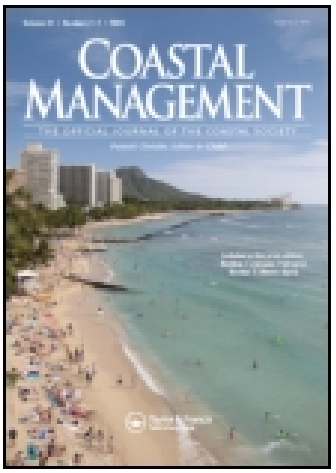

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Multisite, Interdisciplinary Applications of Science to Marine Policy: The Conservation International Marine Management Area Science Program

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Multisite, Interdisciplinary Applications of Science to Marine Policy: The Conservation International Marine Management Area Science Program

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This special issue provides insight into global conservation science by analyzing a 5-year, $12.5 million global marine conservation science and policy program that included over 50 studies in four priority regions involving over 100 scientists and numerous partners. In doing so, it provides reflections on critical challenges for any conservation science program that is intended to inform policymaking, including how to (1) ensure that science process and products influence conservation actions, (2) build global learning from a network of site-based projects, (3) strengthen in-region capacity, and (4) manage relationships across scales among scientists, conservationists, headquarters, and field-based staff. Information is presented on the development and progress of the program as a whole in addition to specific articles covering each of four focal geographic areas: Belize, Brazil, the Eastern Tropical Pacific Seascape, and Fiji.

Keywords marine conservation, nongovernmental organizations, science to policy

Introduction and Justification for this Special Issue

"Knowledge-based" and "founded on science" are core principles of most conservation organizations. These organizations rely on an understanding of the ecological, economic, and cultural context to make informed decisions. Yet, in many cases there is a significant disconnect between the research divisions of these organizations and the divisions responsible for working with governments, the private sector, and other nongovernmental organizations (NGOs) to develop and implement conservation strategies. Consequently, while many of these institutions pride themselves on being "science-based," they often lack the concepts and mechanics to ensure the research is designed, conducted, and communicated so as to best inform policies at local to global scales.

There are a multitude of analyses regarding the impacts of conservation initiatives (Sanchez-Azofeifa et al. 2007; Margoluis et al. 2009; Blom, Sunderland, and Murdiyarso 2010; Hoffmann et al. 2010; Schreckenberg 2010). Few of these analyses have documented how conservation science programs are conducted, from research design through

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to policy implementation and evaluation. There are real needs for programmatic analyses of how conservation science programs actually do—and might better—operate, in particular in translating the science into policy.

This special issue provides insight into the topic of global conservation science programs by analyzing a 5-year, $12.5 million global marine conservation science and policy program that included over 50 studies in four priority regions involving over 100 scientists and numerous partners. In doing so, this analysis provides reflections on critical challenges for any conservation science program that is intended to inform policymaking, including how to:

- Ensure the science (process and products) influences conservation;
- Build global learning from a network of site-based projects;
- Strengthen in-region capacity; and
- Manage relationships across scales among scientists, conservationists, and headquarter- and field-based staff.

The Conservation International Marine Management Area Science Program

The Conservation International Marine Management Area Science (MMAS) program was a five-year, $12.5 million program funded by the Gordon and Betty Moore Foundation (Moore Foundation). It was envisioned in 2003, approved in 2005 and completed in 2010. MMAS was managed by the Arlington, Virginia office of Conservation International (CI), but relied heavily on external partners, particularly in-country researchers, conservationists and other stakeholders actively engaged in conduct of the science and the establishment and management of marine managed areas (MMAs) in four selected regions: Abrolhos, Brazil; Belize; the Eastern Tropical Pacific Seascape (focusing on Panama and the Galapagos); and Fiji. All four regions hosted MMAs and parallel MMAS studies; although the objectives, forms, content, and processes came to vary considerably among the regions under local influence and conditions. Approximately 80% of MMAS resources went to region-specific studies.

A total of 52 studies were conducted (see Table 1) focused around five themes:

1. Management effectiveness;
2. Connectivity;
3. Resilience;
4. Socioeconomic significance; and
5. Economic development and governance.

The studies engaged 100 scientists and stakeholders directly and another 300 indirectly (e.g., through training workshops) and involved partnerships with over 75 institutions at the global to local scales. As a result, 135 grants, contracts, and internal agreements were implemented through the course of the program. Program highlights and science-to-action (S2A) products are available at www.science2action.org.

Four aspects of the program were distinct to MMAS. First, the research was designed to be broadly interdisciplinary from the beginning of the program. Biophysical, socioeconomic, cultural, and governance studies were performed in a common format across the four regional sites. Second, the program made great efforts to ensure that the scientific process and results contributed to marine conservation, particularly MMA strategies. This approach was referred to as S2A. Third, a heavy emphasis was placed on strengthening

Table 1
MMAS studies

Study title	Global	Belize	Brazil	Eastern Tropical Pacific Seascape (Panama & Galapagos)	Fiji (and broader Pacific)
Management effectiveness					
MMA Global Management Effectiveness	Dahlgren/Pomeroy/ Campson (case studies)				
Core MMA Ecological Monitoring	Kaufman (cross-regions)	Shank	Moura	Guzman (Banks)	Bertrand
Core MMA Socioeconomic & Governance Monitoring	Samonte-Tan (cross-regions)	Haylock/Catzim	Curado/ Orbach	Mate/Suman (Quiroga)	Fong
Fisheries Assessment				Vega	
Visualization and Spatial Analysis (MIDAS)		Gopal		Gopal	
Extinction Resistance				Edgar/Brooks	Edgar/Brooks
Ecotourism Effects on Spawning Fish		Heyman			
Cruise Ship Ecological Impacts		McField			
Ecol. Effects of No-Take MMAs					Vincent (Philippines)
Diagnostic System for Ecosystem Health	Sala (case studies)				
Connectivity					

(*Continued on next page*)

Table 1
MMAS studies *(Continued)*

Study title	Global	Belize	Brazil	Eastern Tropical Pacific Seascape (Panama & Galapagos)	Fiji (and broader Pacific)
Cross-Shelf Habitat Linkages		Romero/Ricketts	Moura		
Inter-Reefal Habitats		Lobel	Moura		
DNA Conch Genetic Connectivity		Cigliano/Kilman			
Larval Dispersal Modeling		Paris-Limouzy			
Multi-Species Aggregations			Moura		
Fish Genetic Connectivity					Barber/Drew
Deepwater Shelf Connectivity					Stone (Kiribati)
Coral Connectivity in the Pacific					Palumbi
Hawaii Aquarium Fish Connectivity					Hixon (Hawaii)
Resilience					
Climate change vulnerability assessment				(Quiroga)	
Advanced Biosensors: NFkB Expression	Finnerty (lab)				
Advanced Biosensors: Microbial	Rowher (lab)				

Coral resiliency	Mueller (lab)				
Coral resiliency	Langdon (lab)				
Socioeconomic significance					
Global Socioeconomic Conditions of MMAs	Loper (case studies)				
Core MMA Economic Valuation	Pendleton (cross-regions)	Hargreaves- Allen	Amend	Montenegro	Korovulavula
Core MMA Cultural Roles	Orbach (cross-regions)	Palacio	Curado	Cordero	Veitayaki
Economic development & governance					
Economic Incentives	Niesten (case studies)				
Enforcement Chain Analysis		Neal		Rosero	
Cost Effectiveness of MMAs	Sumalia (case studies)				
Science-to-Action	Wells (cross-regions)				

in-region short- and long-term capacity, which required local, in-country participation in all facets of the program.

Finally, the program provided global learning by drawing primarily on the comparison of first-hand, primary data-based knowledge from the region-based studies, all of which were performed concurrently, identifying transportable principles and making the program as a whole cross-cultural and international.

The four regions represented some commonalities in the biophysical environments and resources (e.g., coral reef-mangrove-seagrass ecosystems; wet tropical watersheds and climates), but were very diverse in other aspects (specific fisheries; social and cultural history and context; governance systems). As opposed to projects that rely primarily on secondary-source data, the MMAS program produced interdisciplinary primary-source data for multiple cases and locations. Much has been written about marine protected areas (MPAs) and MMAs (Agardy 1994; Jameson, Tupper, and Ridley 2002; Christie and White 2007; Charles and Wilson 2009; Cinner, Fuentes, and Randriamahazo 2009; Fox et al. 2012; Hastings et al. 2012) but no project has been conducted in as broad of a comprehensive, multidisciplinary, original data-based, policymaking and interactive international format.

This theme issue will point out the successes and challenges of building and implementing an interdisciplinary science program that is global—yet regionally based—with the ultimate goals of influencing the creation and management of MMAs and building in-region capacity. This article provides a brief history of the program, its central features, and its challenges. We will then present short case studies of the progression of the program in each of the four regions. Finally, we will conclude with a final article outlining the lessons learned regarding not only the establishment and operation of specific MMAs, but also the creation and management of a large, multinational research and application program.

History of the MMAS Program

Conception

MMAS was conceived at the 2003 Defying Ocean's End (DOE), a conference conceptualized by Dr. Sylvia Earle and organized by Conservation International to bring together marine conservation experts from around the world to develop an agenda "to address the sharp decline in ocean wildlife, the disturbing increase in ocean pollution and the neglect of policies and resources to solve these problems" (www.conservation.org). The major DOE funder, Dr. Gordon Moore,[1] took a particular interest in the science agenda coming out of DOE and agreed to consider a proposal related to studying marine management regimes. The proposal was originally conceived as $22 million, meant to be focused entirely on marine science—no conservation or intervention efforts—and was intended to study whether or not no-take marine reserves were making a difference ecologically (see Figure 1). An employee of CI, who was at the DOE conference as well as intensely involved in crafting the original proposal, explains:

> Gordon was interested originally in the notion of whether no take reserves actually worked. He expressed an interest in work being done to move that along, to document that. The MMAS program evolved out of that, the scope of the original proposal. Subsequent work has moved beyond documenting

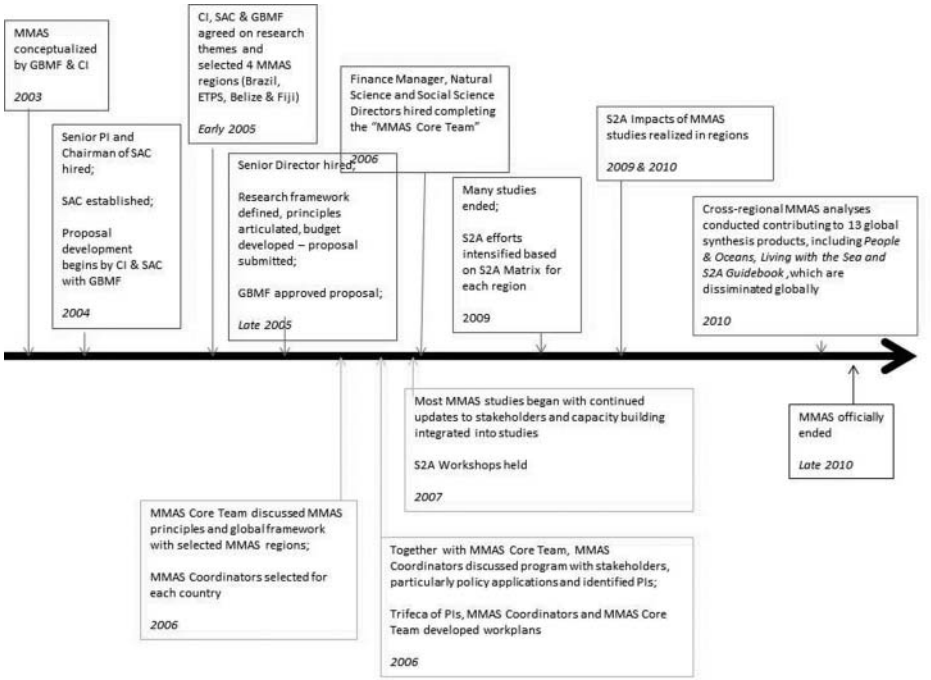

Figure 1. MMAS global program.

whether no take reserves work or not, but that was the impetus, whether MMAs work or are effective management tools or not.

The senior director of the Global Marine Program at CI commissioned one of the conference leaders, a Professor of Marine Ecology (hereafter referred to as the senior principle investigator [PI]) to work with CI staff to develop the proposal. The senior PI worked particularly closely with CI staff in the Center for Applied Biodiversity Science (CABS) and Global Marine Division and field staff, and the senior staff of and the Marine Conservation Initiative at the Moore Foundation in proposal discussions.

During these discussions there were many concerns and disagreements over what the proposal should include. As the core concept, the senior PI initially proposed a network of parallel studies around the world, whose results could be combined and contrasted to reveal the dynamics of coupled human and natural systems in the coastal tropics, at hierarchical spatial scales. The observational instrument in each region would be, in effect, an adaptive management experiment: a marine management area or zoning scheme. By comparing biophysical and socioeconomic outcomes under the different management regimes within a zoning plan (e.g., totally protected, partially protected, open-access), the team hoped to elucidate the workings of social and ecological systems. In contrast, some CI CABS scientists saw the proposal as a way to do species assessments, build CI's marine capacity, create Seascapes (Atkinson et al. 2011), and fill funding shortfalls in various CI country programs.

There was also concern regarding the exclusive focus on science and, consequently, the lack of conservation in the program. As the senior PI noted:

> We were . . . very queasy about the fact that Moore did not want us doing any conservation. . . . The oceans are in such desperate straits, you get an opportunity like that, and you are not supposed to do anything? And that is an odd attitude for a scientist, because normally you just want to do science.

The Proposal

After intensive debate, the original proposal was submitted to the Moore Foundation at the end of 2003. The proposal included the senior PI's core concept of parallel studies around the world in order to achieve four core goals:

1. To scientifically assess the effectiveness of MPAs in conserving biodiversity;
2. To develop and test MPA models;
3. To increase political will to create MPAs; and
4. To build capacity within the CI CABS.

Within these goals were a focus on species assessments, MPA mapping, and rapid assessment protocols (RAPs), all of which reflected the mix of interests within CI.

Following further conversations between CI and the Moore Foundation, the proposal amount was reduced to $12.5 million and there was a move away from species assessments, MPA mapping, and extensive CI capacity building. The Moore Foundation further agreed that the term "MPA" be replaced with "MMA" envisioning MMAS as an initiative that would study the full range of human activities within the marine and coastal zone, and not focus entirely on no-take areas.

Early Commitments

As negotiations continued in 2004 and 2005, three significant steps were taken that affected the future success of the program. First, the senior PI established the Scientific Advisory Committee (SAC), a requirement of the Moore Foundation. The SAC's members were selected based on their expert knowledge and range of expertise, input and suggestions from CI, the Moore Foundation, and the senior PI. The original members (see Table 2) were recognized global experts in the natural sciences, had strong reputations of applying science to conservation, and were "really interested in this opportunity do an experiment that involved different human impacts" (personal interview, core MMAS team member). The SAC was intended to help focus the MMAS proposal and workplan development. It served as a sounding board for the senior PI and CI as they further refined the proposal. The SAC evolved over the five-year duration of MMAS, with some members resigning and others joining.

The second step was that, as part of SAC discussions regarding the core themes to be addressed, the senior PI, CI colleagues, and SAC members began discussing research ideas with marine conservation science experts with a global perspective. These dialogues facilitated exploration of the proposal concept of marine management area effectiveness, and were also important for the Moore Foundation to be able to understand the types of actual studies that would be funded.

Finally, during these continuing discussions in 2004 and 2005 regarding the proposal, CI, the Moore Foundation, and the SAC selected the focal regions for MMAS. As a starting point, an initial list of 10 regions was proposed by CI, which included the final four regions as well as locations in Indonesia, Madagascar, Baja California, Bahamas, and the

Table 2
Scientific Advisory Committee members

Dr. Les Kaufman, Boston University
Dr. Ratana Chuenpagdee, Memorial University of Newfoundland
Dr. Mark Hixon, Oregon State University
Dr. Michael Orbach, Duke University
Dr. Steve Palumbi, Stanford University
Dr. Charles Peterson, University of North Carolina
Dr. Andy Rosenberg, University of New Hampshire
Dr. Enric Sala, National Geographic
Dr. Rashid Sumaila, University of British Columbia
Dr. Keith Sainsbury, Commonwealth Scientific and Industrial Research
Dr. Matthias Ruth, University of Maryland
Dr. Steve Hall, WorldFish Center

Sea of Cortez. This list was narrowed down to four regions based on several criteria: geographic representation (Pacific and Atlantic), biological diversity, existence of MMAs, anticipated partner interest, political stability, logistics, existing infrastructure, and existing synergy with local partners. With the exception of Brazil, where CI maintained an office, there was little ongoing communication with potential regions during this process. The senior PI was communicating with professional colleagues in some regions. However, there was not an institutionalized effort by CI or the SAC to have all potential regions consulted in the selection process. It was felt that extensive partner consultations would be pre-mature and perhaps counterproductive, because the regions had not been finalized and the Moore Foundation had not yet fully committed the funding. A core MMAS team member, not yet part of MMAS in 2004 and 2005 but reflecting back on the process in a 2009 interview, explains:

> But the reality is, you are in a global conservation program funded by a large donor. The donor ends up having a fair bit of influence as to what gets decided, so it becomes this balance. ... But the locations had not been decided. So it would have been impossible to go to every country in the world and say, there is this 5% chance that your country is going to be selected, but what are your priorities?

Implementation Begins

In June 2005 the Moore Foundation committed to funding MMAS, which put immediate pressure on CI to quickly get several MMAS projects up and running with the obvious choices being those discussed during the pre-proposal phase. The intention was to get early scientific results so as to increase MMAS' credibility and indicate to the Moore Foundation and CI that MMAS could deliver progress. This early funding was somewhat opportunistic, and supported rapid basic MMA science projects rather than long-term monitoring or projects oriented toward conservation, which was still not a focus of the program. Projects funded at this stage included studies on Hawaii Aquarium Fish Collecting Impacts, the Ecological Effectiveness of MMAs in the Philippines, Coral Resiliency

in the Bahamas, and Fish Genetic Connectivity. The total amount of MMAS' funding spent on these early projects was approximately 4% of the total $12.5 million.

Opinions on the wisdom of implementing these projects, most of which were not clearly connected to the four focal regions, were mixed. Key individuals at CI and the Moore Foundation felt that the fast tracking of these projects led to some early MMAS disorganization and diluted MMAS' focus on core science at the four main node sites. Additionally, the actual roll out of some of the projects—in particular the Fish Genetic Connectivity project in Fiji—led to problems with regional partners who saw the program as designed without sufficient local input. However, others believed that these projects were necessary to show the Moore Foundation that MMAS could produce results, to advance work on fundamental scientific problems common to all of the candidate study regions, and because early results could inform and improve projects later in the lifetime of the program.

The other important immediate effect of the Moore Foundation committing to funding MMAS was that CI recruited and hired a core management team to direct the program. The senior PI was a professor interested in the intellectual aspects of the program and the connections to conservation, but not interested in directing the operations. Consequently, after the core management team was hired his role shifted to being both the SAC chairman and the senior PI of MMAS, which essentially meant he provided intellectual guidance to the program without getting immersed in day-to-day operations.

In September 2005, MMAS hired a senior director. Beside her experience as a program manager, the selection of the senior director was made to strengthen and build out the social science side of MMAS. Shortly after she joined, the senior director hired an administrative assistant to handle finances and administration. In mid to late 2006 directors for the Social and Natural Sciences were hired, working under the senior director to oversee, respectively, the developing social and natural scientific projects and to be integral parts of the program development. The resulting core CI MMAS management team included a senior director, two directors, and an administrative assistant.

With the establishment of the MMAS Core Team, several significant changes took place quickly: the program gained a clear structure, thematic focus and defined budget; the social sciences were better integrated into the agenda; and S2A became a clear core component of the program with budget allocations and specific tasks. The SAC, the senior director and her staff, the senior PI, and the Moore Foundation began work on selecting themes that would organize the projects into a logical format and increase understanding of MMAS by both MMAS and non-MMAS stakeholders. The exact themes of the program were finalized in late 2005 as:

- Management effectiveness;
- Connectivity;
- Resilience;
- Socioeconomic significance; and
- Economic development and governance.

These themes were selected because they were seen as core MMA issues that would be relevant everywhere in the world. The MMAS Core Team began developing the detailed relationships with the field offices and with the scientists based on these themes.

The scientific themes were also the basis for the detailed Overall MMAS Workplan, which eventually incorporated each of the 52 studies, their budgets, lead principal investigators, study sites and other information (MMAS 2005). Up to this point in MMAS, the

MMAS Overall Workplan had existed as a general framework. By November 2005, as MMAS Regional S2A coordinators (called coordinators throughout this issue) and scientists were brought on board, the overall workplan was developed and would later be used to judge progress and to report back to the Moore Foundation.

While honing the thematic focus of the program, the senior director worked with CI colleagues, social scientists from the SAC, and outside experts to build the social science agenda of the program, increasing the number of social science research projects from seven to twenty-two studies and overall funding dedicated to social science from half a million dollars to closer to four million dollars. More senior social scientists were also recruited to the SAC, and those social scientists helped to balance out the biophysical scientists who had previously made up the majority of the committee. More social scientists contributed to more and broader interdisciplinary discussions, and provided a feedback mechanism for socioeconomic, cultural, and economic workplan development. The intention was to ensure that social and natural science were integrated and balanced in order to address the inevitable tradeoffs among biophysical and socioeconomic and cultural factors involved in establishing and evaluating MMAs.

The final evolution of the program during this phase was the expansion into S2A, which was seen by many within MMAS as a critical point in MMAS' development. This evolution originated with shifts in staff responsibilities at the Moore Foundation. The Moore Foundation staff person with oversight for the MMAS program, in particular, was moved into a larger role in overseeing MMAS. This staffer felt that MMAS presented a significant opportunity to do conservation and capacity building. Contemporary stories in the media at the time about the ineffectiveness of conservation and foundation work further encouraged the Moore Foundation to ensure that their initiatives made a conservation difference (Chapin 2004). An employee at the Moore Foundation explains:

> . . . the Moore Foundation did not want the program to just be about science, we thought the science to action piece . . . was really important. And then there had been a bunch of exposes around that time, the Chapin article and the ineffectiveness of large BINGOs, we were concerned that. . . we wanted the emphasis to be on the field . . . So we also tried to emphasize different ways for in country capacity building to happen.

The MMAS Core Team had similar interests in expanding the role of conservation in the program. As they discussed the concept of translating MMAS science into decision-making at local to global scales, the S2A concept emerged. To make this concept a reality, several important programmatic measures were taken. First, 15% of the budget for each research study was allocated to S2A and not included in the grants to the researchers. This was to guarantee that this money would be used for this purpose would not disappear through science cost overruns or administration fund transfers, and would be available for building a relationship between scientists and regional field staff as well as for science communication, S2A workshops, and S2A products. Second, the research workplans were restructured from traditional science plans (e.g., hypothesis, methods) to include sections defining the anticipated conservation impact, target audiences and how results would be discussed with the audiences. Third, coordinators were identified for each region (explained further below) and these coordinators were invited to be part of the bi-annual SAC meetings to ensure discussions addressed the conservation aspects of the science.

As a result of all the planning, four intended outcomes emerged for the program:

1. Bringing the best interdisciplinary science to bear on the topic of MMAs;
2. Providing global learning through two means: conducting worldwide studies on topics that speak to widely shared problems and issues; and synthesizing learning from site-based research across the regions by conducting comparable studies on central themes and engaging cross-cutting PI by disciplinary area to conduct the synthesis;
3. Informing policymaking at local to global scales by communicating and integrating the new knowledge into decision-making processes; and
4. Build and strengthen regional capacity building through short-term and long-term activities.

These four target outcomes provided the structural framework for the program, including budget allocations. Finally, a separate set of funds totaling less than 5% of the overall budget was designated to provide additional support to build capacity. The funding for this fourth outcome was relatively low because many of the costs (e.g., hiring in-country experts) were included in the actual studies covered in outcomes one to three.

At this point MMAS had a SAC, regions, desired outcomes, scientific themes, a focus on S2A, full staff in Arlington Virginia, and a truly interdisciplinary scientific focus. MMAS then began building more relationships and developing individual scientific workplans in each region.

Program Structure and Process

Program Scientific Themes and Studies

The four outcomes provided an overall framework in which the research themes could be defined and the studies articulated. In accordance with the objectives, the themes and studies were intended to draw from the natural and social sciences, include both worldwide studies and regional studies and address conservation knowledge needs while building in-region capacity. Once this broad scope was agreed on and the funding details resolved, the individual research studies were designed specific to regional needs. Shifting to the regional focus required partnering with key stakeholders in each of the four regions to discuss priority knowledge gaps and to determine how MMAS could address those needs while remaining true to the global objectives and experimental design. Instrumental to these partnerships was the identification of coordinators, whose primary responsibilities were to ensure the research was relevant, useful and ultimately used to further conservation agendas.

A series of one-on-one consultations were held in each region led by the coordinators who also facilitated a series of S2A Workshops in each region to identify regional MMA-related research needs to help refine MMAS plans. In the Eastern Tropical Pacific Seascape (ETPS), for example, 20 partners including local NGOs, federal government agencies, regional fishermen organizations and the Smithsonian Tropical Research Institute participated in a workshop regarding research needs for Coiba National Park, which informed the MMAS studies in Panama.

Once the foci of the studies had been determined and the coordinators put in place, appropriate scientists were identified to lead research within each site, with priority given to in-region scientists. The relationships between the scientists and the coordinators were critical to developing each study plan to ensure that they produced quality science and relevant and useful knowledge. From the scientists' perspective,

the research planning process was rather unique (and challenging) in that it required extensive consultation with the coordinators and MMAS Core Team. In a typical academic research grant scientists respond to a request for proposals, have limited discussions with the donor and then, if approved, implement the grant as they see fit with limited oversight or input from the donor. MMAS was completely different, as the entire program was developed in consultation with the funder (the Moore Foundation) and the specific local work required that a strong relationship be built as the scientists worked with the coordinators and both colleagues and constituents in the study areas. In a sense, this became an exercise in the socialization of natural scientists and the naturalization of social scientists and the harmonization of all of the scientists with other program participants—which was an interesting, challenging, and productive process.

As they wrote the workplans, the scientists and coordinators jointly drafted the objectives and timelines for the regional projects. The scientists drafted the sections that described existing relevant science efforts, how this study would contribute to new knowledge, the researchers and their roles, capacity building efforts, anticipated publications and research budget. The coordinators drafted the sections that described existing conservation efforts, anticipated conservation impacts of the study, target audiences for the results and how they would be engaged, products for the broader conservation community (e.g., white papers, posters) and the S2A budget (15% of overall budget). The result was a joint workplan for the research that ensured the research agenda was defined and the conservation context was incorporated. This partnership relationship between the scientists and coordinators and between the coordinators and in-region stakeholders continued throughout the course of the research, and was critical to ensuring that the research results fed into conservation initiatives.

In addition to the individual studies within each theme, MMAS studies were also structured to provide for global learning through cross-regional analysis. There were four sets of studies that were consistently conducted in all four regions:

1. Socioeconomic and governance monitoring;
2. Ecological monitoring;
3. Cultural roles studies; and
4. Economic valuations.

The idea was that by using somewhat (to the extent that this was practical) standardized approaches across the regions, cross-regional analyses could be conducted for global learning. To do so, a theme PI was identified for each of the cross-region analyses whose task was to ensure comparability in the four study areas among the four regions while realizing the need to tailor both the science and the policy application to the local context. In the case of the socioeconomic monitoring, for example, there was a core set of indicators that were agreed to be the core included in all the regions (Curado 2010; Fong 2010; Jordan 2010). Yet other indicators were added often to ensure comparability with long-term datasets in the region, and the approaches to gathering information on the indications varied also.

At the completion of each theme's four regional analyses, the regional PIs came together with their theme PIs to analyze the data and identify their key findings, which were then published for global learning.

Staff and Partner Organization

The MMAS organizational structure was a complex network of partnerships that included CI Headquarters (HQ) staff, CI field colleagues, region-based scientists, other region-based stakeholders, global experts and other global partners. This structure was in addition to the Science Advisory Committee and the Gordon and Betty Moore Foundation (GBMF) as described previously, and was designed to reflect the emphasis on ensuring the highest quality inter-disciplinary science, the link between science and conservation action, capacity building and global learning based on a network of field studies.

Since MMAS was, at the core, a science program, scientists were critical to success and included three types of engagement. Grants were provided for individual, study-specific scientists to design and conduct the studies and to engage in policy discussions. The 100 directly engaged scientists included approximately 2/3 natural scientists and 1/3 social scientists. Outside experts were brought in when local expertise was not available. About three quarters of the scientists across all sites were in-region experts. To ensure cross-region learning, a set of overall PIs were engaged to oversee the socioeconomic and governance management effectiveness, ecological effectiveness, economic valuation, and cultural role studies. These cross-region PI received grants for their cross-study analyses, which were fundamental to global learning.

The team members most critical for the goal of feeding the sciences into policy were the coordinators. The coordinators were actively engaged in marine conservations agendas in the regions and had established relationships with the various relevant stakeholders. They were responsible for ensuring the research was useful and used for conservation agendas, which meant actively engaging relevant stakeholders in the research plans, implementation and result dissemination. In the cases of ETPS, Brazil, and Fiji these were CI field staff because CI had offices there, whereas in Belize the coordinator was selected from a partner organization.

The resulting structure was a relationship (see Figure 2) among the coordinators, the PIs, and MMAS Core Team. Their respective responsibilities were:

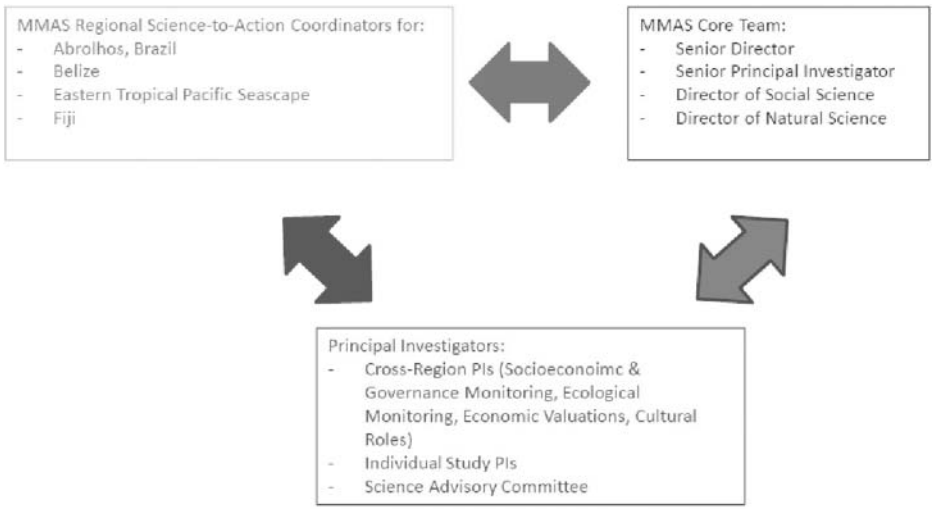

Figure 2. Relationships within MMAS.

- *PIs*—ensure conducting highest quality science; strengthening and building regional capacity; drawing out key lessons;
- *Coordinators*—ensured research was designed to address conservation knowledge need and that results were fed into policy process to help create new, or improve existing, MMAs by identifying key messages (e.g., benefits and challenges of MMAs), sharing those messages in an accessible format and discussing with relevant stakeholders; and
- *MMAS Core Team*—ensuring meeting CI commitments to Moore Foundation; serving as liaison between scientists and conservationists; assisting coordinators in translation and integration of science; ensuring cross-region comparability and synthesizing across regional results; and, seeking and addressing advice from SAC.

This three-cornered relationship was particularly critical for the S2A component and also helped with capacity building, particularly in the case of non-regional PIs who needed in-region assistance from the coordinators to make the links with in-region scientists.

In-Region Organization

The regions varied significantly in how they were organizationally structured.

In Brazil and the ETPS there were CI staff already working in the regions that were deeply knowledgeable and actively engaged in marine policy processes. In Brazil, for example, CI Brazil had five to ten staff focused in Abrolhos for 12 years who were on the advisory boards of the MMAs in the region and had actively assisted in their establishment.

In contrast to the well-established CI-Brazil marine program, Fiji operations were nationally nascent, but regionally strong. When MMAS was initiated, CI only had one staff person in Fiji, who was focused on terrestrial activities, and who passed away within six months of initial discussions. Consequently, MMAS relied heavily on the advice and leadership of the CI Pacific leader for the process of hiring a CI Fiji full-time coordinator, a process that took over a year. The Fiji coordinator, with guidance from the CI Pacific Leader, was invaluable especially as she played a key role in building the relationship with the Fiji Locally Managed Marine Area Network (FLMMA), a network of community leaders and national conservation-oriented organizations.

To some extent a blend of CI-Brazil and CI-Fiji, the CI-ETPS is a regional initiative between Colombia, Ecuador, Panama, and Costa Rica in which CI has a strong investment and long history. During early discussions the ETPS team decided to focus approximately two-thirds of MMAS efforts in Panama because of a greater need due for capacity for the new Coiba National Park. The remaining one-third went to Galapagos and regional work, such as a region-wide enforcement study. Although there was strong capacity at the regional level and in neighboring Costa Rica, the Panama office was not established until three years into MMAS at which point the Seascape program and MMAS split the cost of the Panama director. Consequently, until that time MMAS was led by the regional director based in Galapagos and the Costa Rica director, which resulted in somewhat disjointed initial efforts.

Belize was selected to be one of the four MMAS regions because of the tremendous conservation capacity in-country; ironically, however, there was no CI office in Belize and CI had limited regional capacity and no long term commitment to Belize. In fact, during the fourth year of MMAS the CI MesoAmerica office was closed. Consequently,

MMAS hired a part-time Belize coordinator through a partner organization, Friends of Nature. During the fourth year, the Belize coordinator was replaced with the director of the Healthy Reefs Initiative based in Belize.

Thus the MMA program unfolded and was managed somewhat differently in each of the four regions, under the general umbrella of the MMAS program and coordination from the MMAS Core Team.

Summary

This, then, is how the CI MMAS program came into being, was organized, and proceeded. The "take home" messages are these:

1. The MMAS program concept was initiated at a high level in both the marine conservation and philanthropic communities, with the involvement of specific, prominent personalities;
2. During proposal development the program evolved from a strict marine science program into a marine science and conservation program, and from a primarily natural science program to a relatively balanced natural and social science and policy program;
3. The commitment to a fully funded professional staff to manage the program, in addition to the input from scientists and top organizational managers, shaped the program; and
4. An early commitment was made to the engagement of in-country professionals and constituents as integral and primary components of the program, although the structure and process of this commitment evolved differently in each of the four regions.

The following pages describe how the program unfolded in each of the four regions—Belize, Brazil, Eastern Tropical Pacific Seascape, and Fiji, followed by a concluding article.

Acknowledgments

The data analyzed for this synthesis article were primarily drawn from a comprehensive review of the MMAS program, performed by Dr. Hastings and others (Hastings 2011; Wells, Hastings, and Moure 2011). This publication explains the methodologies for collecting the data analyzed for this article. This article is the first time this material has been presented in a synthesized, comprehensive way detailing the entire MMAS program.

Note

1. Dr. Moore is the founder of Intel Corporation, and along with his wife Betty of the Gordon and Betty Moore Foundation.

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