global ocean waters by 2020, with half off-limits to extractive industrial and commercial activities.[120] According to David Emmett, the senior vice-president for Conservation International's Asia-Pacific program, New Caledonia "exemplifies what other countries in the Pacific can do to fully invest in the long-term health and productivity of their ocean resources."[121]

The New Caledonian LMR is a multipurpose reserve that encompasses the entirety of the territory's EEZ,[122] which totals approximately 1.3 million square kilometers of ocean territory and includes one of the most extensive reef and lagoon systems in the world.[123] This habitat is home to an estimated 900 varieties of coral and an abundance of threatened fish, marine mammals, turtles, and dugongs.[124] This LMR is one of three established protected marine areas in the Coral Sea, which together form an important 'network' of marine conservation.

There are a number of key stakeholders involved in the creation and management of the New Caledonian reserve, including WWF-France, Conservation International (CI), the Association for the Protection of the Nature of New Caledonia, the French Marine Protected

[119] "New Caledonia (France)." *IUCN* (accessed February 12, 2015).
[120] "Pew Applauds New Caledonia's Advancing Ambitious Marine Park Plan." *The Pew Charitable Trusts* (accessed February 24, 2015).
[121] Russell McLendon, "New Nature Preserve Will be Largest on Earth." Mother Nature Network. May 2, 2014. (accessed February 28, 2015).
[122] Susan Colby, "Government of New Caledonia Makes Historic Announcement." *Ecology Global Network*, May 5, 2014 (accessed February 28, 2015).
[123] "An Exceptional Heritage and Its Observatory." *IUCN*, September 1, 2012 (accessed February 1, 2015)
[124] "New Caledonia, Large Marine Reserve." *The Pew Charitable Trusts* (accessed February 1, 2015).

Areas Agency, and the IUCN French Committee.[125] There have also been a number of local actors involved in the planning and managing of the reserve, including the New Caledonian government and leaders from the native Kanak community, an indigenous group that accounts for half of New Caledonia's population.[126] The Natural Park of the Coral Sea is also a Big Ocean site and benefits from this peer-to-peer learning network, a system of knowledge networks designed for learning purposes.

CI and the Pew Charitable Trusts have been very involved in the New Caledonia site. In collaboration with the New Caledonian government and other partners, CI has created a three-year timeline, from the creation of the marine reserve, to create a management plan for the new park. The plan divides the LMR into different zones based on the kinds and levels of activities allowed.[127] The Pew Charitable Trusts has also been working with the New Caledonian government and is advocating for "the designation of at least 200,000 square kilometers as fully protected, in which fishing and other extractive activities would be prohibited."[128]

When asked about imminent threats to New Caledonian waters, Jean-Christophe Lefeuvre, CI-New Caledonia Program Director, asserted that the main threat is non-permitted harvesting. However, he adds, "in the near future … an increase in ship traffic coming in and out of Queensland, Australia, will heighten the risk of collision. In addition, the recent deep-sea oil and mining potential may affect the integrity of nature and ecosystem services in the Coral Sea."[129]

[125] "IUCN Members Presence in New Caledonia." *IUCN*, January 9, 2012 (accessed February 10, 2015).
[126] Molly Bergen, "New Caledonia Establishes World's Largest Marine Park." *Human Nature: Conservation International Blog*, May 1, 2014 (accessed February 10, 2015).
[127] Ibid.
[128] "Pew Applauds New Caledonia's."
[129] "IUCN Members Presence in New Caledonia." *IUCN.*

Aside from illegal fishing, the extraction of nickel poses a serious threat due to the political influence and environmental impacts of the mining industry (Figure 12). It is estimated that the region is home to a quarter of the world's nickel reserves, accounting "for 90 per cent of the export earnings, which equates to billions of dollars annually."[130] Nickel extracted from New Caledonia is primarily shipped to Asian ports, where it is then used to make consumer goods, electronics, and steel.[131]


**Figure 12: Nickel Mining in New Caledonia[132]**

Although much of the nickel mining in New Caledonia currently takes place on land, deep seabed mining and oil drilling in New Caledonia and the Cook Islands are becoming increasingly alluring prospects for large companies, as new technology makes extraction economically feasible. However, both land and sea mining have serious consequences for the surrounding aquatic ecosystems. For example, "in the highlands of Grande Terre, strip mining

[130] Frédéric Angleviel and Stephen I. Levine, *New Zealand-New Caledonia: Neighbours, Friends, and Partners.* (Victoria University Press, 2008), 240.
[131] Peter Tolmé, "Little Scum Takes on Big Mining." *National Wildlife Federation*, June 1, 2002 (accessed February 21, 2015).
[132] "New Caledonia Profile," *BBC News,* October 2, 2014 (accessed February 28, 2015).

has turned great valleys rust red in color and sliced off entire mountaintops."[133] Furthermore, in May 2014, 100,000 liters of acid-tainted effluent seeped into a river that flows directly into the LMR. This incident mirrors a similar event in 2009, when 40,000 liters of sulfuric acid leaked into a nearby river.[134] In the past, conservation efforts in New Caledonia have been met with resistance by the mining industry, because "nickel has made many New Caledonians wealthy, and white islanders enjoy a high standard of living … attacking the nickel industry in New Caledonia is like criticizing Big Oil in Texas."[135] [136]

Despite the threats to the New Caledonian ecosystem, the Pacific Island nation has special conservation potential due to its biodiversity and intact ecosystems with "healthy populations of top predators, and a large number and diversity of large fish."[137] Additionally, unlike other marine ecosystems in the world, the reef system in New Caledonia provides a variety of important oceanographic features, including both warm and cold currents.[138] As an ecosystem, according to National Geographic explorer Enric Sala, New Caledonia is "one of the only examples left of an ocean without people [...] which can help us understand the magnitude and impact of our activities, and what we have lost."[139]

It should be kept in mind, however, that this seascape is home to over a quarter million New Caledonians, and has a significant fishery for tuna, sea cucumber, and for subsistence needs. This context will necessarily affect LMR design and implementation. Most of the fishing that occurs in New Caledonia is small-scale, and is conducted in the reef and lagoon areas where

[133] Ian Lloyd Neubauer, "Is a Vast Marine Sanctuary Any Use If You Can't Police It?" *TIME*, June 30, 2014, World Section (accessed February 28, 2015).
[134] Ibid.
[135] Peteghem, "Little Scum Takes on Big Mining."
[136] Ibid.
[137] "Lagoons of New Caledonia: Reef Diversity and Associated Ecosystems." *UNESCO* (accessed February 12, 2015).
[138] Ibid.
[139] Hans Weise. "Pristine Seas Efforts Inspire Protection of Untouched Reefs." *National Geographic* video, 1:50. 2014 (accessed February 10, 2015).

there is the most species richness.[140] In these waters, fishers conduct their practice in canoes or on foot using a variety of traps, spears, and nets.[141] Although most fish that are caught are used for subsistence and artisanal purposes, "coastal development, agriculture and logging are placing increasing pressure on these productive reef and lagoon systems that provide food to much of the population."[142] The New Caledonian population depends on continued access to the reef and lagoon systems, because seafood is their main source of protein.[143]

Along with ecological and subsistence justifications for the site, the New Caledonian LMR is culturally important for the indigenous Kanak people. Studies have shown that traditional Kanak fishing practices do not have significant negative effects on the marine biome, as reef surveys near Kanak fishing grounds have found "a healthy and diverse reef and lagoon biota unaffected by coral bleaching, starfish predation, or coral disease."[144] This suggests that traditional knowledge and indigenous involvement can be valuable for the conservation of the oceans.[145]

Representation and Transparency in Design, Implementation, and Monitoring

Many of the environmental organizations involved in New Caledonia have asserted that local community involvement is a critical component to the management of this LMR. According to Anthony Lecren, a member of the New Caledonian government who is leading sustainable development efforts in the region, "this project involves all the Caledonians and

[140] Dirk Zeller and Sarah Harper, "Reconstruction of Total Marine Fisheries Catches for New Caledonia." *Fisheries Centre Research Reports* 17, no. 5 (2009).
[141] Ibid, 68.
[142] Ibid, 72.
[143] Zeller, *Reconstruction of Total Marine Fisheries.* 74.
[144] Angleviel et al., *New Zealand-New Caledonia,* 244.
[145] Ibid.

ensures sustainable economic development of the country."[146] This LMR may provide lessons for other LMRs to be declared in populated seascapes.

As the New Caledonian LMR is a newly implemented reserve, methods to increase community involvement are being explored and expanded. WWF-France has been on-site in New Caledonia for roughly 16 years, and has been working with the local people to better understand their needs.[147] Moreover, IUCN Members have focused much of their attention on promoting local initiatives for the sustainable management of coral reefs, mangroves, and seagrass.[148]

CI has been involved with the New Caledonian government by organizing meetings with key stakeholders, financing scientific research, and aiding the development of "a community-based management model that incorporates local rules and uses, supported by science and modern management tools."[149] The plan will integrate economic, educational, and cultural components to ensure that all stakeholder voices are represented.[150] CI has also collaborated with the local government to create a management committee for the LMR that will include members of the Kanak community. With four working groups – institutional, civil society, customary, and scientific – the committee is tasked with developing an effective management strategy and clearly defining key areas of conservation in the reserve.[151] [152] This interdisciplinary effort is exemplary of the transparent union of planning practices integral to the success of an LMR.

[146] "Natural Park of the Coral Sea Joins Big Ocean." *Big Ocean* (accessed February 10, 2015).
[147] Ibid
[148] Ibid.
[149] Bergen, "New Caledonia."
[150] "New Caledonia: Largest Marine Park." *Conservation International.*
[151] Bergen, "New Caledonia."
[152] "Natural Park of the Coral Sea Joins Big Ocean." *Big Ocean.*

Enforcement

Like elsewhere, enforcement is particularly challenging in New Caledonia, as its reserve is newly implemented and management policies are still developing. Once the management plan is set, the reserve will allow various human activities in some areas (some areas are no-take, others are not), but off-limits areas are still not clearly defined, potentially creating ambiguity even for users intending to follow the law. Further, the nation has no navy of its own and relies on a handful of French ships to patrol an area larger than Germany.[153] Speaking generally about the difficulties of enforcement in New Caledonia, one eco-tour operator, Manu Hernu, explained, "This is supposed to be a World Heritage area, but look around you. Where are the patrols? [...] There is no one here to stop people from fishing but me. I have to be the sheriff because the government isn't here."[154]

Penalties for illegal fishing in New Caledonian waters include a hefty fine and jail time. For example, in March 2012, the French Navy seized a Taiwanese vessel for fishing illegally in the region and sentenced the ship's captain to more than six months in jail and an $180,000 fine.[155] Even though Hernu may not have been referring to illegal fishing in particular, his statement nonetheless illustrates the vulnerability of New Caledonian waters to illegal fishing. Although the French Navy patrols the LMR by boat and conducts surveillance flights, these measures are often not enough to stop people from fishing illegally.[156]

Despite enforcement and mining challenges, the New Caledonian LMR delivers meaningful protection for the territory's coral reefs, lagoons, and commercial fish species in

[153] Neubauer, "Vast Marine Sanctuary."
[154] Ibid.
[155] "Illegal Fishing in Exclusive Economic Zone," *Radio Australia*, March 22, 2012 (accessed February 28, 2015).
[156] McLendon, "New Nature Preserve."

comparison to open and unprotected waters.[157] In conjunction with the legislative protection provided by the LMR, CI is protecting terrestrial ecosystems that lie upstream from the protected waters. This "ridge to reef approach" aims to reduce the harmful effects of anthropogenic activities on land.[158] In partnership with the New Caledonian government and other agencies, CI's management strategy will eventually clarify what activities are allowed inside the various zones of the LMR, ideally bolstering compliance, surveillance, and enforcement.[159] Together, these efforts will strengthen management and enforcement within the reserve.

Mitigating Negative Impacts

Compared to other island nations, New Caledonia's economy has been less disrupted by the establishment of an LMR, as the reserve's regulations for any fish closures have not yet been implemented, although information on this still-developing aspect of the site is scarce. It is possible that the lucrative mining industry and French development assistance will offset fisheries losses. Shark ecotourism is also becoming an increasingly profitable business in a majority of Pacific Island nations, as is a potential alternative to marine extraction income. In fact, "according to a new global analysis, shark watching … [generates roughly] $314 million annually," and the business is projected to "double within 20 years, generating over $780 million annually."[160] The profitability of ecotourism suggests its viability as an economic alternative to commercial fishing and other environmentally harmful occupations in New Caledonia.[161] A

[157] Callum M. Roberts, "Selecting Marine Reserve Locations: Optimality versus Opportunism." *Bulletin of Marine Science* 66, no. 3 (2000): 581.
[158] "New Caledonia: Largest Marine Park." *Conservation International*.
[159] Bergen, "New Caledonia."
[160] Emmeline Johansen, "New Shark Protection Laws in New Caledonia May Help Boost the Economy." *New Caledonia Today,* August 8, 2013 (accessed February 2, 2015).
[161] Emmeline Johansen, "New Shark Protection Laws in New Caledonia May Help Boost the Economy." *New Caledonia Today*, August 8, 2013 (accessed February 2, 2015).

carefully designed plan for mitigating any potential negative socioeconomic and cultural impacts is essential to this site's future success.

Research and Monitoring

The New Caledonian LMR is a critical habitat for the persistence of dugongs (*Dugong dugon*), a species in decline.[162] In a study conducted on dugongs using 10 years of aerial surveys, researchers discovered a spatial mismatch between MPAs and dugong habitat in New Caledonia. They found that "important dugong areas in New Caledonia received limited protection from direct threats such as nets in small-scale fisheries boats, and other indirect threats, such as […] the development of coastal mining industries. Currently, low value dugong conservation value areas are highly protected."[163] This spatial mismatch illuminates weaknesses in the planning processes for the reserve and a lack of clearly defined management goals at the site, as well as the larger challenges in determining the location and boundaries of marine reserves. [164] The New Caledonian government and CI can use the study conducted on dugongs as they finalize the management plan for the reserve and determine what activities certain areas will allow. However, it is important to note that there are a multitude of factors that should be considered when designing, implementing, and managing LMRs, not just the consideration of one species.

Along with this ecological information, new tools have been created to help researchers monitor New Caledonia's biodiversity. One is a new mobile application called Marine Mammal Observers of Oceania by Internet (MObI), designed to help distinguish and record sightings of marine species in New Caledonia and Polynesia, available to anyone with a smartphone.[165] Marc

[162] Cleguer, "Spatial Mismatch between MPAs and Dugongs," 154.
[163] Ibid, 160.
[164] Ibid, 160.
[165] MObI, L'application Pour Référencer Les Mammifères Marins Maintenant Disponible!" *Le Caillou Vert* (accessed January 31, 2015).

Oremus, a marine mammal specialist working with the IUCN and the WWF office in New Caledonia, created this application to identify and track marine mammals and other species in real time. When a user spots a marine mammal, they can record the location and time of the sighting, upload photographs, and record the number of mammals seen.[166] The data is saved offline on smartphones, and once an Internet connection is made, the data is sent to databases and other marine surveillance organizations.[167]

By giving the general public an opportunity to help scientists collect information on endangered species, MObI provides a means to track biodiversity, a key indicator of ecosystem health. Mike Donoghue, a Threatened and Migratory Species Advisor for the Secretariat of the Pacific Regional Environment Programme (SPREP), says MObI is "pioneering 'citizen science'" and provides new opportunities to evaluate species and their populations, which can contribute to better conservation and management practices in the region.[168]

Other areas of research have focused on ways to monitor sediment buildup caused by the mining industry in New Caledonia, which often reaches the protected lagoons and damages the coral reefs. As this is a major threat to the reserve, efforts have been made to research and map soil sensitivity to erosion using geographic information tools and remote sensing. These tools "provide valuable results for focusing on areas subject to erosion and serve as a decision-making tool for the minimization of lagoon vulnerability to the natural and human dynamics on the level of the catchment basins."[169]

[166] "MObI—Marine Mammal Survey."
[167] Ibid.
[168] "MObI—Marine Mammal Survey."
[169] Pascal Dumas et al., "Developing Erosion Models for Integrated Coastal Zone Management: A Case Study of The New Caledonia West Coast." *Marine Pollution Bulletin* 61, no 7-10 (2010): 519.

Communications and Outreach

Along with its membership in the Big Ocean learning network, the New Caledonian LMR is a Secretariat of the Pacific Regional Environment Programme (SPREP) member site, and New Caledonian managers are part of an information-sharing network with counterparts from the Cook Islands, the location of another LMR. Facilitated by Big Ocean, the governments of New Caledonia and the Cook Islands signed a sister-sites agreement to coordinate sustainable management in their connected marine areas, which jointly total 2.5 million $km^2$.[170] Both New Caledonia and the Cook Islands will bring valuable knowledge to the network, as "New Caledonia plans to share its experience in the field of trans-disciplinary and multi-sectoral scientific exploration," while "the Cook Islands will bring their expertise in the field of integrated marine governance, both at community and national levels."[171] The agreement is expected to benefit all stakeholders, including the local communities and economies of these nations.[172]

[170] "Marine Protected Areas Agreement between New Caledonia and the Cook Islands." *Secretariat of the Pacific Regional Environment Program*, November 4, 2013 (accessed February 10, 2015).
[171] Ibid.
[172] Ibid.

CI has also been involved with the governments of New Caledonia and the Cook Islands to develop their LMRs under the "The Pacific Oceanscape Initiative." The initiative is endorsed by 22 Pacific Island countries and territories, and pursues the ambitious goal of sustainably developing, managing, and conserving nearly 40 million $km^2$ of marine area – 10 percent of oceans on earth.[173] The Pacific Island nations that have endorsed the Pacific Oceanscape also share stories about their management experiences, and serve as an example for other nations looking to implement LMRs in their waters.

**Big Ocean and Peer Learning Networks:**

Big Ocean is the only peer-learning network designed for LMRs to enable managers to share information in order to establish best management practices. This peer-learning network is made up of 14 member sites, totaling over 7 million square kilometers of the ocean. Big Ocean's main goal is supporting LMR managers, along with NGOs, researchers, and donors, by "developing and enhancing the professional standards or practice, and long-term, effective management of large-scale marine areas." To accomplish this goal, Big Ocean provides a forum for communication and networking among the 14 sites, so managers and staff can define and share best management practices. The initial framework identified learning, knowledge, and communications as the core needs of LMR managers.

Big Ocean has identified three general approaches to help realize their aims and purposes. The first approach is capacity building, which includes "expanding the skills and professional experience of member sites staff to improve operations at the site level and to enhance functioning of the network. Activities include: business meetings, staff exchanges and joint research cruises." Secondly, Big Ocean uses communication to enhance the development, collection, analysis, and sharing of information within and between LMRs. Lastly, Big Ocean uses product development to create "tools and services that enhance management efforts; improve the design, establishment and long-term management of large-scale MPAs; increase the effectiveness of management actions; and further professionalize the field."

Source: *Big Ocean*, bigoceanmanagers.org

[173] "Marine Protected Areas Agreement."

## Conclusion

While the Natural Park of the Coral Sea has a short history, some benefits are already visible, and definite steps have been taken to address initial weaknesses. Completion of a transparent monitoring plan will facilitate enforcement, although lack of enforcement resources, including vessels, continues to challenge the site. The territory's established mining industry, in particular, poses a threat all the more serious for the centrality of the nation's economy. Yet, at the same time, the proactive response to the dugong habitat mismatch, as well as the constructive involvement of outside organizations, demonstrates a strong commitment and openness to research. Additionally, strong community engagement and clear goals will also spur continued progress in this important reserve.

# Palau

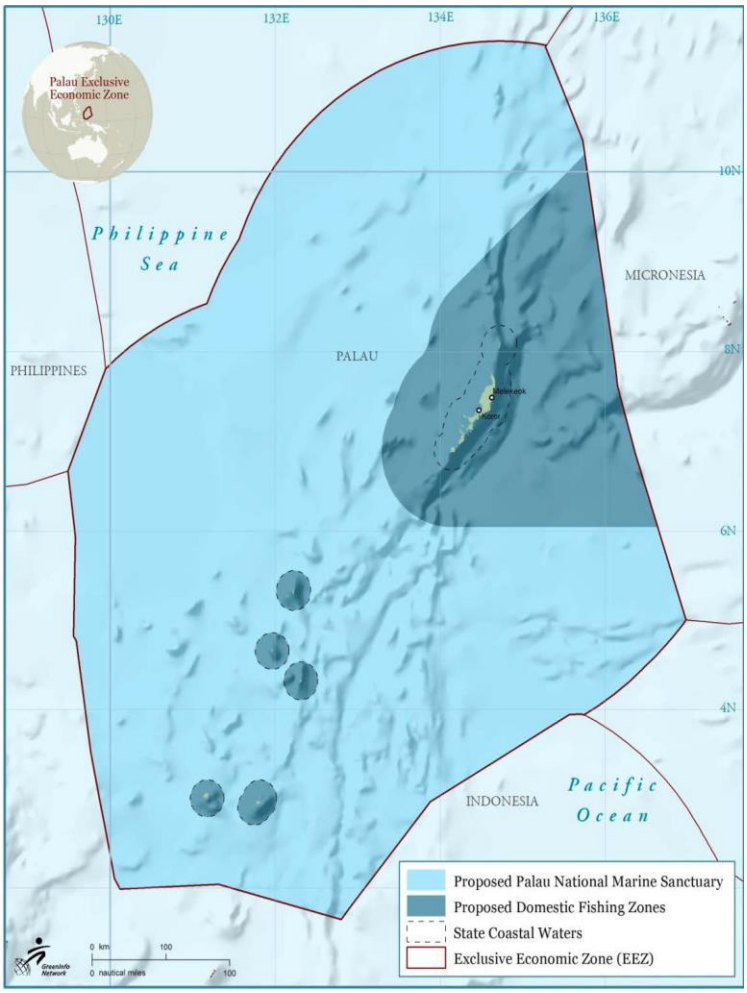


**Figure 13: A Map of Palau's Proposed Marine Reserve**[174]

## Introduction

Composed of six island groups, totaling 250 islands, the nation of Palau is located in the Western Pacific Ocean.[175] With 700 coral reefs hosting 1,300 species of fish, and 130 species of sharks and stingrays, as well as a jellyfish lake, Palau attracts scuba divers and tourists from

[174] "Palau National Marine Sanctuary Fact Sheet." *National Geographic: Voices,* June 2014 (accessed February 28, 2015).
[175] Jenny B. Davis and Amanda C. Quick, "Palau." *World Press Encyclopedia*, 2nd ed., Vol. 2 (Detroit: Gale, 2003), 707.

around the world, in addition to foreign commercial fishers.[176] The islands are economically dependent on tourism, with an estimated 100,000 visitors annually.[177] Japanese and Taiwanese boats also pay fishing taxes and license fees to fish Palauan waters for bigeye and yellow fin tuna, but fishery taxes and fees earned the country only $5 million in 2013, compared to $140 million from tourism in 2010.[178] [179]

During an address to the United Nations in 2014, Palauan President Thomas Remengesau Jr. iterated his plan to close Palauan waters to commercial fishing and declare an LMR the size of France, garnering international attention.[180] The LMR will establish a no-take zone encompassing 80 percent of Palau's EEZ, of which 20 percent will be reserved for domestic fishers, as part of a broader plan to invest in ecotourism and move away from a fisheries-based economy.[181] In an interview with the Huffington Post, President Remengesau said the 20 percent set aside for local and domestic fishers will also support Palau's ecotourism industry.[182]

Palau also has a long history of terrestrial conservation and MPAs. Perhaps most notable among Palau's pre-LMR efforts has been the Protected Areas Network Act (PAN), established in 2003 by a Palauan law creating a national system of small MPAs.[183] The enactment of PAN also led to the creation of a "non-government corporation, the Protected Areas Network Fund

[176] Ibid.
[177] "No Bul: A tiny Pacific nation considers a ban on fishing." *The Economist*, June 7, 2014 (accessed February 28, 2015).
[178] Ibid.
[179]Gabriel Vianna et al., "Socio-Economic Value and Community Benefits from Shark-Diving Tourism in Palau: A Sustainable Use of Reef Shark Populations." *Biological Conservation* 145, no. 1 (January 2012): 267–77. 21
[180] United Nations. "Healthy Oceans and Seas: A Way Forward" Palau Government, February 4, 2014 (Accessed February 22, 2015).
[181] Ibid.
[182] Anna Shen, "Q&A: 'My Country Will Not Go Down Without a Fight.'" *The Huffington Post*, September 30, 2014 (accessed February 1, 2015).
[183] "Palau Protected Areas Network (PAN)," *Palau Conservation Society* (accessed February 22, 2015).

(PANF), and the creation of a Green Fee (a $30 fee collected from visitors to Palau upon departure from the airport)."[184]

Palau also effectively created a shark sanctuary in its waters with the Shark Haven Act of 2009, which banned all commercial shark fishing.[185] President Remengesau has since justified the shark sanctuary with reasoning similar to his argument for creating the LMR – current extraction levels are not only unsustainable, but do not necessarily offer greater economic benefits than conservation. Today, shark tourism is a significant part of Palau's tourism economy.

In declaring the LMR, President Remengesau affirmed the nation's goals of conserving natural resources and establishing protection from overfishing, pollution, acidification, and climate change.[186] While the legislation that will officially establish the reserve remains in draft, and the mechanics of monitoring and enforcement remain in some cases unknown, the case has real value as an example of the realities of unilateral conservation actions. Furthermore, by contextualizing the current initiative within more than a decade of Palauan reserve management geared toward the same objectives, additional clarity on the likely final form of some of the larger reserve's basic mechanisms may be gained.

Representation and Transparency in Design, Implementation, and Monitoring

Palau's LMR is prominent for its unilateral imposition, with public announcements from the executive branch essentially starting the process, including review of legislation by the Palauan Congress. Under proposed legislation, the LMR will be implemented in stages, six months to one year apart, until the entire statute is in force by year-end 2019. Under current but

[184] "Palau-MPA Design." Reef Resilience (accessed February 12, 2015)
[185] Ibid.
[186] Ibid.

yet-to-be-released frameworks, the Minister of Natural Resources, Environment and Tourism will draft all additional regulation for the proposed LMR. The Ministry's duties include the conservation, management, and exploitation of living resources in the LMR, in addition to defining domestic fishing zones. President Remengesau has also reached out to a team of actors who have access to technology, conservation organizations, and civic groups.[187] Palau International Coral Reef Center (PICRC) is not currently mandated to oversee Palau's proposed LMR, but alongside proposed legislation, officials are working on creating a new department to supervise monitoring and enforcement.[188]

While specifics on the developing framework of the Palauan LMR are limited, examining past conservation efforts, such as PAN, yields relevant insight. Current MPAs in Palau function under multilevel governance and multilateral environmental agreements, with several actors and institutions involved in the decision-making process. These actors include: Protected Areas Network Office within the Ministry of Natural Resources; Environment and Tourism; PICRC; Fish and Wildlife Protection Division (National Government) designated site management authority at the community and state level; and the Protected Areas Network Fund (PANF).[189] [190]

Enforcement

Currently, illegal commercial fishing within Palauan waters is tracked via automatic identification systems (AIS), which broadcast ships' locations. AIS are already used in commercial shipping and by patrol and fishing vessels to prevent collisions. One downfall of AIS is the ability of boat captains to switch the system on and off, but when the system is closely

[187] Shen, "Q&A."
[188] Noah Idechong.
[189] Rebecca L. Gruby and Xavier Basurto, "Multi-Level Governance for Large Marine Commons: Politics and Polycentricity in Palau's Protected Area Network." *Environmental Science & Policy* 33 (2013): 260-272. 1.
[190] Noah Idechong.

monitored, the disappearance of a ship on the system becomes a flag to authorities.[191] Also, according to National Public Radio, the Pew Charitable Trusts is assisting in enforcement efforts by acquiring satellite images and radar of ships engaged in illegal fishing in Palauan waters.

According to President Remengesau, Palau only has three ships to monitor and intercept illegal fishing vessels.[192] To remedy this deficiency, President Remengesau is seeking innovative ways to enforce the proposed LMR.[193] In August 2013, Palau conducted its first test of drones and is currently working with an Australian drone manufacturer, where the mission-deployment cost of a drone is $360 USD versus $37,000 USD for a vessel.[194] Overall, the goal is to use drones and work with other governments and NGOs to improve enforcement, obtain additional vessels and technology, and expand cooperation on conservation.[195] [196]

To ensure the efficacy of AIS-based monitoring, currently proposed Palauan legislation will also require all vessels to be registered with the Forum Fisheries Administration (FFA) and with the Western and Central Pacific Fisheries Commission (WCPFC).[197] Furthermore, all vessels will also need to be inspected by the Bureau of Oceanic Fishery Management to ensure that each is in full compliance with all requirements of the law.[198]

Additional enforcement challenges that may arise with regard to Palau's future LMR are currently unclear, especially given that proposed enforcement frameworks have yet to be enacted, or even formalized. At the same time, however, the basic conservation philosophy

[191] Christopher Joyce, "Gotcha: Satellites Help Strip Seafood Pirates Of Their Booty," *The Salt.* National Public Radio, February 5, 2015 (accessed February 8, 2015).
[192] Shen, "Q&A."
[193] Ibid.
[194] Giff Johnson, "Ban Commercial Fishing: Palau's Goal." *Islands Business Magazine,* July 12, 2013 (accessed February 22, 2015).
[195] Shen, "'Q&A."
[196] Ibid.
[197] *Palau National Marine Sanctuary Bill,* S 9-30 SD1, 1st sess., daily ed (March 2013).
[198] Ibid

behind the LMR is understood and generally accepted by local communities.[199] Ideally, evolving legislation will leverage this fact to ground robust enforcement practices in strong on-the-ground support.

**Drones: A Cost-Effective Solution?**

Drones are an additional approach to minimizing difficulties of enforcing LMRs. Military and recreational interest in drones has catalyzed innovation in drone technology that makes the use of drones in conservation, especially ocean conservation, promising. However, drones are expensive. Several years ago, the use of drones for enforcement in Papahānaumokuākea Marine National Monument (PMNM) was an exciting possibility. However, PMNM's current drones are incapable of patrolling such a vast area of ocean, and the budget does not allow for additional expenditures. Thus, the question of necessity arises, as remoteness often renders drones ineffective financially.

Belize is also exploring the use of drones in the Glover Reef Marine Reserve, as illegal fishing remains a serious problem. In March of 2014, the European Union banned all seafood imports from Belize on the grounds that the country was not doing enough to prevent illegal fishing. A few months later, with the help from the Wildlife Conservation Society and Conservation Drones, Belize implemented a new drone monitoring program to help the its Fisheries Department monitor for illegal fishing activities. After extensive testing the previous July with drones that cost $2,400 apiece, drones could fly on expeditions over an hour long, and could take high-resolution videos and photographs. This made drones an attractive solution to the Belize Fisheries Department, as costs for surveillance boats can amount to $13,500 per trip.[1] The use of drones enables the government and local communities to protect their most valuable assets – marine ecosystems.

Sources: *Selbe, Shah "Robot Eyes Protecting From Above: Drones and Ocean Conservation." National Geographic. Aulani Wilhem, personal communication; Brian C. Howard, "Can Drones Fight Illegal 'Pirate' Fishing?" National Geographic.; James Gorman, "Drones on a Different Mission." The New York Times.; Howard. "Can Drones Fight Illegal 'Pirate' Fishing?"; Adele Ramos, "Unmanned aerial drones to police Belizean waters." Amandala.*

Mitigating Negative Impacts

The proposal for the LMR in Palau, in conjunction with a ban on foreign commercial fishing, will reduce revenue from the foreign commercial fishing sector, which amounted to

[199] Noah Idechong, phone interview by Shelby Keith, University of Washington, February 9, 2015.

approximately $5 million in 2013, generated mostly through fishing taxes and licensing fees.[200] Along with seven other island states in the region, Palau is a member of the Parties to the Nauru Agreement (PNA), a sustainable tuna fisheries treaty organization. However, Palau is significantly less dependent on revenue from the tuna fishery than other members, because the majority of the tuna fisheries lie outside Palauan waters.[201] [202] President Remengesau has voiced intentions to sell Palau's allotted fishing days to other PNA members, generating about $2.5 million to offset lost fisheries revenue.

Enactment of the reserve could also spur punitive actions from countries from which Palau currently receives development aid and who benefit from fishing in Palauan waters. In 1987, the U.S. and Palau, along with other Pacific Island states, signed the South Pacific Tuna Treaty, which allows the U.S. to benefit from Palauan fisheries. Palau also receives economic assistance and grants in the amount of $215 million dollars from the U.S. until 2024. These funds are technically unrelated to the treaty, but at least one U.S. expert has said that the money is likely partly reciprocation for ongoing participation in the treaty. The U.S. has supported Palau at the United Nations, and President Remengesau has been quoted saying he feels the U.S. will not retaliate, but the same expert asserted aid withdrawal was a real possibility should the U.S. fleets lose access to Palauan waters. [203] [204] [205] Japan is another nation that gives financial assistance to Palau and fishes in Palauan waters. As of March 2012, Japan had given $202 million in aid, including partial funding for the construction of the PICRC.

[200] "No Bul." *The Economist*.
[201] "About US." PNA Tuna (accessed February 20, 2015)
[202] Johnson. "Ban Commercial Fishing."

[203] "Palau's Plans to Ban Commercial Fishing Could Set Precedent for Tuna Industry." *The Guardian*, March 26, 2014 (accessed February 23, 2015).
[204] "South Pacific Tuna Treaty." U.S. Department of State (accessed February 23, 2015).
[205] "Palau's Plans to Ban Commercial Fishing." *The Guardian*.

Ecotourism is responsible for 56 percent of Palau's gross domestic product.[206] President Remengesau has stated that the nation can replace its fishing revenue by augmenting its ecotourism industry, while conserving Palau's marine biodiversity.[207] In addition to the proposed registration and inspection requirements, a fee on tourists integrated into the cost of airline tickets has been floated as another way to fund the proposed LMR, similar to the PANF Green fee.[208] While the ability of the ecotourism market to expand sufficiently to account for lost revenues is impossible to predict, the required increase – a net $5 million expansion – would amount to only four percent growth for the sector, hardly an unrealistic target.

Further, reviews of the shark diving industry and the value of sharks as non-consumptive resources indicate Palau annually obtained $18 million USD from shark-related tourism.[209] This study measured and compared the monetary value of living reef sharks ($179,000 USD annually) with the monetary value of shark fins, the intent behind shark fishing (a few hundred USD per year).[210] Living reef sharks, over a lifetime, represent $1.9 million USD.[211] However, the economic benefits from ecotourism, while compelling, are not equally distributed throughout all of Palauan society – just as the costs of environmental conservation are not equally distributed. Once the new LMR is in place, it would be useful to monitor the effects of ocean biodiversity on the local population, and any increases in ecotourism. These findings could be used as a tool to help mitigate negative impacts in the future.

[206] Amy Weinfurter, "Small Nation Palau Makes Big Waves." *Environmental Performance Index*, August 19, 2014. (accessed February 25, 2015.)
[207] Ibid.
[208] *Palau National Marine Sanctuary Bill,* S 9-30 SD1, 1st sess., daily ed (March 2013).
[209] Vianna et al., "Socio-Economic Value and Community Benefits." iii
[210] Ibid.
[211] Ibid.

Research and Monitoring

While little information is available on monitoring processes that will be implemented in Palau's LMR, some monitoring mechanisms are already in place in regions that are set to become part of the reserve. Also, as previously stated, additional insight may be gained from examining Palauan management and monitoring philosophies, as they are visible in the already-implemented Protected Area Network.

One practice already in use involves training local resource users to take part in the data collection process. Starting in 2012, The Nature Conservancy spent a year training Palauan fishers to collect data on fish catches and monitor fish stock.[212] Through the program, research was conducted on reefs outside of existing MPAs, where gathered data indicated 60 percent of catches were juveniles that did not have a chance to fully mature, which can lead to growth overfishing.[213] [214] Involving local fishers in the research has empowered them to understand the need to preserve their cultural traditions of fishing and pass on resources to future generations.

As part of the program, scientists and fishers in Palauan communities held meetings to discuss findings and options. Some the options identified were to set minimum size limits when harvesting fish and to close some areas to fishing until fish stocks recovered. Training local fishers to collect data on fisheries serves as a low-cost solution for monitoring changes in the data and assists in making management decisions.[215]

[212] Carl Safina, "Fishermen In Palau Take On Role of Scientist To Save Their Fishery." *Voice Ocean Views*, November 5, 2013 (accessed February 24, 2015.)
[213]Ibid.
[214] Daric Palmquist and Carmen Revenga. "A Breakthrough for Data-Poor Fisheries Starts in Palau." Cool Green Science. October 24, 2013. (accessed February 23, 2015.)
[215] Daric Palmquist and Carmen Revenga. "A Breakthrough for Data-Poor Fisheries Starts in Palau."

**Figure 14: Measuring fish length as part of the Palau Stock Assessment Project. Credit: Andrew Smith[216]**

While not an active part of the currently proposed Palauan LMR, the program has applicability as a model. Encouraging meaningful discourse between local fishers and scientists could not only help with data collection, but also could significantly engage stakeholders on a meaningful level.

The Palau International Coral Reef Center (PICRC) is also involved in monitoring MPAs in the Palauan Protected Areas Network and has developed a protocol for monitoring protected areas across Palau.[217] According the PICRC 2012 annual report, this protocol "standardizes monitoring by providing guidance on objectives, sampling design, indicators, methodology and equipment."[218] While PICRC is focused on smaller sites, the preexisting institutional knowledge and area-specific literature and best practices will likely inform planning of the larger LMR.

Communications and Outreach

Palauan authorities have yet to indicate a formal communication platform or outreach strategy for the LMR, but numerous announcements from President Remengesau have promoted

[216] Ibid.
[217] Palau International Coral Reef Center, *2012 Annual Report* (accessed February 10, 2015).
[218] Ibid.

the nation's planned reserve on an international level. Starting with the early 2014 announcement of his LMR plans at the United Nations, a crowd-funding campaign called "Stand with Palau" commenced, that attempted to not only publicize, but in fact outsource some of the funding for the reserve.[219]

International advocacy is also not a new tactic for Palau. Despite its small size, the nation has been involved with the United Nations to change international law and conservation policy. As a result of these changes, Palau has been successful in curtailing destructive deep-sea bottom trawling, strengthening shark protections, and making progress on other environmental issues, to the extent that national statements claim some credit for current prioritization of ocean issues in the United Nation's development agenda.[220]

As above, insight into the Palau's stance on communication may be gained from observing its historical and current policies on outreach around the Protected Area Network MPAs, where NGOs work to reach local communities around Palauan MPAs. One is the Palau Conservation Society (PCS), a community-based organization that implements conservation activities and partnerships. The PCS interacts with the community through outreach programs such as a weekly radio show, school visits and community meetings, and is dedicated to fostering environmental awareness. According the Palau Conservation Society website, "In 2008, PCS's partner *Roll 'em Productions* conducted research and found that television was a preferred news source for individuals in the 45+ age group, which includes many of Palau's policymakers."[221] Centered on this evidence, PCS expanded its outreach mechanisms to television – it created a weekly show called *Environmental Update* that airs on the Oceania

[219] "Stand With Palau: Crowd-funding to Protect and Restore the Ocean." *Palau Oceans* (accessed February 12, 2015).
[220] Ibid.
[221] "Public Outreach and Environmental Awareness." *Palau Conservation Society* (accessed February 12, 2015).

Television Network.[222] The PICRC also focuses on educating the public about "the ecological, economic and cultural importance of coral reefs," providing amenities for researchers, and collaborating with institutions, NGOs, researchers, and traditional leaders.[223]

## Conclusion

Although the ultimate success of Palau's proposed LMR is impossible to predict, useful observations may still be drawn from both preliminary processes and the national stance toward conservation, as demonstrated by its Protected Areas Network. As awkward as President Remengesau's unilateral declaration certainly appears to have made the subsequent political process, it is important to consider whether his bold move was to further leverage the political will of a nation already dedicated to broad conservation, and force the hand of international actors on the public stage. If nothing else, it appears Palau is genuine in its goals of addressing overfishing, ocean acidification, and whole-biome conservation.

[222] Ibid.
[223] Palau International Coral Reef Center, *2012 Annual Report.*

**The Great Barrier Reef Marine Park: An Interdisciplinary and Participatory Success**

Incorporating interdisciplinary approaches and involving local communities in the implementation of LMRs is essential to a reserve's effectiveness. Australia's Great Barrier Reef Marine Park (GBRMP) serves as a prime example of these processes. The GBRMP spans 344,400 square kilometers across Australia's Northeastern coast and includes the world's largest coral reef ecosystem.

In 2004 that the Australian Parliament approved final plans to substantially increase the percentage of no-take areas in the GBRMP, as both tourism and local fishing are significant industries that provide income for coastal communities in Queensland. Two key committees – the Scientific Steering Committee and the Social, Economic, and Cultural Committee – designed guiding principles. The latter was used to maximize positive impacts on the ecosystem while also minimizing negative effects on marine users.

Public opinion was essential to the successful implementation of this LMR. Over 31,000 public comments were taken into consideration. This helped shape a zoning plan that considered biophysical goals, such as greater biomass and biodiversity, and socioeconomic impacts on the coastal communities. In the last redesign of the park, the Australian government utilized scientific research and participatory planning to determine additional no-take regions, resulting in a 33 percent increase of no-take areas.

Unfortunately, a well-designed LMR does not guarantee success in effective conservation. Studies show that despite what is "generally seen as the best example of Ecosystem Based Management," coral cover has declined since the 2004 redesign of the park. Other coral health indicators, such as coral diversity, have also declined. These declines can be attributed to terrestrial runoff from agriculture, climate change, and ocean acidification.

Sources: *Australian Government: Great Barrier Reef Marine Park Authority; Belinda Jago et al., "Bringing the Great Barrier Reef Marine Park zoning into the 21st century: an overview of the representative areas program." Coast-to-Coast Conference, Hobart (2004); Great Barrier Reef Marine Park." Protect Planet Ocean; Jon Brodie et. al., "A critical review of environmental management of the 'not so Great' Barrier Reef." Estuarine, Coastal and Shelf Science;*

# Northwestern Hawaiian Islands

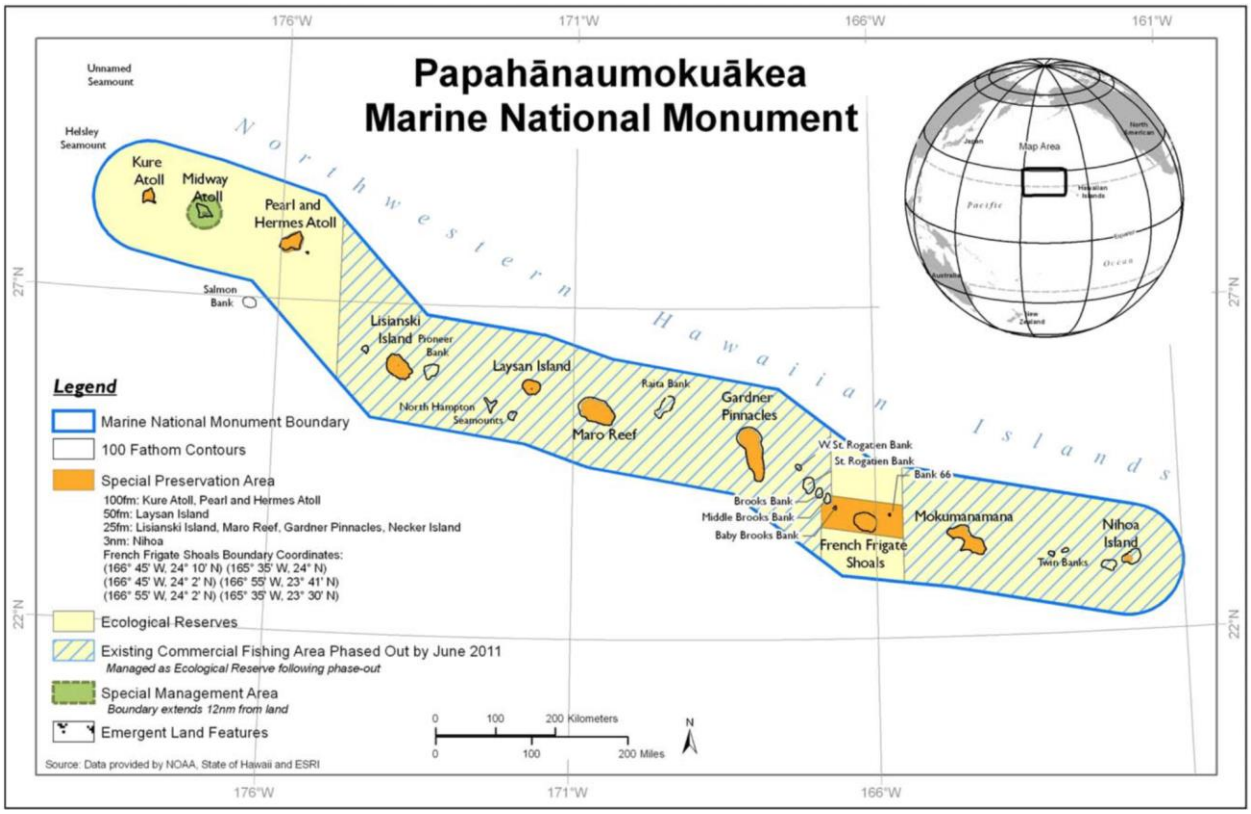


**Figure 15: Map of Papahānaumokuākea Marine National Monument and Zones**[224]

## Introduction

Presidential Proclamation 8031 established the Northwestern Hawaiian Islands Marine National Monument, or, Papahānaumokuākea Marine National Monument (PMNM), under the Antiquities Act on June 15, 2006.[225] At the time of establishment, the Monument was the largest no-take marine conservation area under United States management.[226] Although larger reserves have since been established, PMNM continues to rank among the most expansive LMRs in the

[224] "Papahānaumokuākea." *UNESCO World Heritage Centre* (accessed February 9, 2015).
[225] "About." *Papahānaumokuākea Marine National Monument* (accessed February 9, 2015).
[226] "Global Ocean Legacy - Hawaii." *Pew Charitable Trusts* (accessed February 3, 2015).

world, with a total area of 362,075 km$^2$.[227] As an established site, PMNM is widely considered a successful marine reserve.[228] However, the designation of PMNM, despite the overall receptive response from the world, was also contentious, as its final designation was a unilateral decision taken by then President George W. Bush.

With a total ban on commercial fishing and extractive activities enacted in 2010, PMNM also became the most extensive no-take marine reserve at the time.[229] Presently, minimal extractive activities are permitted for Native Hawaiian cultural usage, scientific research, and those residing on the Midway Atoll.[230] As a UNESCO World Heritage Site, the cultural and traditional aspects of PMNM are widely recognized. Despite the unilateral declaration of the reserve, cultural relevance was eventually acknowledged in the management process, prompting the incorporation of local interests in the establishment of the NWHI Coral Reef Ecosystem Reserve by President Clinton in 2000.[231]

The Northwestern Hawaiian Islands (NWHI) consist of islands, shoals, reefs, and atolls roughly 1,931 kilometers northwest of the main Hawaiian Islands (MHI).[232] Together, they make up the Hawaiian Archipelago, which hosts one of the most intact and resource-rich reef systems on the planet.[233] [234] Approximately 25 percent of the 7,000 known marine species are endemic to the region,[235] including 23 threatened or endangered species dependent on the unique ecosystem

[227] "Papahānaumokuākea." *UNESCO World Heritage Centre.*
[228] ʻAulani Wilhem, Skype interview with Yang Liu, February 5, 2015.
[229] "Global Ocean Legacy - Hawaii." *Pew Charitable Trusts.*
[230] John N. Kittinger et al., "Marine Protected Areas, Multiple-Agency Management, and Monumental Surprise in the Northwestern Hawaiian Islands." *Journal of Marine Biology* (2010): 2-3.
[231] Alan M. Friedlander et al., "Understanding the Scale of Marine Protection in Hawaiʻi: From Community-Based Management to the Remote Northwestern Hawaiian Islands." *Advances in Marine Biology: Marine Managed Areas and Fisheries* 69 (2014): 181.
[232] "Papahānaumokuākea." *UNESCO World Heritage Centre.*
[233] Alan M. Friedlander et al., "Contrasts in Density, Size, and Biomass of Reef Fishes between the Northwestern and the Main Hawaiian Islands: The Effects of Fishing down Apex Predators," *Marine Ecology Progress Series* 230 (2002): 254.
[234] Ibid.
[235] "About." *Papahānaumokuākea Marine National Monument.*

for their survival.[236] In comparison with the populated and heavily fished main Hawaiian Islands, PMNM has three times more shallow reef fish, consisting of "non-apex carnivorous and herbivorous fish."[237] In addition, more than half of the total fish biomass in the PMNM consists of apex predators as opposed to 3% in the MHI.[238] Management efforts from state and federal agencies continually strive to preserve the area from anthropogenic impacts, such as climate change and marine debris.

With the establishment of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve by President Clinton, Congress initiated the process to designate the reserve as a National Marine Sanctuary, following preexisting procedures from the National Marine Sanctuaries Act (NMSA).[239] However, designation of the area as a Marine National Monument by President Bush in 2006 superseded previous sanctuary designation efforts. The terms of Proclamation 8031 also extensively borrowed regulation and management concepts prepared for the planned National Marine Sanctuary.[240]

A recent proposal for the expansion of the Pacific Remote Islands Marine National Monument (PRIMNM) by President Obama, under the authority of the Antiquities Act of 1906, has sparked similar controversies as seen with the proclamation of PMNM.[241] Groups tasked with management of effective conservation in the U.S. Pacific Islands, such as the Western Pacific Regional Fishery Management Council, claim that the use of the Antiquities Act

[236] "Global Ocean Legacy - Hawaii." *Pew Charitable Trusts.*
[237] Friedlander et al., "Contrasts in Density, Size, and Biomass." 255.
[238] Alan Friedlander et al., "Understanding the Scale of Marine Protection in Hawai'i". 182.
[239] David Freestone. "Place-Based Dynamic Management of Large-Scale Ocean Places: Papahānaumokuākea and the Sargasso Sea," n.d., 203.
[240] Ibid., 204.
[241] "Consensus Statement from the Ad-Hoc Committee on the Socio-Cultural and Economic Impacts of Expanding the Pacific Remote Islands Marine National Monument (PRIMNM)." *Western Pacific Regional Fishery Management Council* (July 3, 2014): 1

bypasses public contributions and opinions in the process, and overlooks effective management systems and measures already in effect.[242]

Although there was resistance from some Hawaii residents and fishing organizations, the benefits that stem from the strengthening of existing protection factors, in addition to the implementation of novel ones, greatly contribute to the preservation of the Monument. PMNM's efforts to connect both cultural and natural heritage also serve as an example of the benefits of the integration of social and ecological sciences in marine reserves.[243] Collaborative efforts between federal and state agencies have strengthened management processes and lessons learned from the Monument have helped shape best practices in other areas.

Representation and Transparency in Design, Implementation, and Monitoring

Protection of the islands began with the creation of the Hawaiian Islands National Wildlife Refuge in 1909.[244] A number of federal conservation areas were already in existence prior to the establishment of PMNM, and have since been incorporated into the reserve.[245] The establishment of the Monument led to the establishment of three agencies, NOAA, the US. Fish and Wildlife Service (USFWS), and the State of Hawaii, Department of Land and Natural Resources, (DLNR), as co-trustees of the area.[246] With the co-management system of PMNM, the co-trustees instituted a Memorandum of Agreement (MOA), which created the Monument Management Board (MMB) as the core of the decision-making and managing process among the co-trustee agencies.[247] The MMB consists of seven members of representatives from NOAA,

[242] Ibid.
[243] 'Aulani Wilhelm.
[244] Friedlander et al., "Understanding the Scale of Marine Protection in Hawai'i." 181.
[245] Ibid.
[246] Kittinger, "Marine Protected Areas." 3.
[247] Ibid.

FWS, the State of Hawaii, and the Office of Hawaiian Affairs (OHA).[248] A Senior Executive Board oversees the actions of the MMB, and working groups exist below the MMB to facilitate and address any needs in the management process.[249] In addition, civic involvement in the current management of the Monument also includes stakeholders from various governmental and nongovernmental agencies and organizations, as well as academia and the public in general.[250]

To facilitate coordination and work towards the preservation and diversity of PMNM, the Monument Management Plan (Management Plan) established the framework for the Papahānaumokuākea Natural Resources Science Plan.[251] The objective of the Science Plan is to assist in the overall management of the Monument by providing necessary information for any management actions carried out.[252] Under the Science Plan are the Cultural Research Plan and Maritime Heritage Plan, which are both in the process of development. Both serve to address Native Hawaiian cultural and historic resources and their influence on the current management plans.[253]

The proclamation and numerous regulations that established the Monument charged the federal and state agencies, along with various partner agencies, with carrying out management process in the area. To provide a more suitable and area specific management, resource management works directly with the local agencies. Involvement with local communities began with the implementation of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve (NWHICRER) by President Clinton.[254] The NWHICRER serves to advise NOAA and the Office

[248] "Papahānaumokuākea: Marine National Monument, Hawai'i." *IUCN Evaluation Report* (2010).
[249] Ibid.
[250] "Papahānaumokuākea Marine National Monument: Natural Resources Science Plan." *Papahānaumokuākea Marine National Monument* (2011-2015).
[251] Ibid.
[252] Ibid.
[253] Ibid.
[254] "Guidelines on the Design and Management of Large-Scale MPAs." *Review Draft by IUCN,* Ver 4.2 (2014).

of National Marine Sanctuaries (ONMS) on various management-planning issues.[255] Of the twenty-five members on the council, fifteen represent community interests.[256] In addition, three of the fifteen seats in the Reserve Advisory Council are designated for Native Hawaiian representatives.[257] With the interest in the incorporation of native Hawaiian perspectives in the management processes, groups such as the Native Hawaiian Cultural Working Group, one of the reserve's co-managing agencies, work under the Reserve Council to provide direct Hawaiian community participation and recommendations in the management practices of PMNM.[258]

Enforcement

Although enforcement of the Monument continues to be a primary focus of the management process, it does not present the same magnitude of concern in comparison to other marine reserves, which likely stems from its isolation from human populations.[259] Illegal activities, such as illegal fishing, do occur within the Monument but such events are generally infrequent.[260]

Due to the vast size of the region, enforcement of the reserve requires collaboration between several state and federal agencies. The National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Services (USFWS), the U.S. Coast Guard (USCG), and a few others conduct enforcement of the Monument.[261] NOAA Office of Law Enforcement (OLE) ensures compliance by employing vessel-tracking systems (VMS) and

[255] Ibid.
[256] Ibid.
[257] Ibid.
[258] Ibid.
[259] Ibid.
[260] Ibid.
[261] Mark Richardson, "Protecting America's Pacific Marine Monuments: A Review of Threats and Law Enforcement Issues." *Marine Conservation Institute* (2012): 10-11.

performing routine inspections.[262] The USFWS operates two National Wildlife Refuges that are responsible for the protection of all islands, except Kure.[263] These refuges also include all reefs at Midway, as well as all reef areas to a depth of 10 fathoms.[264] The U.S. Coast Guard has jurisdiction for the enforcement and protection of 1.5 million square miles of American MPAs in the Pacific Islands, with PMNM under the watch of District 14 of the U.S. Coast Guard.[265] The capabilities of the Coast Guard to conduct both air and sea patrols make it the primary agency responsible for enforcement in the Monument. In terms of state waters, the State of Hawaii Department of Land and Natural Resources (DLNR), Division of Aquatic Resources (DAR) is responsible for the management of marine biodiversity extending out 3 nautical miles from all shorelines, with the exclusion of Midway Atoll.[266]

In addition to the overall management of the Monument, specific management plans also deal with the marine mammals and preventive measures for protection from invasive species.[267] Designation by the International Maritime Organization (IMO) of PMNM as a Particularly Sensitive Sea Area (PSSA) and an Area to be Avoided (ATBA) all contribute to monitoring efforts.[268] [269] This designation implements measures to prevent areas with ecological and cultural significance, such as coral reefs and shipwrecks, from harm,[270] including vessel routing and

[262] Ibid., 10.
[263] Hawaii Department of Land and Natural Resources, *Northwestern Hawaiian Islands/Kure Atoll Assessment and Monitoring Program,* by William J. Walsh, Ryan Okano, Robert Nishimoto, and Brent Carman. NA070A0457. (Honolulu, HI, 2002). 3.
[264] Ibid.
[265] Richardson, "Protecting America's Pacific Marine Monuments". 10-11.
[266] Hawaii Department of Land and Natural Resources, "*Northwestern Hawaiian Islands"*. 3.
[267] Katherine Peet, "Establishing Large-Scale Marine Protected Areas in the U.S." (Master's Thesis, University of Washington, 2014), 10-11
[268] "Strategy for Clarifying Enforcement." *NOAA*.
[269] "Papahanaumokuakea Marine National Monument Designated a 'Particularly Sensitive Sea Area.'" *Ocean News & Technology* 14, no. 3 (2008): 20–21.
[270] "Strategy for Clarifying Enforcement Needs and Testing Enforcement Measures," *National Oceanic and Atmospheric Service* (January 2010).

equipment usage.[271] In addition, the IMO established reporting requirements listed in the U.S. Code of Federal Regulations for all ships traveling through PMNM waters.[272]

Invasive species are a serious concern within the Monument.[273] Invasive species have a direct impact on native ones as they compete for the same limited resources. The Resource Protection Program at PMNM responds to this threat with a detailed management effort including a permit system for vessel inspection and disinfection programs for all ships entering the Monument. [274] [275] Inventory and monitoring of all alien species is conducted to ensure early detection if efforts are needed to address these issues.[276]

Mitigating Negative Impacts

In January of 2010, the National Marine Fisheries Service announced that all commercial fishing would cease in the Monument with the closure of the last fishery in 2011, generating controversies.[277] The profitability of lobster and bottomfish fisheries in the 1970s and 1980s led to an increase in economic yield from the region, and their closure with the establishment of the NWHI Coral Reef Ecosystem Reserve in 2010 led to arguments regarding their importance to the main Hawaiian islands' economy, as they not only provided jobs but also provided marine products to local businesses. Ultimately, the industries received roughly 20 percent of the funding towards the establishment of PMNM as compensation for their displacement.[278]

[271] Peet, "Establishing Large-Scale Marine Protected Areas in the U.S." 10
[272] Ibid.
[273] "Education and Outreach." *Papahanaumokuakea Marine National Monument.* (accessed February 16, 2015).
[274] "Science and Research." *Papahanaumokuakea Marine National Monument* (accessed February 16, 2015).
[275] "Education and Outreach."
[276] Ibid.
[277] Friedlander et al., "Understanding the Scale of Marine Protection in Hawai'i." 182.
[278] Ibid., 184.

Research and Monitoring

Research is a critical component in PMNM and there are many ecological, cultural, and maritime studies that have been conducted at the Monument.[279] The Coral Reef Research Program has focused on the characterization of habitats that lie within the reserve. Surveys of the reef systems in PMNM have also been conducted to record the population density and diversity of various marine species in various locations of the reserve.[280] Additionally, deep-water observations have been conducted to gather information about little-known species and habitats found far below sea level. These research efforts will all serve to assist in the further development of LMR management plans.[281]

Along with this research, the main stakeholders involved in PMNM are working on a 15-year science plan, which focuses on the research that is necessary in the management process and "builds on extensive discussions, planning, and prioritization efforts conducted over the last 5 years."[282] The plan presents five focus areas for further analysis: "habitats and biodiversity, ecological processes and connectivity, human impacts, indicators and monitoring of ecosystem change, and modeling and forecasting of ecosystem change."[283] This research will in turn inform management needs and further research on the biological and ecological aspects of the marine organisms and their habitats, as well as the natural differentiations that serve to characterize the marine ecosystems, which will improve the protection provided to the Monument.[284]

The Northwestern Hawaiian Islands Research Partnership, a "research partnership between the Hawai'i Institute of Marine Biology and … the Papahānaumokuākea Marine

[279] "Papahānaumokuākea Marine National Monument: Natural Resources Science Plan." *Papahānaumokuākea Marine National Monument* (2011-2015).
[280] Ibid
[281] Ibid.
[282] Ibid.
[283] Ibid.
[284] Ibid.

National Monument,"[285] works to integrate science in the management process to better understand the issues associated with LMRs. Although research had been done in the NWHI for years prior to the establishment of the Monument, the partnership between the Hawaii Institute of Marine Biology and the NOAA has placed research emphasis on "understanding connectivity through movement patterns and genetic population structures," coral reef health, as well as the monitoring of marine ecosystem threats.[286] While marine biomass was at an estimated 20 percent of pre-exploitation biomass, the Monument has currently recovered to 80% of pre-exploitation biomass.[287]

Most social science research was conducted in the early design phase, including collaboration with the Hawaii Institute of Marine Biology examining social impacts.[288] There has been limited oral history work on usage of Northwestern Hawaiian Islands sites by people from Kauai.[289] Members of NOAA are interested in pursuing human dimensions research, but budget limitations are been difficult to overcome.

Coral reef ecosystems have long played a vital role in cultural practices and sustenance of the native people. Human activities and environmental impacts including overexploitation and various pollutants have all led to an increase on the focus of MPAs and LMRs. The ecosystem provides habitat for a variety of species.

[285] Carlie S. Wiener et al., "Creating Effective Partnerships in Ecosystem-Based Management: A Culture of Science and Management." *Journal of Marine Biology* 2011 (2010). 1.
[286] Ibid., 4.
[287] Friedlander et al., "Understanding the Scale of Marine Protection in Hawai'i." 157.
[288] 'Aulani Wilhelm.
[289] Ibid.

Communications and Outreach

Four major public outreach campaigns have been conducted since the creation of the NWHI Coral Reef Ecosystem Reserve by President Clinton in 2000;[290] [291] the first being a push for the protected area in 2000 by native Hawaiian leaders, then again after the Monument's establishment.[292] A campaign with National Geographic also included photo exhibits and coffee table books that provided influential photos illustrating the variety of wildlife in the marine ecosystem, furthering the awareness of LMRs to the general public (Figure 16).[293]

**Figure 16: Image of a Moray Eel in Red Algae from National Geographic Campaign[294]**

In addition to the direct state and federal agency associations, PMNM has also incorporated a variety of outreach strategies in conjunction with the integration of scientific research and traditional ecological knowledge. This includes the involvement of local agencies and communities in the initial design phase of the protected area, as well as the incorporation of

[290] Friedlander et al., "Understanding the Scale of Marine Protection in Hawai'i." 157.
[291] 'Aulani Wilhelm.
[292] Ibid.
[293] Ibid.
[294] David Liittschwager and Susan Middleton, "Hawaii's Outer Kingdom." *National Geographic,* October 2005 (accessed February 28, 2015).

scientific research with an ecosystem-based management, and cultural understanding.[295] The Northwestern Hawaiian Islands Research Partnership (NWHI-RP) serves as an example with its communication plans including interdisciplinary outreach programs to encourage local and public involvement.[296] Scientists have been able to present their research and findings both within the partnership and to the public, as well as publications.[297] As of 2011, research from the partnership has reached 27,000 people since 2007 through various public and community events and institutional presentations.[298]

Collaborations with the Hawaii Institute of Technology and various other academic institutions have also brought scientists and cultural practitioners together to conduct interdisciplinary research through expeditions to the protected area.[299] Annually, numerous local community outreach events on the main Hawaiian Islands are conducted by the Monument agency, including educational activities, conferences, and interactive events.[300] Through partnering agencies, PMNM is currently shown on maps in schools, building basic awareness of the Monument in the public at an early age. The publishing of state atlases with the incorporation of PMNM and its boundaries is also considered a tangible advancement.[301]

## Conclusion

PMNM, as one of the most established LMRs, illustrates the potential of an extremely large, well-resourced reserve. While challenges are present with reserves of this vast size in addition to anthropogenic threats, collaborative efforts between state and federal agencies have

[295] Wiener et al., Creating Effective Partnerships." 6.
[296] Ibid.
[297] Ibid.
[298] Ibid.
[299] 'Aulani Wilhelm.
[300] "Get Involved." *Papahanaumokuakea Marine National Monument* (accessed February 16, 2015).
[301] 'Aulani Wilhelm.

created robust processes that simultaneously protect the Monument and deepen institutional understanding of best management practices. The integration of cultural, indigenous, and scientific understandings in administration of the Monument serves as an illustration of the potential of LMRs.

## Case Studies Conclusion

These case studies represent a broad cross-examination of the major challenges facing LMRs as conservation tools and highlight their tremendous potential in the same vein. While the success of the Hawaiian case is a clear example of the potential for LMRs as tools managed by governments with world-class enforcement and monitoring capabilities, more complicated cases, such as New Caledonia, point to the feasibility of large reserves even in developing nations, provided strong community engagement is achieved. Likewise, from the momentum of Palau's nationwide commitment to conservation, coupled with the challenge of backing a unilateral declaration with legislation produced in a democratic process, powerful lessons can learned about the need for careful planning and coordination between both national political leaders and outside conservation groups hoping to affect partnership-based LMRs.

These varying contexts offer a window into the multitude of ecological, political, and socioeconomic configurations LMRs may assume as policy instruments – and the real effects decisions within them have across ecosystems and cultures. At the same time, for all the diversity and specificity of the cases presented, the encountered challenges and successes often typify LMR design and implementation. Drawing on the experiences of New Caledonia, Palau, and the NWHI as archetypal, the thematic framework established in the first part of this paper may be further developed, to provide a foundation for the exploration of best management practices in marine conservation in the next section.

# Strategic Action Plan

## Introduction

The large marine reserve (LMR) case studies in New Caledonia, Palau, and the Northwestern Hawaiian Islands (NWHI) were selectively chosen for this report, as they all serve as examples to inform current and future LMRs. Each case study uniquely addresses the themes of representation and transparency, negative impact mitigation, enforcement, research and monitoring, and communications and outreach, and each case has varying degrees of effectiveness in design, implementation, and monitoring processes. From these analyses, strategic recommended actions have been distilled to successfully establish and maintain LMRs. The Strategic Action Plan simultaneously confronts management gaps acknowledged in both the Introduction and Case Studies sections and articulates a framework of strategic actions. Implementing these strategic actions will situate the Pew Charitable Trusts' GOL campaign at the leading edge of effective ocean conservation.

This Strategic Action Plan focuses on gaps and shortcomings in an attempt to suggest means to further improve LMRs in these and other sites. In the LMRs of New Caledonia, Palau, and NWHI, adequate representation of all stakeholders has not been executed to an extent necessary for successful implementation. The *Parc naturel de la mer de Corail* and the PMNM have used some degree of stakeholder participation. Palau has not, partially because that LMR is at an early development stage. Additionally, in many cases the implementation process has not been transparent and open to public council. Although some effort has been made in the NWHI and New Caledonia to participate in the Big Ocean learning network, and public education efforts have been made in Palau, greater efforts are needed to communicate complex information in an understandable and relatable manner to target audiences. Moreover, efforts to mitigate

negative impacts felt by those affected by LMR implementation have been insufficient. Enforcement remains a challenge in most contexts, and satellite surveillance – notably, boat tracking technology – is not employed consistently. There are opportunities to strengthen educational programs related to LMR rules and enforcement and to generate awareness of the LMR by actively engaging local communities and the general public. This plan suggests ways to monitor and evaluate progress, and defines opportunities to improve LMR management effectiveness. Notably, research and monitoring in New Caledonia, Palau, and the NWHI should balance the social and environmental sciences in their monitoring strategies. Adaptive management should draw upon this information to address emerging challenges as they develop.

The following table summarizes the recommended actions to improve LMR effectiveness. Each recommended action is based on the gaps addressed in the Introduction and the New Caledonia, Palau, and NWHI case studies. Recommended actions have been ranked by priority considering analyses of peer reviewed literature, MPA guidebooks, and discussions with MPA and LMR managers. Following the table is an infographic encapsulating the main themes of this report and the Strategic Action Plan.

Table 1: Recommended Actions for the Global Ocean Legacy Campaign

| Themes | Selected Recommended Actions | Priority [1 is highest] |
|---|---|---|
| Representation | • Identify stakeholders and ensure stakeholder involvement throughout processes<br>• Keep processes as transparent and publicly accessible as possible<br>• Establish a learning network between both local marine reserves and international organizations<br>• Explicitly define and codify objectives for designing, implementing, and managing an LMR at the onset<br>• Facilitate productive partnerships through ground rules, cooperation, and a balance of power<br>• Create an LMR management plan in a transparent and participatory manner that is context appropriate | 1 *(1.1 for narrative) Pg. 78*<br>2 *(1.2 for narrative) Pg. 79*<br>3 *(1.2 for narrative) Pg. 79*<br>4 *(1.2 for narrative) Pg. 79*<br>5 *(1.2 for narrative) Pg. 79*<br>6 *(1.2 for narrative) Pg. 79* |
| Enforcement | • Implement educational and awareness programs within region directly affected by LMR<br>• Implement satellite surveillance – Automatic Identification System (AIS) and Vessel Monitoring System (VMS tracking)<br>• Use violation punishments – graduated monetary sanctions, gear/vessel seizures, or fishing permit revocation<br>• Increase at-sea presence using support from international agencies, such as the U.S. Coast Guard (USCG), the National Oceanic and Atmospheric Administration (NOAA), or national navies<br>• Foster stronger cooperation between governments and fishery management programs<br>• Use existing social media and mobile technology to increase enforcement capacity and engage stakeholders in enforcement efforts | 1 *(2.2 for narrative) Pg. 86*<br>2 (2.*6 for narrative*) *Pg. 89*<br>3 *(2.5 for narrative) Pg. 89*<br>4 *(2.4 for narrative) Pg. 88*<br>5 *(2.7 for narrative) Pg. 90*<br>6 *(2.3 for narrative) Pg. 87* |
| Impacts | • Mitigate negative impacts of LMR using a variety of compensation and incentive-based approaches (i.e., additional livelihood options, direct payment, alternative fishing locations)<br>• Use adaptive management to adjust mitigation techniques to best suit LMR site<br>• Increase transparency of benefits and negative impacts: which stakeholder receives specific benefits and costs<br>• Inform stakeholders when negative impacts will be felt | 1 *(3.1 for narrative) Pg. 92*<br>2 *(Intro for narrative) Pg. 95*<br>3 *(3.2 for narrative) Pg. 94*<br>4 *(3.2 for narrative) Pg. 94* |
| Research & Monitoring | • Balance social science and environmental science using interdisciplinary techniques<br>• Implement monitoring strategies and indicators to make sure data is collected correctly and efficiently upon inception of an LMR<br>• Develop an effective monitoring strategy that helps an LMR reach its goals and objectives<br>• Design a monitoring strategy that considers a diverse audience (i.e., stakeholders, local community members, and NGOs, among others)<br>• Select monitoring methods that will facilitate data collection by identifying who, when, where, why and how data will be collected. | 1 *(4.1 for narrative) Pg. 95*<br>2 *(4.5 for narrative) Pg. 98*<br>3 *(4.3 for narrative) Pg. 97*<br>4 *(4.2 for narrative) Pg. 97*<br>5 *(4.4 for narrative) Pg. 98* |
| Communications & Outreach | • Generate awareness while communicating complex and essential information<br>• Create partnerships with scientific, recreational and business community<br>• Promote international public awareness using social media platforms. | 1 *(5.1 for narrative) Pg. 104*<br>2 *(5.2 for narrative) Pg. 105*<br>3 *(5.3 for narrative) Pg. 105* |

## Representation and Transparency in Design, Implementation, and Monitoring

### 1.1 Stakeholder Identification

Stakeholders can be described as: "Individuals, groups or organizations who are, in one way or another, interested, involved or affected (positively or negatively) by a particular project or action toward resource use."[302] Some stakeholders hold considerable political and economic influence over resources, depending on their historical dependence or economic interest, among other concerns. Due to this political and economic influence over resource allocation and processes, stakeholders need to be properly identified before establishing an LMR. Stakeholder identification is a process by which LMR policymakers identify discrete social groups and their vested interests in an LMR.[303] Conducting stakeholder identification early in the planning process will reduce unintended consequences of LMR policies and regulations by categorizing impacts of proposed reserves and determining mitigation or compensation strategies. To make sure stakeholders are not overlooked, it is imperative that identification is conducted methodically. One method to identify stakeholders is by the possession of one or several of these attributes: the stakeholder's power to influence the policy; the legitimacy of the stakeholder's relationship with the policy; the extent to which the stakeholder will be influenced by the policy; the networks and coalitions to which stakeholders belong; and/or the urgency of the stakeholder's claim on the policy.[304]

[302] Robert S. Pomeroy et al. *Fishery co-management: a practical handbook*. CABI, 2005.
[303] Pomeroy et al., "How is your MPA doing?" 485-502.
[304] Ronald K. Mitchell et al., "Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts." *Academy of Management Review* 22, no. 4 (1997): 854.

**Recommended Actions:**

- Identify stakeholders for an LMR. Possible stakeholder groups associated with LMRs are: groups representing commercial and recreational fishers, non-consumptive users, conservation organizations, resource managers, indigenous peoples, and state and federal agencies.
- Identify the obligations involved with establishing an LMR. This could include the obligations of governments, NGOs, or local law enforcement.

1.2 Stakeholder Involvement and Transparent Planning

The long-term effectiveness of marine reserves often depends on whether stakeholder involvement in design and implementation processes has been sufficient to encourage compliance, especially for areas with weak governance.[305] Stakeholder participation can enhance information exchange, encourage accountability, build confidence in the decision-making process, and facilitate stakeholder collaboration – leading to mutually acceptable solutions.[306] [307] Early and consistent participation can result in informed, invested users, who are more likely to support and adhere to rules they helped establish,[308] potentially avoiding future conflict and delay, which may save time and money over the life of the LMR. Stakeholder involvement has been empirically shown to make resource management initiatives more justifiable and reflective of local situations, creating a more cohesive and coherent experience for community

[305] S.F. Walmsley and A.T. White, "Influence of social, management and enforcement factors on the long-term ecological effects of marine sanctuaries." *Environmental Conservation* 30 (2003): 388–407.
[306] IUCN World Commission on Protected Areas (IUCN-WCPA), "Establishing Marine Protected Area Networks—Making It Happen." Washington, D.C.: *IUCN-WCPA, National Oceanic and Atmospheric Administration and The Nature Conservancy*, (2008): 118.
[307] Peter J.S. Jones, "Marine protected area strategies: issues, divergences and the search for middle ground." *Reviews in Fish Biology and Fisheries* 11 (2002): 197–216.
[308] Eric L. Gilman, "Community based and multiple purpose protected areas: A model to select and manage protected areas with lessons from the Pacific Islands." *Coastal Management* 25, (1997): 59–89.

stakeholders.[309] In fact, community participation has been credited as being one of the main factors contributing to the success of the Great Barrier Reef Marine Park (GBRMP); in 2002, over 31,000 public comments were collected during a zone redefinition process, exceeding levels required by legislation.[310] Such levels of public participation incurred costs in resources and time, but the final outcome was considered worthwhile and cost-effective in the long term,[311] as public participation increased compliance with regulations.[312] Whether the GBRMP will be able to address all environmental stresses is unlikely, but the public engagement process, use of scientific data, and re-zonation scheme are widely considered successful. Global comparative MPA and fisheries management studies similarly demonstrate the essential nature of collaborative planning, and the importance of considering social and ecological processes simultaneously in planning.[313] [314] [315]

Research has demonstrated that clear and enforceable rules are positively correlated with improved performance of marine protected zones.[316] Clear rules will foster commitment to the negotiation process and will facilitate constructive stakeholder interactions. Once objectives are established, it becomes possible to frame the issues requiring resolution, establish a plan for working through said issues, and develop a strategy for addressing potential obstacles and

[309] Svein Jentoft et al., "Social theory and fisheries co-management." *Marine Policy* 22 (1998): 423–436.
[310] James Innes et al., "Managing, analyzing and presenting public submissions to achieve marine park planning outcomes: an example from the Great Barrier Reef Marine Park." *The Planning Institute of Australia* (2004).
[311] Jon Day, "Zoning lessons from the Great Barrier Reef Marine Park." *Ocean and Coastal Management* 45 (2002): 139–156.
[312] Jon Day, "The need and practice of monitoring, evaluating and adapting marine planning and management—lessons from the Great Barrier Reef." *Marine Policy* 32, no. 5 (2008): 823-831.
[313] Richard Pollnac et al. "Marine reserves as linked social–ecological systems." *Proceedings of the National Academy of Sciences* 107, no. 43 (2010): 18262-18265.
[314] Food and Agriculture Organization of the United Nations, *Fisheries management: Marine protected areas and fisheries* (Rome: *FAO Technical Guidelines for Responsible Fisheries*. No. 4, Suppl. 4, 2011, 14
[315] Gutiérrez et al., "Leadership, social capital and incentives promote successful fisheries." 386-389.
[316] Michael B. Mascia, "Designing effective coral reef marine protected areas." *Report IUCN/WCPA-m* (Washington DC 2001).

sensitivities.[317] Unclear objectives and inattention to social dynamics have resulted in conflict that manifests in various and complex forms and can derail progress.[318] Because different stakeholder sectors value ecosystems in different ways, the best way to mitigate conflict is through partnerships and transparency.[319]

Furthermore, the planning process of an LMR needs to be transparent – including intentions, design, and impacts – as support for spatial conservation is likely to increase when affected stakeholders are adequately informed and have confidence in the integrity of the decision-making process.[320] When the affected stakeholders are not adequately informed or feel marginalized, the effectiveness of the LMR can be compromised. For example, in La Parguera in Puerto Rico, the regional fishers felt inadequately consulted in the development of the management plan, and were wary of government interference with 'their' resources. Meetings held on the issue were conducted in English, discouraging full participation and angering many locals. This lack of adequate communication ultimately resulted in the noncompliance of the community.[321]

Moreover, planning processes need to be established to eliminate power imbalances that undermine project effectiveness and allow for equal access to information.[322] When working with local communities, meetings and materials should be available in their native language, which will encourage stakeholder representation and involvement in the LMR implementation

[317] Scott McCreary et al., "Applying a mediated negotiation framework to integrated coastal zone management." *Coastal Management* 29 (2001): 183–316.
[318] Franklin E. Dukes and Karen Firehock, "Collaboration: A guide for environmental advocates." *Institute for Environmental Negotiation* (University of Virginia, 2001).
[319] Jones, "Marine Protected Area Strategies." 201.
[320] Fanny Douvere, "The importance of marine spatial planning in advancing ecosystem-based sea use management." *Marine Policy* 32.5 (2008): 762-771.
[321] Shirley J. Fiske, "Sociocultural aspects of establishing marine protected areas." *Ocean & Coastal Management* 17.1 (1992): 25-46.
[322] Chris Cocklin et al., "Marine reserves in New Zealand: Use, rights, public attitudes, and social impacts." *Coastal Management* 26 (1998): 213–31.

and planning phases. On a local level, transparency can be improved by engaging the local community. On an international scale, transparency can be promoted by outreach campaigns that reflect the intentions and effects of the LMR, such as the Barry the Wrasse campaign, a very positive advertisement promoting the Coral Sea Marine Reserve.[323]

Learning networks are one effective form of stakeholder involvement. Networks are "both a governance structure and a process of socialization through which disparate actors and organizations are connected in a coherent manner for mutual benefits and synergies."[324] Networks promote coordination by connecting stakeholders and involved institutions. For example, communities in the Philippines have formed learning networks by sharing information and experiences through newsletters, e-mail, and a growing list of loose organizations,[325] learning from the ecological, planning, or administrative experiences of other managers.[326] One such effective network is the national alliance of community-based MPA managers, the PAMANA Ka Sa Pilipinas Inc., composed of local representatives from municipal marine sanctuaries.[327] Another example is Big Ocean, "the only peer-learning network created 'by managers for managers' of large-scale marine areas," whose main objective is to support those involved in the growing field of LMRs.[328] While it is still an emerging area of LMR implementation, learning networks have immense potential.

[323] "Protect Our Coral Sea." *Save Our Marine Life* (accessed February 4, 2015).
[324] Henry Wai-chung Yeung, "Organizing 'the firm' in industrial geography I: networks, institutions and regional development." *Progress in Human Geography* 24, no. 2 (2000): 301-15.
[325] Alan White et al. "Scaling up to networks of marine protected areas in the Philippines: biophysical, legal, institutional, and social considerations." *Coastal Management* 37, no. 3-4 (2009): 274-290.
[326] Ibid., 287
[327] Alan White, et al. "Integrated coastal management in Philippine local governance: Evolution and benefits." *Coastal Management* 34.3 (2006): 287-302.
[328] "Big Ocean- Purpose and Aims." *Big Ocean* (accessed February 20, 2015).

**Recommended Actions:**

- Contact and organize stakeholders and interest groups to facilitate participation. Have each stakeholder group nominate a spokesperson.
- Minimize power imbalances and ensure access to information to encourage equal representation.
- Explicitly define and codify objectives for designing, implementing, and managing an LMR at the onset.
- Frame stakeholder involvement as a 'partnership', where the government works directly with recognized stakeholders and communities to jointly make management decisions.[329]
- Involve stakeholders in design, implementation, and monitoring processes by establishing channels through which they can voice their opinions and concerns.
- Hold regular panels to discuss plans and issues of the LMR in the native language of the region. Provide educational material about the LMR.
- Schedule and market public meetings to maximize awareness and accessibility.
- Promote transparency using international campaigns that reflect the intentions and effects of the LMR.
- Support GOL sites by establishing or joining a learning network, such as Big Ocean, to facilitate information-sharing and encourage stakeholder participation.

1.3 Implementation of LMR Management Plan

The development and implementation of an LMR management plan is vital in guiding the LMR process. The objective is to have broad participation in the design process, maximize and

[329] Michelle Voyer et al., "Methods of social assessment in Marine Protected Area planning: Is public participation enough?" *Marine Policy* 36.2 (2012): 432-439.

diversify benefit distribution, and mitigate negative effects. In certain instances, when a particular strategy proves ineffective, adaptation is necessary. Adaptations to an LMR's management plan may be considered, but only after a thorough evaluation of ecological and socioeconomic effects.[330] In other words, management plans should not be static documents. New knowledge and understanding of the marine reserve can affect future management decisions. Strategies and objectives often need to be flexible to reflect changes in a reserve's conditions, the surrounding community, the knowledge base, and the regulatory environment.[331]

**Recommended Actions:**

- Define membership and responsibilities of a management committee, involving various key stakeholders from different levels of society.
- Draft a local resolution or ordinance to establish the reserve and encourage citizen participation in national policies.
- Create an LMR management plan in a transparent and participatory manner that is context appropriate.

## Enforcement

### 2.1 Need for Comprehensive Enforcement System

A comprehensive enforcement system is crucial for an LMR to maintain its social and ecological effectiveness. The absence of sufficient regulatory authority and enforcement techniques results in reduced cooperation amongst stakeholders, restricting the effectiveness of

[330] Oregon Department of Fish and Wildlife, *Redfish Rocks Marine Reserve: Site Management Plan*, by David Fox et al., ODFW (2012): 9.
[331] White, *Creating and Managing Marine Protected Areas in the Philippines.* 19.

community compliance.[332] Static regulatory regimes often create systemic imbalances or weaknesses that are compounded over time, while at the same time, systems that fail to adapt can actually incentivize the gradual evolution of compliance-avoidance strategies. Further, when fishers do not see imposed regulations as legitimate, they are more likely to violate them. For this reason, the implemented enforcement system must take legitimacy into consideration. Additionally, being in a marine environment, LMR boundaries can be difficult to specifically define, and thus challenging, expensive, and time-consuming to police. Consequently, technology and at-sea policing methods make up a large portion of LMR budgets. For example, enforcement and surveillance activities accounted for one-third of the annual budget of the Great Barrier Reef Marine Park in Australia.[333] Yet despite the high costs of enforcement, research has shown that economic and ecological benefits can outweigh the initial costs if policies allow local fishers to benefit from environmental improvement.[334]

2.2 Local Involvement: Education/Awareness Programs

Regulation compliance will be low if marine resource-users perceive policies and enforcement to be illegitimate. Users may also be simply unaware of regulations, resulting in accidental noncompliance. Education programs can thus support enforcement systems and increase awareness of the LMR. Although not a form of active enforcement, these programs increase legitimacy and compliance of LMR regulations. They are also less expensive than other enforcement activities. It was estimated that the education costs for the management of the Great Barrier Reef Marine Park were approximately one-tenth the cost of active enforcement

[332] National Oceanic and Atmospheric Administration and National Marine Protected Areas Center, *Enforcing US marine protected areas: synthesis report*, by Braxton C. Davis and Greg S. Moretti (Silver Springs, MD, 2005).
[333] Peter McGinnity, "MPA Enforcement: Practitioners Employ Mix of High-Tech and Community-Based Strategies." *MPA News* 2, No. 5 (2000).
[334] Katrina Davis et al., "Accounting for Enforcement Costs in the Spatial Allocation of Marine Zones." *Conservation Biology* (2015): 226-37.

programs.[335] These programs are not a replacement to traditional enforcement, but could be used as a crucial supplement.

**Recommended Actions:**

- Implement education and awareness programs tailored for a specific location and local community. Such programs increase transparency and foster local investment.
- Include larger scale awareness programs aimed at the commercial and recreational industry. Education and awareness material can be distributed by an official at-sea enforcement team when encountering users, or at local ports.
- An education program can be required for fishers obtaining their fishing permits.

2.3 Local Involvement: Self-Enforcement

The term 'self-enforcement' refers to the actions taken by local-users to deter violations by other IUU users.[336] Establishing a system could be remarkably easy, as cell phones are nearly ubiquitous in many developing nations. For example, between 70-80% of people in Indonesia and the Philippines own cell phones[337] The widespread use of Internet and mobile technology could be leveraged for enforcement purposes, with little additional expense to LMR management. With the proper use of education and outreach, a violation reporting system, and mobile devices, a system of self-enforcement could be established that would be relatively inexpensive, engage the local community, and increase rule compliance.

[335] Jackie Alder, "Have tropical marine protected areas worked? An initial analysis of their success." *Coastal Management* 24.2 (1996): 97-114.
[336] MPA Synthesis Report, *NOAA*.
[337] "Emerging Nations Embrace Internet, Mobile Technology." *Pew Research Centers Global Attitudes Project RSS,* February 13 2014 (accessed February 4 2015).

**Recommended Actions:**

- Create a 'violation hotline' to report LMR violations within a community and to a central authoritative body. There would be both an official and informal aspect of this system. An unofficial system of emails and texts amongst locals will immediately alert a community of a violator. An official hotline could also alert official authorities.
- Provide incentives for reporting violators, if financially or materially feasible.

2.4 Governmental Involvement: Increased At-Sea Presence

Despite high cost barriers, at-sea enforcement can be effective in maintaining compliance by catching and penalizing violators. In the U.S. context, the Coast Guard, NOAA and the U.S. Fish and Wildlife Service continue to effectively enforce offshore marine protected areas, such as the Papahānaumokuākea Marine National Monument.[338] The Coast Guard is an important institution for marine conservation, with sufficient resources to conduct regular vessel boarding and inspections.[339] However, even in the U.S. context and especially in countries unable to afford a robust at-sea presence, government-led enforcement has mix effectiveness and may not be viable in many contexts with weak enforcement agencies.

**Recommended Actions:**

- In the U.S., increase federal funding for the Coast Guard and related enforcement agencies to increase law enforcement capabilities.[340]
- Use relatively well-funded governmental agencies, such as the U.S. Coast Guard, the NOAA Office of Law Enforcement (OLE), or the French Navy, to train enforcement

[338] Richardson, "Protecting America's Pacific Marine Monuments." 10-11.
[339] USCG. 2004. Coast Guard Shield of Freedom, Breaking the Ice. February 2004.
[340] MPA Synthesis Report, *NOAA*.

organizations in other regions hosting LMRs when possible. The specific collaboration will be context-dependent.

2.5 Governmental Involvement: Violation Punishments

An enforcement presence needs to be coupled with a system of sanctions to address LMR regulation violations. When imposing sanctions on violators, the nature, circumstances, history of prior acts, and extent of the acts must be taken into consideration. It is important to design a sanction system that is legally grounded, commensurate to violation severity, and context appropriate. [341] Establishing high initial sanctions can undermine the legitimacy of the LMR and create resentment, making the system more difficult to sustain.[342] The level of sanctions should depend on violator's abilities to pay.

**Recommended Actions:**

- Enact context-appropriate sanctions to dissuade violations.
- Employ graduated sanctions. Sanctions should be mindful of a violator's prior knowledge of regulations.
- If appropriate, consider gear and vessel seizures as a form of sanction.
- Suspend or revoke fishing permits for large-scale commercial operations.

2.6 Technologies

On-site enforcement is often difficult and costly in remote LMRs. Certain regions, such as Palau, cannot afford a large at-sea enforcement presence. The use of remote sensing

[341] Elinor Ostrom, *Governing the commons: The evolution of institutions for collective action,* (Indiana University, Cambridge University Press, 1990), 90
[342] Ibid., 94.

technologies has become a potentially effective and cost-effective alternative. Satellite Applications Catapult relies on data transmitted from vessels all over the world. The data originates from a ship's automatic identification system (AIS) and its vessel monitoring system (VMS). A ship's AIS broadcasts important information such as identity, position, velocity to nearby ships, coastal stations, and satellites.[343] All commercial vessels are required to carry an AIS, although they can be shut off by the captain. Thus, a fishing vessel would shut off its AIS to hide profitable fishing grounds from other vessels, or to evade authorities. However, commercial ships are also required to carry a VMS, which transmits data similar to AIS, but directly to authorities. A VMS relays information strictly to officials, so there is no excuse for disabling it. Using these two monitoring systems, fishing vessels can be tracked. Certain actions, such as turning off either of the monitoring systems or engaging in unusual fishing patterns such as slowing down or zigzagging (a technique used for tuna), will trigger a response from officials.

Remote sensing buoys are a system of sensors attached to a fiber-optic cable that sends real-time information to shore. Traditionally, this monitoring system has been used for water quality testing and whale observing, but the same technology can be applied as an enforcement tool. The buoys' sensors will transmit data to monitoring officials when vessels within their range. The ship can then be tracked using satellite imaging.

**Recommended Actions:**

- Utilize new monitoring system developed by Satellite Applications Catapult.
- Encourage the use of remote sensing buoys.

[343] "Dragnet." *The Economist Newspaper*, January 24 2015 (accessed February 4, 2015).

2.7 Treaties, International Cooperation, and Partnerships

There must be transparent coordination amongst non-governmental and governmental organizations to minimize the number of regulation violations. These organizations need to be involved in the development of site-level enforcement plans and priorities, as coordinating regulations can lead to a better allocation of limited funding. International agreements can also help improve enforcement. A lack of proper coordination may result in miscommunication between agencies and governments, rendering learning networks ineffective.

The Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated (IUU) Fishing, commonly called the Port State Measures Agreement or PSMA, is an international treaty adopted by national governments. PMSA deals with enforcement, but not in the traditional policing sense. Instead, it requires ports to exert greater controls on foreign-flagged ships trying to land prohibited fish for sale.[344] In theory, port states enforcing the treaty will refuse port-access to those engaging in IUU fishing. This treaty will come into effect once 25 nations have ratified it, but only 11 countries have thus far. Notably, the PSMA was adopted by the UN Food and Agricultural Organization in 2009.[345]

**Recommended Actions:**

- Ratify the PSMA, as internationally coordinated networks minimize the duplication of efforts.[346] Outreach campaigns need to be conducted to advocate for this treaty and garner political support.

[344] "Stopping Illegally Caught Fish at the Dock: How the Port State Measures Agreement Will Curb Illegal Fishing." *The Pew Charitable Trusts* (accessed February 4, 2015).
[345] Ibid.
[346] NEASPEC Secretariat. *Subregional Cooperation for Strengthening Marine Protected Areas in North-East Asia*. November 2012

## Mitigating Negative Impacts

Establishing an LMR can take considerable time – several years from conception to implementation is not unusual. The social and ecological benefits from an LMR can take even longer to materialize, with the initial tangible economic impact being negative.[347] By restructuring human interactions with the marine environment, LMRs influence the quantity and quality of benefits derived from marine ecosystems, as well as the distribution of these benefits among social groups.[348] It is these negative impacts that create the greatest controversy in the planning process, as they influence the behaviors of stakeholders. There are multiple ways to mitigate these negative impacts, thus it is important to consider that a solution in one community may not be appropriate in another, even in areas with seemingly similar cultural, social, and economic characteristics.[349] In all cases, adaptive management should be used to properly address negative impacts.

### 3.1 Mitigating Fisheries Displacement

The long-term positive ecological benefits stakeholders gain from an LMR can help mitigate initial negative impacts, such as fishery displacement and catch restrictions. However, benefits usually take time to materialize, while costs are immediately apparent. To mitigate the displacement of fisheries direct payment compensation or 'buy-outs' and alternative employment opportunities can help soften the impacts of fisheries displacement. For example, in PMNM, management financially compensated fishers affected by the LMR. In New Caledonia and Palau,

[347] Astrid Scholz et al., "Participatory socioeconomic analysis: drawing on fishermen's knowledge for marine protected area planning in California." *Marine Policy* 28, no. 4 (2004): 335-349.
[348] Michael Mascia and Ann Claus, "A property rights approach to understanding human displacement from protected areas: the case of marine protected areas." *Conservation Biology* 23 (2009): 16–23.
[349] Richard Pollnac et al., "Fishery policy and job satisfaction in three southeast Asian fisheries." *Ocean and Coastal Management 44* (2001): 531–544.

protection laws were enacted to develop ecotourism, a nascent sector in which former fishers can work. However, retraining and employing fishers as tourism brokers is a difficult and sometimes futile effort, since fishers are either not interested or do not have the skills to succeed in this new sector.[350]

**Recommended Actions:**

- When fisheries displacement occurs, compensation or governmental efforts to provide alternative employment should be provided on a case-by-case basis.
- Alternatively, if commercial fishing activities are deemed problematic but subsistence fishing is not, the subsistence fishers located near the MPA could be allowed to continue fishing even within LMR due to historical and cultural significance. This arrangement incorporates local communities and can increase the effectiveness of the MPA by garnering greater acceptance from local people, possibly leading to local stewardship and enforcement of the LMR.
- Another option would be to shift the fishing activities in certain areas outside of the LMR. This option maintains the full conservation benefits of the LMR itself, but still allows continued fishing in lieu of complete fisheries removal. However, it is important to note that shifting fishing activities will likely place increased resource strains on adjacent areas.
- Efforts should be made to introduce alternative local employment, especially forms that are feasible and socially acceptable by fishers and those engaged in associated livelihoods. Creation of an LMR can help diversify the coastal economy through

[350] Ibid.

ecotourism, thus increasing economic resilience. But tourism development plans must recognize that international tourism can be volatile.

- Adapt mitigation plans based on current and projected needs.

3.2 Distribution, Timing and Communicating about Positive Impacts

The ability for marine conservation to generate socio-economic benefits that are distributed over a wide range of social groups could be the deciding factor for the long-term acceptance and success of an LMR, especially in developing countries.[351] It is beyond the scope of this analysis to identify potential outcomes for various social groups. But fishers, for example, frequently bear costs in the short-term of an MPA, while improvements in catch size and composition may not be realized until the distant future – or at all. Tourism sector development can be a slow process. By actively communicating when positive impacts are likely to occur, members of negatively impacted social groups can recognize that they have much to gain by remaining engaged in negotiating the terms of impact mitigation.

**Recommended Actions:**

- Determine which stakeholders derive benefit from the site, including economic, cultural, recreational, and subsistence benefits. Evaluate potential changes in benefit patterns from the LMR. Consider the distribution of both positive and negative impacts on stakeholders
- Make clear throughout the entire planning process that negative impacts may arise from LMR implementation.

[351] World Bank, *Scaling up marine management: the role of marine protected areas,* World Bank Report, 36635-GLB (Washington, DC, 2006), 100.

- Investigate and communicate which stakeholders will likely to experience both positive and negative impacts.
- Inform stakeholders which mitigation methods discussed earlier will be used as compensation for the negative impacts felt.

## Research and Monitoring

### 4.1 Striking a Balance between the Sciences

Addressing social, institutional, and economic considerations is essential to LMR effectiveness,[352] as they can dramatically affect the outcome of LMR implementation. Ineffective social assessment can alienate local communities, and research has shown that the imposition of marine reserves without broad consensus often leads to failure.[353] [354] Furthermore, strong stakeholder participation has been empirically demonstrated to be a factor in the success of marine reserves.[355] [356] However, consideration of social factors is often taken into account secondary to ecological and oceanographic issues in most conservation endeavors.[357] This report asserts that to implement a successful LMR, social factors need to be jointly considered with biological and oceanographic factors.[358]

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[352] Carolyn J. Lundquist, and Elise F. Granek. "Strategies for successful marine conservation: integrating socioeconomic, political, and scientific factors." *Conservation Biology* 19, no. 6 (2005): 1771-1778.
[353] Patrick Christie and Alan White, "Best practices in governance and enforcement of marine protected areas: an overview." *FAO Expert Workshop on Marine Protected Areas and Fisheries Management: Review of Issues and Considerations,* (FAO, Rome, 2007): 330.
[354] Anthony Charles and Lisette Wilson, "Human dimensions of Marine Protected Areas." *ICES Journal of Marine Science* 66 (2009): 6–15.
[355] Richard B. Pollnac et al., "Discovering factors influencing the success of community-based marine protected areas in the Visayas, Philippines." *Ocean and Coastal Management* 44 (2001): 683–710.
[356] Sebastian C.A. Ferse et al., "Allies, not aliens: increasing the role of local communities in marine protected area implementation." *Environmental Conservation* 37, no. 01 (2010): 23-34.
[357] Astrid Scholz et al., "Participatory socioeconomic analysis: drawing on fishermen's knowledge for marine protected area planning in California." *Marine Policy* 28, no. 4 (2004): 335-349.
[358] Ben G. Blount and Ariana Pitchon, "An anthropological research protocol for Marine Protected Areas: creating a niche in a multidisciplinary cultural hierarchy." *Human Organization* 66 (2007): 103–11.

There are divergent opinions on the weight that should be given to community views. While some advocate for an ecological-dominant, top-down approach, often involving 'preservationist' worldviews or no-take solutions, others argue for a community-based, bottom-up approach often centered on a sustainable use approach to conservation.[359] The latter approach is usually grounded in social science perspectives.[360] This Task Force recommends an interdisciplinary approach to achieve LMR effectiveness, especially when involving populated areas.

**Recommended Actions:**

- Examine natural science issues hand-in-hand with relevant societal values, historical and current human uses in the area, and indigenous attitudes and practices.
- Conduct relevant social science to take into consideration, gender, resource use and dependency patterns, stakeholder characteristics and perceptions, market attributes for extractive and non-extractive uses, market and nonmarket use values.[361]
- Take an interdisciplinary approach balancing both social science data and environmental data, especially when considering LMRs with substantial affected populations. This involves examining the expectations, concerns, and resource-use patterns of involved stakeholders.

[359] Jones, "Marine protected area strategies." 197-216.
[360] Patrick Christie. "Creating Space for Interdisciplinary Marine and Coastal Research: Five Dilemmas and Suggested Resolutions." *Environmental Conservation* 38.02 (2011): 172–18.
[361] L. Bunce et al., "Socio-economic Manual for Coral Reef Management." *National Ocean Service, NOAA* (2000): 251.

4.2. Determine Monitoring Strategy

Monitoring systems help ensure that LMRs have a set of achievable goals. A monitoring plan provides the data required to evaluate changes in marine ecosystems and impacted human communities. These evaluations are essential for determining effectiveness, improving design, and providing progress reports to stakeholders.[362]

Defining the audience of the LMR monitoring strategy is the first step.[363] There is frequently more than one audience (i.e., stakeholders, local community members, NGOs, etc.) to be accounted for in the design of the monitoring strategy. It is important to identify the interests of each of these specific audiences to establish strategies to address their concerns or interests. Once the monitoring objectives are determined that is related to an LMR's goals and objectives, a monitoring strategy can be designed. Relevant data for each particular audience is then collected to meet these set monitoring objectives that is fed into a planning process.

4.3 Selecting Methods and Establishing Relevant Tasks for Data Collection

Selecting a proper and feasible strategy and method determines whether relevant data are collected. Biological and ecological research improves understanding of LMR success, but this report focuses on the often overlooked human dimensions of MPA implementation determining the success of MPA designation.[364]

[362] Peter H. Flournoy, *Marine Protected Areas: Tools for Sustaining Ocean Ecosystems* (Washington, D.C: National Academy Press, 2000), 126.
[363] Richard Margoluis and Nick Salafsky, *Measures of Success: Designing, Managing, and Monitoring Conservation and Development Projects* (Washington, DC: Island Press, 1998) 87.
[364] Patrick Christie et al., "Toward Developing a Complete Understanding: A Social Science Research Agenda for Marine Protected Areas." *Fisheries* 28.12 (2003): 22–25. Print.

4.4 Data Collection

Baseline data are collected before a project commences to provide a benchmark against which change that occurs during the project period can be assessed. These data will also be used to develop a management plan and later to evaluate the impact of the marine reserve.[365] When data are collected, the methods and sampling protocols must remain constant over time to ensure consistent results.[366] When conducting baseline data for social dimensions, it is important take the following into consideration:

- When should information be collected?
- How will the information be used?
- What are the procedures for collecting, storing, retrieving, and analyzing the data?
- What qualitative and quantitative data can indicate improvements?[367]

4.5 How Data Will Be Collected

Establishing a social and ecological baseline before LMR implementation is a priority. Data should be collected prior to starting the project to establish baseline information. The management team needs to decide how often data should be collected, whether that be on a daily, weekly, monthly, or annually basis. The frequency of data collection will need to be tailored to the phenomena under investigation. Ecosystem, fish population, human behavior and institutions change at different rates. Financial and logical considerations also affect monitoring design. Excellent guidebooks exist to guide MPA monitoring protocols.[368] Replicating monitoring efforts and randomizing sampling at the same locations is important for detecting real changes derived from the project over time. Whenever possible control sites should be used to help detect

[365] Alan White, *Creating and Managing Marine Protected Areas in the Philippines*, 20
[366] Ibid.
[367] Smith, *Research and Monitoring.*
[368] Margoluis and Salafsky, *Measures of Success.* 87.

project impacts from non-project locations; however, determining proper control sites for LMR may present spatial challenges due to large scales and few replicates.

It is important to establish a collaborative team prior to LMR implementation to collect the relevant data that informs LMR design and impact assessment. For example, fishers in Palau have been taught by The Nature Conservancy to collect and monitor data. Planners, local communities, user groups, NGOs, academics, and the private sector should be involved in the participatory monitoring and evaluation of an LMR, especially those near human settlements.[369] Cooperative and collaborative research with non-project personnel is encouraged, as it fosters stewardship and builds trust with project managers and scientists, and will help encourage long-term project involvement.[370]

4.6 Monitoring Strategy Implementation: Developing Indicators

To meet these objectives and goals, it is necessary to identify assessment indicators.[371] An indicator is a unit of information measured over time that documents changes in a specific condition.[372] Selecting appropriate indicators should be based on the peer reviewed scientific literature as well as local contextual factors. Properly selecting indicators before the project commences is critical, because after baseline data collection is completed, adding new indicators and knowing with certainty that changes to them are a result of the project becomes challenging.

[369] White, *Creating and Managing Marine Protected Areas in the Philippines*, 46
[370] Fox, *Redfish Rocks Marine Reserve: Site Management Plan,* 6.
[371] White, *Creating and Managing Marine Protected Areas in the Philippines*, 42
[372] Margoluis and Salafsky, *Measures of Success.* 87.

An indicator should always meet the following criteria:[373]

- Measurable: Recorded and analyzed in a quantitative or qualitative method.
- Precise: Able to be recorded in a uniform manner.
- Consistent: Never changing the way in which the research is measured and recorded.
- Sensitive: Change is appropriate in response to the condition of items being measured.

## 4.7 Monitoring Strategy Implementation: Methods

Quantitative and qualitative methods have advantages and drawbacks. Throughout monitoring, it is crucial to determine which method will be more appropriate for certain indicators, but both methods should be considered. Quantitative data collection methodologies are represented numerically, are generally cost effective and easy to replicate over time, and are effective for describing variables such as income and population densities. Qualitative data is also useful to gain insight into subjective information pertaining to LMRs. Quantitative information can provide a broad, comparative understanding in many places, while qualitative information provides site-specific details.

A mixture of methods is usually used in concert with one another.[374] Some key human dimension quantitative variables that may be track in relation to LMR implementation are income levels, profits, community participation, and demographics. Key informant interviews may be conducted by a skilled interviewer. Usually, these interviews are flexible and allow an interviewer to explore new concepts in a natural, conversational manner. Direct observation and checklists are be used to collect information on human activities, animals, events, or conditions.

[373] Ibid., 88.
[374] Margoluis and Salafsky, *Measures of Success.* 149.

## 4.8 Outline of Indicators

The following table suggests indicators and methods linked to key themes and gaps referenced throughout this report. These indicators are general for GOL sites, and are therefore not specific enough for any particular site.

Table 3: Summary of Indicators

| **Theme: Priority Action** | **Indicator** | **Monitoring Method** | **Person Responsible for Monitoring Activity** | **Frequency (When and how often)** | **Where** |
|---|---|---|---|---|---|
| *Representation*: Establish a learning network between both local marine reserves and international organizations | Formal participation of GOL sites in a learning network.<br><br>Collection and sharing of LMR management effectiveness data annually at local network meetings at all GOL sites within learning network. | Collate attendance records of people who attended GOL site learning network meetings.<br><br>Application of How Is Your MPA Doing? monitoring methods as appropriate for site.<br><br>Distribution of data collected at learning network meetings and electronically. | Program coordinators from the Pew Charitable Trusts and other collaborating organizations | Monitoring conducted annually | Within GOL sites<br><br>Data collected at GOL site level, but sharing at network level |
| *Enforcement*: Implement education and awareness programs within region directly affected by LMR | Awareness of LMR rules in communities near LMR. | Tally number of community members present at LMR educational meetings and seminars.<br><br>Quantitatively survey people within LMR area regarding awareness of LMR regulations | Program coordinators from the Pew Charitable Trusts and other collaborating organizations | Attendance data collected at each major meeting or seminar.<br><br>Annually until majority of community members are aware of LMR regulations | At seminars and meetings related to enforcement and LMR rules<br><br>Within GOL sites |

| | | | | | |
|---|---|---|---|---|---|
| *Research/ Monitoring*: Balance social science and environmental science- using interdisciplinary techniques | Presence of natural and social science monitoring programs at each GOL site. | Ensure that annual reports of monitoring programs report whether social and natural science monitoring is conducted.<br><br>Document how social and ecological information is integrated and informs policies. | Program coordinators from the Pew Charitable Trusts and other collaborating organizations | Annually. | Within GOL sites |
| *Impacts*: Mitigate negative impacts using a variety of compensation methods | Percent change in income over time among local fishers (and other sectors) affected by LMR declaration before and after declaration<br><br>Percent change in income over time among local fishers (and other sectors) due to mitigation strategies | Evaluate the income levels of local fisherman (or other impacted sectors) using quantitative survey methods<br><br>Survey income of ~10% of fishers derived from fishing | Local academic or consultant contracted to conduct study | Bi-annually, ongoing | Within GOL sites |
| Communication/ Outreach: Generate awareness while communicating complex and essential information | Local community members awareness of ecological and social conditions of LMR.<br><br>Awareness of LMR boundaries. | Survey or interview educational program participants after each educational event.<br><br>Survey local community members awareness of LMR boundaries. | Local academic or consultant contracted to conduct study | Measure after each educational event.<br><br>Annually until majority of community members are aware of LMR boundaries | Within local communities near LMR |

## Communications & Outreach

Effectively disseminating LMR successes to the general public will raise awareness and likely will garner political and financial support. Public involvement and outreach should be an ongoing objective of designing, implementing and monitoring processes. Scientific and other information should be made available to the public through outreach and websites to reach an international and local audience.

5.1 Generating Awareness while Communicating Complex and Essential Information

Ecological and regulatory information can be technically and conceptually complex, making it difficult to communicate to stakeholders and the general public. Yet this information is often essential to the understanding the LMR and its objectives. Therefore, it is important to communicate information in a comprehensible and coherent manner.

**Recommended Actions:**

- Indicate LMR physical boundaries to the public. Delineate boundaries on commonly used regional and local maps, GPS systems, as well as on Google Earth. Demarcation systems will need to be context-appropriate. Many resource-users, including recreational boaters, do not know the boundaries of LMRs.[375]
- Share complex and technical information in a manner that is understandable to the target audience. MPA communication attempts have been marred by difficulties in translating terminology and scientific information.[376]
- Generate interest by relating the LMR to the everyday lives of those involved. If relevant, establish brochures and signs at nearby marinas detailing LMR zoning schemes and general information. This could also improve compliance, since any potential offenders see the marinas' involvement in enforcement.

[375] National Oceanic and Atmospheric Administration's Coastal Services Center, in cooperation with the National Marine Protected Areas Center, *Marine Protected Areas Technology Needs Assessment, Final Report* (Charleston, SC: Coastal Services Center, 2003), 9-10

[376] Katie Davis et al., *Engaging Communities in Marine Protected Areas: Concepts and Strategies from Current Practice* (PhD dissertation, University of Michigan, 2014): 22-25.

5.2 Create Partnerships with Scientific, Recreational, and Business Communities

Partnering with scientific, recreational, and business communities creates networks that can be drawn upon for financial, logistical, and political support.

**Recommended Actions:**

- Gain support from the scientific community by providing research opportunities and making relevant scientific data available online.
- Seek support from the recreational community by recruiting recreational organizations, such as diving companies. General information about the sites can be promoted by these organizations through pamphlets and sponsored events.
- Establish efficient communication methods for learning networks.

5.3 Promote International Public Awareness Using Social Media Platforms

Social media can efficiently and instantaneously reach both a local and international audience. It is also an inexpensive means of outreach. However, it is imperative to clarify that social media is best thought of as a complementary tool to other, non-digital campaigns. Relevant and influential social media platforms include Facebook, Twitter, Instagram, YouTube, and Pinterest.

**Recommended Action:**

- Initiate and employ social media campaigns, incorporating images, infographics, and interactive media. For an example of a successful social media campaign, see Coral Reef

Alliance's use of Facebook.[377] Big Ocean also uses Facebook to facilitate communication among members.

## Strategic Action Plan Conclusion

These recommended actions are a result of literature review, interviews, gap analysis, and case study analyses. They confront gaps in management and address LMR challenges in the realms of representation and transparency, enforcement, negative impact mitigation, research and monitoring, and communications and outreach. While this plan is not comprehensive, it speaks to the main challenges presented by LMRs. When implemented, these recommended actions will augment LMR effectiveness. Yet, as each LMR site is unique, recommended actions should be adaptively employed to address the most pressing concerns of a particular site. Used wisely, implementing this Strategic Action Plan will situate the Pew Charitable Trusts' GOL campaign at the leading edge of effective ocean conservation.

[377] Davis et al., *Engaging Communities in Marine Protected Areas*, 22-25.

# Conclusion of Report

This Task Force has conducted a gap analysis of large marine reserves (LMRs), explored themes and challenges in case studies in New Caledonia, Palau, and the Northwestern Hawaiian Islands, and crafted recommended actions to augment the effectiveness of the Pew Charitable Trusts' Global Ocean Legacy campaign. The Introduction detailed the declining health of the oceans and the emergence of LMRs as a marine conservation tool, and examined the unique benefits and challenges that accompany this shift to large-scale marine protected areas. The Introduction then conducted a gap analysis, in order to establish a thematic framework for the report and identify current management gaps.

Identified gaps were then organized by theme, spanning Representation and Transparency in Design and Implementation; Enforcement; Mitigating Negative Impacts; Research and Monitoring; and Communications and Outreach. Within these larger areas, specific gaps included continuing deficiencies stemming from the inherent challenges presented by the size of large reserves, including, but not limited to:

- Failure to address the broad spectrum of socioeconomic effects often elided by a common conception of LMRs as purely ecological tools;
- Weak communication of long-term benefits and short-term costs to invested stakeholders and the general public;
- Failure to develop robust long-term monitoring and fisheries displacement plans, especially in developing nations.

The selected case studies collectively present a broad cross-examination of the major challenges facing LMRs as conservation tools, and at the same time highlight their tremendous potential. The success of the Hawaiian case is a clear example of the potential of large reserves

managed by governments equipped with the resources to conduct extensive, active enforcement and monitoring. However, more complicated cases, such as New Caledonia, suggest the feasibility of large reserves even in nations with limited resources, provided strong community engagement can be achieved. Likewise, the case of Palau makes evident the challenge unilateral declarations can create, even in nations already remarkably committed to conservation. Palau also reveals the need, in turn, for deep collaborative processes between both national political leaders and outside conservation groups hoping to create durable large reserves.

The strategic action plan draws on the experiences of New Caledonia, Palau, and the NWHI as archetypal, and strives to develop the thematic framework established in the Introduction into an exploration of best management practices in marine conservation. Comprised of concrete recommended actions, the Strategic Action Plan is tailored to the Pew Charitable Trusts. Key recommendations include, but are not limited to:

- Identification and subsequent involvement of stakeholders in design, implementation, and monitoring processes;
- Use of adaptive management to respond to changing ecological and socioeconomic conditions;
- Participation in learning network(s), such as Big Ocean;
- Encouragement of self-enforcement through education and awareness programs;
- Investment in enforcement technologies, such as satellite systems;
- Negative impact mitigation through a variety of compensation and incentive-based approaches;
- Balancing of social science and environmental science through the use of interdisciplinary techniques;

- Development and implementation of a monitoring strategy;
- Generation of LMR awareness through outreach, partnerships, and social media.

The implementation of this Strategic Action Plan will result in enhanced effectiveness of LMRs and their management, and will situate the Global Ocean Legacy campaign at the forefront of ocean conservation. The authors applaud the efforts of the Pew Charitable Trusts and are confident that these recommended actions will result be relevant and useful.

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