

**Marine Management Area Science**

**Final Narrative Report**

**October 15, 2010**

**Submitted to: Gordon and Betty Moore Foundation**

**Submitted by: Conservation International Marine Management Area Science Program**

**MMAS Final Report  
October 15, 2010**

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NOTE: The Final Narrative Report and the four attachments are being delivered via email on October 15, 2010. The Supplemental Materials noted below are being hand delivered on October 18. All of the files are provided electronically unless noted otherwise. Hard copies (HC) are provided where noted.

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- Abrolhos, Brazil
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- Global
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  - Fish Genetic Connectivity Final Report 030210.doc
  - Hawaii Aquarium Fish Collecting Impacts Final Report 030210.pdf
  - MMA Effectiveness Philippines Final Report 031910.doc

## **S2A Products**

- Global
  - Booklets:*
    - People and Oceans.pdf (HC)
    - Living with the Sea.pdf (HC)
    - MMAs-What Why and Where.pdf (HC)
    - Socioeconomic Conditions Along the World's Tropical Coasts 2008.pdf (HC)
    - Economic Values of Coral Reefs Global Compilation.pdf (HC)
  - Policy Briefs:*
    - Economic Incentives Policy Brief.pdf (HC)
    - Cultural Roles Policy Brief.pdf (HC)
    - Ecological Monitoring Policy Brief.pdf (draft; HC)
    - Lessons on Connectivity and Conservation in Coral Reef Habitats.pdf (HC)
  - Guidebooks and Tools:*
    - Economic Incentives Guidebook.pdf (draft; HC)
    - Economic Incentives Case Studies.docx
    - Coral Health Index (draft; HC; no electronic file)
    - Science2Action Guidebook.pdf (early draft; HC)
    - Marine Integrated Decision Analysis Software (MIDAS) Global Version (separate CD)
- Belize
  - Anti-spear fishing posters – Real Men use their hands (HC; no electronic file)
  - Marine Integrated Decision Analysis System (MIDAS) Belize Version (separate CD)
  - Scrap the Trap T-shirt (HC; no electronic file)
  - Seafood Guide for Belize (HC; no electronic file)
  - No Beat Di Reef Stickers (HC; no electronic file)
  - Fisheries Regulations laminated cards (HC; no electronic file)
  - Newsletters: Belize S2A Newsletter Fall 2008.pdf and Belize S2A Newsletter Feb 2010.pdf (HC)
  - Newspaper Articles:*
    - Belize Newspaper Article - Gladden Spit Pays Back.pdf
    - Belize Newspaper Article - Marine Reserves and Zones.doc
    - Belize Newspaper Article - Marine Reserves and Zones2final.doc
    - Belize Newspaper Article - Marine Reserves and Zones3.doc
    - Belize Newspaper Article 5.doc
- Brazil

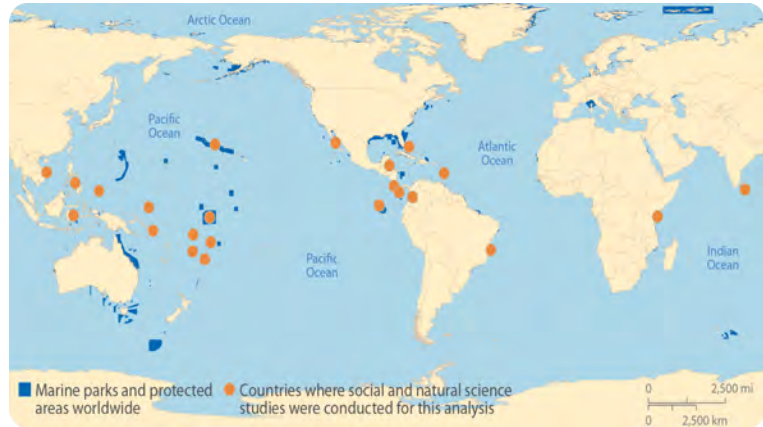
- Abrolhos: Diversidade e Riqueza Ambiental, Social e Cultural poster (HC; no electronic file)
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  - 3 Posters-ETPS Panama.pdf: Parque Nacional Coiba Conservar para vivir poster, Los Tesoros del Mar, Parque Nacional Coiba Si me utilizas bien, ganamos todos (HC)
  - Radio interviews and newspaper articles
  - Coiba Tesoro de Biodiversidad (separate DVD)
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  - Galapagos S2A Booklet (HC; no electronic file)
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  - Coiba National Park Calendar ETPS Panama.pdf
  - Fish of Coiba National Park Brochure ETPS Panama.pdf
  - Key Biodiversity Areas (HC; no electronic file)
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  - Reef Connectivity.pdf poster (HC)
  - Fiji's Coral Fish Discovery.pdf poster (HC)
  - Why Are MMAs Important.pdf poster (HC)
  - Understanding Your Marine Environment Using Indicator Species– English and Fijian Versions.pdf booklet (HC)
  - Why I Love My Tabu booklet (HC; no electronic file)
  - Managed Areas: A case study in Fiji video (separate DVD)
  - Stories of Today from the Reef video (separate DVD)
  - Healthy Reef, Plenty Fish, Happy People Protecting a MMA T-shirt (HC; no electronic file)
    - Photo-Fiji Festival showing S2A t-shirts DSC01215.JPG
    - Photo-Fiji Festival showing S2A t-shirts DSC01262.JPG

## Executive Summary

In October 2005, Conservation International received a \$12.5M grant from the Gordon and Betty Moore Foundation to launch one of the world's largest global marine conservation science initiatives and the largest science initiative focused on marine managed areas. Now at its closure, the Marine Management Area Science Program (MMAS) has conducted an unprecedented amount of work examining the biodiversity and human well-being aspects of marine managed areas, which has directly contributed to conservation worldwide. In doing so, CI has fulfilled its obligations under the grant.

Conservation International's Marine Management Area Science program, which was built on partnerships with more than 100 institutions, conducted cutting-edge research on the biodiversity, ecosystem services, and human well-being aspects of marine management areas, drawing on both natural and social sciences and in direct support to CI's new mission. "Science-to-Action" (S2A) was a central focus of the

program—addressing critical management questions through a global learning network that was designed to ensure high-quality science was used in decision-making. The MMAS studies were conducted in 23 countries; however, the primary focus was in four nodes: Belize, Brazil, Fiji, and the Eastern Tropical Pacific Seascape.



Global network of 23 countries in which MMAS conducted studies.

Particularly unique to this program compared to other marine conservation science initiatives was the emphasis on:

- Examining both the biodiversity and human well-being aspects of marine conservation efforts working with more than 200 scientists worldwide;
- Ensuring the science fed into conservation action at the local to global levels by establishing close partnerships between scientists and field conservationists; and
- Synthesizing findings from the 50 studies to identify key insights based on experiences in 73 MMAs worldwide.

MMAS was conducted over five years (Fall 2005 to Fall 2010), during which time the Program transitioned from planning (year 1) to data collection and analysis (years 2 to 4) to synthesis across studies and S2A (years 4 to 5), although there were components of each throughout the five-year grant period. The final year of the grant focused on synthesizing results from the 50 studies to produce a series of cross-study publications, including *People and Oceans*, *Living with the Sea*, and *MMAs: What, Why and Where* and feeding the scientific findings into conservation action at the local to global levels.

The greatest achievements of the MMAS Program were:

- Demonstrating the benefits and challenges of MMAs to human well-being and biodiversity;
- Demonstrating the significant role of oceans in people's lives;
- Demonstrating the ecological importance of local conservation efforts;
- Influencing the establishment of new MMAs in Fiji, Panama, Brazil, and the central Pacific, and improving the effectiveness of existing MMAs in Fiji, Panama, Ecuador, Belize, Brazil, and Kiribati;
- Building a worldwide network of expertise in 23 countries and 73 MMAs from which insights were drawn for global learning;
- Developing and implementing a framework for S2A to maximize the conservation impacts of the scientific findings from local to global levels; and
- Building short-term and long-term capacity in the four nodes.

Over the past five years, marine conservation science has become engrained in Conservation International through both the Science & Knowledge and Global Marine Divisions. While the MMAS Program is ending, marine conservation science is highly respected and an integral part of CI and one to which CI Leadership is fully committed. During the course of the Program fundraising efforts successfully solicited \$6.2M (\$.5M to CI; \$5.7M leveraged to partners). Building on MMAS experience, the next iteration of marine conservation science at CI, *Marine Science-to-Action*, will build on MMAS experiences and incorporate new issues by focusing on marine spatial planning, fisheries management, climate change, policy scenarios, ocean health indicators, and S2A.

## Progress on Outcomes, Outputs, Activities, and Key Achievements

This Final Narrative Report highlights the major achievements of the entire MMAS Program organized by Outcome (1—Programmatic; 2 and 3—Scientific; 4—Capacity Building; 5—S2A), the major publications, and the lessons learned regarding conducting a global marine conservation science program. The following documents support the main text:

- *Attachment 1—MMAS Grant Outcome Plan*: Provides update on MMAS outcomes, including the 50 studies (Activities). Explains objective of each study (Activities), major scientific and S2A publications and conferences (Deliverables), status of research and key scientific messages (Status of Activity), and status of completion (% Complete/Actual Completion Date);
- *Attachment 2—MMAS Indicators of Success*: Quantifies the progress toward outcomes 4 and 5 (capacity building and S2A);
- *Attachment 3—MMAS Studies, Contacts, Data*: Provides list of studies, major contact point for each study, and location of data;
- *Attachment 4 – Sample S2A Framework*: Provides example of S2A framework, which were created for each node and globally

This Final Narrative Report complements numerous materials provided to the Gordon and Betty Moore Foundation at the same time this Final Narrative Report is being submitted, including all the science synthesis reports, individual study reports, and S2A materials noted in the Table of Contents.

### Outcome 1: Programmatic

- MMAS established a strong HQ-Field Offices partnership, including 4.25 HQ staff (Senior Director, Senior Principal Investigator (0.25), Directors for Natural and Social Science Studies and Outreach, Finance and Administrative Manager) working closely with the four nodes, specifically the S2A Node Coordinators (one in each node, including one in Panama and one in Galapagos) and their counterparts (e.g., Sue Tai for the Pacific, Scott Henderson and Manuel Ramirez for the ETPS).
- Strong partnerships were established throughout CI, particularly with other Science & Knowledge Division programs, the Global Marine Division, and, to a lesser extent, the Center for Environmental Leadership in Business, the Center for Conservation and Government, and Communications. Relationships also were strengthened



*Bottom Row: S2A Coordinators from Brazil, Panama, Belize, Fiji and Galapagos & Senior Director of MMAS; Top Row: CI ETPS leadership and Marine VP*

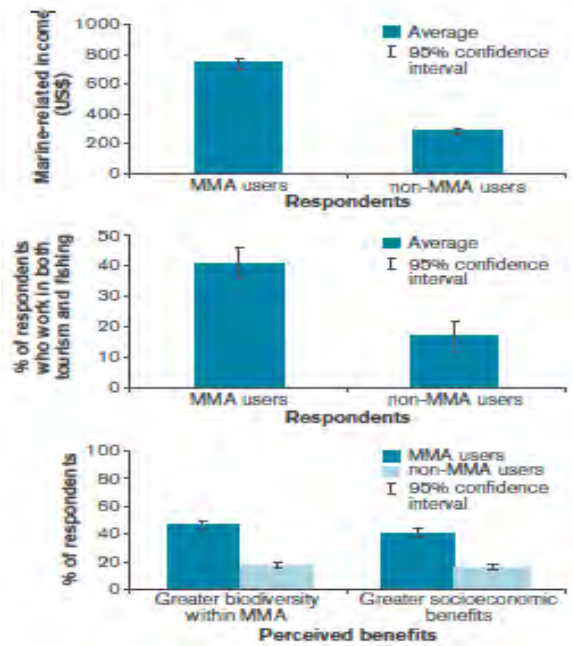
with non-node CI field offices, as evidenced by requests to include MMAS in funding proposals for the Coral Triangle Initiative and for MMAS input on projects in the Philippines and Indonesia.

- In addition to CI internal relationships, MMAS established partnerships with approximately 100 institutions, both scientific and conservation oriented, working at the global to local scales. CI intends to continue these partnerships in the next phase of marine science.
- The existence of MMAS staff enabled conservation and science efforts that would not have been possible otherwise. For example, CI Brazil staff actively engaged in creating the Cassuruba Marine Extractive Reserve and CI HQ is leading development of the Ocean Health Index human well-being indicators. While staff time was covered by other funding sources, without these positions being largely supported by MMAS, they would not have been available for such short-term yet critical efforts.
- Ecological and socioeconomic monitoring programs, with standardized yet locally-tailored protocols, have been established in all four nodes, and capacity building will enable in-country scientists to continue these efforts. Monitoring is expected to continue in Belize through partner organizations, in Brazil through CI Brazil, in ETPS through STRI and others, and possibly in Fiji through the University of the South Pacific.
- MMAS significantly evolved the concept of “Adaptive Management” into “Science-to-Action” and documented this process (see Science Synthesis Reports, MMAS Overall: *Science to Action Assessment Report*). Together CI HQ and the S2A Node Coordinators developed S2A Frameworks to plan and implement the S2A processes. The S2A process has influenced CI HQ (Science and Knowledge Division has adopted this approach) and our field partners (e.g., the Brazil government has adopted many principles in working with scientific institutions; Belize NGO partners have discussed using the approach when working with scientists; and CI Fiji has worked closely with the Fiji Locally Managed Marine Area Network to develop a process for ensuring FLMMA input on any research plans prior to implementation).
- The [www.science2action.org](http://www.science2action.org) website was launched as a partnership site to share the publications and insights emerging from the program. This site is intended to evolve into a more interactive site for sharing among scientists and decision makers.
- All of the originally committed studies have been completed (see *Attachment 1: MMAS Grant Outcome Plan*) and immediate S2A efforts conducted in all nodes. Ripple S2A effects are expected for the next two to five years.
- Over the last five years, MMAS processed 111 grants, consulting agreements, and internal agreements.
- MMAS successfully raised nearly \$500,000 from the following sources: Asian Development Bank, Castle Foundation through CI Global Marine Fund, NOAA through National Fish and Wildlife Foundation, Oak Foundation through CI Center for Environmental Leadership in Business, Walton Family Foundation through CI Global Marine, one of CI’s Chairman’s Council members through CI Global Marine, and an anonymous donor.

- MMAS successfully leveraged the following \$5.7 million in funds that go directly to MMAS' partners to support joint studies: \$3,078,676 for Ecological Effects; \$14,000 for Socioeconomic and Governance Effects; \$1,626,858 for Population and Habitat Connectivity; \$203,130 for Resiliency; \$395,600 for Economic and Cultural Values; \$40,000 for Training and Equipment; and \$413,000 for Science-to-Action.

**Outcomes 2 and 3: Science, Global and Cross-Study Syntheses** (See Attachment 1 - MMAS Grant Outcome Plan for detail by activity)

- Analysis of MMAs worldwide (node and non-node) identified several human wellbeing benefits: more diversified livelihoods, improved household income, greater food security, improved human health, greater community participation, enhanced community empowerment, reduced user conflicts, improved compliance, greater recognition of user rights, greater environmental awareness, enhanced social capital, and greater social resilience. However, MMAs also pose challenges, including loss of access to fishing grounds, inequitable distribution of benefits, dependence on project assistance, and unmet expectations. In-depth cross-node analysis of the socioeconomic benefits of 11MMAs in Belize, Ecuador, Fiji, and Panama identified the following improvements: higher average income, more diversified livelihoods (that is, community members are more likely to be engaged in both tourism and fishing), and a much greater appreciation for the biodiversity and socioeconomic benefits of the MMA.



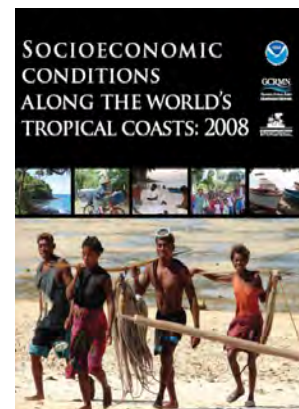
Cross-node analysis demonstrating the income, livelihood option, and awareness benefits of MMAs.

- Analysis from the nodes revealed that MMAs can reduce fisheries declines by providing sanctuary and/or by reducing harvest; however, they are insufficient to reverse degradation due to pollution or climate change. Furthermore, the analysis found that while MMAs do not compensate for human population increases and associated pressures, they can provide resilience to various stressors, which is increasingly important in the face of global change.
- MMAs in which 'no take zones' are effectively maintained and enforced result in diverse, productive reefs with large predators, extensive live coral cover, and reduced macroalgae. Data from reference sites in the Line Islands indicate that even modest human development pressures can have significant impacts on coral reefs, including subtle impacts on microbial communities. The highest levels of biodiversity and ecosystem services are maintained in MMAs with the most protection.
- Analyses of fishes and corals from the tropical western and central Pacific have shown that these organisms are more localized in their dispersal abilities than previously assumed.

Despite their planktonic dispersal mechanisms, the dispersal envelopes are in the range of 10s of kilometers rather than 100s or 1,000s. Consequently, local resource users and MMA managers cannot rely on distant populations to replenish local populations with new recruits, indicating that local management efforts are critical for long-term viability of local fish and coral populations.

- Analysis of the role of economic incentives in driving behavioral change in 27 MMAs worldwide demonstrated that approaches such as buyouts, conservation agreements, and alternative livelihoods provide positive incentives for altering human behavior. Combining features of the three approaches can remove harvest capacity to reduce pressure on resources, provide ongoing incentives to ensure long-term compliance, and create alternative economic options to generate income. In terms of MMA investment, an analysis of eight MMA sites in Central and South America revealed that the total expenditures for these sites ranged from US\$88,000 to US\$1,431,300 and covered a variety of uses, with enforcement (13-37%), research and monitoring (10-43%), and field operations (30-56%) composing the largest proportion of their budgets. A global literature review found that outreach is a critical component of MMA success indicating that since outreach is typically a small component of budgets, more resources need to be put into this component.

- The report *Socioeconomic Conditions Along the World's Tropical Coasts: 2008* found that as much as 90% of coastal communities are dependent on fishing as a primary source of income, specifically in Southeast Asia and South Asia; and marine conservation efforts are recognized as working, with more than 75% of respondents in the Caribbean and Southeast Asia acknowledging marine protected area benefits. This global report catalyzed the production of *Managing the Seas of East Asia for Human Well-being*, which was produced in collaboration with the Palawan State University, GEF/UNDP/PEMSEA, and WorldFish Center to raise awareness in the region.



- *Economic Values of Coral Reefs, Mangroves and Seagrasses: A Global Compilation* provided the first compilation of all economic valuation statistics for these tropical marine ecosystems (also on <http://www.consvalmap.org/>). Further, the economic as well as cultural values of MMAs were evident in the nodes, specifically: 1) there is a wealth of traditional knowledge that guides customary practices, which needs to be identified and integrated into the formal regime of MMAs; and 2) marine resources have tremendous economic value that far exceeds current investments in marine governance, generating fishing revenues each year ranging from US\$1.3 million to 2.5 million and net annual economic values from park visitation ranging from US\$50,000 to \$788,000.



- The Advanced Biosensor study uncovered genetic stress-response pathways in cnidarians, which is expected to produce tools for early threat-detection at coral reefs around the world. In related research, candidate stress-response marker genes in corals have been identified, advancing the search for a select few genes regulating protein and antibody development in response to temperature stress.

**Outcomes 2 and 3: Science, Abrolhos, Brazil** (See Attachment 2—MMAS Grant Outcome Plan for detailed information by activity)

- Ecological monitoring demonstrated the positive effects of no-take reserves on fish biomass within the reserves as well as the spill-over effects to surrounding areas. Monitoring also documented extensive distribution of disease in Abrolhos reef communities, which could lead to the extinction of important reef builders, such as brain coral, if infection rates do not change.
- MMAS researchers discovered one of the largest and most concentrated larval recruitment pulses ever recorded in the Western Atlantic for a commercially important snapper species (the dog snapper, *Lutjanus jocu*) in Abrolhos National Marine Park, Brazil.
- Results from the socioeconomic and governance monitoring show that the MMAs have resulted in greater fisheries benefits to local communities compared to migratory fishermen, higher incomes for fishers adjacent to the marine extractive reserve compared to five years ago, and the formal empowerment of local communities with management responsibilities as a result of the exclusive use rights concession for the maritime territory.
- The economic valuation and cultural roles studies demonstrated that even remote MMAs like Abrolhos National Park can generate substantial economic value, with annual net revenues from fishing estimated at \$1.65 million and annual visitation fees totaling \$50,000. The coastal communities of Bahia also share many cultural characteristics—religion, traditional festivities, and strong community structure supported by family and “*compadrio*” ties—that play a significant role in community organization and influencing resource management decisions.



Site of dog snapper larval recruitment



Fiesta de São Pedro no Prado

**Outcomes 2 & 3: Science, Belize** (See Attachment 2—MMAS Grant Outcome Plan for detailed information by activity)

- The ecological monitoring measured no significant increase in fish biomass or live coral cover/reduced macroalgal cover inside the MMAs versus outside the MMAs. When strict no-take zones versus outside MMAs boundaries were compared, the findings were the same. This finding indicates that more effective enforcement is needed and increasing the size and representativeness of fully protected zones will help achieve target improvements in fish biomass and reef health.
- The socioeconomic and governance monitoring found that, while those engaged in tourism-related activities reported a mostly positive economic effect from the establishment of marine managed areas, they are also likely to engage in unsustainable marine resource use practices in order to maximize their income. Sustainable resource use practices are, therefore, not a matter of values or lack of information, but related to economic survival, which must be considered a priority within the larger development framework for Belize.

- The ecotourism impacts on SPAGs found that the impacts from well-managed dive ecotourism on spawning aggregations of dog and cubera snappers, Nassau groupers and whale sharks are very limited, particularly when compared to the potentially negative impact of unregulated extractive fishing. Management measures imposed by the Southern Environmental Association (SEA) at the Gladden Spit Marine Reserve provide an excellent example of precautionary adaptive management of dive ecotourism at a spawning site.
- The economic valuation study suggests that further investment in MMAs, such as the Gladden Spit and Silk Cayes (GSSC) Marine Reserve, are likely to have an attractive return. In the GSSC, management expenditures of US\$315,000 for 2007 helped to secure net annual benefits of at least US\$4 million. The average family in the village nearest to the GSSC enjoys \$373 in annual benefits, equal to around 2 percent of average annual income. Increases in reserve entrance fees could be considered to bolster funding for the MPA's management.

***Outcomes 2 & 3: Science, Eastern Tropical Pacific Seascape (See Attachment 2—MMAS Grant Outcome Plan for detailed information by activity)***

- The ecological effects of managed areas around Coiba National Park (CNP) are mixed but with some strong signs of recovery. Some species, notably commercial fishes, have benefited substantially from existing fishing regulations, but enforcement is critical to full recovery and can be greatly improved. The ecological monitoring study found that the total fish biomass of commercial and non-commercial fish species increased in Isla Coiba managed zones between 2007 and 2009. These are the largest increases recorded in the CNP. The study also found that carnivorous and herbivorous fishes rose, with no-fishing zones experiencing the largest gains. Shellfish, conch and oyster densities rose significantly in protected areas, despite no clear pattern in density change. In contrast, live coral cover decreased non-significantly (ca. 15%) between 2002 and 2009 in both protected and unprotected areas.
- The CNP provides significant livelihoods through fishing and tourism, which is particularly important given that this is a region with limited economic opportunities. The Coiba area supports 275 direct fishing jobs, which provide twice the income of non-fishing livelihoods. The area generates \$1.3 million in net annual revenues from fishing and tourism. The CNP earns \$234,200 in annual visitation fees.
- The governance study noted several critical limitations in the management structure of Coiba National Park: lack of fisheries sector participation (one representative was inappropriately representing the entire sector), lack of general public participation in meetings, lack of a communication strategy, lack of information and documentation of the Park, and lack of coordination among institutions such as ANAM (Autoridad Nacional del Ambiente – Environment National Authority), ARAP (Autoridad de los Recursos Acuáticos de Panamá – Water Resources Authority of Panama) and AMP (Autoridad Marítima de Panamá - Maritime Authority of Panama) for issues on fisheries management, surveillance and research. The study recommended these limitations be addressed and, in addition, that the Directive Council be given an independent physical office, be provided a budget sufficient for permanent technical and administrative support, develop an annual operating plan, and provide training for its members.
- The Galapagos socioeconomic monitoring found that community residents who are involved in commercial fishing and tourism have a higher income than other residents, which was

attributed to the success of the Galapagos Marine Reserve. The ecological monitoring study also demonstrated the reserve's effectiveness, specifically that there is a direct positive correlation between biomass of predatory (but not herbivorous) fish and degree of enforcement in MPAs. The study also found that the corals that survived the El Niño event in 1982/3 were resistant to the stress of the subsequent 1997/8 El Niño event and are now undergoing recovery, suggesting that subsets of these species have been selected for survival. The extinction resistance study of the region further found that increasing the area of protected coastal zones in sensitive areas by as little as 2% would afford significant protection to certain threatened species and marine habitats.

- Analysis of the enforcement chain in each of the ETPS nations (Colombia, Ecuador, Panama, Costa Rica) found that surveillance and detection were strong; whereas prosecution was weak, indicating the need to focus efforts in this area of enforcement to ensure overall regional success.

**Outcomes 2 & 3: Science, Fiji and Pacific** (See Attachment 2—MMAS Grant Outcome Plan for detailed information by activity)

- Ecological monitoring, socioeconomic monitoring, and cultural roles studies have demonstrated that MMAs are important to the improvement of biodiversity and human well-being. However, the tabus (no-take areas) are continuously threatened by poachers. The ecological monitoring studies have shown increased fish and coral diversity, fish abundance, and fish biomass within long-term tabus, such as Waitabu and Navakavu. There was no evidence of spillover from the two tabus, but this may be because communities are putting a lot of fishing pressure on areas outside the tabu areas.
- Navakavu and Waitabu communities, which depend on the marine environment for more than 60% of their income, have experienced increased social and economic benefits, such as greater educational opportunities, better infrastructure and alternative sources of income. Other communities, such as Gau, Kubulau, and Malolo, have experienced similar impacts of MMAs. The studies also found increased sales of fish catch associated with the locally managed marine areas, thus improving the source of income generated from the marine environment for those communities studied—Waitabu, Navakavu, Gau and Kubulau. Average household monthly fishing income had also improved since the MMAs were established. These communities have also demonstrated that through their MMAs they were able to generate more diversified income from ecotourism through levies and fees and through employment opportunities, such as tourist guides, boat drivers, and divers.
- The 2008 research expedition to the Line Islands demonstrated the continuum from no human impact to moderate human impact. From this analysis the major indicators of reef health were hypothesized to be density of top predators, coral and fish abundance, and microbial composition. A subsequent 2009 research expedition to the Phoenix Islands Protected Area (PIPA) confirmed these indicators, providing support for the *Coral Health Index* protocol. The analysis also demonstrated that areas under low human pressure are relatively resilient to bleaching caused by global warming.

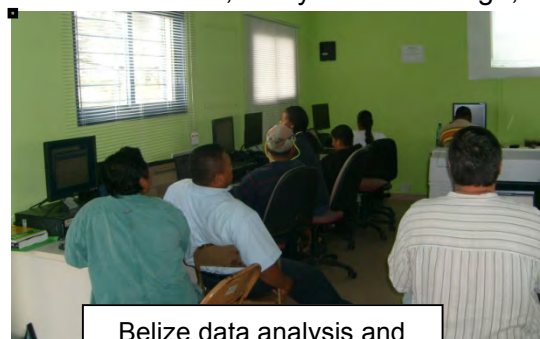


Post-bleaching coral regrowth demonstrating resilience of PIPA reefs

The genetic connectivity research found Fiji's coral reefs fishes were distinctively different from those in the waters of Indonesia, Papua New Guinea, and the Solomon Islands. In fact, 5 new species were discovered as part of this research, further demonstrating the unique, rich biodiversity of Fiji's water. The analysis also revealed intra-connectivity within the Fijian archipelago (see *Fiji's Coral Fish Discovery* and *Reef Connectivity* posters). This research was expanded to Tuvalu, Samoa, and Tonga, where results confirmed a new species from Samoa and documented connectivity between Fiji/Samoa/Tonga indicating a "southwest Pacific assemblage" but interestingly not connectivity northward with Tuvalu.

**Outcome 4: Capacity Building** (see Attachment 3 – MMAS Indicators of Success for details)

- Over 100 partnerships supported the program, which led to 67 long-term partnerships with local and international organizations. 604 government agencies and 132 stakeholder groups (nongovernmental organizations, including academia) engaged in research.
- 79 workshops, seminars, and other training opportunities conducted.
- 237 in-country junior scientists and 52 in-country senior scientists on research teams.
- 17 national, regional and global databases supported by MMAS research.
- 444 critical target audiences (e.g., village leaders, fishermen associations) contacted regarding research plans, implementation, and results to discuss policy implications through 112 Science-to-Action (S2A) activities (e.g., focus groups, one-on-one meetings, public presentations) and employing 88 S2A products (e.g., white papers, posters, films).
- As part of long-term capacity-building efforts to ensure in-country scientists hone their skills to better design, implement and use excellent science, MMAS focused particularly in Fiji and Belize, where CI and the country have little capacity and it is, therefore, particularly important. In particular:
  - In Belize, more than 15 individuals were trained in data collection, analysis and storage, including officials from the Ministries of Fisheries and Tourism. They are using their skills to monitor ecological conditions, determine the status of fish-spawning aggregations, assess impacts from tourist visitation and ensure long-term access to baseline data. In addition support from Boston University was facilitated for a full scholarship for a Belizean to conduct his M.S. in Marine Ecology.
  - In Fiji, training was provided to create a core FLMMA team for long-term ecological monitoring. Further training on data analysis and GIS was conducted in October 2009.



Belize data analysis and storage training workshop

**Outcome 5: Science-to-Action (S2A), Global**

- Influencing decision-makers worldwide to promote sustainable management practices, including support for MMAs, was a top priority of this global marine science initiative. Target audiences were government authorities (e.g., fisheries departments, tourism authorities) working through the CI Field Offices and multilateral institutions (i.e., Inter-American Development Bank, Asian Development Bank, FAO, UNEP, World Bank, GEF). To influence these organizations, the MMAS team developed a suite of “Science-to-Action” materials highlighting in accessible, visually appealing format the key messages emerging from the 50 studies in 23 countries and 73 MMAs. The three central booklets are: *People and Oceans*; *Living with the Sea*; and *MMAs: What, Why and Where*. These booklets provide an opening at seminars and one-on-one meetings with these organizations to discuss the importance of the oceans to people, the need for local conservation efforts, and how these efforts have been shown to benefit people and biodiversity. In the first month of release, nearly 2,000 sets have been mailed out and 1,000 sets have been downloaded from the [www.Science2Action.org](http://www.Science2Action.org) web site. They were also sent out by email to over 2000 people not including thousands more through 26 listserves. They have been, or will soon be, shared at major venues, including the Convention on Biological Diversity at Nagoya, the Small Fisheries Southeast Asia Conferences, and the Cartagena Convention UNEP Meeting.

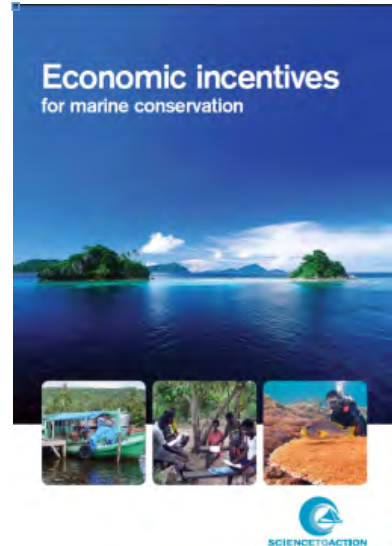


- To facilitate more in-depth discussions regarding the economic, socio-cultural and ecological aspects of marine conservation, the following three-page policy briefs are in development: 1) *Economic Incentives Motivate Human Behavior Change* ; 2) *Bridging the Gap Between Human Culture and Conservation* ; and 3) *Ecological Effects of MMAs*. Drafts of the first two briefs were disseminated at the Annual Biodiversity and Economics for Conservation Conference (September 2009, Venice, Italy), East Asian Seas Congress (November 2009, Manila, Philippines), Marine Katoomba Meeting (February 2010, Palo Alto), Annual Symposium on Sea Turtle Biology and Conservation (April 2010, Goa, India), and the Global Oceans Conference (May 2010, Paris, France). The final versions will be released in mid-November to spawn further discussions with multilaterals, government



agencies, and non-government institutions regarding the need for sustainable management practices.

- To determine to what extent the MMAS studies have influenced conservation in the nodes and to draw lessons regarding why some science is more influential than others, an assessment was conducted of the Science-to-Action activities in the 4 nodes, which noted the tremendous impacts of the science on conservation strategies, the significant partnerships and the critical role of the MMAS S2A Node Coordinators. This assessment helped define the S2A frameworks for the 4 nodes (*see Attachment 4 – Sample S2A Framework*).
- One of the critical ways MMAS has influenced decision makers is by providing 'how to' guides that are designed to provide practical advice to managers and scientists. These guides include:
  - *Economic Incentives for Marine Conservation*, which provides guidance on how to select and implement incentive-based solutions: buyouts, conservation agreements, and alternative livelihoods ;
  - *Coral Health Index*, which provides a comprehensive methodology for monitoring the condition of coral reef ecosystems ;
  - *Science-to-Action*, which provides practical guidance for scientists and decision-makers on using science to inform ocean policy and management ;
  - *Marine Integrated Decision Analysis System*, which is a spatial decision support system that allows users to select values for a set of governance, ecological and socioeconomic variables to demonstrate the effectiveness of MMAs. Both a generic global version and Belize-specific version have been developed ; and
  - *Coral Whisperer*, which is a tool in early development to predict and detect physiological stress in reef-building coral and to identify the cause. A consortium of scientists from Stanford, Boston University, and Woods Hole Oceanographic Institute are working on what will be an easy-to-use diagnostic tool.
- The global learning drawn from the global socioeconomic and governance monitoring studies, enforcement chain analyses, and incentive study was used in a training course by RARE Program for Sustainable Fishing. The World Bank Climate Change Thematic Group will be referencing the economic valuation studies in courses on sustaining natural capital for growth and poverty reduction. These courses will be adopted by at least two regional learning institutions: University of Buea, Cameroon, and Cheikh Anta Diop University, Institut des Sciences Environnementales, Senegal. Colleagues have also noted plans to incorporate MMAS materials into courses led by Coral Reef Alliance, NOAA Marine Sanctuaries International Office, University of Oregon, and others.



### **Outcome 5: Science-to-Action (S2A): Abrolhos, Brazil**

- The Cassurubá Extractive Reserve, which was created by the Brazil Government in 2009, harbors 95% of Abrolhos' mangroves and is a key nursery site for many ecologically and economically important fish species in the region. Results from the socioeconomic monitoring, which documented that 1,000 families depend on the natural resources to make a living, and the connectivity studies, which demonstrated the importance of the mangroves for commercial fish species' life cycles, strongly influenced the decision to establish the reserve.
- Results from the ecological monitoring, cross-shelf, inter-reefal, and socioeconomic monitoring studies were emphasized in the successful RAMSAR application for the Abrolhos region. The results demonstrated that the Abrolhos region is high in biodiversity and has cultural significance to neighboring communities. Officials from the Chico Mendes institute said that CI-Brazil's data and assistance in this application were extremely helpful. The application was submitted to the RAMSAR convention and, subsequently, Abrolhos National Park was declared a RAMSAR site on February 2, 2010.
- Results from the inter-reefal study, showing that Abrolhos had a more extensive reef system than previously thought, spurred discussions with the Chico Mendes Institute (ICMBio) to expand the area of MMAs in the Abrolhos Region. CI-Brazil has developed and negotiated a workplan with ICMBio to work toward this goal. Data from the ecological monitoring, socioeconomic monitoring, inter-reefal, and cross-shelf studies are supporting the resulting Systematic Conservation Planning Effort for the region. In April 2010, the two organizations jointly held a workshop where, using MMAS data and in concert with local and national stakeholders, the participants discussed priority geographical areas for conservation in the Abrolhos Bank. ICMBio expects final definition of the protection zones to be completed in 2010, and the entire workplan implemented by the end of 2011.
- Information on fisheries monitoring—subparts of the EcoMon and the SocMon—helped to show that parrotfish in the Abrolhos region are decreasing in size and abundance. Using these data and working with the Chico Mendes Institute and the IUCN specialty group has resulted in IUCN placing the Abrolhos parrotfish on its Redlist, thus elevating concern about its status to a higher national and international level. CI is also reviewing the Brazilian redlist and, with funding from the Ministry of Environment, will do database work to alter the list to be in line with IUCN criteria.
- While MMAS funding for CI-Brazil enabled studies and scientific results, it also served to give CI-Brazil flexibility to engage in extensive political and community outreach. One of the results of this flexibility has been CI-Brazil's continuing involvement in the Canavieiras region. Using assistance from MMAS, CI-Brazil had been engaged in creating the Canavieiras extractive reserve council, by collaborating with the Chico Mendes Institute and local community leaders. These councils help local groups be heard and give the community a significant say in how the extractive reserve is managed.



President Lula declares Cassurubá Extractive Reserve.

### **Outcome 5: Science-to-Action (S2A), Belize**

- MMAS scientists have provided technical support to the development of the film *Some Day is Now!*, which is designed to gain public support for completing and implementing a national coastal zone management plan. The film, which is being produced by CAVU, is a hard-hitting piece of work that strongly calls for completing this plan, protecting not just the ecosystem but the way of life that Belizeans cherish. The launch of this film coincides with a reef summit, featuring the PIs from some of the studies. This further advances the findings of the 2010 Mesoamerican Reef Report Card, to which MMAS findings also contributed, and will also be launched during the reef summit.
- The inter-reefal studies uncovered five new species of reef fish and demonstrated the high degree of larval fish retention within Belize's inner reef system. This endemism helped to convince the Fisheries Department to create a new conservation (no-take) zone in Pelican Cayes within the South Water Caye Marine Reserve, which is now being enforced. This work also helped underscore that these unique inner reefs are discreet and need more representation in the national MPA Network, which will be addressed in future revisions.
- The Fisheries Department, assisted by MMAS S2A Coordinator Melanie McField and supported by results of the ecological monitoring and the enforcement chain analysis, held an enforcement training workshop in July 2010 covering all aspects of enforcement from public relations to prosecutions. The training is one of many steps the Department is taking to professionalize and standardize the ranks of enforcement officers in both the government and in NGO partner organizations. MMAS is also working to improve compliance through three S2A products: 1) A Guide to Fisheries Regulations, a laminated card for fishing vessels; 2) The Seafood Pocket Guide, a small card for restaurants and consumers to raise awareness of closed seasons and size limits for the seafood they consume, which is being disseminated to local tour operators, restaurants, and hotels aimed at promoting sustainable tourism and sustainable seafood harvesting; 3) a poster stressing the importance of not spear fishing ; and 4) a poster (in final production) highlighting the MMA boundaries and noting major statistics, which will be distributed to fisheries departments and reserve stations nationwide, NGOs that manage marine reserves, as well as fisheries cooperatives with the goal of gaining greater compliance and enforcement of the new zones. Several large poaching busts have been featured on the news, and the word on the streets is now "don't break the rules."
- The MIDAS model, which illustrates spatial planning decisions including oil spill scenarios, has been a particularly useful tool in light of the growing concern regarding oil spills due to the Gulf of Mexico BP oil spill and the looming threat of offshore oil drilling and exploration in Belize. The MIDAS oil spill timed scenarios were featured on national television reaching a countrywide audience and generating public support for a ban on offshore oil development. These efforts helped support the Belize Coalition to Save Our Natural Heritage, which is now calling for a referendum on the issue. MPA managers are also using MIDAS for a variety of management purposes, including facilitating stakeholder discussions regarding coastal issues, and the Glovers Reef reserve has requested to be included in the model.
- The Ecological Monitoring Study helped to foster the Scrap the Traps campaign, which resulted in the production of a video and t-shirts for distribution to local fisherman through the Belize Fisheries Cooperative Association. The video is being aired on national television,

essentially reaching the entire country. Fishers are growing increasingly supportive, given the declining health of the reef and fish stocks.

- Six news articles in the nation’s leading newspaper, *The Amandala*, highlighted the importance of MMAs and related marine conservation issues by building on MMAS science. With on-line and print dissemination to essentially the entire country, the importance of protecting and advocating for marine reserves reached Belizeans nationwide and the global community. Also, “reef fact stints” were aired weekly on the national radio station KREM. These one-and-a-half minute blurbs highlighted key messages from the CI MMMAS project. For three months the KREM stints focused on raising public awareness of the financial importance of Gladden Spit marine reserve, reinforcing proper reef etiquette to reduce visitor impacts, and highlighting the reasons for adhering to regulations that prohibit the use of certain outboard engines, which disturb whale sharks and spawning aggregations.



No-take zone of Coiba National Park consists of a 1-mile radius around the islands.

**Outcome 5: Science-to-Action (S2A), ETPS**

- MMAS studies, particularly the fisheries assessment, socioeconomic monitoring and economic valuation, were critical in the development and approval of the Coiba National Park (CNP) management plan, the main goal of the research. The studies provided a rigorous scientific baseline for the management plan, which is widely considered the best management plan Panama has ever had. In addition, MMAS funding, due to complementary funding from UNESCO and Walton, enabled a more participatory management plan creation process.
- Results from the fisheries assessment, which demonstrated the importance of no-take areas to maintaining snapper reproductive stocks, and the socioeconomic monitoring, which identified the areas and frequency of fishing activity as well as governance issues, helped to convince the Directive Council and local fishermen groups to adopt a one-mile, no-take zone ringing Coiba. This no-take area was established by a legal degree and is 20% of the park’s marine area.

- Results from the fisheries assessment showed that fishermen were catching sexually immature snapper because of the size of their hooks and helped to increase local public support for using medium hook sizes, particularly during three fishermen workshops and two broader stakeholder workshops held in 2008. As snapper are a commercially important fishery in the area, using appropriately sized hooks will ensure economic and biological benefits.



Image illustrating the relationship between gonad, hook, and fish size

- An intense outreach campaign was launched over the last five months to highlight the benefits and importance of the CNP with the goal of gaining public support for maintaining it. The campaign drew on results from the socioeconomic and ecological monitoring, cultural and economic valuations, and raised awareness of fishing regulations and highlighted alternative businesses to reduce fishing pressure. Nine workshops were held with more than 700 stakeholders from community members and technical government authorities (i.e., ANAP, ARAP, ATP, INAC), the Coiba Directive Council, the University of Panama in Santiago Veraguas, and the neighboring 25 communities. During all these activities, outreach materials designed for these audiences were distributed, including 1,500 posters, booklets, and calendars. Community members were impressed with the results and with the process of sharing them, in particular that they were engaged in the learning process along with government decision makers.
- As a complement to the outreach campaign, a media campaign was conducted to raise broad public awareness of the importance of CNP for future generations and to gain regulatory compliance. The campaign included publications of fisheries research results in the local journal *Genesis* and in the national newspaper *La Prensa*, and a television program titled “Coiba, Biodiversity Treasure” on FETV. The campaign also included 15 local radio program interviews with MMAS researchers arranged through MarViva and the University of Panama .
- In Galapagos, the research findings will be used in the upcoming zoning discussions for the Galapagos Marine Reserve. With this in mind, an information packet was prepared to improve decision makers’ capacity to generate a technically sound zoning scheme in contrast to the previous scheme, which was based on usage, not technical information. The friendly format in which the information was presented will enable an open discussion about the Galapagos Marine Reserve among the local people and their representatives before the Participatory Management Board, a counsel of users who have direct voice and decision over Reserve issues. These packets have been widely distributed through the media, at a launching ceremony with more than 50 prominent government officials (e.g., Mayor of San Cristobal, Undersecretary of Tourism, President of the Galapagos Government Council), and at follow-up meetings.

**Outcome 5: Science-to-Action (S2A), Fiji and Pacific**

- Discussions with more than 80 communities across different island groups in Fiji regarding the ecological and socioeconomic importance of the resources and their connectivity, led to the communities revising their natural resource management plans. These discussions also resulted in more than 60% of these communities creating new tabus, extending existing boundaries and upgrading temporary ones to permanent status. The island Yadua Taba, currently an iguana sanctuary and one of Fiji’s heritage sites, was identified as a permanent tabu by communities of Yadua Island. MMAS influenced these decisions with findings from the socioeconomic and ecological monitoring studies on the importance and opportunities of MMAs and the genetic connectivity study on the importance of networks of protected areas, which were shared during a series of



Discussions between MMAS scientist and village chief regarding the importance of networking MMAs.

community workshops. These messages were emphasized in a set of connectivity posters, t-shirts noting “Healthy Reef, Plenty Fish, Happy People,” and a video articulating the importance of MMAs, all of which were shared at the community meetings.

- The results from the socioeconomic monitoring and cultural roles study, which showed that poaching in MMAs was a key problem faced by many of the study sites, were shared with the Permanent Secretary of Fisheries and other key government officials. As a result, the Fiji Navy began monitoring poaching and illegal fishing in nearshore waters, prosecution of illegal fishermen in the Fiji Court system improved significantly, the Fisheries Department improved routine checks in key landing sites for Fiji, and more than 60 community members from seven districts were trained as honorary fish wardens.
- A three-island natural resource committee, Yaubula Management Support Team (YMST), was established after MMAS emphasized the importance of island networking based on the genetic connectivity study. YMST was established to help monitor all natural resource development projects in Vanua Balavu, Gau, and Levuka through the support of the Provincial-level administrators. Island-level management plans were also developed for these three islands.
- Protection improved for a grouper spawning aggregation in Vanua Balavu and for sea turtles in Mamanuca after communities were informed of the importance of tabus and the potential to further protect these species based on the ecological monitoring results.
- In the wider Pacific, the MMAS Phoenix Island expedition findings were distilled, summarized, and used to complete the 2010-2014 Phoenix Island Protected Area (PIPA) Management Plan and the PIPA World Heritage Nomination. The research demonstrated the links between all PIPA habitats from island to deep sea and open ocean, examined what was known about linkages, and made a strong case as the world’s first large deep-water World Heritage site. PIPA’s World Heritage inscription was successful in August 2010 and in part a direct result of the synthesis of science results, including the expedition led by MMAS. PIPA is currently the world’s largest World Heritage site and third largest marine protected area in the world.

## **Results Dissemination—Publications**

In addition to the extensive Science-to-Action activities and products, the MMAS results were released in 59 peer reviewed publications, and an additional 66 papers are underway (in preparation, submitted, or in press).

### ***Overall MMAS***

Kaufman, L., Karrer, L.B. and Peterson, P. 2009. Monitoring and Evaluation. In: Leslie, H. and K. McLeod (Eds.). *Ecosystem-Based Management for the Oceans*. Pp. 115-128 (Chapter 7). Island Press, Washington, DC, USA. 392 pp.

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Grober-Dunsmore, R., L. Wooninck, J. Field, C. Ainsworth, J. Beets, S. Berkeley, J. Bohnsack, R. Boulon, R. Brodeur, J. Brodziak, L. Crowder, D. Gleason, M. Hixon, L. Kaufman, B. Lindberg,

M. Miller, L. Morgan, and C. Wahle. 2008. Vertical zoning in marine protected areas. *Fisheries* 33(12):598-610.

In prep: Kaufman, L., et. al. Marine managed areas: the biodiversity and human well-being realities drawing on lessons worldwide.

### ***Global Studies***

#### *Global MMA Effectiveness – Case Study Analysis and Predictive Model (MIDAS)*

Campson, T. Marine Conservation in Developing Countries: The economics of Marine Managed Areas. 2010. Doctoral dissertation. University of Connecticut.

In preparation: Campson, T. and Pomeroy, R. Validating a model of marine managed area economics with structural equation modeling (*Ecological Economics*)

In preparation: Campson, T. and Pomeroy, R. Empirically testing policies associated with marine managed area outcomes specific to compliance and ecological health. (*Conservation Biology*)

In preparation: Campson, T. and Pomeroy, R. The economics of conservation applied to marine managed areas in developing countries: a review of the literature. (*Conservation Biology*)

In preparation: Hrishikesh P., Gopal, S., Kaufman, L., Carleton, M., Holden, C., Pasquarella, V., Ribera, M. and Shank, B. A Spatial Decision Support System for Monitoring Marine Management Areas (*Regional Science*)

#### *Socioeconomic and Governance Monitoring Cross Node Analysis*

In preparation: Samonte, G., Mate, J., Suman, D., Catzim-Sanchez, A., Fong, P., Quiroga, D., Mena, C. and Wang, X. Socioeconomic Assessment of Marine Managed Areas (*Marine Resource Economics*)

In preparation: Samonte, G., Suman, D., Wang, X., Mate, J., Catzim-Sanchez, A., Fong, P., Quiroga, D. and Mena, C. Governance Factors for Improving Marine Management (*Environment and Resource Economics*)

#### *Ecological Monitoring Cross Node Analysis*

In preparation: Kaufman, L., Moura, R., Shank, B., Bertrand, J.F., Guzman, H., Banks, S., Edgar, G., Witman, J., Brandt, M., Comley, J., Francini-Filho, R., Tschirky, J. Effective marine managed areas as adaptive approaches to reducing overuse of resources and user conflicts.

#### *Cultural Roles Cross Node Analysis*

In preparation: Orbach, M., J. Veitayaki, D. Cordero, I. Curado, and J. Palacio. The Critical Role of Cultural Belief, Attitudes and Practices (*Society and Natural Resources*)

#### *Economic Valuation Cross Node Analysis*

In preparation: Pendleton, L., R. Montenegro, V. Hargreaves-Allen, J. Reid, and M. Amend. The Economic Value and Impact of Marine Managed Areas (*Ocean and Coastal Management*)

### *Global Socioeconomic Conditions*

In preparation: Loper, C, R. Pomeroy, P. McConney, M. Pena, A. Sanders, G. Sriskanthan, S. Vergara, M. Pido, C Vieux,, and I.Wanyonyi. Global socioeconomic assessment of the importance of marine resources to people in tropical coasts. (*Society and Natural Resources*)

### *Economic Incentives*

Gjertsen, H. and E. Niesten. 2010. Incentive-based Approaches in Marine Conservation: Applications for Sea Turtles. *Conservation and Society* 8: 5-14.

In press: Niesten, E. and H. Gjertsen. Incentives in Marine Conservation Approaches: Comparing Buyouts, Conservation Agreements, and Alternative Livelihoods. *Environment and Development Economics*.

In preparation: Gjertsen, H., T. Groves, D. Miller, J. Watson, and E. Niesten. A contract-theoretic model of conservation agreements.

### *Cost Effectiveness of MMAs*

In press: McCrea-Strub, A., Zeller, D., Sumaila, R., U., Nelson, J., Balmford, A., & Pauly, D. Understanding the cost of establishing marine protected areas. *Marine Policy*.

### *Cross-Site Synthesis Techniques*

Dinsdale E.A., Pantos O., Smriga S., Edwards A.R., Angly F. et al. 2008. Microbial ecology of four coral atolls in the Northern Line Islands. *PLoS One* 3(2):e 1584. doi:10.1371/journal.pone.0001584.

Sandin S.A., Smith J.E., DeMartini E.E., Dinsdale E.A., Donner S.D., et al. 2008. Baselines and degradation of coral reefs in the Northern Line Islands. *PLoS One* 3(2):e 1548. doi:10.1371/journal.pone.0001548.

### *Organismal Resiliency*

A User's Guide to the Coral Resiliency Assay: A Protocol for Assessing Coral Response to Stress. Erich Mueller. 2008.

Mueller, E.M. and C. J. Booker. Assessment of resilience in *Montastrea faveolata* inside and outside of a marine park. Proc. 11th Int. Coral Reef Symp., Ft. Lauderdale, July 2008. 2:875-879. (2008)

In preparation for submission to Mar. Ecol. Prog. Ser.: Porter, M. and C. Langdon. The effects of increasing carbon dioxide concentrations on *Montastrea faveolata* skeletal growth and lesion regeneration: Using skeletal growth and lesion healing as indicators of coral resilience.

### *Advanced Biosensors – Genetic*

Reitzel, A., Sullivan, J., Traylor-Knowles, N., Finnerty, J. 2008. Genomic Survey of Candidate Stress-Response Genes in the Estuarine Anemone *Nemostella vectensis*. *Biol. Bull.* 214: 233-254.

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Traylor-Knowles, N., Hansen, U., Dubuc, T.Q., Martindale, M.Q., Kaufman, L., Finnerty, J.R.. 2010. The evolutionary diversification of LSF and Grainyhead transcription factors preceded the radiation of basal animal lineages. *BMC Evolutionary Biology*. 10:101. [www.biomedcentral.com/1471-2178/10/101](http://www.biomedcentral.com/1471-2178/10/101)

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In preparation: Dubuc T., Traylor-Knowles N., Hansen U., Finnerty, J.R., Martindale, M.Q. Wound healing in the sea anemone *Nematostella vectensis* requires MAPK/ERK signaling and is associated with grainyhead expression.

In preparation: Lubinski T., Granger B., Opfelt S., Stefanik D., Traylor-Knowles N., and Finnerty, J.R. The *Pocillopora damicornis* genomics database.

In preparation: Wolenski, F., Traylor-Knowles, N., Lubinski, T., Finnerty, J.R., Gilmore, T.D. Insights into the ancestral NF $\kappa$ B signaling-pathway from the sea anemone *Nematostella vectensis* and the lace coral *Pocillopora damicornis*.

## **Abrolhos, Brazil**

### *Ecological Monitoring*

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## **Lessons Learned**

After five years of conducting the Marine Management Area Science program, the team has learned numerous lessons. Many of these are noted in the *MMAS S2A Assessment Report* and in the *MMAS Overall Science Synthesis Report*. Following are the primary lessons learned:

- Ensure research is wanted and relevant to management issues. If fisheries are a big issue, then ensure research relates to fisheries. The best way is to determine what information is needed is to consult with decision makers before committing to do research. For example, CI ETPS and STRI co-hosted a stakeholder focus group workshop to identify science needs for Coiba National Park. The other nodes also held one-on-one meetings and stakeholder workshops to discuss how the research related to management priorities. These discussions need be vertical as well to ensure HQ, for example, is fundraising around field needs.
- Feed into existing research. For example, the Belize ecological monitoring team built on existing ecological and socioeconomic monitoring protocols, which facilitated comparison and increased likelihood of the monitoring continuing.
- Select study sites where science can contribute to existing conservation efforts and may be supported by existing funding. Anticipate from the beginning how the research can contribute to what conservationists are already undertaking and how funders in the area may benefit and be interested in sustaining the work. For



Fiji stakeholders meeting to identify priority research needs and conservation applications.

example, the Walton Family Foundation is now supporting ecological and socioeconomic monitoring in ETPS building off the MMAS monitoring protocols.

- Select sites with local scientific and conservation capacity.
- Invest time in planning to ensure a program that is strategic and avoids getting drawn into opportunistic studies that do not relate to the overall vision.
- Realize that conducting useful and useable science takes more time than conducting “parachute-in-science.” In countries where there is no office, setting up will take at least a year based on experiences in Fiji and Belize. Also, ensure scientists are aware that the timeline will include vetting and tailoring, which could add an additional six to twelve months beyond a “parachute-in-science” timeline based on experience in Fiji.
- For these reasons, work where there is a programmatic commitment (e.g., an office) to ensure start-up is efficient and to ensure follow-up beyond the research funding.
- Realize that social change happens on the decadal time scale; three-to-five year projects will not both create and see the results from social change.
- Ensure the program has the flexibility (in budget and in commitments) to address unexpected issues. For example, climate change was not a major marine science issue when MMAS was initiated and, consequently, there were only limited allocations to climate change related studies. Due to commitments to the initially agreed studies, the team was not able to shift resources to better examine this issue.
- To facilitate cross-study learning, assemble the lead scientists (i.e., disciplinary PIs and node principals) together, both within and across nodes, early in the project, and as often as practical after that, not just at the end.
- Engage local scientists as much as possible at the senior to junior levels. Local scientists are typically most knowledgeable of the literature relevant to the area and will be able to help translate and disseminate the results during the S2A phase.
- Make capacity building a priority—both short-term (e.g., hiring in-country scientists, holding training workshops) and long-term (e.g., feeding into local databases, supporting networking of colleagues).
- Hire S2A coordinators who understand marine science, but have communications expertise and do not expect to work as scientists; instead, the coordinators should be focused on drawing out the key messages from the research, identifying priority conservation actions for each target audience, and then strategizing how to use the key messages to get the audiences to undertake the actions. They should be focused on facilitating key meetings with the audiences and producing relevant materials (e.g., policy briefs, posters, stickers, etc.).
- Work at multiple levels. CI Brazil, for example, works with government ministers to fishermen leaders. At the same time, target where your efforts can be most effective. In Fiji, for example, CI Fiji decided the government was too unstable and, consequently, most resources are committed to the village level.

- For global learning, think about and plan syntheses at least a year in advance.
- To ensure global learning, invest in communication and networking of experiences. Annual meetings are important to share achievements and experiences and to seek input for addressing problems.
- Prioritize quality over quantity. In countries where the team focused on a few MMAs (i.e., Brazil, Panama), the team was able to be more strategic than countries such as Belize, where multiple MMAs made it difficult to track and influence all processes.

## **Conclusion**

One of the main lessons learned from the Marine Management Area Science Program is that process is as important as outcomes. Not only has MMAS produced ground-breaking science and influenced conservation actions worldwide, but in the process of doing so, the program has had a tremendous impact on how Conservation International, our partners, and other stakeholders think about and do marine conservation science.

Conservation International is deeply grateful to the Gordon and Betty Moore Foundation for providing the guidance and funding that launched this tremendous program. Without the Foundation's support, the knowledge, capacity building, and conservation actions would not have been possible. As a result of the Foundation's vision, in five years the MMAS Program was able to build more than 100 institutional partnerships and work with over 200 scientists in 23 countries and 73 MMAs to create a global network that led to insights that will influence conservation at the local to global scales for many years to come.

Thank you.