

# An Analysis of Issues Affecting the Management of Coral Reefs and the Associated Capacity Building Needs in Guam

JANUARY 2014





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## **PREPARED FOR:**

Coral Reef Management Network in Guam & National Oceanic and Atmospheric Administration's  
Coral Reef Conservation Program

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The concepts and methods described in this document have evolved over many years and benefited from the ideas, experience and wisdom of many people, from scientists to spiritual leaders, from policy makers to practitioners. This document is a product of continued learning, based upon the art of convening and listening. Our goal is to improve our collective understanding and practice of the ecosystem approach by creating authentic engagement in meetings, gatherings and conversations to address the pressing issues of our time. Since the ultimate objective of this capacity needs assessment is to increase capacity for stewardship of coral reefs, we firmly believe the approach must integrate across sectors, social structures, and disciplines and take on a systems view that incorporates biophysical and social dimensions. We call this integrated approach the ecosystem approach. It is neither easy nor inexpensive to practice and requires continued investments in building capacity. The methods applied in this document draw from many sources including the work of Stephen B. Olsen, Director Emeritus of the Coastal Resources Center at the University of Rhode Island, a key author of *Increasing Capacity for Stewardship of Oceans and Coasts: A Priority for the 21st Century* (NRC, 2008) and the lead advisor of our consultant team. We have integrated methods and lessons learned from the fields of needs assessment for social interventions, innovations in interdisciplinary scholarship, developmental evaluation, capacity assessment practice and theory in the context of international development as well as complexity concepts drawn from ecosystem science. Because the methods are a composite of elements from a wide range of disciplines, they are experimental, and will be customized for each jurisdiction to match the context and capacity of the situation. This capacity assessment process has been designed in close consultation with NOAA CRCP.

*Cover Photo: Mouth of a river that drains southeastern Guam near Umatac. (Photo credit: Glenn Page, SustainaMetricx.)*

# Acronym List

**Use of Acronyms in the Document:** For the purpose of consistency and brevity, acronyms will be used and are spelled out in detail below. We recognize that there are some acronyms that may cause confusion such as the distinction between a national agency and a territorial agency (e.g. Department of Agriculture), for the national agency the full name will be used (e.g. United States Department of Agriculture) for the territorial agency the acronym will be used (e.g. DOA refers to Department of Agriculture in Guam). If full names of acronyms presented below are spelled out in the document, they are done so for the purpose of clarity.

<b>AG</b> - Attorney General (Guam)	<b>EPSCoR</b> - Experimental Program to Stimulate Competitive Research
<b>BMPs</b> - Best Management Practices	<b>FY</b> - Fiscal Year
<b>BMR</b> - Bureau of Budget Management and Research (Guam)	<b>GCC</b> - Guam Community College
<b>BSP</b> - Bureau of Statistics and Plans (Guam)	<b>GCEF</b> - Guam and Chamorro Educational Facility
<b>CIA</b> - U.S. Central Intelligence Agency	<b>GCMP</b> - Guam Coastal Management Program
<b>CNMI</b> - Commonwealth of the Northern Mariana Islands	<b>GCRI</b> - Guam Coral Reef Initiative
<b>CO<sub>2</sub></b> - Carbon Dioxide	<b>GCRIACC</b> - Guam Coral Reef Initiative Coordinating Committee
<b>CZM</b> - Coastal Zone Management	<b>GCRIAC</b> - Guam Coral Reef Initiative Policy Advisory Committee
<b>DAWR</b> - Division of Aquatic and Wildlife Resources (Guam)	<b>GIS</b> - Geographic Information Systems
<b>DFW</b> - Division of Fish and Wildlife (Guam)	<b>GDP</b> - Gross Domestic Product
<b>DOA</b> - Department of Agriculture (Guam)	<b>GSA</b> - U.S. General Services Agency
<b>F&amp;SRD</b> - Department of Agriculture, Forestry and Soil Resources Division (Guam)	<b>Guam EPA</b> - Guam Environmental Protection Agency
<b>DoD</b> - U.S. Department of Defense	<b>GVB</b> - Guam Visitors Bureau
<b>DOI</b> - U.S. Department of the Interior	<b>HRRA</b> - Hagatña Restoration and Redevelopment Authority
<b>DOL</b> - Department of Labor (Guam)	<b>J-CAT</b> - Jurisdictional Capacity Assessment Team
<b>DPR</b> - Department of Parks and Recreation (Guam)	<b>LAS</b> - Local Action Strategy
<b>DPW</b> - Department of Public Works (Guam)	<b>LBSP</b> - Land-based Sources of Pollution
<b>EO</b> - Executive Order	<b>MC</b> - The Micronesia Challenge

**MOA(s)** - Memorandum(s) of Agreement(s)  
**MOU(s)** - Memorandum(s) of Understanding  
**MPA(s)** - Marine Protected Area(s)  
**NGO(s)** - Non-governmental Organization(s)  
**NOAA** - National Oceanic and Atmospheric Administration  
**NOAA CRCP** - National Oceanic and Atmospheric Administration Coral Reef Conservation Program  
**NOAA NCRMP** - National Oceanic and Atmospheric Administration National Coral Reef Monitoring Program  
**NOAA OCRM** - National Oceanic and Atmospheric Administration Office of Ocean and Coastal Resource Management  
**NOAA OLE** - National Oceanic and Atmospheric Administration Office of Law Enforcement  
**NOAA PIFSC CRED** - National Oceanic and Atmospheric Administration Pacific Islands Fisheries Science Center Coral Reef Ecosystem Division  
**NOAA PIRO** - National Oceanic and Atmospheric Administration Pacific Islands Regional Office  
**NPS** - National Park Service  
**NRC** - National Research Council  
**NRCS** - Natural Resource Conservation Service

**PAG** - Port Authority of Guam  
**POC** - Point of Contact  
**PSD** - Priority Setting Document  
**SCUBA** - Self Contained Underwater Breathing Apparatus  
**SHPO** - State Historic Preservation Office (Guam)  
**TNC** - The Nature Conservancy  
**U.S.** - United States  
**UoG** - University of Guam  
**USACE** - United States Army Corps of Engineers  
**USEPA** - United States Environmental Protection Agency  
**USFWS** - United States Fish and Wildlife Service  
**USGS** - United States Geological Survey  
**WERI** - Water and Environmental Research Institute of the Western Pacific at the University of Guam  
**WESPAC** - Western Pacific Regional Fishery Management Council  
**WPCRI** - Western Pacific Coral Reef Institute at the University of Guam

# Summary of Major Findings and Recommendations

This capacity assessment, commissioned by [NOAA CRCP](#), directly follows the coral reef management priority setting process facilitated by NOAA CRCP and initiated in Guam in 2009. In Guam, the priorities are summarized in the 2010 publication of “Guam’s Coral Reef Management Priorities” (henceforth, the “PSD”) and the PSD forms the general lens for the capacity assessment process.

As outlined in **Section One** of this report, the consultant team facilitated a rapid, largely qualitative, participatory approach to gain the perspectives of a representative group of resource users, managers, upper-level administrators and funders who are engaged in coral reef management in Guam.

The primary purpose of this assessment is to examine the issues that affect capacity in Guam as it relates to implementing the priorities expressed in the PSD and present a set of near-term recommendations for addressing persistent capacity gaps and barriers. The recommendations are offered in an appreciation of the unique and dynamic context of Guam. Implementation of the recommendations will require an adaptive strategy. Based on emerging information some recommendations may well be dropped, others prioritized and others still added to address a context that may not have been anticipated as part of this process.

While many of the recommendations in this document focus on the staff of Bureau of Statistics and Plans, Guam Coastal Management Program and the local partners engaged in the Guam Coral Reef Initiative there are many territorial (i.e. Department of Chamorro Affairs, Guam Office of Oceans and Coastal Resource Management, State Historic Preservation Office, etc.) and federal agencies with authorities to engage in the management of coral reefs (USFWS, DoD, NRCS, NPS, USACE, NOAA, etc.)<sup>1</sup>. The entire coral reef management community is fully expected and invited to participate in the review of the recommendations and to identify how each can contribute to the process and play a significant role for implementation of capacity building strategies.

**Section Two** of this report presents the context for coral reef management and why reefs are extremely valuable and important to the economy, culture and future of the territory’s 160,000 residents (CIA World Factbook) and approximately 1.2 million annual visitors. The combined area of coral reef and lagoon in the nearshore waters of Guam contain 108 km<sup>2</sup>. As in other parts of the world, the coral reefs in Guam are fragile, subject to increasing pressures of over harvesting of marine resources, water quality decline from land use in adjacent watersheds, and climate change. While much of what we have found regarding capacity to manage coral reefs in Guam is increasingly complex, increased adaptive capacity is needed to address the degree of complexity, working across scales in an uncertain and dynamic context.

**Section Three** presents findings related to the capacity to manage coral reefs in Guam. We briefly review the recent progress that has been made in coral reef management in Guam and we utilize both “Process” and “Outcomes” analysis as tools to foster the building of adaptive capacity for the management of coral reefs in Guam. Similarly, we apply an ecosystem lens that balances the focus on the biophysical condition with attention to the societal condition.

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<sup>1</sup> In this introduction, federal agencies are referred to with their acronym and territorial agencies are spelled out for greater clarity for the reader who may be unfamiliar with the local agencies of Guam.



To operationalize these distinctions, we apply the Management Cycle and the Orders of Outcomes framework as described in Section 1.2. These conceptual frameworks are applied to recent past and current coral reef management in Guam to help shape capacity building recommendations for the future. A timeline is presented that provides ample evidence that capacity to manage coral reefs is increasing but also provides evidence that the challenges are accelerating.

Indeed, the challenges facing coral reef management in Guam, and the rest of the world, will require more than a strategy for building capacity within the current governance system where decision-making is often reactive and many challenges lie in the socio-political dimensions associated with resource conservation. As situations become less predictable and producing desired outcomes becomes less certain, the degree of complexity increases. Stakeholders offer different perspectives articulating competing values, and posing different solutions. While not uncommon, controversy can be both positive if facilitated well and negative if not. The more points of view there are and the greater the debate among different stakeholders, the more socially complicated the situation becomes. How these disagreements are handled is often initially unknown and only become knowable as the interactions unfold. Some of the disagreements center around the technical challenges associated with scientific evidence, proving cause effect relationships as to what may be more or less damaging to overall reef health. Other disagreements center on a perception of fundamental value differences relating to access, safety, traditional practices and often how to even define the challenge (Patton, 2012). The depth and source of disagreement can pose particularly challenging situations and the current governance structure is not well positioned to continually mediate, negotiate and facilitate compromise and consensus.

Shifting to new governance pathways may be very difficult but not impossible as the history reveals a resilient character. In the past there have been examples of compromise and collaboration, shared values and common goals, where incentives and power relationships were transformed to work collaboratively to face a common challenge. While this report focuses on building capacity within the current governance paradigm, the recommendations are intended to build adaptive capacity to move toward a time to reconfigure and reorganize to face the uncertainty ahead and to create a fundamentally new governance system that supports the ecological, economic and social benefits that coral reef ecosystems have provided the Chamorro people and now serves a wide diversity of stakeholders.

Currently, the issues in Guam are managed by a wide range of agencies and organizations, each with their own mandates, policies, goals and objectives, some of which are complementary to what other agencies are doing, and sometimes competing or disconnected. Issues are becoming more and more interrelated with less clear cause-effect relationships and addressing these issues requires increased quality of collaboration. In the short run, this current governance structure, with its highly complex management context involving a myriad of actors means more effective management that requires the capacity to work effectively together. Highly complex management challenges must be met with quality coordination and collaboration. Even with this growing network, there are a number of issues at the global scale that are well outside any agencies control such as ocean acidification, sea level rise, increasing climate variability and other effects associated with global drivers of ecosystem change.

Therefore, an uncertain future is ahead and preparing for it requires an adaptive learning-by-doing approach. Wisdom gained through thousands of years of traditional management of reefs is bringing insight into adaptive strategies. However, today's challenges have no real historical analogue for the multi-scale and rapid pace of change. While

integrated engineering solutions are essential, the challenges today require a long list of competencies related to issue analysis, selecting options, securing formal commitment, implementing in shifting context and having the time, energy and methods to adaptively learn along the way. Interpersonal competencies are also needed to build emotional intelligence (i.e. mutually-beneficial professional relationship building, creative conflict resolution, etc.) to foster effective collaboration. This is not simple, and there is no clear and obvious path, panacea, or training program that will solve these challenges of enforcement and compliance, remove procurement barriers, solve staff recruitment and retention issues, transform science to better inform policy, and grow better relationships with local government and the legislature. Addressing these persistent barriers takes time, resources and collective commitment. Nevertheless, from an analysis of the issues, we have offered a set of recommendations to serve as a “road map” for the continued development of adaptive capacity.

**Section Four** presents a set of recommendations that are divided into three groups. The first group involves decisions that are highly political in nature. The ultimate timing, control and direction for implementing these recommendations need to be decided from the highest levels of government within the territory. We believe these actions are the most critical to build long-term adaptive capacity to manage coral reefs and promote a transition toward an ecosystem approach to coral reef management. The second group requires increasing quality of collaboration among implementing and funding partners to more fully define and realize common goals. The third group is a range of actions that can be done at the scale of committees, task forces, within organizations, and by groups of individuals. These are important, but the overall impact will only be realized if there is significant progress made in capacity building by the other two groups.

This first group begins with the priority to clarify the legal roles, mandates and responsibilities of local and federal partners and identify obvious areas of overlap. This recommendation links with the need to establishing “Master Natural Resource Plans” every five years. This group also includes recommendations related to improving enforcement programming, connecting with the tourism sector to “make the case” for investing in improved coral reef management, and recommends that efforts to streamline procurement and grants management processes should be continued. This group is also the most complex because they feature difficult political decisions that need to be made by senior officials in Guam who must factor in a wide range of extenuating circumstances.

The second group of recommendations involves a series of collaborative actions that can be done within a relatively small segment of the coral management network and focused on select geographies. The recommendations generally focus on increasing public environmental stewardship through support for outreach and education efforts and building capacity for the nascent civil society sector.

The third group of recommendations includes actions that contribute to building adaptive capacity and implementing them can be controlled by a smaller group of people within an organization or an informal network. While this group is more commonly associated with the traditional capacity building tasks of developing and improving knowledge, skills and competencies, we believe investment here will have far greater return as long as attention is paid to implementing the two groups described above.

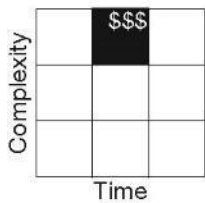
**Section Five** concludes the report with a strategy for the development of a long-term capacity building action plan that will require contributions from all stakeholders to fully implement these recommendations. Creating capacity building

action plans allows the wide range of implementing partners in government, civil society and market forces to more effectively preserve and protect coral reefs. Committing to a long-term capacity building strategy will require support and participation from resource management agencies, from local to federal, civil society, from coalitions and funding partners, from resource users who depend on the coral reefs of Guam for their livelihood, and from upper-level administrators.

## LEGEND

TIME SCALE	COMPLEXITY SCALE	MONETARY SCALE
<b>Short</b> = <1 year	<b>Simple</b> = Somewhat context independent recommendations such as “best practices” and “standard operating procedures” that have fairly high certainty of building capacity.	<b>\$</b> - Less than \$5,000
<b>Medium</b> = 1 to 2 years	<b>Complicated</b> = Context is more important and the recommendation may require either coordination of technical expertise that may or may not be present in the system, or may require a degree of social engagement and relationship building that creates a common ground; i.e., either socially or technically complicated.	<b>\$\$</b> - Between \$5,000 and \$20,000
<b>Long</b> = >2 years	<b>Complex</b> = Context is highly dependent and the recommendation may require strategies that are adaptively implemented and address dynamic, emergent, non-linear and complex conditions.	<b>\$\$\$</b> - Between \$20,000 and \$100,000  <b>\$\$\$\$</b> - Greater than \$100,000

## EXAMPLE



This graphic shows project time scale of 1 to 2 years (**Medium**) with complexity scale equal to **High** and monetary scale between \$20,000 and \$100,000 (**\$\$\$**).

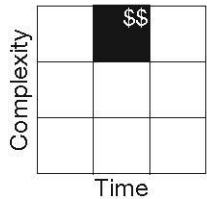
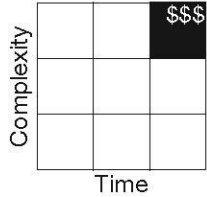
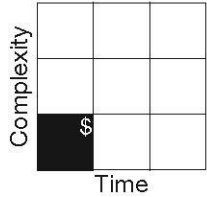
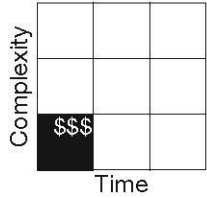
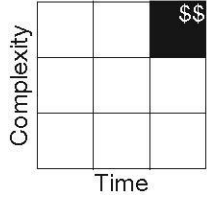
## PRIORITIZATION

The prioritization was developed in consultation with the Guam J-CAT members who were asked to rate each recommendation. The resulting top recommendations are presented in order of priority in this table and in this document. Please note, while prioritized, the recommendations are not intended to be implemented sequentially as a checklist. Rather, in complex and dynamic systems, adaptive capacity will be about building momentum with investments in relatively simple, inexpensive and quick forms of capacity building, and marking progress toward the larger systemic changes that are needed to effectively build adaptive capacity.

GROUP 1 RECOMMENDATIONS

Politically Challenging Goals to Improve Formal Commitment to Coral Reef Conservation

The recommendations in this section are politically challenging, and in many respects, accomplishing them will require actions beyond the reach of NOAA CRCP, BSP/GCMP, and the larger coral reef management network in Guam. Nonetheless, there are concrete measures that NOAA and the GCRI can take that may improve the likelihood of success and can lead to an improved climate for coral reef management. A top priority to build the capacity for effective coral conservation in Guam is to generate high-level institutional and political support for coral reef conservation and management.

PAGE #	CAPACITY BUILDING STRATEGY / RECOMMENDATION / POTENTIAL PARTNERS		COMPLEXITY / TIME / COST
46	<b>4.1A</b>	<p><b>Clarify the Legal Roles, Mandates, and Responsibilities of Local and Federal Partners and Identify Obvious Areas of Overlap</b></p> <p><b>Potential Partners:</b> All federal and local partners, including: DOI, DCA, DoD, External Consultant, GCMP, Governor’s Office, USEPA, NOAA, NPS, SHPO, UoG, USACE, USFWS, Division of Grants Management of the Department of Administration</p>	
46	<b>4.1B</b>	<p><b>Work with GVB to Make the Business Case for Improved Coral Reef Management</b></p> <p><b>Potential Partners:</b> Chamber of Commerce, GCC, GCMP, Lions Club, NOAA CRCP, Rotary Club, UoG Marine Lab and WERI</p>	
48	<b>4.1C</b>	<p><b>Add Administrative Component for the Citation System Related to Marine Preserves</b></p> <p><b>Potential Partners:</b> AG Office, Court System, DOA, Guam EPA, Governor’s Office, Legislature</p>	
48	<b>4.1D</b>	<p><b>Improve Internal Management of Conservation Officer Program</b></p> <p><b>Potential Partners:</b> AG Office (Natural Resource Attorney), Customs Office, DOA, GCMP, Guam Police Department, Mayor’s Office, NOAA OLE, PIMPAC</p>	
49	<b>4.1E</b>	<p><b>Update and Adopt Sediment Erosion and Control Guidelines, Rules and Regulations for BMPs</b></p> <p><b>Potential Partners:</b> DPW, GCMP, Governor’s Office, Guam Contractors Association, Guam EPA, Guam Land Use Commission Bureau of Land Management, Legislature</p>	

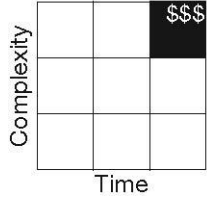
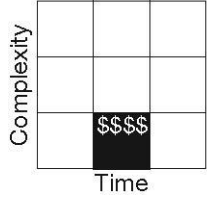
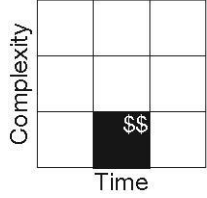
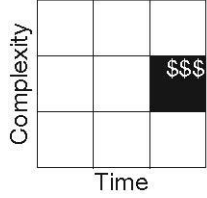
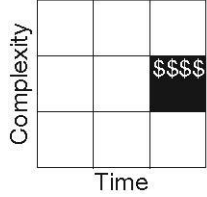
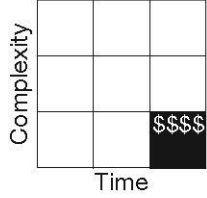
PAGE #	CAPACITY BUILDING STRATEGY / RECOMMENDATION / POTENTIAL PARTNERS		COMPLEXITY / TIME / COST
49	<b>4.1F</b>	<p><b>Update the “Natural Resources Strategy 2012” to Create a Roadmap for Revised DoD Buildup Intensity</b></p> <p><b>Potential Partners:</b> DCA, DoD, External Consultant, GCMP, Governor’s Office, NOAA, NPS, SHPO, UoG, USACE, USFWS</p>	
50	<b>4.1 G</b>	<p><b>Hire and Train Fire Protection Personnel</b></p> <p><b>Potential Partners:</b> Conservation Officers, F&amp;SRD, Guam Fire Department</p>	
51	<b>4.1H</b>	<p><b>Co-develop Briefing Presentations with GVB to Present to the Tourism Industry and other Stakeholders</b></p> <p><b>Potential Partners:</b> Chamber of Commerce, F&amp;SRD, DPW, GCMP, Guam EPA, GVB, NOAA CRCP, Rotary Club, Sea Grant, UoG Marine Lab, WERI, UoG WPCRI</p>	
53	<b>4.1I</b>	<p><b>Continue Efforts to Streamline Procurement and Grants Management Processes</b></p> <p><b>Potential Partners:</b> GSA, Governor’s Office, Governor’s Task Force on procurement issues, Grants Managers of Natural Resource Agencies</p>	

**GROUP 2 RECOMMENDATIONS**

**Using a Common Management Framework to Pursue Ecosystem-based Management at Priority Sites**

This group of recommendations will require a collaborative and coordinated approach to management at select priority areas, and involve interconnected systems and engagement with multiple resource users, government entities, NGOs and funders.

PAGE #	CAPACITY BUILDING STRATEGY / RECOMMENDATION / POTENTIAL PARTNERS		COMPLEXITY / TIME / COST
54	<b>4.2A</b>	<p><b>Further Build Engagement with Mayors, Church Leaders, Youth Organizations, Elders and Other Influential Community Members at Priority Sites</b></p> <p><b>Potential Partners:</b> Churches, DCA, existing NGOs, GVB, Mayors Council, NOAA, Municipal Councils, NPS, Pacific Historic Parks Association</p>	

PAGE #	CAPACITY BUILDING STRATEGY / RECOMMENDATION / POTENTIAL PARTNERS		COMPLEXITY / TIME / COST
55	<b>4.2B</b>	<p><b>Increase Social Science on Human Dimensions to Help Inform Management in Priority Sites</b></p> <p><b>Potential Partners:</b> GCMP, GCEF, NPS, Sea Grant, UoG Pacific Center for Economic Initiatives, WERI, NOAA CRCP</p>	
56	<b>4.2C</b>	<p><b>Continued Trainings for Contractors Related to BMPs for Sediment Control</b></p> <p><b>Potential Partners:</b> Contractor Licensing Board, DPW, GCMP, Guam Contractors Association (has already agreed to host the courses), Guam EPA, Guam Trades Academy, Professional Engineers and Architects and Land Surveyors</p>	
57	<b>4.2D</b>	<p><b>Strategic Public Outreach Campaign to Gain Support for Stronger Sediment Control Regulations</b></p> <p><b>Potential Partners:</b> DPW, GCC Eco-Warriors and the Guardians of the Reef, GCMP, Guam Contractors Association, Guam EPA, Guam Trades Academy, Students and educators involved with UoG Sustainability Group (Green Army), North and South Soil and Water Conservation Districts</p>	
57	<b>4.2E</b>	<p><b>Build Adaptive Capacity of NGOs</b></p> <p><b>Potential Partners:</b> Local NGOs, PIMPAC, Sea Grant, TNC, UoG, WERI</p>	
58	<b>4.2F</b>	<p><b>Apply Lessons-learned from Humatak Project's Watershed Restoration Efforts</b></p> <p><b>Potential Partners:</b> Center for Sustainability, College of Applied and Natural Science at UoG, DOA DFW, DPW, DoD, EPSCoR, GCMP, Guam EPA, NOAA, NPS, Mayors Council of Guam, Students and educators involved with UoG Sustainability Team, USFWS, WERI</p>	
58	<b>4.2G</b>	<p><b>Increase Environmental Stewardship in Education Curriculum</b></p> <p><b>Potential Partners:</b> DCA Museum, GCC, GCMP, Department of Education, UoG WPCRI</p>	

GROUP 3 RECOMMENDATIONS

Tractable Projects

This group of recommendations can be controlled by a small group of people, an organization or a network of organizations. This group of recommendations includes programs and trainings that focus on building a range of technical, financial, social, institutional and political capacities.

PAGE #	CAPACITY BUILDING STRATEGY / RECOMMENDATION / POTENTIAL PARTNERS		COMPLEXITY / TIME / COST
59	<b>4.3A</b>	<p><b>Establish On-island Native Species Nurseries</b></p> <p><b>Potential Partners:</b> 4-H Club, Agriculture Extension Service at UoG, Ayuda Foundation, Center for Island Sustainability, Farmer’s Co-op, DOA, Fishermen’s Co-op, Girl Scouts in conjunction with NPS, Guam Northern Soil and Water Conservation District, HRRA, Lieutenant Governor Beautification Task Force, Mayors Council, NPS, Nurseryman’s Association</p>	
60	<b>4.3B</b>	<p><b>Establish On-island Native Species Nurseries</b></p> <p><b>Potential Partners:</b> 4-H Club, NOAA CRCP, DFW, F&amp;SRD, USFWS, GCC, GCEF, NRCS, UoG Agriculture Department</p>	



# Section One: Introduction

## 1.1 Scope and Purpose of this Assessment

This capacity assessment is a component of the coral reef management priority setting process facilitated by the [NOAA CRCP](#) and initiated in 2009. The stated purpose of this process is “to develop place-based, local coral reef management priorities” for the seven U.S. state and territorial coral reef jurisdictions, including Guam. In Guam, the priorities were identified in the 2010 publication of “Guam’s Coral Reef Management Priorities” (henceforth, the “PSD”). The Guam PSD forms the lens for the capacity assessment process. The PSD includes, in Appendix Three, a brief summary of governance capacity issues in Guam entitled “Preliminary Identification of Capacity Gaps.” In September 2011, NOAA CRCP selected SustainaMetrix as part of a competitive bid process to conduct a more detailed assessment across all seven jurisdictions including Guam, which expands on this initial intent to address capacity gaps in ecosystem governance for coral reef management in Guam. This report summarizes the findings of our capacity assessment conducted in Guam between April 2013 and September 2013, including a 7-day site visit to Guam from June 7 to June 14, 2013, review of over 125 background documents, over 50 interviews, and ongoing collaboration with the Guam J-CAT.

The PSD indicates “specific priority locations for activities” (or “priority sites”) to apply key goals and objectives. Several priority sites were highlighted in the PSD, and for the purposes of this assessment we focus on Piti-Asan Watershed, Manell-Geus Watershed and Apra Harbor, as selected in consultation with the Guam J-CAT. The PSD guided our initial approach to the capacity assessment, essentially framing the assessment in terms of the capacity present in the system to accomplish the goals and objectives. From this starting point, the consultant team adaptively deployed a set of methodological tools aimed at building an understanding of the coral reef management system and illuminating current capacity gaps, as well as persistent barriers to building capacity, as they related to realizing the goals and objectives in the PSD.

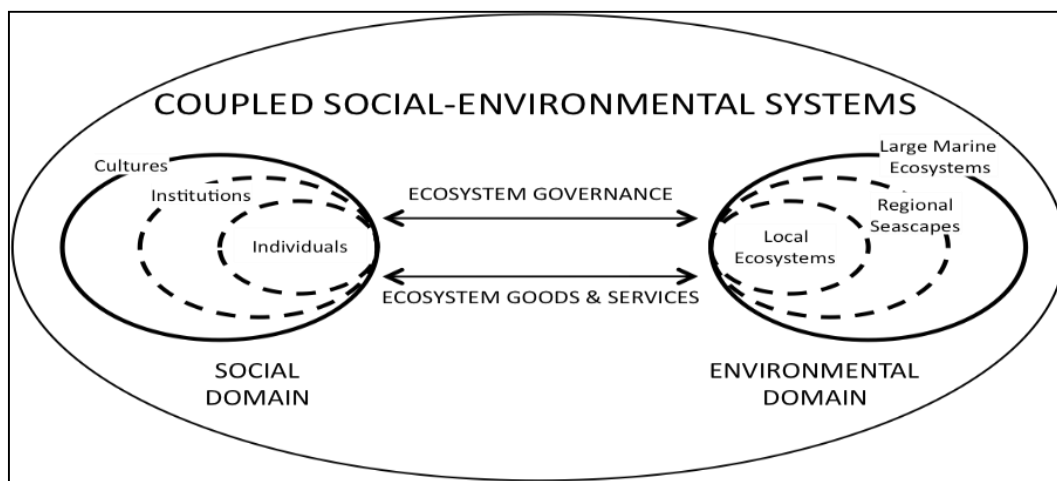
The 2009 NOAA document “Coral Reef Conservation Program Goals and Objectives 2010-2015” (hereafter, “2010-2015 Goals and Objectives”) acknowledged that while threats to coral reefs are diverse and operate at a range of scales, from local fishing pressures and regional pollution impacts to the global drivers of climate change and ocean acidification, the document concluded that “within each threat...[there is a] common need to select and work in priority coral reef areas to ensure a holistic and integrated management approach to support healthy, resilient coral reef ecosystems.” In Guam, this directive was expressed by the creation, in the PSD, of the five priority goals (impacts of land-based sources of pollution, fisheries and impacts of fishing, impacts of military buildup, impacts of recreational use, and the impacts of climate change) and the ten priority objectives to be addressed primarily at priority sites. In the strictest sense, as envisioned by these high-level NOAA CRCP documents (the PSD and the 2010-2015 Goals and Objectives) the scope of our work in the jurisdiction is to assess the capacity to manage coral reefs in Guam as it relates to the PSD goals and objectives, made operational at the priority sites.

That being said, we recognize the complexity inherent in managing coral resources and realize that issues are often interrelated, dynamic, and constantly evolving. As a result, approaches and capacities will need to be adaptive and

relevant to the local context, link across a range of topics (that require a broad range of competencies and capabilities) and at a variety of scales beyond priority sites, to adequately address the challenge of managing Guam’s marine resources. As discussed in more detail at the end of this Section (Section 1.6), one of the challenges of this capacity assessment, which we believe mirrors, in many ways, the challenges of coral management, has been to balance the need to aim our inquiry flexibly across multiple scales and topics with the critical need to preserve focus on the more circumscribed issues laid out by the PSD goals and objectives addressed at the priority sites. Experience with building adaptive capacity around the world suggests that Ecosystem-based Management is complex, does not follow a simple recipe, and interactions can be volatile, unpredictable, and unknowable in advance. Indeed, high uncertainty of how to produce a desired result can fuel disagreement and if disagreement intensifies, it can expand the parameters of uncertainty creating less desirable outcomes and escalating conflict.

## 1.2 Our Approach: Ecosystem-based Management

Our approach to conducting this capacity assessment, which we believe aids in creating the required flexibility, is described in the document prepared by SustainaMetrix “[Coral Reef Management Capacity Assessment Methodology](#)” which was submitted to, and approved by, NOAA CRCP in February 2012. Our methodology builds off of a conceptual framework known as “Ecosystem-based Management”, or simply “the ecosystem approach” ([NRC, 2008](#); [Olsen et al., 2009](#); [McLeod and Leslie, 2009](#)). The ecosystem approach has been expressly endorsed by NOAA CRCP in its 2010-2015 Goals and Objectives document and in the language included in the preliminary capacity assessment appendices in most of the jurisdictional PSDs (including Guam). Simply put, the ecosystem approach acknowledges that ecosystems and the people that live within and in proximity to them, and depend on them for goods and services, must be understood and managed as a dynamically linked, interdependent system. The ecosystem approach requires a fundamental management paradigm shift that transcends single-species management, as well as the more holistic consideration of larger natural systems (e.g., watersheds, coral reefs), to explicitly include the human and social dimensions. It further accepts that natural and social systems are dynamically linked and that changes in one realm have impacts in the other and that these impacts can include self-reinforcing feedbacks (Figure 1).



**Figure 1**

*Dynamic human and ecological systems are referred to as “coupled social-ecological systems.” Interactions between the social and ecological domains occur over multiple geographic scales, and understanding connections across scales is critical to long-term success. Figure adapted from McCleod and Leslie (2009).*

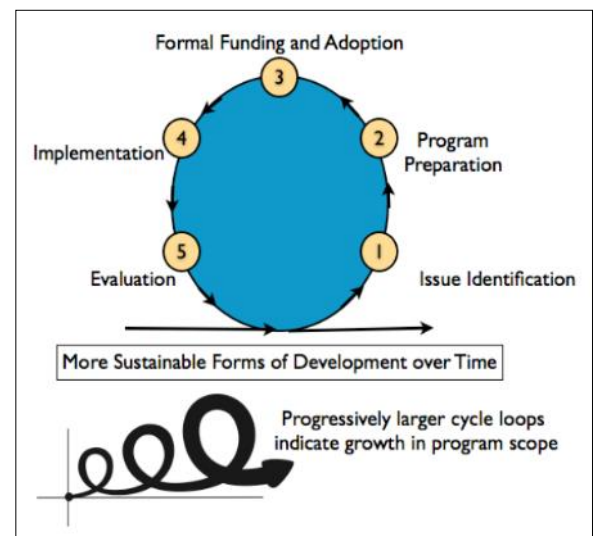
In our approach to the assessment of adaptive capacity to the practice of Ecosystem-based Management, we have complemented a core philosophy with a peer-reviewed set of tools, methods and a common vocabulary to achieve the goal of a rapid diagnostic approach that can generate a set of actionable recommendations. The common vocabulary terms are defined in Appendix A: Glossary.

These methods are designed for application in a variety of locations, embracing the local context as well as the complexity and dynamism of the coupled social and natural ecosystem. Our purpose is to help assess capacity of a given management system’s readiness and capability in a relatively rapid and synoptic manner to pursue management actions that are realistic with the current operational realities and that seek a more holistic approach to understand, consider and adapt to changes in the coupled human/natural system. Our goal is to provide products and services that can generate useful recommendations for short-term action (1-3 years), that have the best likelihood of meaningful success given current situational dynamics and politics. Among these tools are two related frameworks for assessing the maturity of an Ecosystem-based Management program and its progression along a series of steps toward program success, growth and long-term goal attainment. We have designed these to be simplifying frameworks that feature systems thinking and complexity concepts. These frameworks are intended to enhance innovation in management and use of findings.

The first of these tools is the **Management Cycle** (Figure 2), which gives a clear and straightforward presentation of the main steps along which a program should progress through linked cycles of adaptive management.

These steps are:

- Analysis of problems and opportunities (Step 1);
- Formulation of a course of action (Step 2);
- Formalization of a commitment to a set of policies and a plan of action and the allocation of the necessary authority and funds to carry it forward (Step 3);
- Implementation of the policies and actions (Step 4); and,
- Evaluation of successes, failures, learning and a re-examination of how the issues themselves have changed (Step 5).



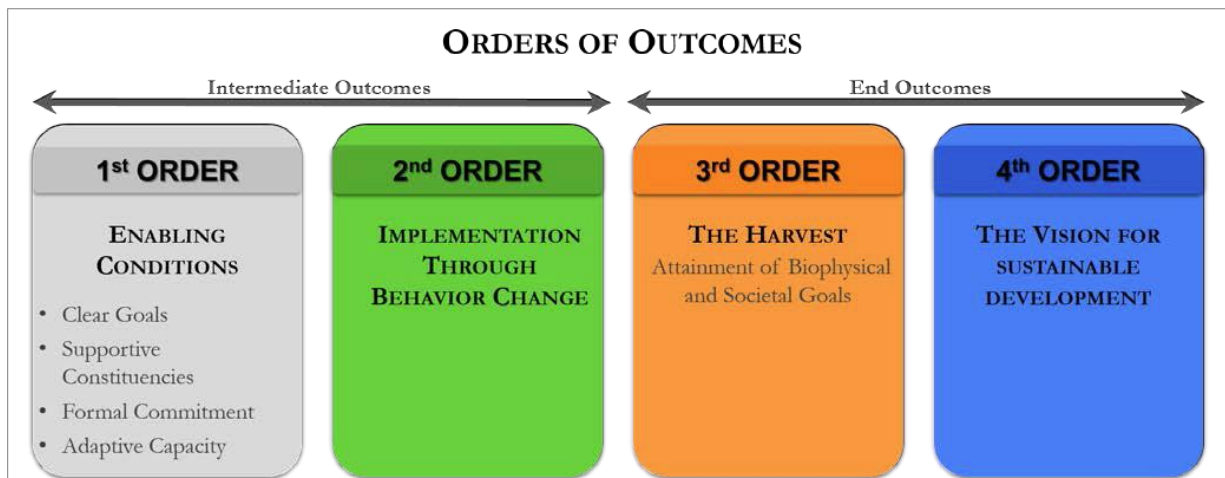
*Figure 2 The Management and Learning Cycle.*

These steps are imagined as a cycle, in that evaluation and learning in Step 5 can and should inform a new round of analysis, matching program formulation with the situation and context (ideally more ambitious and innovative as time progresses), the securing of additional formal commitment, new program implementation, followed by reflection and so on. Ideally, thoughtful progression through these linked cycles facilitates true “adaptive management.”

The second tool, **Outcome Analysis**, is envisioned as a complement to the Management Cycle and is intended to help focus analysis clearly on the specific, intended outcomes of programs that seek to work generally to achieve societal and environmental goals (Figure 3).

This tool helps to disaggregate and characterize the goals of a program into well-defined Orders of Outcome that can be readily discussed, analyzed and compared across disparate settings (e.g., priority areas or the seven U.S. Flag coral jurisdictions). Within the Orders framework, the four Orders of Outcome progress from assembling the enabling conditions for success through to the realization of long-term, sustained social and natural systems health, with two intermediate steps:

- **First Order Outcomes:** Assembling the enabling conditions for the successful implementation of a plan of action;
  1. Clear, time-bound and unambiguous goals that describe both realistic and desired societal and biophysical conditions that may be reached in the near-term (such as 5-10 years);
  2. Supportive and informed constituencies for attainment of the desired goals;
  3. Formal commitment for a desired plan of action to meet the goals; and
  4. Sufficient institutional capacity to implement the plan of action to meet the goals.
- **Second Order Outcomes:** Successful program implementation resulting in the desired behavioral change that is required to meet the goals;
- **Third Order Outcomes:** Achievement of target environmental and societal conditions as defined in the First Order – this is fully expected to be adaptive; and,
- **Fourth Order Outcomes:** Guiding long-term vision towards a purpose, such as sustainable development, that may include sustaining and maintaining the target outcomes over the long-term.



*Figure 3 Orders of Outcomes analysis helps focus analysis clearly on the specific, intended outcomes of programs that seek to work generally to achieve societal and environmental goals (Olsen et al., 2009).*

While, the “Preliminary Identification of Capacity Gaps” presented in Appendix Three of the Guam PSD makes explicit reference to the necessity of addressing capacity gaps and enabling conditions in coral reef management for program success, it does not expressly refer to the enabling conditions within the Orders framework. Doing so simply recognizes that assembling the key enabling conditions is a 1<sup>st</sup> Order Outcome; that is, there are appropriate first order goals that must be achieved before programs can be mounted that seek to change behaviors (2<sup>nd</sup> Order), in order to achieve targeted social and environmental outcomes (3<sup>rd</sup> Order), which can then be institutionalized to achieve a stable, sustainable and healthy social and environmental norm (4<sup>th</sup> Order).

With respect to this (or any) capacity needs assessment, it is important to recognize that having the capacity present within an organization is only one piece of a whole that also includes setting clear and realistic goals, having supportive constituencies, and obtaining formal commitment across all levels of the government. That said, GCMP is at the center of a larger, complex system of coral reef management entities within Guam, including local government, several NGOs and other local as well as federal managing agencies. This necessitates a broader view of “capacity” beyond the financial, personnel and equipment resources that reside within the target organization.

It is our intent in this capacity assessment to apply these analytical tools (The Management Cycle and the Orders of Outcome) to create a common language in order to examine the capacity present in the coral reef management system in Guam. While the concepts and vocabulary may be unfamiliar to some, we believe that they provide a clear and well-developed methodological framework for both process and outcomes that will help coral practitioners across Guam, from local site managers to high-level government officials, and will clearly evaluate and compare plans and programs that intend to improve social and environmental outcomes.

### 1.3 Our Approach: Adaptive Capacity

While employing the tools and language of Ecosystem-based Management can add great clarity to the process of identifying issues, developing goals and the plans to accomplish them, and while engaging in meaningful reflection and learning, it is equally important to recognize that the process is inherently complex, dynamic and highly contextual. Social and environmental conditions are undergoing constant change, and the nature of this change, and how best to respond to it, can vary significantly from place to place. Acknowledging this, and creating robust methods to detect, understand and respond to change in a contextually relevant manner (i.e. “adaptive capacity”) is essential.

Accomplishing this in the complex and multi-level system that exists to manage and protect coral reefs in Guam presents many unique challenges. Building resilient and flexible management regimes that can sense, learn from, and adapt to operational and strategic issues that emerge and evolve at a variety of scales across federal, state and local natural resource management programs (Figure 4) will be more and more critical to long-term, sustainable and successful management of natural systems around the globe ([Armitage, 2005](#)). This process explores both operational and strategic issues for building adaptive capacity and aggregates the findings by providing a set of actionable recommendations described in Section 4. For this application, the unit of analysis is on the larger coral reef management system, not on specific individuals or specific organizations depth and breadth across these issues of adaptive capacity.

In the remainder of this Section, we review the specific methods we used to gather data about coral reef management in Guam and analyze and integrated it into a coherent description of the challenges and opportunities for further developing the adaptive capacity of the system to respond to management issues. We review the findings and explain the development of our recommendations for sequencing and prioritizing capacity building activities that meet the management needs as understood from the perspective of adaptive capacity and Ecosystem-based Management.

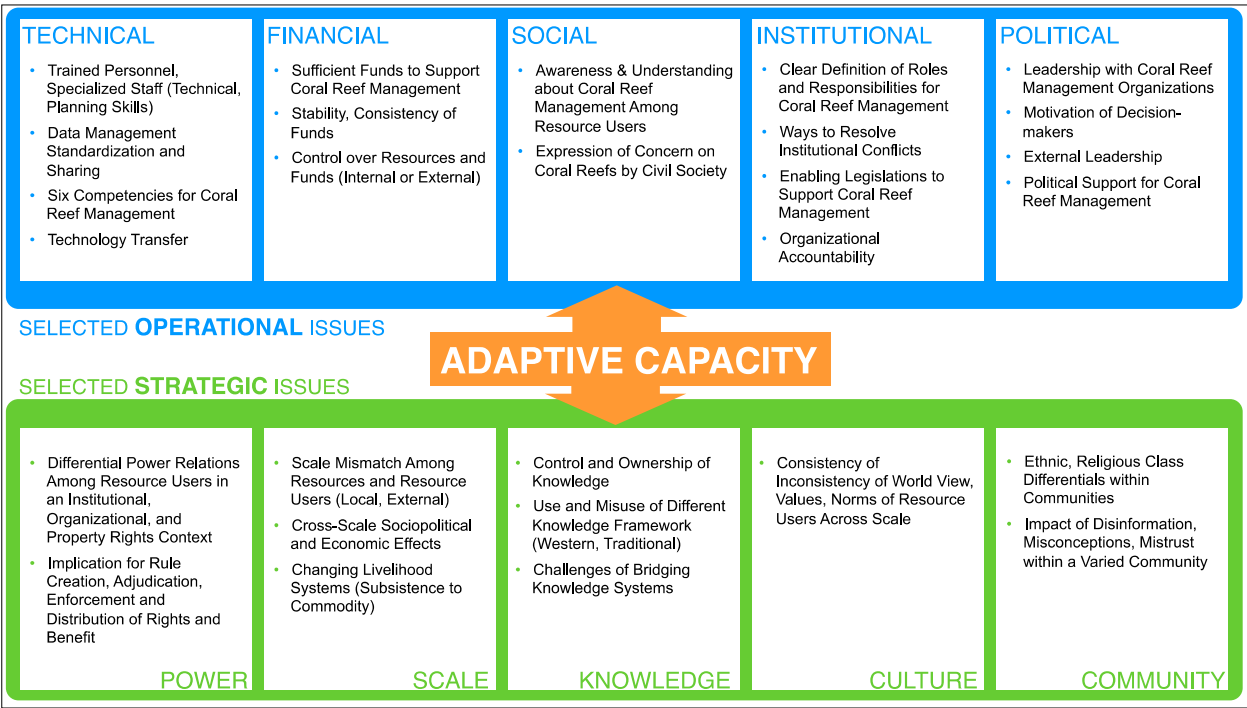


Figure 4 Adaptive capacity diagram displays the dialectic between operational and strategic issues (adapted from Armitage, 2005).

## 1.4 Additional Capacity Assessment Tools

The capacity assessment work began with a detailed document review and discussions with key NOAA personnel, as well as a review of the current literature, selected projects, pressing issues, and preparation of a timeline to grow an understanding of recent activities in coral reef management in Guam. This review was used initially to illuminate capacity gaps as well as to underscore existing management capacity in the system. The assessment continued with in-depth telephone interviews, email correspondence, and extensive in-person interviews and focus groups conducted during a site visit to Guam in June 2013. After the site visit, the data gathering continued with further document review, analysis and synthesis through November 2013, with a wide range of stakeholders throughout the Guam coral reef management system. The key components of how we gathered and analyzed data and conducted the capacity assessment are summarized below.

**Jurisdictional Capacity Assessment Team:** As part of the process of inquiry into capacity needs, we convened a small standing committee of people with in-depth knowledge and deep personal involvement in coral reef management in Guam that we dubbed the “J-CAT.” We held six meetings with this group, either by conference call or in person, between April 2013 and August 2013 including one during our June 2013 site visit. We collaborated with J-CAT members during scheduled meetings, as well as on an ad hoc basis, to:

- Share available information at key points in the capacity assessment process;
- Create a shared communications strategy about the capacity assessment process;
- Customize the methods based on local context;
- Coordinate an efficient process of data collection;

- Provide input to assist in prioritizing capacity building needs;
- Analyze and summarize results and recommendations; and,
- Make the overall process as useful as possible within the current context of coral reef management in Guam.

Our goal was to build high-quality collaboration among the consultant team and the J-CAT with a clear beginning, middle and end to our process that provided extensive opportunity for input along the way. It is important to note that while consensus was a common outcome from the J-CAT, the consultant team made it clear that the role of the J-CAT was as a supportive and guiding function across all aspects of the process, not with the specific goal to arrive at consensus. Unfortunately, due to a range of circumstances, participation of J-CAT members was uneven and the consultant team remains responsible for the overall product and process. This document has been developed, reviewed, prioritized and edited in consultation with the Guam J-CAT.

**Goals and Objectives for Coral Reef Management in Guam:** The Guam PSD identifies five primary management goals:

- **GOAL 1:** Improve the condition of coral reef ecosystems by reducing the amount of sediment and pollution from development, fires, recreational users and agriculture in Guam’s watershed
- **GOAL 2:** Protect Guam’s coral reef fisheries resources for current and future generations through effective management that conserves aquatic and marine ecosystems and ensures the condition, welfare and integrity of marine ecosystems
- **GOAL 3:** Mitigate the existing and anticipated pressures of rapid development on Guam’s coral reefs by implementing the Guam Natural Resources Strategy with a focus on Apra Harbor through 2012
- **GOAL 4:** Improve the condition of Guam’s coral reef ecosystems by reducing negative recreational impacts
- **GOAL 5:** Improve management of Guam’s coral reef ecosystems to enhance resilience and recovery processes

An early step in the capacity assessment was to review previous LAS as well as site-based management plans, as appropriate, for the three priority sites. Plans and reports on coral reef management across Guam were used to better understand the wide array of coral reef related projects in the system, with the goal of investigating the capacity present in the system to execute these projects and achieve the goals and objectives stated in the PSD.

After building background knowledge of coral reef management in Guam we developed a list of questions associated with the various initiatives and projects across Guam and developed a plan to interview J-CAT members. Interviews with J-CAT members built our understanding of projects, context and how specific projects fit into the larger coral reef management system in the territory and how its “performance story” could illuminate capacity gaps and persistent barriers as well as successes in building capacity and managing coral resources. The current coral reef management initiatives became a primary, but not the only line of inquiry for the interviews conducted during the site visit.

**Timeline for Coral Reef Management in Guam:** We assembled a timeline of key events affecting coral reefs in Guam, and their management, beginning in a general sense with traditional Chamorro history to the present with attention to the events that signaled increase in capacity for coral reef management. A brief analysis is presented in the next Section 2.2 and 2.3. The timeline also includes events that affect capacity to manage coral reefs such as large

cyclones and bleaching events, as well as key governance milestones, from political events like the establishment of Guam as a U.S. territory, to laws and rulings that directly affect coral management. The timeline was based upon interviews and anecdotes as well as published information from social science, humanities and natural science.

We printed out, on a long sheet of paper (about 10 feet), a physical timeline and brought it with us to meetings during the site visit for review and input. The timeline proved to be of interest to interviewees, who often expressed gratitude in the level of detailed information about coral reef management over time pulled together in one place. All were encouraged to “grab a Sharpie” and add new events. With strong input, the timeline became far more detailed and complete during the course of our visit and afterwards via email (see Appendix B: Guam Timeline for a tabular representation of the timeline, including these additions). The timeline not only presents highly useful, contextually relevant information, but it serves as a visual reminder of the wide range of antecedents, actions, and plans that have built the platform for contemporary coral reef management and that current and future managers need to consider. The timeline also became an “icebreaker”, creating an engaging environment within which to conduct our interviews. The final timeline is presented in Appendix B: Guam Timeline of this report.

While never complete, the timeline reveals that there has been a positive trend of increasing capacity built to manage coral reefs as well as major policy initiatives and a blossoming of role of civil society and market forces that depend upon the health of the coral reefs. However, as implementation progressed, there has neither been clear agreement among the diverse stakeholders on the best methods of implementation nor certainty and predictability about how to best solve the problem. These forces of fragmentation, challenges posed by dynamic natural and social systems and conflicting priorities, have increased. These are forces that can constrain institutional capacity building and adaptive implementation of coral reef management.

**Adaptive Approach to Capacity Needs Assessment:** Over the course of conducting the assessment and applying the tools discussed above, we adapted our approach due to realities encountered during the site visit and during interviews. In some instances, neither the PSD nor other relevant management plans appeared to be the key expressed driver of their coral reef management priorities or activities. Furthermore, several people scheduled and confirmed for in-person interviews during the site visit were unable to attend. Nonetheless, our semi-structured interview approach and comprehensive approach to seeking input from across the coral reef management system worked well. We often began inquiring about a specific activity and expanded the scope to include more open-ended dialogue that illuminated gaps and barriers, successes, and more broadly, the current status and context of the coral reef management system in Guam. Finally, we conducted an internal analysis of the enabling conditions (1<sup>st</sup> Order), which includes reflections on what may be needed regarding changes in behavior and social norms (2<sup>nd</sup> Order) required to effectively build capacity and improve coral reef management in Guam.

Our investigation of current activities yielded specific and often detailed information about gaps and barriers to successful implementation of the projects. These findings are not presented here in a project-by-project review, as that would be beyond the scope of this effort. The findings on capacity building needs, as presented here, are therefore informed by:



- A review of over 125 documents relevant to the system (please see Literature Cited and Appendix C: For More Information);
- Over 50 in-depth interviews with key actors in the system (please see Appendix D: Interview List for full interview list);
- Development of the timeline (with over 140 entries) and review of current activities as defined above;
- Our discussions with, and feedback from, the J-CAT, which spanned over 6 meetings held on: April 8, May 6, May 28, June 14 (in-person), July 17, and August 26, 2013;
- Our immersion in and contributions to the professional literature of adaptive capacity, Ecosystem-based Management, ecosystem governance, capacity assessment, organizational behavior and other related disciplines; and,
- Our professional judgment, informed by similar assessments in other U.S. Flag coral jurisdictions and locations around the world.

**Generation and Prioritization of Recommendations:** The recommendations in Section Four are intended to serve as the core of a comprehensive capacity building strategy. Section Five presents a capacity building “road map” of how to move from this report to an action agenda with an overview of elements that would serve as main ingredients for a long-term capacity building strategy. Together, they represent a range of tasks that should not be viewed as another long list of things to do. Rather, they are presented as core elements needed to transition towards an ecosystem approach that recognizes that context is dynamic and ever changing, and investment in adaptive capacity is needed to build resilience and response to ecosystem change. Therefore sequencing and prioritizing what is done to build momentum for capacity building is crucial. The recommendations presented in this report were generated after careful consideration of the need to sequence and prioritize, and in close coordination with the Guam J-CAT, based on the current context of what is possible within the current coral reef management system.



*The botanical diversity of the island includes an impressive mix of indigenous and exotic species. (Photo credit: Glenn Page, SustainaMetricx.)*

# Section Two: The Context for Coral Reef Management in Guam: Trends and Current Conditions

## 2.1 Introduction to Context in Guam

Situational awareness and contextual understanding is important for all natural resource managers. As noted in the previous section, assessment of capacity to manage coral reefs in Guam is highly dependent on the socio-ecological context within which such management is taking place. This calls for an understanding of the pressures on coral reef ecosystems, the current state (condition) and likely emerging trends in the coral reef condition and comprehension of the larger governance dimensions that are responding to the drivers and pressures influencing the state of the coral reef resources. We use the term drivers to include natural or human induced factors that cause changes to the state of the coral reefs of Guam. Direct drivers unequivocally influence ecosystem processes while indirect drivers cause ecosystem change by influencing one or more direct drivers ([Millennium Ecosystem Assessment, 2005](#)). This analysis helps to ensure that recommendations in Section 4 of this report are grounded in the awareness that specific attributes and determinants of adaptive capacity may be scale-dependent ([Adger and Vincent, 2005](#)), culture and place specific ([Adger, 2003](#)), and may involve tradeoffs ([Folke et al., 2002](#); [Allison and Hobbs, 2004](#); [Pelling and High, 2005](#)). In this section we briefly characterize the context for coral reef management in Guam across these dimensions. For a more detailed summary of coral reef health please consult The State of Coral Reef Ecosystems of Guam ([Burdick et al., 2008](#)).

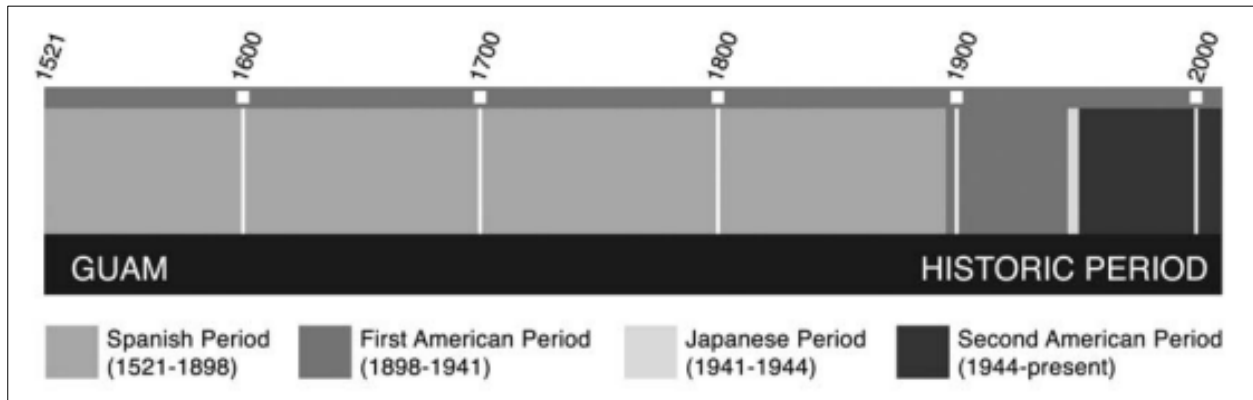
Table 1: Overview of select biophysical and socio-economic characteristics of Guam. (Sources: 1. [Chin et al., 2011](#), 2. [Burdick et al., 2008](#), 3. [CIA World Factbook](#).)

<b>Marine Area</b> <sup>1</sup> : 218,000 km <sup>2</sup>
<b>Coastline</b> <sup>1</sup> : 125.5 km
<b>Land Area</b> <sup>1</sup> : 560 km <sup>2</sup>
<b>Combined area of coral reef and lagoon in nearshore waters (0-3 nautical miles)</b> <sup>2</sup> : 108 km <sup>2</sup>
<b>Area of coral reef in federal waters (greater than 3 nautical miles offshore)</b> <sup>2</sup> : 110 km <sup>2</sup>
<b>Total MPAs</b> <sup>2</sup> : 5
<b>Population (July 2013 estimated)</b> <sup>3</sup> : 160,378
<b>Population (2050 projected)</b> <sup>3</sup> : 267,800
<b>Urban population (2010)</b> <sup>3</sup> : 93%
<b>GDP (2010 est.)</b> <sup>3</sup> : U.S. Dollar \$4.6 billion
<b>GDP per capita (2010 estimated)</b> <sup>3</sup> : U.S. Dollar \$28,700

## 2.2 Importance of Social and Historical Context

For millennia the Chamorro inhabited the island of Guam and developed an increasingly complex society and culture (Amesbury & Hunter-Anderson, 2008). Portuguese circumnavigator Ferdinand Magellan was the first Westerner to reach Guam. The Spaniards were the first to colonize Guam, followed by the Japanese and finally, the North Americans. Colonization has profoundly disturbed the connection of local inhabitants to the coral reef ecosystem and its resources. Spanish colonizers systematically sought to disconnect the Chamorro from their indigenous way of life by taking away their fishing boats and other means of making a living. As the largest and most populous island of Micronesia, Guam is a cosmopolitan epicenter for the region where Filipino, Japanese, American and others Micronesians have immigrated to Guam – each with their own unique stewardship ethics related to coral reef resources. The trigger for Guam’s expanded tourist economy was U.S. President John F. Kennedy’s removal of the security clearance in 1963, opening up the island to a range of economic opportunities. Along with tourism, government’s

military spending and growth has dominated Guam’s economy throughout the latter half of the 20<sup>th</sup> century. The history of Guam since World War II has included steady growth with periods of greatly accelerated growth primarily through post-war military development and tourism-driven investment. Guam’s strategic location in the Western Pacific is convenient for Asian markets and U.S. strategic military deployments ([Sablan Environmental, 2012](#)).



*Figure 5: Periods of colonization of Guam from 1521 to present. (Source: Amesbury & Hunter-Anderson, 2008.)*

### Current Cultural Connections to the Coral Reefs

The relationship of the inhabitants of Guam, and use of coral reef resources, has shifted throughout the centuries – notably marked by the variable stewardship ethics of colonizers. The Chamorro were the first inhabitants of the Mariana Archipelago and used a semi-nomadic archipelago-wide settlement system. They were highly dependent on the coral reef resources for their source of livelihood and protein ([Glazier, 2011](#)). Little is known about the depth and breadth of traditional ecological knowledge; however, the interest in the culture seems to be on a sharp increase. For present day Chamorro, fishing is critically important for “perpetuating their maritime history and cultural identity” ([Allen and Bartam, 2008](#)). In recent years, “Chamorro have rekindled a deep sense of cultural identity with strong ties to marine and coastal resources, forests, streams, rivers, and the wildlife with which they share these resources” (Sablan Environmental, 2008).

The revival of Chamorro culture promotes the Chamorro language and encourages the exploration of Chamorro traditional practices. While the generation after WWII was punished under Naval rule if they spoke Chamorro, today there is a renaissance of sorts as the traditional language is taught in many schools including a Chamorro immersion school. The Chamorro identity is proudly displayed at traditional archeological sites and a wide range of cultural community events and gatherings where the traditions and customs of Guam’s island heritage, its language, dance, song, and storytelling are alive today.

The majority of the population, estimated at 37%, is native Chamorro, with 40% Filipino and Caucasian combined, the remaining 27% include people of Japanese, Korean, Chinese and others of Pacific Island descent. With such diversity, Guam has an interesting mixed and multilingual culture. English and Chamorro are the official languages of Guam, however other languages such as Japanese, Korean, Chinese, Filipino and other Micronesian island dialects are common across the roughly 19 villages. In each village, population ranges dramatically from 1,000 to 50,000 people comprising many different ethnic backgrounds.

Local residents engage in recreational activities linked with marine ecosystems, primarily through weekend barbecues and swimming or wading at the beach. Freshly caught fish is an important component of the local diet, with surveys showing that most households consume fish approximately twice a week (van Beukering et al., 2007). Hook and line fishing at shallow depths, trolling, and spear fishing with snorkeling gear are popular fishing methods. Fishermen surveyed in the 2007 report noted that they fish primarily because it strengthens social bonds and because they enjoy it rather than relying on it as their sole source for livelihood. While there are some fishermen on Guam who sell their catch in local markets, there is no export and fishing on Guam is neither a dominant subsistence activity that drives food security nor a dominant commercial activity that drives livelihoods. However, fishing remains a very strong cultural practice (van Beukering et al., 2007).

## 2.3 Brief Summary of the Current State of the Coral Reefs in Guam

Guam is the southern most island of the Mariana Archipelago, a volcanic island surrounded by a coralline limestone plateau. It is the largest (560 square kilometers) and the most heavily populated island in Micronesia. It has a total shoreline of 244 kilometers. The northern and southern halves of Guam differ geologically. The northern half is comprised of uplifted limestone and holds the island's main aquifer. The southern half is comprised of mainly volcanic rock and is highly prone to erosion due to dramatic elevation changes. The island contains 96 rivers that are drained by numerous watersheds (Burdick et al., 2008).

In 2005, surveys showed that there is an average live coral cover of 23% island-wide. Variations in coral cover could be caused by stressors such as land-based sediments in the southwestern corner coral reefs (0-5%) due to sedimentation and poor water quality and lower coral cover in Pago Bay due to Crown of Thorns (COTS) outbreaks (Chin et al., 2011). Health of Guam's coral reefs varies across the island due to the variety and intensity of stressors.

The vitality of Guam's coral reefs has declined over the past 40 years. Average live coral cover on fore reef slopes was at 50% in 1960s, and dropped to less than 25% in the 1990s (Burdick et al., 2008).

Fringing reefs are the predominant reef type extending around Guam and there are also patch reefs, submerged reefs, offshore bands and barrier reefs. Around the island, the width of the shallow (0-2 meter) reef flat platform varies from tens of meters to over 781 meters in Pago Bay (Randall and Elderedge, 1976). Nearshore waters (between 0-5.5 nautical miles offshore) include an area of approximately 108 square kilometers of coral reef and lagoon habitats. Federal waters (greater than 3 nautical miles offshore) include an additional 110 square kilometers. The approximately 70-hectare mangrove forest at Apra Harbor is "the largest and most developed mangrove

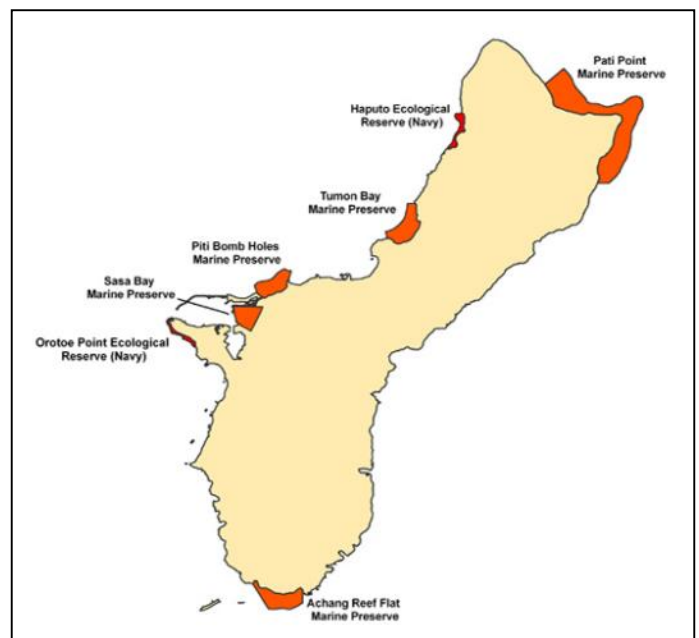
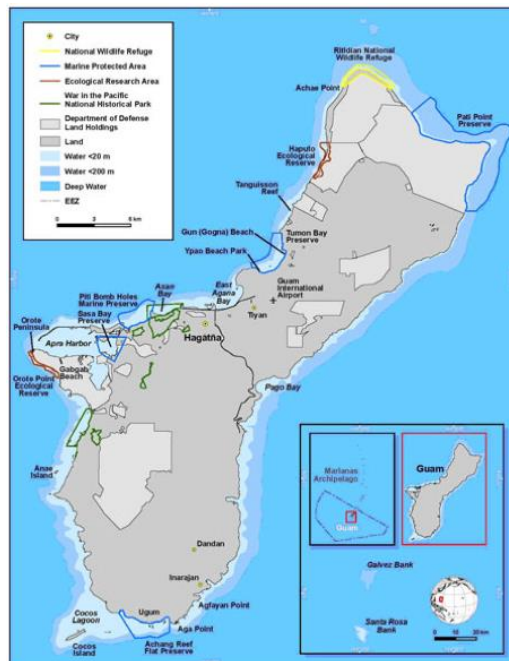


Figure 6: Marine protected areas of Guam (Guam Marine Lab).

forest in the Mariana Islands” (Burdick et al., 2008). Smaller growths exist in the southern villages of Merizo and Inarajan. Guam is home to one of the most species-rich marine ecosystems among the U.S. jurisdictions, with over 5,100 marine species in its coastal waters including over 1,000 nearshore fish species and more than 300 species of scleractinian coral (Paulay, 2003; Porter et al., 2005). Guam’s corals benefit from the proximity to the Indo-Pacific center of coral reef biodiversity (Veron, 2000).

An economic valuation in 2007, funded by NOAA CRCP (van Buekering, 2007) estimated Guam’s coral reef resources at \$127 million per year. Guam has been struggling with both marine and terrestrial invasive species since World War II. A major COTS outbreak in 1973 reduced coral cover in some areas from 50-60% down to less than 1%. Twelve years later, the coral cover recovered to 60% in most of those places (Burdick et al., 2008) however COTS are still a persistent threat and likely exacerbated by LBSP.

A significant shift in natural resource policy in Guam occurred in 1997 with the establishment of five marine preserves. The primary impetus for the establishment of the marine preserves was the decrease in coral reef fish stocks (Guam DOA’s DAWR). Under local territorial law, sections of Guam’s coastline are now set aside by the five marine preserves at Tumon Bay, Piti Bomb Holes, Sasa Bay, Achang Reef Flat and Pati Point. It was not until 2001 that the marine preserves were fully enforced to limit fishing activity. The Pati Point Marine Preserve is the largest preserve, and was set up by the U.S. Air Force in 1993 as a federal conservation area and was later recognized by the government of Guam in 1997 as a marine preserve (Sablan Environmental, 2008). The Sasa Bay Marine Preserve includes valuable mangrove resources. The Tumon Bay Marine Preserve, which lies off shore of the highly developed Tumon Bay tourism district, is an important site for recreation and tourism. The protection of Tumon Bay also has strong biological implications, as it has critical nursery areas for several reef fish species and spawning aggregations.



*Figure 7: Marine and terrestrial ecologically protected areas of Guam (NOAA’s Coral Reef Information System).*

## 2.4 Major Biophysical Pressures and Drivers of Coral Reef Condition

### Land-based Sources of Pollution

After World War II, most of Guam's forest cover was completely destroyed and the re-vegetation of the island has been a steady and largely successful endeavor since that time. Current LBSP remain a major threat for Guam's coral reef ecosystems with the primary pollutants to most waters around Guam being microbial organisms, petroleum hydrocarbons and persistent issues of sedimentation. Severe upland erosion causes major stress on sedimentation flows to the coastline. Sedimentation issues are most pronounced in the southern portion of Guam due to steep slopes, barren lands, compromised vegetation, underlying volcanic rock and lateritic clay-like soils. Marine "snow", which is sedimentation combined with organic matter, is a persistent issue that is visible in many locations.

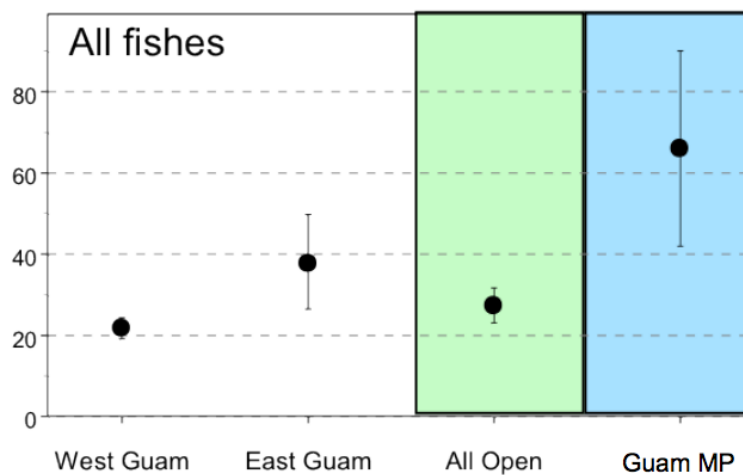
Common anthropogenic practices that have accelerated sedimentation include wildland fires, the clearing and grading of forested land, inappropriate road construction, recreational off-road vehicle use, and grazing by feral undulates, such as an undocumented number of feral pigs that some estimate may outnumber the people on the island. Wastewater management on Guam is antiquated and the subject of significant attention of territorial and federal agencies as the island's sewage treatment plant outfall pipes have historically discharged close to known coral reefs. Two out of the three major outfall pipes were recently deepened in attempts to decrease the impact to the surrounding environment. Historically, during major rain events, stormwater leakage into ageing sewer lines would force sewage treatment plants to divert untreated wastewater directly into ocean outfall pipes ([Chin et al., 2011](#)). In 2013, Guam EPA closed the Agana sewer pipes, and this is no longer as critical an issue. Currently, The U.S. Navy is working to restore 15 sites contaminated with toxic chemicals during World War II, in accordance with Comprehensive Environmental Response, Compensation and Liability Act and the Resource Conservation and Recovery Act. For over 50 years, Guam's only public unlined and overcapacity landfill has been a source of leachate that could be the source of harm to the coral reefs by Pago Bay. Efforts are being made to develop more effective methods of waste management on Guam, and a new sanitary, compliant landfill is now operational.

Land use has affected LBSP in Guam through the negative impacts of increased development and poor agricultural practices. The projected increase of visitors and residents in the future will only further exacerbate the effects of sewage outfalls, sediment erosion, and silt caused by the degradation associated with the economic development ([van Beukering, 2007](#)). While most development between 2004 and 2007 centered on residential and other small-scale construction, there are projections for some major development projects given the growing tourism sector (e.g. Outrigger Resort) and the planned military buildup (e.g. Apra Harbor). There are 1,300 farms on Guam, 200 of which are for commercial production. Guam EPA regulates and monitors fertilizer and pesticide use ([Burdick et al., 2008](#)).

Non-point source pollution in the northern portion of the island can originate from sources such as septic tanks, sewage spills, run-off from livestock and agricultural areas, chemical discharge from urban runoff, farms and illegal dumping. Depending on aquifer connectivity and travel time of pollutants, non-point source pollution in the northern portion of the island may discharge into springs along the seashore and subtidally onto the coral reefs. For more information, please see [Guam Coastal Nonpoint Source Pollution Plan](#).

## Fisheries and Impacts of Fishing

Coral reef fisheries are important both economically and culturally in Guam, but the fisheries have been in decline in the last few decades, due to local and global stressors (Zeller et al., 2007). In 1997, a series of five marine preserves were established to protect fisheries resources. Initial surveys indicate that “fish stocks in the preserves have increased and appear to be working as designed,” however enforcement of illegal fishing in these marine preserves remains a major hurdle (Burdick et al., 2008). The chart below displays the phenomenon that fish biomass is higher in the unpopulated areas of the Mariana Islands, suggesting that anthropogenic stressors concentrated in the populated southern region negatively affect fish populations (Figure 10). For more information, please review *An Analysis of Archaeological and Historical Data on Fisheries for Pelagic Species in Guam and CNMI* (Amesbury & Hunter-Anderson, 2008), *The Status of the Coral Reef Ecosystems of Guam* (Burdick et al., 2008), and *Status of Coral Reef Fish Assemblages and Benthic Condition Around Guam: A Report Based on Underwater Visual Surveys in Guam and the Mariana Archipelago* (Williams et al., 2012).



*Figure 8: Fish biomass by location (g/m<sup>2</sup>), and differences between marine preserves and open access areas. (Figure adapted from Williams et al., 2012).*

## Impacts of Military Buildup

Significant social, economic, and environmental impacts were expected with a previously planned DoD buildup that projected as much as a 40% increase in Guam’s population by 2014. The start of substantial growth originally identified in the Final Environmental Impact Statement based on the assumptions for population growth and additional revenues from buildup construction in 2010 was deferred until at least Fiscal Year (FY) 2015. In 2012, the size and scope of the military buildup had been reduced and a supplemental EIS was initiated to evaluate base and firing range location options and to quantify associated impacts. As of September 2013, the military’s preferred site for the Marine Corps base and family housing is the U.S. Naval Computer and Telecommunications Station in Finegayan, and their preferred site for the live fire training range is Northwest Field on Andersen Air Force Base. Along with a decision to locate fewer U.S. Marines and their dependents on Guam, military construction activity and development of housing and business associated with the buildup is now expected to increase at a slower rate. A Record of Decision from the DoD is expected in mid-FY2015.

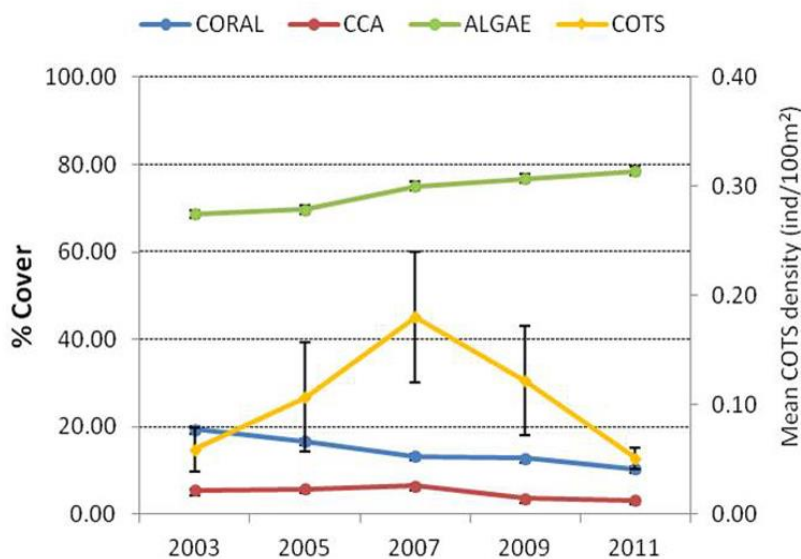
The trajectory of military buildup in the future remains uncertain, however it is less than initially anticipated. Nonetheless, the buildup has been the catalyst for reviewing the existing legal and regulatory mechanisms and has sparked discussions for how to update and improve them in light of development in the future. It has encouraged discussions within government agencies for possibly updating zoning requirements, procedures and potentially developing watershed management plans and even a Guam Master Plan. EO 2012-06 created the Guam First Advisory Council with the purpose of tracking military expansion and promoting a unified front for Guam’s role and interests in the buildup.

### Impacts of Recreational Use

Tourism is a major activity that contributes up to 30% of the annual GDP and generates up to 15,000 jobs, with the majority of tourists engaged in marine recreational activity during their visit (source GVB personal communication). The growing tourism economy contributes to the estimated 300,000 dives and 6,000 open water dive certification courses that are performed on Guam each year. Certain dive sites experience recreational diving pressure that far exceeds their documented diver per year threshold. For example, estimates show that on average over 18,000 divers visit a .25 hectares area in Piti Bomb Holes each year, which has a carrying capacity of 4,000-6,000 divers per year (Burdick et al., 2008). Innovative methods to handle the growing recreational diving pressure in Guam have not yet been fully addressed, but certain initiatives such as eco-permitting may be developed in the near future. The rate of population growth in Guam is lower than other Pacific islands (such as Papua New Guinea or the Solomon Islands), however Guam’s population is still projected to increase by approximately 38% over the next ten years. This increase in population will likely increase pressure on natural resource use for recreational and commercial development purposes and intensify management challenges (Burdick et al., 2008; Chin et al., 2011).

### Impacts of Climate Change

Global drivers, such as climate changes and the El Niño-Southern Oscillation events, are causing stress to coral and it has been documented that the thermal stress related to these events and trends causes coral to expel their symbiotic algae that they host, which leads to coral bleaching.



*Figure 9: Concurrent data of density of crown-of-thorns sea stars (COTS, *Acanthaster planci*), percent cover of live hard corals, crustose coralline red algae, and fleshy macroalgae and turf algae during an 8-year period between 2003 and 2011 suggests that COTS negatively affects hard coral cover. Increased COTS outbreaks are associated with climate change (NOAA PISC, 2013).*



Guam experienced critical bleaching events in 1994 and 1996, with recent satellite-derived sea surface temperature measurements suggesting that higher than average water temperatures may have played a role. Coral bleaching events were again observed in Guam in 2006, 2007, and 2008, giving indication that such events may become more severe and frequent in the coming decades (Burdick et al., 2008).

In addition, increases in the concentration of CO<sub>2</sub> create conditions that impede coral reef growth, specifically coral calcification to occur. The rising atmospheric CO<sub>2</sub> levels due to the burning of fossil fuels are irreversible on human time scales and are causing the rapid acidification of the world's oceans. This will result in the decrease of carbonate minerals available to marine calcifying organisms (especially corals) to form biogenic materials (Burdick et al., 2008).

## 2.5 Governance Context and Institutions Involved in Coral Reef Management and Their Recent Development Over Time

Guam is home to a wide range of decision-making groups among the 19 different villages and communities, particularly with respect to coral reef management. Understanding the power dynamics within communities and the territory at large has been a necessary yet informal capacity that has been developed to identify what is truly important to the people of the place. As many of the interviewees recognize, this capacity is critical for coral reef management in Guam.

The three major expressions of governance in the system are government, market forces and civil society. These are expressed at different scales. For the government, it is expressed in Guam through the federal agencies, the Government of Guam and local mayoral units. Government expresses its power through laws and regulations, taxation and spending policies, and educational outreach. Market forces are expressed through differently sized corporations and businesses. Their power is expressed through profit-seeking activities, ecosystem service valuation, and cost-benefit analyses. Civil society includes organizations and institutions whose geographic and programmatic scopes vary. Examples include large international NGOs, mid-sized civic organizations and small local community organizations. Their power within a governance system is expressed through advocacy and lobbying activity, vote casting and stewardship activities.

### Context of Government Institutions<sup>2</sup>

The government in Guam is multi-scalar, including local mayoral units, the Government of Guam, and federal agencies. The federal agencies of government that are most directly related to coral reef management include: NOAA OCRM, NOAA CRCP, NOAA PIFSC, WESPAC, NRCS, USFWS, NPS, USGS, and USACE. The DoD and USFWS are stewards to major land holdings (military bases and reserves) on the island that roughly comprise 1/3 of the land area.

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<sup>2</sup> In this section, federal agencies are referred to with their acronym and some territorial agencies are spelled out for greater clarity for the reader.

At the local government scale, the agencies most directly related to coral reef management include: Bureau of Statistics and Plans Guam Coastal Management Program, Department of Agriculture, DOA Division of Aquatic and Wildlife Resources, DOA Division of Forestry and Soil Resources, Department of Chamorro Affairs, Guam EPA, Port Authority of Guam, Department of Parks and Recreation, Department of Administration, Department of Labor, and Guam Visitors Bureau. The natural resource management community on Guam is a small and well-networked group of professionals. Most of the members serve concurrently on several working groups, committees, and other partnering efforts (Sablan Environmental, 2008).

In 1997, EO 97-10 called for increased comprehensive and effective management of Guam's coral reef ecosystems through the creation of the GCRI. A 2012 update in the 2012-05 EO further articulates the structure and functions of the GCRI. The GCRI is comprised of two bodies: the Policy Advisory Committee and the Coordinating Committee. The GCRI is not yet a fully developed program with an institutional home. Guam is a member of the U.S. Coral Reef Task Force. As part of the task force the DCA serves as Guam's Coral Reef POC, and GCMP administer the NOAA CRCP Cooperative Agreement.

The 2012-05 EO articulates that the GCRIPAC is comprised of the following members: representative of the Governor's Office, Guam's POC (will serve as the Chairperson of the GCRIPAC); representative of academia, with knowledge of coral reefs, to be appointed by the Governor; representative of commercial fisheries to be appointed by the Governor; representative of recreational fisheries to be appointed by the Governor; representative of the maritime industry to be appointed by the Governor; representative from maritime recreation (i.e., SCUBA diving, thrill craft operators, etc.) to be appointed by the Governor; representative from traditional indigenous Chamorro organization with emphasis on fishing to be appointed by the Governor; representative from a Guam-registered Environmental NGO to be appointed by the Governor; and, one at-large representative from the Guam community with coral reef interests.

Duties of the GCRIPAC include: "providing advice, comments, input, and recommendations on the Guam LAS to the GCRICC; identifying problems, issues, concerns, and recommendations regarding coral reefs to the GCRICC; reviewing current and potential policies, regulations, legislation, etc., with regards to coral reefs and providing advice, comments, input, and recommendations to the GCRICC; providing minutes of meetings and other reports to the GCRICC; and such other duties as assigned by the Governor".

The 2012-05 EO articulates that the GCRICC is comprised of the following members: Governor's Point of Contact to NOAA on coral reef issues (shall serve as the Chairperson for GCRICC; Director of DOA, or designee; Director of the BSP, or designee; Director of the Guam Economic Development Authority, or designee; Administrator of the Guam EPA, or designee; President of DCA, or designee; President of the UoG, or designee; Director of the DPR, or designee; and, General Manager of the GVB, or designee.

The duties of GCRICC as outlined in 2012-05 EO: developing, updating, and monitoring of the Guam LAS; utilizing the Guam LAS for developing prioritized lists of coral reef issues; determining funding priorities for coral reef issues in Guam, and coordinating and developing protocols regarding applications for federal grant money for coral reef projects; incorporating advice and input from GCRIPAC into the Guam LAS; providing advice and comments to the

Governor and Guam agencies on potential government issues, policies, and potential regulations; and, providing quarterly reports to the Governor on status of coral reef issues, funding, and priorities.

While Guam has a diverse set of laws aimed at conservation and environmental protection, few are implemented or fully enforced. The Guam Natural Resource Strategy 2012 identified two primary deficiencies responsible for this: 1) a lack of social and political will; and, 2) a lack of any substantive and enforceable growth management policy.

### Context of Major Market Forces

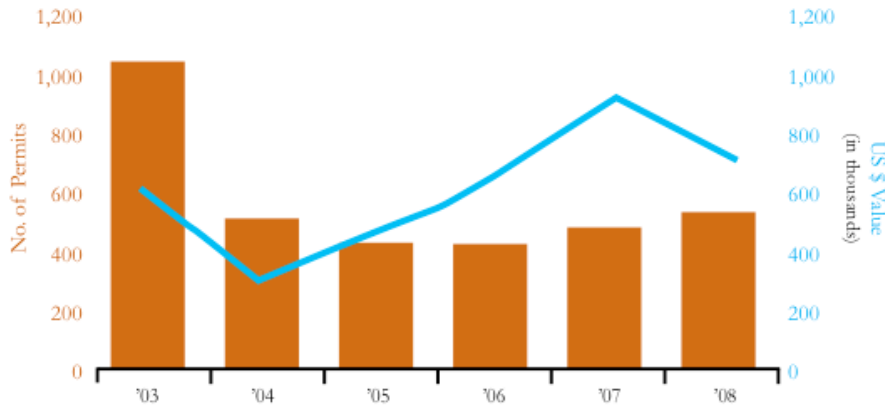
The two major market forces are tourism and economic development associated with DoD buildup. A majority of tourism operators are profit-oriented, and there are very limited expressions of eco-tourism.



*Figure 10: Military presence on Guam is evident by their significant land holdings throughout the island, particularly in the north of Guam with Anderson Air Force Base ([Global Research, Centre for Research on Globalization](#)).*

There was expected to be a major increase in population and development of housing and businesses associated with the planned DoD buildup, which would have had significant environmental impact. However, since DoD build up has been reduced for a variety of reasons, including the 2010 EPA “Environmentally Unsatisfactory” rating of the Draft EIS ([EPA](#)), other factors associated with the Base Realignment and Closure Commission and a host of other factors, the associated development has not been as dramatic as once envisioned. Indeed, given available real estate on base, there were fears the military may require active duty to live on base, further reducing the economic growth associated with base expansion.

### Residential Construction Permits 2003–2008



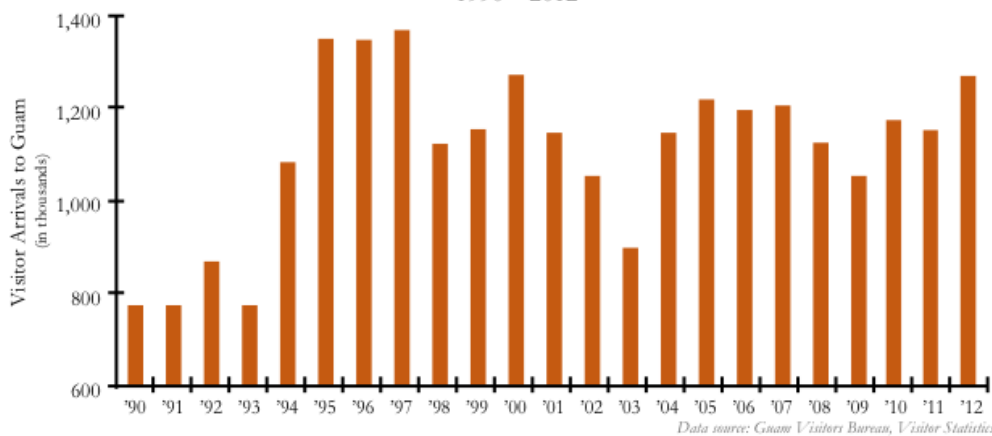
Data source: Guam Department of Public Works

**Figure 11:** Increase in property values with speculation of Military buildup (Guam DPW).

Guam’s economy has experienced a recent shift away from DoD development and towards commercial, tourism-driven development. This can be seen in the increase of recreational and commercial activities, hotels, shopping malls, and annual visitors to Guam. Tourism is now the largest economic sector in Guam.

Tourism has fluctuated greatly over the past decades (see Figure 12). The Asian economic boom of the 1980s spurred increased tourism in Guam and the recession of the 1990s decreased the tourism numbers. According to a 2007 study, there are an estimated 300,000 dives performed each year off the shores of Guam and this number is expected to increase with the additional military personnel and their dependents from the DoD buildup (van Beukering et al., 2007). Despite fluctuations in annual visitor arrivals, tourism is still the most influential economic driver in Guam, accounting for up to 60% of the government’s annual revenues and providing more than 26% of Guam’s total payroll employment (Guam Economic Development Authority et al., 2011).

### Guam Visitor Arrivals 1990 – 2012



Data source: Guam Visitors Bureau, Visitor Statistics

**Figure 12:** Guam Visitor Arrivals statistics from 1990 to 2012 (GVB).

## Context of Civil Society and NGO partners

Civil society is in its nascent stage of organizing as conventional 501(c)3 non-profit entities to build their structural capacity. There is a limited presence of NGOs working in Guam and they include RARE, The Asia Pacific Academy of Science, Education and Environmental Management known locally as APASEEM, TNC, The Ayuda Foundation, Guam Environmental Education Partners, Inc., and Chamorro Land Trust. Guam is a signatory to the MC that has the goal to effectively conserve at least 30% of the nearshore marine resources and 20% of the terrestrial resources across Micronesia by 2020. Guam's efforts to support the MC are supported by TNC. Guam is developing a strategy to implement the MC with partnerships between the government, NGOs and local communities. Humatak Foundation is an example of a small emerging local NGO in Guam. Increasing the capacity of civil society in Guam will be important to supplement some of the territorial capacity for coral reef management and to act as a bridge between the government and the public.

## Context of Regional Partnerships

Guam is also heavily engaged in a wide range of regional partnerships, such as the MC/Micronesia Chief Executives Summit, Sustainable Futures Organization, Invasive Species Council, and several others. Smaller island jurisdictions and nations such as Guam benefit from these cross-sector collaborative structures, particularly for networking and sharing lessons learned. The continued success of these cross-sectoral collaborative entities demonstrates the importance of engaging with regional partners, particularly in the conservation field for improved environmental outcomes.



*An informational sign for visitors at Piti Bomb Holes Preserve, one of the five marine preserves established in 1997. (Photo credit: Glenn Page, SustainaMetricx)*

# Section Three: Findings Related to Coral Reef Management Capacity in Guam

## 3.1 Introduction

In this section, we briefly review the recent progress that has been made in coral reef management in Guam and we utilize both “Process” and “Outcomes” analysis as tools to foster the building of adaptive capacity for the management of coral reefs in Guam. We apply the Management Cycle and the Orders of Outcomes framework as described in Section 1.2. These conceptual frameworks are applied to recent past and current coral reef management in Guam to help shape capacity building recommendations for the future.

## 3.2 Status of Coral Reef Management In Terms of the Management Cycle

### Recent Generations of Coral Reef Management

While there were likely many expressions of coral reef ecosystem management by traditional communities, a recent evidence-based approach was initiated in the early 1970’s with the use of SCUBA equipment and advances in marine science. Identification of the extent of the resource and issues associated with coral reef management was documented by natural resource management agencies from the 1970s and into the 1990s. For example, DAWR identified a decline in fisheries and subsequently conducted a management study that led to the proposed concept of a system of MPAs across the island to protect resources. Based upon this study, the results informed a policy directive whereby DAWR drafted proposed regulations and conducted a series of three public hearings for MPAs. Additional dialogue was held regarding the establishment of GCRI. In 1997, [EO 97-10](#) was adopted and the GCRI was formed. In the same year, legislation ([Public Law 24-21](#)) was passed to create [five marine preserves](#) at Pati Point, Tumon Bay, Piti Bomb Holes, Sasa Bay and Achang Reef Flat. Subsequently, in 1998 the GCRI published the “Guam Coral Reef Initiative: Background and Briefing Book” that established a policy development mechanism for the protection of Guam’s coral reefs and describes the vision and strategies of the GCRI. There was a five-year gap until enforcement was effectively implemented for these marine preserves in 2001. Thus, this could be described as the first major cycle of recent coral reef management as it completed the essential steps of the policy cycle of issues identification (Step 1), analysis of options that led to a plan (Step 2), the formal commitment and mandate (Step 3) as well as implementation of the plan of action (Step 4) and reflection to generate adaptive learning (Step5).

### Next Generation

In 2002, the GCRICC went through the issue analysis stage (Step 1) of a second generation through the process of selecting and prioritizing the main threats to local coral reefs upon which to focus LAS efforts for the next three years. In 2003, GCRICC drafted the LAS, successfully completing Step 2 with a formulation of a set of management plans. In 2005, planning documents were produced for five of the LAS (Recreation Misuse/Overuse, Lack of Awareness, Fisheries Management, LBSP, and Disease/Climate Change and Coral Bleaching). In 2005, the first Status of the Coral Reef Ecosystems of Guam was published, addressing the loss and degradation of Guam’s coral reef ecosystems

(updated in 2008). The only LAS to be revised of the original 2005 planning documents was the Climate Change and Reef Resilience LAS. Implementation of the LAS planning documents were done in a loosely coordinated fashion and routine meetings allowed managers to reflect and make adaptive changes.

### Current Generation

The current generation of coral reef management is marked by the shift towards site-based and prioritized action planning strategies as seen through the PSD and the CAP process. This generation of management has somewhat successfully moved through the first three steps of the cycle (issue identification, program preparation and formal commitment). The first step of the Management Cycle (issue identification) featured ongoing investment in biophysical monitoring and evaluation of the coral reef ecosystems (e.g., updated 2008 Burdick et al.). The second step of the Management Cycle (preparation of a management plan) involved the publication of the PSD for Guam and the establishment of the CAP process at priority sites. The third step of the cycle involved the formal adoption and approval of both the PSD in 2010 and the Piti-Asan Management Plan in 2012. Since that time, other than pilot demonstration scale projects, limited on-the-ground project implementation is underway. Policy for managing coral reefs was also revised in 2012 by [EO 2012-05](#), with additional details on establishing a policy development mechanism (see Section 2.7 for more details). Based on interviews conducted as part of the capacity assessment, persistent barriers exist that inhibit on-the-ground implementation including the need to define clear and unambiguous goals, develop supportive constituencies, secure high-level commitment and further grow adaptive capacity. Implementation that does occur is largely piecemeal, and not at a scale that would have the effect necessary for threat reduction, improvement in resource health and greater community involvement.

### Priority Area Timeline

One of our methodological tools is the use of timelines, which provide running narratives of the progress made in recent years that addresses coral reef management priorities. Displayed here is the timeline we developed for the Piti-Asan Watershed priority area. Coupled with the steps in the Management Cycle and the degree to which the enabling conditions are present, it provides a rich narrative of what may be possible in terms of directing resources to future work, specifically sequencing and prioritizing actions in this specific geography. For the full timeline developed for Guam as described in Section 1.4, please see Appendix B: Guam Timeline.

*Table 2. Timeline for the Piti-Asan Watershed Priority Area*

1978	War in the Pacific National Historic Park created
1997	Law to create the marine preserves
1998	Launch of the Guam Coral Reef Initiative through executive order
2001	Actual enforcement for the MPAs begins
2002	Started the Local Action Strategies process – especially fisheries management focused on building capacity for the Marine Protected Areas
2003 – 2005	National Park Service did sediment work in Asan (studying the flow of sediment, erosion pins in the upland portion, overland flow, sediment collection tubes, coral settlement plates)
2004	New vehicles for conservation officers in the preserve
2004 – 2011	Masso Reservoir Restoration
2005	Natural Resources Conservation Service David Flores Streambank Protection

2005/2006	CNMI example in Laolao – first place-based management example, started the shift to priority sites, rallied Guam to do a similar initiative in Piti-Asan
2006	Masso Reservoir and Watershed designated a conservation area by Executive Order 2006-14
2006/2007	Allowed seasonal take of juvenile fish and atulai (scad)
2006	Began work with the Masso Reservoir (starting re-working the deeds)
2006	United States Geological Survey started doing stream work (stream flow and stream bank information that informed the Piti-Asan Management Plan)
2006	History of sediment impacts in Nimitz Hill well known
2006	Piti and Asan combined to become a priority site
2007	Natural Resources Conservation Service Slope Stabilization
2007/2008	First introduction of indigenous fishing rights bill 29-127
2008	Public Law 29-127 was signed
2008	Masso Reservoir and Watershed Mitigation started
2009	Piti-Asan Public Outreach
2010	Masso Watershed Restoration
2010 – 2011	Masso River Bridge Embankment Restoration
2010 – present	Streambank Stabilization in the Piti Watershed
2011	Phase I of the Pedro Santos Memorial Park Improvement
2011	Asan Flood Control River – Rehabilitation Project
2012	Pedro Santos Memorial Park Rain Garden
2012 – 2014	Community Coral Reef Monitoring Program

### 3.3 Status of Coral Reef Management Long-Term Goals

Long-term coral reef management goals would define a shared set of desirable long-term conditions and long-range priorities of a governance system and the degree to which economic development and conservation priorities are balanced to guide the process of more sustainable forms of development. Currently, such goals have not yet been articulated and stakeholders seem far from agreement as to the specific nature of such long-term goals. However, the PSD does identify five general categories of priority goals (LBSP, Fisheries, Development Pressure, Recreational Impacts and Climate Change). The PSD neither attempts to define the coral reef conditions and qualities that management efforts are designed to achieve, nor does it attempt to define the associated desired forms and intensities of coral reef use by society and the goods and services that healthy coral reefs could generate. As such, the coral reef conservation goals are not yet defined by time bound and quantitative targets.

### 3.4 The Current Status of the 1<sup>st</sup> Order Enabling Conditions

#### Unambiguous goals define desired coral reef conditions and intensities of use

The PSD outlines the top five priority goals:

1. Improve the condition of coral reef ecosystems by reducing the amount of sediment and pollution from development, fires, recreational users and agriculture in Guam’s watersheds;



2. Protect Guam's coral reef fisheries resources for current and future generations through effective management that conserves aquatic and marine ecosystems and ensures the conditions, welfare and integrity of marine ecosystems;
3. Mitigate the existing and anticipated pressures of rapid development on Guam's coral reefs by implementing the Guam Natural Resources Strategy with a focus on Apra Harbor through 2012;
4. Improve the condition of Guam's coral reef ecosystems by reducing negative recreational impacts; and,
5. Improve management of Guam's coral reef ecosystems to enhance resilience and recovery processes.

Based on interviews with stakeholders, the degree of support for these goals varies considerably and many were unfamiliar with and in some cases felt excluded from the priority setting process and therefore expressed little support for its purpose as a management tool. Even among the federal partners, there was not strong evidence of a shared sense of agreement toward a specific set of management goals that could more effectively align federal and territorial goals and leverage resources.

### **Informed and supportive constituencies for coral reef conservation**

It became clear that there is a growing group of committed coral reef managers in Guam that are highly aware and supportive of management issues and needs. It was also reported and there was anecdotal evidence that much of the general population is supportive of coral reef management actions and understands their benefit. Through our assessment process, we heard repeatedly that one of the biggest barriers to coral reef management in Guam is effective communication. One of the main challenges among managers involved is getting the “right message” out to the “right people”, particularly to politicians, those in leadership positions at stakeholder agencies and organizations, and the general public. Coral reef user groups seemed aware of the management initiatives' goals but the degree of support varies. Coral reef resource management staff in Guam are primarily managers or biologists that do not specialize in communications. Many expressed the need for more expertise in communications, developing effective communication campaigns, and the need for coordinated communication initiatives. Windows of opportunity may be opening with the increased use of talk radio, newspapers, and recent developments in social media that are having an emerging influence on public awareness. Some of the successful outreach efforts on the island include the Guam Community Coral Reef Monitoring Program, Guardians of the Reef, [\*Man, Land & Sea\*](#) (Taotao, Tano & Tasi) newsletter, Earth Month, Environmental Education Committee, Go Local, RARE Campaign, Humatak Foundation, Humatak Project, Ayuda Foundation and service learning requirements in the local high schools. Engagement with communities concerning natural resource protection issues has increased over the past couple of decades. For more information on the community outreach efforts on Guam, please review [\*Man, Land & Sea\*](#) newsletter online. Community involvement in natural resource management at the grassroots level is emerging and there is an opportunity to empower people to have conversations around natural resource management, provide information to the communities through mechanisms other than agencies and public hearings, and liaise between the two realms. Guam's assorted history of colonization has also contributed to its varied levels of support for environmental management. Much of the traditional ecological knowledge in Guam has been lost and replaced with cultural practices from countries such as Spain, Japan, and a variety of Western influences.

As noted above, Guam is currently experiencing a renaissance in Chamorro culture. Several described a lack of awareness and connection to the environmental resources of the island. While this may be improving, several described the need for more science and environmental education in the schools of Guam, and an environmental ethic that can be reinforced through K-12 education that moves “bottom-up”, from students to parents and relatives throughout the population. Many described how Guam public schools consistently underperform as evidenced by comparative education metrics. There are alarming trends such as a high dropout rate, symptomatic of an education system in need of reform, leading many in leadership roles in education to focus on “Direct Instruction,” with an emphasis on reading, writing and math as opposed to education that features a deeper understanding of Guam’s landscape/seascape and people. Students in Guam are generally detached and unfamiliar with the terrestrial and marine ecosystems of their island.

Many people who were interviewed cited fishing as a practice that ties members of the local community directly to their cultural heritage. There seemed to be a strong sense among resource users to maintain this heritage yet several described a diversity of opinion amongst the resource users on how to best conserve the fisheries. Degree of access to the marine preserves is a particularly contentious issue, with some who believe that no-take is the proper management approach and others who seek to increase access to marine preserves ([Chin et al., 2011](#)).

Within the tourism and recreation industry, there are some dive and commercial recreation operators who understand the need to protect marine resources through responsible use. However, there is a substantial contingent of operators who “are less familiar with the goals of marine preserve management and how easily corals can be damaged” ([Chin et al., 2011](#)). Engagement with this contingent of the tourism sector will prove critical for improving the sustainability of the tourism sector in Guam. The Japanese market is the largest portion of visitors to Guam annually, and the GVB conducts quarterly visitor exit surveys. Of the three top reasons for choosing Guam as their vacation destination in 2012, Japanese tourists cited pleasure, “Guam’s natural beauty/beaches” and price (QMark Research, 2012 Data Aggregation Report). Transmitting stewardship messages across multiple languages will be important for reaching the linguistically diverse set of visitors to Guam (Japanese, Chinese, Korean, Russian, etc.).

### **Formal Commitment to Coral Reef Management**

The government’s commitment to coral reef conservation has principally been expressed through the creation of the five protected areas under Public Law 24-21 passed in 1997. The 1997 and 2012 EOs related to the creation of the GCRI ([EO 97-10](#)) and the adoption of the policy development mechanism ([EO 2012-05](#)) are two other expressions of the government’s commitment to coral reef conservation.

The issues in Guam that receive the most funding and political attention are education, health, and public safety. Given the current state of the economy in Guam, economic development typically outweighs natural resource issues. However, general education and awareness of natural resource protection issues are on the rise, as is the demand for the authority needed to effectively implement and enforce management decisions. It was noted by many that tensions are high at resource agencies and communication, collaboration and transparency between policy-makers, natural resource agencies and the public is not functioning at a high level. While there are numerous capacity issues that surfaced during the interviews, some of the most pressing are issues related to human resources, procurement, and a lack of integration across the territorial natural resource agencies to work together effectively as implementing partners.

## Human Resource Issues

A clear goal expressed by virtually all who were interviewed was the importance of increasing local involvement in natural resource management and stewardship, and specifically increasing the number of local members of the community in the natural resource management agencies. Political appointees are frequently placed in management roles and some can be extremely effective, while others are less familiar with natural resource management issues and can have conflicting agendas. As with other sectors that require highly trained and capable staff, Guam has experienced a significant “brain drain” of qualified natural resource managers and resource specialists who have left territorial agencies for federal agencies with more appealing offers (particularly salaries that far exceed Guam salaries). The challenges related to low morale are also a key driver for “brain drain.”

## Procurement Challenges

The Government of Guam’s current system of procurement, the creation of contracts, and the use of mechanisms such as MOUs contributes to the inefficient distribution and use of funds (multiple review layers in Government of Guam with unclear value added for each step), significantly delays project implementation, unnecessarily utilizes large numbers of staff hours to navigate bureaucracy, and occasionally results in the loss of unspent funds. Procurement can take a month, two, sometimes more (and even into the one-year plus category for some items and services). The processing of MOUs and contracts and contract amendments usually takes several months and often longer. Once federal funds are available, establishing an account takes more time and only then are funds distributed to the appropriate sub-grantee, contractor, etc. These bureaucratic delays often hinder efficient distribution of grant funds and can lead to grant extensions.

## Higher Education

The primary and secondary educational system in Guam is fraught with issues of high dropout rates and poor test scores. Approximately 25% of students attend private schools and 75% attend public schools (BSP, Statistical Yearbook 2010). The two institutes of higher education in Guam are UoG and GCC, and students also pursue higher education opportunities on the mainland. UoG is one of the 72 land grant universities of the U.S. and features a Sea Grant program as well. Currently there is a UoG Marine Laboratory that provides advanced degrees in Marine Biology; however the University lacks the resources to develop an undergraduate degree in Marine Biology to feed into the graduate program. There is a need to identify funding and resources to build this capacity for educating natural resource practitioners on-island.

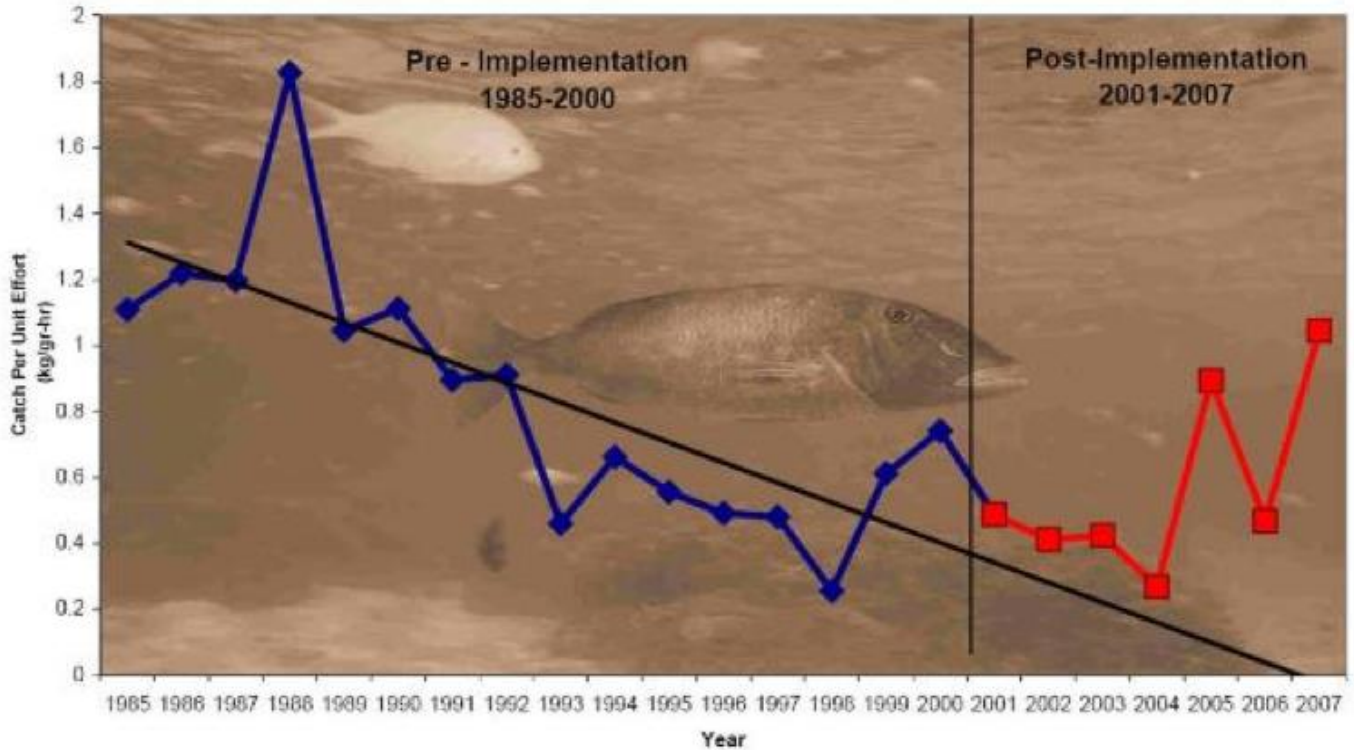
## Regulations and Legislation

As a territory of the U.S., Guam is subject to federal laws and regulations. These include, but are not limited to, Section 404 of the 1972 Clean Water Act, 1969 NEPA, 1978 National Marine Fisheries Service Habitat Protection Policy (NMFS 1978), 1981 USFWS Final Mitigation Policy (USFWS 1981), 1990 MOA between USEPA and the USACE on mitigation under Clean Water Act Section 404 (b)(1) guidelines (USEPA and USACE 1990), and 1998 EO 13089 (EO 1998).

The establishment of the 5 MPAs in 1997 through Public Law 24-21 was the most significant measure to manage Guam’s coral reef resources through increased regulation of fisheries. [Public Law 27-87](#) created a system of eco-

permitting, administered by DAWR. [Public Law 31-10](#) banned the selling and possession of shark and ray parts. The Guam DAWR is the government body with the responsibility related to natural resources ([Sablan Environmental, 2012](#)). There is currently no licensing program, limited fishing regulations, no formally agreed upon size limits, few species restrictions (and those in place have not changed for 20 years or more), and uneven enforcement. Nearshore areas have not had updated planning and zoning controls, and the government commitment to reducing LBSP could include increased measures related to nearshore land use protections. The Guam Soil Erosion and Sediment Control Regulations were adopted originally in 1985 and were revised in April 2000.

### Marine Preserves Reverse Decline in Gill Net Catch Rate



*Figure 13: Decline in gill net catch rate displayed pre- and post-implementation (2001) of enforcement measures in the MPA system in Guam ([Guam Department of Agriculture/DAWR](#)).*

## Section Four: Priority Capacity Building Strategies

### 4.0 Scope of Available Financial Resources

An assessment of capacity building needs for coral reef management in Guam has to balance the responses to identified needs with the scope of the funding and resources that can be brought to bear. In Guam the financial context for coral management can be divided into external resources, principally from NOAA, and financing provided by the territory. While it is beyond the scope of this capacity assessment to completely quantify the magnitude of territorial funds that, to varying degrees, may impact coral reef conditions and coral reef management, it is useful to assess the general scope of funds available to address coral reef management needs. These investments include programs and activities that concern the management of fisheries and a diverse array of programs and activities associated with coastal management, nonpoint source pollution, education and outreach, biophysical monitoring, land use, watershed management and other measures to control impacts to coral reefs.

Funding directed at Guam from the NOAA CRCP Cooperative Agreement was roughly \$580,000 in FY2012, with a roughly \$22,000 match from the territory. Activities funded through the cooperative agreement are the primary focus of this capacity assessment. The balance of funds flowing to the territory include various grants and agreements funding scientific monitoring, public education, and staff as well as regional programs that contribute to Guam coral management. The BSP/GCMP is responsible for managing the NOAA CRCP cooperative grant to the territory, and has an average annual budget of approximately \$1.1 million. Roughly 25% of their budget comes from the NOAA CRCP cooperative grant, with the other 75% coming from the CZM Grant through NOAA OCRM.

Many other local agencies involved in coral reef management are largely federally funded. The BSP has an annual budget of about \$7 million, 90% of which comes from federal funding. The Guam EPA has an annual budget of approximately \$3 million, 80% of which comes from federal funding. The Guam DOA is typically between 50-60% federally funded each fiscal year. The DOA houses the Conservation Officer program, however federal funds to DOA are not permitted to contribute to enforcement, and there are very few local funding mechanisms to support enforcement. Other major contributing federal granting agencies include the USEPA, the USDA, the U.S. Forest Service, and NOAA. Several federal agencies, such as NOAA National Marine Fisheries Service, NRCS and NPS, receive funding specifically for staff and offices located in Guam. Their annual budget is typically in the \$200,000-\$300,000 range. Local funding sources include Special Funds, the Territory General Fund, and local penalties and fines.

Few NGOs or local organizations in Guam related to natural resource management receive consistent core funding. The majority of these NGOs are dependent on opportunistic grants from federal agencies, large NGOs, foundations or private donors. Annual budgets for local NGOs typically range from \$20,000 to \$100,000. Organizations that have contributed to NGO funding in Guam in recent years include Global Green Grants, the Western Forestry Leadership Coalition, the Micronesia Conservation Trust, TNC, and a range of private foundations.

A persistent barrier to sustainable financing in Guam is the lack of local funding mechanisms. As stated earlier, most of the agencies and organizations in Guam are largely dependent on federal funding. The issue of local funding is

exacerbated by the fact that some federal grants are unable to contribute to programs such as enforcement where capacity is needed. Formal commitment for building local sustainable finance for natural resource management should be fostered in order to support a sustained long-term investment in capacity building.

**Note on recommendations:** The recommendations in this section have been divided into three groups based upon their complexity, scale, practicality and the degree of control over their implementation. The Group 1 Recommendations are highly political in nature, will require high-level governmental action, and, in many respects, lie beyond the direct reach of the Guam coral reef management network. The Group 2 Recommendations will require a collaborative and coordinated approach to management, are largely directed to work at select priority sites and involve multiple partners, and may involve interconnected systems and engagement with multiple resource users, government entities, NGOs and funders. The Group 3 Recommendations are designed to build capacity at an organizational scale where leadership and control over implementation is relatively high. Each recommendation includes insight into the degree of complexity, cost, and the time required to implement as well as the related linkage to the priority goals as defined in the PSD. Finally, a set of proposed partners are recommended as a logical core group to work on this issue but are by no means the only potential partners or the best. It is important to note that a lead organization is needed, but based on dialogue with the J-CAT, it was decided that leadership roles would be discussed and decided on a case-by-case basis. Section Five presents broader contextual guidance on how to develop a long-term strategy to build adaptive capacity to improve coral reef management in Guam.

TIME SCALE	COMPLEXITY SCALE	MONETARY SCALE
<b>Short</b> = <1 year	<b>Simple</b> = Somewhat context independent recommendations such as “best practices” and “standard operating procedures” that have fairly high certainty of building capacity.	<b>\$</b> - Less than \$5,000
<b>Medium</b> = 1 to 2 years	<b>Complicated</b> = Context is more important and the recommendation may require either coordination of technical expertise that may or may not be present in the system, or may require a degree of social engagement and relationship building that creates a common ground; i.e., either socially or technically complicated.	<b>\$\$</b> - Between \$5,000 and \$20,000
<b>Long</b> = >2 years	<b>Complex</b> = Context is highly dependent and the recommendation may require strategies that are adaptively implemented and address dynamic, emergent, non-linear and complex conditions.	<b>\$\$\$</b> - Between \$20,000 and \$100,000  <b>\$\$\$\$</b> - Greater than \$100,000

## 4.1 Group 1 Recommendations: Politically Challenging Goals to Improve Formal Commitment to Coral Reef Conservation

The recommendations in this section are politically challenging, and in many respects, accomplishing them will require actions beyond the reach of NOAA CRCP, BSP/GCMP and the larger coral reef management network in Guam. Nonetheless, there are concrete measures that NOAA and the GCRI can take that can improve the likelihood of success and can lead to an improved climate for coral management and marine conservation in the territory. A top priority to build the capacity for effective coral conservation in Guam is to generate high-level institutional and political support for coral reef conservation and management.

### 4.1A Clarify the Legal Roles, Mandates, and Responsibilities of Local and Federal Partners and Identify Obvious Areas of Overlap

There is a need to clarify the roles of local and federal partners. We recommend that inter-agency collaboration be further developed to foster improved federal-local relationships amongst agencies. Having a legal reference document such as a handbook or binder that clearly outlines the roles, responsibilities and mandates of federal and local agencies involved in coral reef management would be a critical step towards building high-quality collaboration. This effort could potentially be tied to the upcoming renewed [Natural Resources Strategy 2012](#) (see Recommendation 4.1F – Establish “Master Natural Resource Plans” Every 5 Years) and should also be conducted by an external consultant.

Alignment of federal and local agency goals regarding coral reef management would ensure efficient communication and collaboration between entities. This may also allow local agencies to leverage federal funds more efficiently in the future. Specifically, local actors could develop a dialogue with federal grantors to craft creative collaborative processes for receiving services, resources and expertise. There is an identified need for partners in Guam to sit down with federal grantors (i.e., NOAA and DOI) to look together at creative and potentially flexible solutions to the large issues surrounding procurement. These solutions could increase efficacy of grants management and create clarity around grant requirements. Past examples of creatively acquiring expertise and services for local partners include an external valuation study, TNC model monitoring sea level rise, and the GIS and Coral fellows. Developing a system or database so that grantees can review what funding is available to them could help local partners in Guam effectively utilize funds.

**Related PSD Priority Goal:** Builds capacity for all PSD priority goals

**Potential Partners:** All federal and local partners, including: DOI, DCA, DoD, External Consultant, GCMP, Governor’s Office, USEPA, NOAA, NPS, SHPO, UoG, USACE, USFWS, Division of Grants Management of the Department of Administration

**Time:** Medium

**Cost:** \$\$ if in-house, \$\$\$ for a consultant

**Complexity:** Complicated

### 4.1B Work with GVB to Make the Business Case for Improved Coral Reef Management

There is a clear link between natural resources management and improved economic, social and environmental conditions within the territory as a whole. A succinct and clear document clearly stating the economic benefits of coral reef management would engage potential partners in the tourism sector, such as [GVB](#). Such a case statement, when

completed, should be a shared document that stakeholders can understand and that clearly presents strategic implementation plans, types and amounts of expenditures, and metrics of success. It would be a valuable tool to support coral reef management in Guam, and for allocating existing funds coming to Guam from NOAA CRCP and other federal partners for coral reef management projects.

Components of such a business case could include:

- Economic valuation of coral reefs (examples may range from dollar value of coral reef protection to maintaining or growing jobs and job opportunities associated with the tourism and recreation sector);
- An updated valuation of ecosystem services of coral reefs [an important step will be to determine if and when a completely new and updated coral reef valuation study is required];
- Long-term and short-term return on investment in coral reef management and protection;
- The importance of coral reef management in building resilient communities in Guam;
- Balancing responsible extractive activities while maintaining the cultural and social integrity of coral reefs;
- The promise of sustainable development; and,
- A list of literature that references the source of this information.

The following steps should be taken to implement this recommendation:

**Step 1)** Clarify the evidence of the status and trends of the coral reefs. Develop a clear set of messages regarding what is known about the health of the coral reefs that can be communicated to stakeholders. Engage the scientific community as well as managers from a wide range of agencies and partner organizations.

**Step 2)** Define the economic impact of coral reefs in clear terms regarding property value, tourism, direct foreign investment, etc. With this information, partners should work together to develop a “business case” as to the importance of the coral reef and its relationship to economic development and tourism (as well as to cultural, social, and other economic aspects of Guam).

**Step 3)** Once the case has been made, then broadcast it out to a wide range of tourism sectors (large-scale tourism operations). See Recommendation 4.1H – Co-develop Briefing Presentations with GVB to Present to Tourism Industry Stakeholders. In the next funding cycle for GCMP, there are funds available for a tour guide certification program. Currently the program is on a volunteer basis, but the long-term intention is to develop the project legislatively so that it is required of all recreational tourism operators in Guam. There will likely be a coral reef component to the tour guide certification. Developing a briefing that can be used to concisely communicate the “business case” for and value of coral reef protection to tourism operators and their tour guides may be a beneficial aspect of the certification. GCMP will be working with GCC to further develop the certification program.

**Related PSD Priority Goal:** 4

**Potential Partners:** Chamber of Commerce, GCC, GCMP, Lions Club, NOAA CRCP, Rotary Club, UoG Marine Lab and WERI

**Time:** Short

**Cost:** \$ (\$\$ or \$\$\$ if the cost of updating the economic valuation is included)

**Complexity:** Simple



#### 4.1C Add Administrative Component for the Citation System Related to Marine Preserves

To increase the efficiency of the citation prosecution process, an additional system should be created that moves away from the criminal citations toward administrative court cases for infractions specifically related to marine reserves. There should be a complementary system for administrative citations. The creation of an administrative citation system would require a statutory change that the legislature would need to pass. The administrative citation process could be modeled after the traffic court. Currently, the natural resources attorney in Guam is working to determine the exact requirements of a citation system, and progress is being made towards implementation.

Currently, if one is caught breaking the law in a marine reserve one is arrested, charged and the case must go to court. These cases often get thrown out largely due to the fact that, once violations reach the full prosecution level, other cases such as criminal sexual conduct, robbery, murder, etc., take priority. While the criminal component should remain, adding an administrative component to these types of infractions would make prosecution faster and easier. This would allow for more efficient attention to be paid to natural resource cases. Some violations would be in a separate category from criminal cases, and therefore enforcement would be more efficient and realistic.

Training officers to work more effectively within the legal, regulatory and criminal justice system could prove useful for closing gaps and barriers to enforcement. There is an opportunity for enforcement officers to work directly with mayors and communities to ensure that expectations are clear with respect to rules and regulations (especially with fishing in MPAs), and demonstrate mutual support and to ensure that there is even enforcement.

**Related PSD Priority Goal:** 1, 2, 4

**Potential Partners:** AG Office, Court System, DOA, Guam EPA, Governor's Office, Legislature

**Time:** Long

**Cost:** \$\$

**Complexity:** Complex

#### 4.1D Improve Internal Management of Conservation Officer Program

If the DOA intends to improve the Conservation Officer Program, there are two reforms to the program that are needed:

- 1) Dedicate additional sustainable local funding for the full-time officer positions and necessary material and infrastructural needs of the program; and,
- 2) Develop a renewed focus through community outreach and education to raise awareness and improve public compliance with Guam's natural resource rules, regulations and laws by implementing the reserve officers program.

The new identity of the Conservation Officer Program could focus on public outreach and education to increase compliance with natural resource rules and regulations in order to reduce future infractions. The Conservation Officer Program could also renew their focus on community engagement, educating the public on the rules and regulations and methods for reporting violations. Improving the efficiency of response and follow-up will be important for engaging effectively and building trust with the community. Specifically, a dedicated call-in number for reporting violations could be established by the program. The current Conservation Officers could undergo training about community outreach (i.e., how to be proactive and introduce themselves to the public while on duty).

Specific infrastructural support that could benefit the program includes two pick-up trucks, one SUV and potentially new uniforms. Standardize new uniforms for the Conservation Officers that are more approachable to the public. The material and infrastructural needs of the Conservation Officer Program should be revisited by the DOA on an annual basis.

**Related PSD Priority Goals:** 1, 2, 4

**Potential Partners:** AG Office (Natural Resource Attorney), Customs Office, DOA, GCMP, Guam Police Department, Mayor's Office, NOAA OLE, PIMPAC

**Time:** Short

**Cost:** \$\$\$

**Complexity:** Simple

#### **4.1E Update and Adopt Sediment Erosion and Control Guidelines, Rules and Regulations for Best Management Practices (BMPs)**

There may be an opportunity to move forward with addressing LBSP issues in the current legislature (burning regulations, off-road vehicles, development pressure, etc.). Multiple stakeholders should be engaged and involved to increase the level of buy-in and formal commitment for new/updated criteria, rules and regulations. New standards are also being implemented that may help with the sediment and erosion program.

It will be important to review the EO 2012-05 to determine the roles and responsibilities of the local agencies. EO 2012-02, which identifies the proper existing manuals to address development, should also be reviewed, and potential new regulations that specifically address compliance for residents, farmers, etc., should be considered.

Draft updates to the [Guam Stormwater Manual and Stormwater Management Criteria](#) are still within Guam EPA and have not yet been submitted to the Guam EPA Board or the legislature. Adopting the draft phases and enforcing those guidelines should be prioritized by both the legislature and Guam EPA. Formal commitment and the political will to adopt the updated guidelines should be fostered within Guam EPA. The first step is to ensure that those draft updates and draft phases are brought to the Guam EPA Board. From there, the Board can approve them and move on to the next phase of implementation, moving them through the Guam legislature.

**Related PSD Priority Goal:** 1

**Potential Partners:** DPW, GCMP, Governor's Office, Guam Contractors Association, Guam EPA, Guam Land Use Commission Bureau of Land Management, Legislature

**Time:** Long

**Cost:** \$\$

**Complexity:** Complex

#### **4.1F Establish "Master Natural Resource Plans" Every 5 Years**

[The Natural Resources Strategy 2012](#) should be revisited and rebranded as a "Master Natural Resource Plan" independent of DoD Buildup (such as a Guam Master Plan). The Natural Resources Strategy 2012 was a successful expression of the ecosystem approach of engaging different agencies and organizations with different mandates and cooperating around a coordinated strategy. If it's deemed a priority, this process should be revisited every 5 years and developed with all partner agencies. Special updates could occur on a case-by-case basis, such as an updated document on tourism. These reports could provide the opportunity to develop a shared vision and to coordinate goals regarding revised military buildup for the multiple natural resource management agencies in the near-term, and could also serve

to clarify the mandates of each agency and organization (local and federal) involved in coral reef management in Guam (see Recommendation 4.1A – Clarify the Legal Roles, Mandates, and Responsibilities of Local and Federal Partners and Identify Obvious Areas of Overlap). As such, contributions should come from all local natural resource management agencies and federal partners to draft a comprehensive updated Natural Resources Strategy document.

Three agencies need to sign off on the updated Strategy: The [SHPO](#), the Governor’s Office, and [The Department of Chamorro Affairs](#). There is currently a staff member at the Governor’s Office designated to handle the buildup strategy who would be a critical partner for implementing this recommendation. There is also a [Task Force](#) mandated by EO to deal with the military buildup in Guam, which is part of the [Natural Resources Subcommittee](#) in Guam. Existing platforms for regular engagement between federal and local partners, such as the [Natural Resources Subcommittee](#), should be sustained and new venues should be developed.

**Related PSD Priority Goal:** 3

**Potential Partners:** DCA, DoD, External Consultant, GCMP, Governor’s Office, NOAA, NPS, SHPO, UoG, USACE, USFWS

**Time:** Medium

**Cost:** \$\$ if in-house, \$\$\$ for a consultant

**Complexity:** Simple

#### 4.1G Hire and Train Fire Protection Personnel

In the past few years, there has been an increase in public awareness of the impacts of burning as it relates to sediment and erosion control and the connection to coral reef health. In the long-term, there may need to be a review of the issues surrounding prosecution for arson, which may require a statute change in the long-term (or a change in the language of the statute) that would change arson statutes to more effectively prosecute the cases. In the short-term, there are two phases to this recommendation. A potential first phase to improving the enforcement and compliance for those statutes is to hire a community outreach fire protection officer and additional fire personnel within the F&SRD as needed. If this is considered a priority, allocate resources to hire a fire protection officer trained to work directly with communities to organize outreach campaigns against burning (as well as to potentially hire more fire personnel). If it is found that funds are not immediately available to support that initial step, then an additional effort should be put in place to provide fire protection training to a wide range of partners. Police officer training could include trainings on community engagement and fire training.

A second phase in the short-term would include training for the [Guam Fire Department](#) (GFD) in partnership with the F&SRD. There has been some initial engagement between the two organizations and the natural resource community to consider partnering on training processes to respond to wildland fires. BSP/GCMP are also working on assisting GFD with its outreach campaign geared toward youths regarding burning in Guam. Ensuring that partners have proper equipment and resources for responding to wildland fires, as well as educating the public, will both be critical for this recommendation. It is in the best interest of both the GFD and the natural resource community in Guam to develop this partnership. Both the GFD and the F&SRD should receive training in community engagement and should collaborate to increase public awareness and outreach on topics such as arson and wildland fires. Identifying overlapping goals and priorities may be a useful practice. Delivering more trainings to a wider range of enforcement and emergency personnel would increase the pool of people available to efficiently respond to incidents of arson. The

F&SRD fire officers, which are heavily involved in response to wildland fires, will also be critical partners to engage in cross-training and implementation of this recommendation.

We recommend that a training module be developed for fire responders to address levels of sensitivities of the ecosystem, particularly relating to protection of life and protocol for what to do once the responders leave the fire. This could be tied to the outreach officer and an outreach campaign for arson, and would provide an opportunity to raise awareness on ecosystem connectivity and human-coral reef coupled systems.

**Related PSD Priority Goal:** 1

**Potential Partners:** Conservation Officers, F&SRD, GFD

**Time:** Long

**Cost:** \$\$\$\$

**Complexity:** Complicated

#### **4.1H Co-develop Briefing Presentations with GVB to Present to the Tourism Industry and other Stakeholders**

If the business case (Recommendation 4.1B – Work with GVB to Make the Business Case for Improved Coral Reef Management) can be made then the next phase is to engage key stakeholders in a dialogue that explores how to best promote the importance of coral reef health to leaders in the tourism industry. Natural resource managers trained to give presentations are ideal collaborators to communicate the importance of the coral reefs at meetings, however they must make sure to adjust the messages to be relevant to the audience. Presentations could be made to [GVB](#), Hotel and Restaurant Association ([GHRA](#)), and the Japan Guam Travel Association. The GVB has quarterly membership meetings where approximately 100-150 members attend. Another potential opportunity would be to present to the GVB Board of Directors and their sub-committees. An example presentation might be on the topic of *The Status of the Coral Reef Ecosystems of Guam* (2008). These presentations should include compelling narratives about how the coral reefs are doing and their importance for the Guam “brand” and the long-term sustainability of the tourism industry. Once presentations are developed and successfully presented at the scale of the tourism industry, similar briefings could be held for other stakeholder groups that are interested in attracting investors to Guam such as small businesses. Such briefings could be used to affect behavior change across multiple sectors of the society and economy in Guam.

Within the past five years an effort has been made by natural resource agencies to work with GHRA and GVB (examples include [Island Pride Campaign](#) and [2008 Year of the Reef](#)). It is critical to ensure that capacity is in place within the natural resource agencies to sustain and perpetuate those relationships.

The following steps should be taken to implement this recommendation:

**Step 1)** Make the case to GVB to protect coral reefs (Recommendation 4.1B – Work with GVB to Make the Business Case for Improved Coral Reef Management). Once the case is developed, presentations should be made and information should be disseminated to the GVB Board of Directors and their [committees](#). Scientists as well as managers trained in communication should be guest speakers and make presentations at GBV venues, the [Guam Chamber of Commerce](#), meetings of tourism operators, the [Rotary Club](#), etc. There may be an opportunity to create a sort of “road show”, and to work with a local entity to develop a narrative package on

how the coral reefs are doing and why they are important to the brand and long-term sustainability of businesses in Guam. Engage the management community as well as the science community ([UoG Marine Lab](#), [WERI](#), etc.) in fostering collaborative research and connections to the economy of Guam. Land-based partners such as [DPW](#) should also be engaged in outreach and dissemination of the business case for coral reef management.

**Step 2)** A direct communication effort could be coupled with an outreach and education campaign for domestic and foreign tourists on the importance and value of Guam's coral reefs. Presentations and outreach material should also be created for tourists themselves in their native languages. (For example, [GCMP](#) is working on updating and redoing some of the beach signage to incorporate more languages). With roughly 70% of the Guam's tourists coming from Japan, it is very important for education and outreach campaigns to reach foreign (as well as domestic) tourists in their native languages for optimum effect. Increasing the amount of information and material on coral reefs that is available at the airport may be beneficial as well. There may also be an opportunity to incorporate aspects of [Guam's Coral Reef Management Priorities](#) into the tour guide certification process to raise awareness of coral reef issues specifically related to Guam.

**Step 3)** Ensure sustainability by planning for follow-up after making the case and continue engagement with GVB. This may require hiring a full-time staff member in each of the key resource agencies dedicated to this engagement (ex. [Guam EPA](#), [GCMP](#), [DCA](#), DOA, DAWR, DFSR, [Center for Island Sustainability](#), etc.). Those staff members could form a cohort to be the link between natural resource management and tourism in Guam.

**Step 4)** The resource agencies should continually help to ensure that GVB is spending money effectively to protect coral reefs and affect behavior change. There should be recurring meetings to ensure knowledge exchange so that effective and strategic investments are made by GVB.

Following the implementation of this recommendation, the next step would be to explore sustainable financing opportunities within the tourism sector. There are several potential partnerships with the tourism sector that may foster sustainable financing for coral reef management in Guam. GCMP has been looking to partner with the GHRA in enabling volunteer donation funds to go towards coral reef management and Guam's endowment for the [MC](#). GCMP is currently drafting a strategic plan to present to the GHRA on this topic.

One potential launching pad for this collaboration could be [Reef Vision](#). Reef Vision is an electronic outreach tool for tourists providing an introduction to the coral reefs of Guam and best practices for tourism activities around them. It is available in multiple languages and intended to be attached to e-tickets when visitors come to Guam. GCMP and CZM have been working to update it. Future distribution could be included as an in-flight component for the Reef Vision videos.

**Related PSD Priority Goal:** 4

**Potential Partners:** Chamber of Commerce, F&SRD, DPW, GCMP, Guam EPA, GVB, NOAA CRCP, Rotary Club, Sea Grant, UoG Marine Lab, WERI, UoG WPCRI

**Time:** Medium

**Cost:** \$

**Complexity:** Simple

#### 4.1I Continue Efforts to Streamline Procurement and Grants Management Processes

It is important to support ongoing efforts to streamline the procurement and grants management processes in Guam. Steps are already being taken towards implementing this recommendation, and those efforts should be continued and supported. One potential effort toward improving the issues related to procurement and grants management in Guam would be to simply map the standard process, and assess changes that would improve management practices at the various agencies involved. Ultimately, high-level meetings with the GSA would be necessary to get the formal commitment for a revised system. As part of this process, there should be an assessment of the grant funding currently being underutilized (returned, lost, etc.). This assessment of grant funding should inform future procurement and management practices. Creating MOUs may improve government-wide cooperation related to procurement protocol. Workshops could help educate new staff and refresh existing staff on the standard operating procedures regarding procurement and legal processes. In 2013, the Governor held a symposium to educate administrative officers on the procurement process. Such trainings should be continued on a regular basis. Dedicated staff/liaisons in each agency to track legal, procurement and grants management processes could improve communication and efficiency. Streamlining the review process would benefit natural resource management across the island. A similar streamlining analysis, if deemed a priority, could also be done for the hiring process in Guam.

The following steps should be taken to implement this recommendation:

**Step 1)** Build the case for why the procurement and grants management processes in coral reef management should be improved. This is already on the agenda of various agencies and political leaders in Guam. An analysis (possibly a spreadsheet) should be done to look into grant money that is not being pursued as well as grant money that has been returned to the grantor or that has not been spent in the last 5-10 years. All natural resource agencies should go through and see where money was or wasn't spent and why (issues with establishing accounts, lack of creating MOUs, unsynchronized deadlines with AG office, etc.). A separate analysis could also be conducted on job hires and position vacancies in all GCRI agencies if streamlining of the hiring process was also deemed a priority.

**Step 2)** Build political will and formal commitment. The case for improvement should be brought to the Governor's Office, and high-level meetings should then be held to decide on revision or total overhaul. Mechanisms are already being developed towards this step of the recommendation. The Governor currently has a Task Force for reviewing the procurement process, which should be a key partner in this step. The Governor's symposium to educate agency heads on the procurement process should also be continued and repeated on a regular basis. This step could be coupled with Recommendation 4.1B – Work with GVB to Make the Business Case for Improved Coral Reef Management.

**Step 3)** Adjust the system to increase accountability and transparency. Make this a priority with stakeholders at different scales throughout Guam (with the Governor, with his Task Force reviewing procurement, with the natural resource agencies, etc.). This should be coupled with widespread education and dissemination of the procurement process to all agencies involved in coral reef management in Guam.

**Related PSD Priority Goal:** Builds capacity for all PSD priority goals

**Potential Partners:** GSA, Governor's Office, Governor's Task Force on procurement issues, Grants Managers of Natural Resource Agencies

**Time:** Medium

**Cost:** \$

**Complexity:** Simple

## 4.2 Group 2 Recommendations: Using a Common Management Framework to Pursue Ecosystem-based Management at Priority Sites

This group of recommendations will require a collaborative and coordinated approach to management at select priority areas, and involve interconnected systems and engagement with multiple resource users, government entities, NGOs and funders.

### 4.2A Further Build Engagement with Mayors, Church Leaders, Youth Organizations, Elders and Other Influential Community Members at Priority Sites

In order to build local capacity for coral reef management in Guam, organizational engagement with communities should begin with the local mayors. Engagement with mayors should be followed by continued engagement with other key community groups, such as elders, church leaders, schools teachers and other influential community leaders. A manual should be created that articulates the best practices and successful methods for improving community outreach in Guam. Each mayor should be provided with a customized educational packet on coral reefs specifically in their area. Highly site-specific and targeted outreach and education tools would help build support and awareness from the bottom-up in communities. Ideally, mayors could then present that material and literature to the schools in their area. Information for school presentations would include topics such as: Where are the coral reefs in your area? How healthy are they? How do we impact them? How can we help preserve them? Ensuring that information is circulated to the children and therefore to their parents is a crucial link to building stewardship at the community scale, and there is an opportunity for the mayors to be engaged in that process.

General presentations by coral reef management representatives on the health and value of the coral reef could be conducted at the [Mayor Council Meetings](#). Mayors could encourage such presentations at Town Hall meetings to raise awareness in their own community. These presentations could be adapted from the presentations described in Recommendation 4.1B – Work with GVB to Make the Business Case for Improved Coral Reef Management and Recommendation 4.1H – Co-develop Briefing Presentations with GVB to Present to Tourism Industry Stakeholders. Mayors could also create timelines for each town, with details on historic events and natural resources that include traditional local voices. Ideally, such a timeline would be created through a participatory method using social media, for example, where the local populations can access and augment their timeline. Engaging with

communities via mayors, churches, elders and other influential local leadership is a critical path toward improving communication and “getting the message out” about coral reef conservation, health and management.

GCMP and NOAA Coral Reef Ecosystem Division have been working to develop a web-based meta-data search engine that can reference all of the biophysical data from the long-term coral reef monitoring program, as well as efforts from community-based monitoring programs, photographs collected, etc. If this database is created, it could present a window of opportunity to formally engage community members in coral reef monitoring and to maintain the database as a centralized location for that information.

GVB is currently conducting community outreach as well. For example, the establishment of the Mango Festival, Hot Pepper Festival and Banana Festival have all received support from GVB. More mayors across Guam are asking for this type of engagement, which demonstrates an increased level of political will for natural resource protection at the community scale. GVB may also be a critical partner in implementing this recommendation in the future.

The NPS has an NGO group called the [Pacific Historic Parks Association](#) that works with parks in Hawaii as well as Guam. They conduct a Reef Rangers summer camp that takes kids snorkeling on the coral reef and targets local 5<sup>th</sup> and 6<sup>th</sup> graders. High school students get involved as well, and they receive training on taking children out snorkeling, adding a mentorship component to the camp. The program is an example of adaptive management. Every year there is an evaluation procedure by which the NGO reflects on how to improve the program (involve more kids, more safety, become more efficient, etc.). Membership is free, and demand is increasing (they take 20 each week, 2 weeks for 5<sup>th</sup> and 6<sup>th</sup> graders, one week at the beginning where 10 high school students are getting trained). This is a potential model for other government agencies, in this case a federal agency through their NGO extension, to effectively engage with communities in building awareness for coral reef management. If resources were available, there is also interest to scale up this effort.

**Related PSD Priority Goal:** 1, 2, 4

**Potential Partners:** Churches, DCA, existing NGOs, GVB, Mayors Council, NOAA, Municipal Councils, NPS, Pacific Historic Parks Association

**Time:** Medium

**Cost:** \$\$

**Complexity:** Complicated

#### **4.2B Increase Social Science on Human Dimensions to Help Inform Management in Priority Sites**

There is a need to assess the social, economic and cultural benefits of sustainable natural resource management in Guam. Support should be built for formal inclusion of the human dimensions in coral reef management. One potential method of providing that support would be to require a social science aspect as part of grants awarded for coral reef management. Adding the human dimension and specific expressions of social science could be strongly encouraged or stressed in new programming through grant conditions. One example is that of the grant process for USDA. The GCEF in partnership with the Guam Museum Foundation is currently applying for grants from USDA, and though the USDA will not fund the construction of the facility they have provided funding for its development on the basis that the facility creates programming related to social science, is a conduit to the community, and creates jobs. The USDA has also helped fund partners engaged in the GCEF to hold trainings on social science and the



human dimension of environmental management. Such grant conditions could be used as a model to encourage and foster the formal inclusion of social science in coral reef-related research in the future.

There should be an introductory document developed on “What is the human dimension of environmental/coral reef management and why is it important?” to raise awareness among stakeholders. [UoG Pacific Center for Economic Initiatives](#) could be a partner in creating such a document, as they are engaged in socio-economic work in Guam. A team at UoG, including staff from the [Marine Lab](#), the [Environmental Science Program](#) and [WERI](#), were recently awarded funding from NPS to conduct a Natural Resources Condition Assessment for Guam. The grant condition is fairly interdisciplinary and flexible, and there is potential for human dimensions to be included in the assessment. UoG has gotten more involved in the social science aspect of natural resource management in the past 5-10 years, mostly through perception studies and surveys. The opportunity exists for those efforts to expand in the future to include topics such as retrospective studies, and tracking of social indicators and resilient communities. The GCEF will also be a critical partner and venue for this recommendation in the future, as social science, cultural ties to the environment, and the human dimension of environmental management will be integral parts of the facility’s curriculum.

There are times during the internal process when time and money from NOAA’s NCRMP become available to do particular projects related to social science monitoring. For example, NOAA CRCP plans to conduct human dimension data collection as part of NCRMP on a 3-4 year cycle, with Guam tentatively planned for 2015-2016. This may be a potential source of funding for this recommendation in the future. A socioeconomic study was just initiated in Manell-Geus. A general socioeconomic study of the priority watershed was started last year, and it is now moving towards an expanded, comprehensive social study of the area. The goal is to gain baseline data for social dimensions from the local community in concert with biophysical characteristics from academic professionals in order to effectively determine management priorities for the watershed. The study has shed light on several major unanticipated social issues, such as the fact that flooding is a key concern for the local community and as such should be incorporated into environmental management there in the future. This is a model that could be replicated at other priority watersheds in order to increase the use of the human dimension in coral reef management decisions.

**Related PSD Priority Goal:** 1, 2, 3, 4

**Potential Partners:** GCMP, GCEF, NPS, Sea Grant, UoG Pacific Center for Economic Initiatives, WERI, NOAA CRCP

**Time:** Long (ongoing)

**Cost:** \$\$\$

**Complexity:** Complicated

#### **4.2C Continued Trainings for Contractors Related to BMPs for Sediment Control**

Continue to build upon the success of the training program for contractors and contracting companies, and focus efforts at priority sites. Establish a tracking system that notes who has completed trainings and which companies are performing well. There were 80 trainees in 2009 and 90 in 2012. This training should be required of all contractors pursuant of updated rules and regulations related to stormwater erosion control. Cost-effective methods of conducting these trainings at a larger scale should be explored. Sustainable financing for the program could be crafted through a mandatory registration fee associated with the training sessions. The trainings could potentially be incorporated into existing programs to decrease the initial cost. Successful contractors could be involved in the trainings to demonstrate

their application of the BMPs at their sites, reinforcing the quality of work. Visiting demonstration sites coupled with outreach tools and interpretive signage could be a key aspect of the training for contractors. Interpretive signage could be installed at sites such as at the Santos Memorial site, where a successful rain garden has been built to increase awareness of the importance of proper erosion control measures. Disincentives for non-compliance with the training could include fines, retracting licenses and other measures. Incentives for compliance could include a reduction of property taxes for successful implementation and maintenance of BMPs.

[The Guam Contractors Association](#) may be a critical partner to conduct trainings with the contractors, and it also may be beneficial to explore the potential of having sedimentation specialists on-site at development projects to ensure that erosion and sedimentation rules and regulations are followed. This could also be coupled with a general education campaign for the public, including developers, contractors, recreational users, visitors, tourists, and DoD affiliates such as officers, families and staff.

**Related PSD Priority Goal:** 1

**Potential Partners:** Contractor Licensing Board, DPW, GCMP, Guam Contractors Association (has already agreed to host the courses), Guam EPA, Guam Trades Academy, Professional Engineers and Architects and Land Surveyors

**Time:** Medium

**Cost:** \$\$\$\$

**Complexity:** Simple

#### 4.2D Strategic Public Outreach Campaign to Gain Support for Stronger Sediment Control Regulations

Photographic documentation of the effects of runoff during each annual rainy season (July - December) is needed to showcase the effects of sedimentation. Strategic use of crowd-sourced photography distributed across multiple media platforms (local press, social media, etc.) could expand awareness of the issue to both the general public as well as government officials involved in updating and adopting new regulations. Possible opportunities include linking with the UoG Sustainability Group ([Green Army](#)), [GCC](#)'s Eco-Warriors and the [Guardians of the Reef](#) to train the students on a documentation protocol for capturing photographic evidence of the issues. Students as well as teachers could post images and thoughts on sedimentation and erosion events to social media sites in a strategic fashion. In addition to this recommendation, it may be beneficial to use lessons learned from Talofof Bay to prevent erosion and foster shoreline stabilization, as well as to build community support for those efforts. This recommendation would help to foster grassroots and community efforts to raise awareness on issues related to sedimentation and erosion throughout Guam.

**Related PSD Priority Goal:** 1

**Potential Partners:** DPW, GCC Eco-Warriors and the Guardians of the Reef, GCMP, Guam Contractors Association, Guam EPA, Guam Trades Academy, Students and educators involved with UoG Sustainability Group (Green Army), North and South Soil and Water Conservation Districts

**Time:** Medium

**Cost:** \$\$

**Complexity:** Simple

#### 4.2E Build Adaptive Capacity of NGOs

The government should support existing NGOs as well as support the growth of informal community organizations in the initial stages of formalizing their organizational structures. Several environmental NGOs in Guam are pursuing

501(c)3 status and external support to increase their structural capacity. Existing NGOs have made large strides in building capacity of civil society for supporting and enabling coral reef conservation. Robust NGOs that foster supportive and informed constituencies at the community scale are a critical enabling condition for coral reef management on Guam. Financial support could be dedicated to increase the capacity of local NGOs to develop their business plans, sustainable financing, grant writing, outreach and educational materials development, program planning and other areas of needed operational support. These efforts could begin first with targeted support of NGOs at the priority sites. TNC has an extensive history of trainings to support NGO capacity and could be a key partner in implementing this recommendation. Many local NGOs lack the capacity to effectively manage grants. Special attention should be put into increasing the capacity for grants management in particular. Supporting and fostering the adaptive capacity of these grassroots efforts will benefit coral reef management in Guam over the long-term, as these NGOs can act as effective bridges between government efforts and the public.

**Related PSD Priority Goal:** 1, 2, 4

**Potential Partners:** Local NGOs, PIMPAC, Sea Grant, TNC, UoG, WERI

**Time:** Long (long-term investment, started and ongoing)

**Cost:** \$\$\$\$

**Complexity:** Complicated

#### 4.2F Apply Lessons-learned from Humatak Project’s Watershed Restoration Efforts

Define lessons learned from the recent [Humatak Project](#). This model could be expanded to new sites, particularly priority sites in the near future. There is currently a Watershed Coordinator at Guam EPA who could play a key role in this recommendation. In addition, there are other valuable partners in WERI, NRCS, NPS, USGS, the Green Team at UoG, and several others that should be engaged. There are a large number of stakeholders and partners involved in the [Humatak Project](#). A “brain trust” is forming around this project, but there has not yet been a knowledge exchange between them. There is, currently, an opportunity for those involved to come together and create a centralized body of knowledge around the [Humatak Project](#) and document and exchange the lessons that have been learned in a meaningful way to foster adaptive learning. There may be opportunities for this to scale up in the future into a potential “watershed think tank.”

A federal or local partner agency should be considered as lead for consolidating this work and bringing the partners together. The lead would be engaged not only in outreach, but also in consolidating the lessons learned from all involved, facilitating a sharing of knowledge, and fostering a culture of high quality collaboration around the project.

**Related PSD Priority Goal:** 1

**Potential Partners:** Center for Sustainability, College of Applied and Natural Science at UoG, DOA DFW, DPW, DoD, EPSCoR, GCMP, Guam EPA, NOAA, NPS, Mayors Council of Guam, Students and educators involved with UoG Sustainability Team, USFWS, WERI

**Time:** Long (and ongoing)

**Cost:** \$\$\$

**Complexity:** Complicated

#### 4.2G Increase Environmental Stewardship in Education Curriculum

Use priority sites as a starting point to increase environmental stewardship with Guam’s formal education system. Focus pilot projects in schools near priority sites and create lesson plans based on environmental stewardship. Lesson

plans should focus on the relationship between the human populations and the connection to watersheds and coral reefs. Build off of the success of existing programs such as the [Coral Reef Ambassadors Program](#). More experiential learning opportunities should be created for students such as summer camps, internships and after school programming to encourage local students to study marine biology and other natural resource fields. UoG [WPCRI](#) has been developing a coral reef curriculum, which includes other natural resource components, and could potentially be used as a model or starting point from which to build this recommendation. The [GCEF](#) is also creating an educational component to their facility. The facility will actively incorporate educational programming focused on land and sea topics as well. The museum could be another location to implement aspects of the curriculum and it may also present an opportunity for others to build on their existing lessons plans.

**Related PSD Priority Goal:** Builds capacity for all PSD priority goals

**Potential Partners:** DCA Museum, GCC, GCMP, Department of Education, UoG WPCRI

**Time:** Long

**Cost:** \$\$\$\$

**Complexity:** Simple

### 4.3 Group 3 Recommendations: Tractable Projects

This group of recommendations can be controlled by a small group of people, by an organization or a network of organizations. This group of recommendations includes programs and trainings that focus on building a range of technical, financial, social, institutional and political capacities.

#### 4.3A Support Pilot Conservation Demonstration Efforts

UoG and the Soil Conservation Service are working together to investigate the potential market for compost. Recently, there were two events where UoG and the Soil Conservation Service sold compost. An important issue related to compost on Guam is that part of the compost processing needs to include treatment against rhino beetles (which are an invasive species). Home composting is also being promoted, but it is currently at the pilot stage. Increasing the necessary infrastructure (such as material and land) for creating compost on-island will be an important component for restoration projects and will mitigate the effects of sediment erosion if properly applied with vegetation. Developing resources such as compost and making those available to the public will provide communities and organizations with a source of information so they know where to go and what to do if they want to start initiatives such as conservation landscaping in their village. This will also be a valuable resource to foster a wider-scale movement to address issues such as food security and sustainability at the local scale in the future. This could be linked with Recommendation 4.2B – Increase Social Science on Human Dimensions to Help Inform Management in Priority Sites and could help support and provide sustainable infrastructure for native plant nurseries across Guam (Recommendation 4.3B – Establish On-island Native Species Nurseries). [The Center for Island Sustainability](#) could potentially be engaged in an integrated aquaculture demonstration to support this recommendation. The [Lieutenant Governor’s Beautification Task Force](#) may also be able to help with maintenance, which has historically been a consistent barrier to these types of efforts.

**Related PSD Priority Goal:** 1, 3

**Potential Partners:** 4-H club, Agriculture Extension Service at UoG, Ayuda Foundation, Center for Island Sustainability, Farmer's Co-op, DOA, Fishermen's Co-op, Girl Scouts in conjunction with NPS, Guam Northern Soil and Water Conservation District, HRRRA, Lieutenant Governor Beautification Task Force, Mayors Council, NPS, Nurseryman's Association

**Time:** Long (ongoing)

**Cost:** \$\$\$\$

**Complexity:** Complicated

#### 4.3B Establish On-island Native Species Nurseries

There is an opportunity with the DoD's new standard that 50% of all future landscaping on any DoD project (including off-base projects) has to include native plant species. Currently there is only one small nursery on Guam. A small grant from NOAA has already gone through to propagate natives for which NFWF has not yet released the funds. The DOA currently has nursery infrastructure that is used for ornamental non-native trees, and the cost for this recommendation could be reduced if the DOA could provide some of the required infrastructure such as watering, compost and other necessary materials. The DOA should consider recommitting to native species in their nursery and projects. There is potential to link promoting natives with the sediment erosion control regulations, considering that acacia and other nitrogen fixing plants are most useful for that purpose. If successfully established, native plants can reduce the threat from invasive species as well. Local ownership of such a nursery could become a job creator, and could present a valuable opportunity to hire locals for meaningful jobs that are tied to the land but do not require a significant amount of formal education.

This effort would need to be tied to on-the-ground planting projects that meet the needs of agency initiatives as well as local residents and businesses. There is an opportunity to increase education for children related to farming, agriculture, and concepts of living off the land. There needs to be a shift away from the mentality of "Why should I do that when I could just buy it at the grocery store?" Schoolyard gardens and habitat should be fostered so students can learn how plants grow. The value of fostering an attitude shift associated with caring for plants is particularly strong in children, and getting them to have experiences with growing plants early on could help create a paradigm shift in the future. Trees and native plant nurseries could be grown on school grounds where possible and the students could be responsible for maintaining them.

Some examples where this is currently happening that are opportunities for partnerships include:

- The Arbor Day Foundation;
- Simon Sanchez school is building a rain garden in their school;
- Talofoto Elementary has a garden;
- The Ayuda Foundation is working to create another school garden in Dedeo;
- There is currently a combination land grant for UoG Center for Island Sustainability and F&SRD to do native propagation;
- UoG has an Endangered Plant Program;
- GCEF will have an herbarium on the grounds for endangered plant species and medicinal plants;
- There may be some informal NOAA funding going to GCC in the fall of 2013 to do some demonstration work with native nurseries;

- NRCS and USFWS both have a plant component to their work in Guam; and,
- The Department of Agriculture has been engaged in work on managing the Rhino Beetle.

**Related PSD Priority Goal:** 1, 3

**Potential Partners:** 4-H Club, NOAA CRCP, DFW, F&SRD, USFWS, GCC, GCEF, NRCS, UoG Agriculture Department

**Time:** Short

**Cost:** \$\$\$

**Complexity:** Simple

# Section Five: Developing a Strategy for Building Adaptive Capacity

## 5.1 Three Phases of the Assessment of Coral Reef Management Capacity

There are three phases to the capacity assessment process: Phase I featured the initiation of the capacity assessment and began with the priority setting process and continued through the development of the most recent LAS and concluded with the formation of the J-CAT in 2013. Phase II featured collecting and examining information related to capacity, building an understanding of needs across stakeholders, summarizing key issues and prioritizing recommendations. This phase is concluded with the preparation of this report. Phase III is based upon the distribution of the report, a socialization process that includes soliciting and receiving comments, preparing an action plan based upon local context, implementing and monitoring the plan for a defined time period, and evaluating what was learned from the capacity assessment process and defining further action.

Given that building capacity for improved coral reef management is a journey, with no clear and precise destination, this section is intended to provide the basics for making the transition from Phase II to Phase III.

The importance of Phase III or post-capacity assessment, cannot be overstated because very little will happen if post-assessment activities do not take place. If Phase III is done well, it positions Guam and the coral reef management network for improvement and further development toward its intended goals. If results are not acted upon in some manner, it can serve to undermine future processes of stakeholder engagement in Guam and underscore the inadequacy of the status quo. Key actions in building an action plan include engaging a team to finalize the sequence and prioritization of the plan, identifying persons responsible, and creating timelines and mechanisms for assessing progress. Such a team might form organically out of the J-CAT process, and additional participants and perspectives should be encouraged to join in the Phase III process. Success will be determined by both the substance of the plan as well as the facilitation process used to broadly communicate and gain support for, adaptively implement, monitor associated activities, and revise it as needed. The following sections have been developed with insight from experiences in building capacity for the ecosystem approach in other locations around the world and in a wide range of organizational development contexts ([Stevahn & King, 2009](#)).

Building capacity requires change. Change, by its definition is acting in new ways, using resources differently, and seeing the world through fresh eyes. This is neither easy nor simple; indeed it is complex and can create discomfort, anxiety, confusion, and some ineffectiveness when transition occurs from one way of doing something to another. Adaptive capacity is rooted in the ability to collectively work through concerns, anxiety and fears as new practices are tested, new skills developed, and new understandings are revealed (Fullan, 2007). Done well, positive momentum is built and can be leveraged for greater change. Done poorly, it reinforces fear, anxiety and mistrust. A range of literature exists that can guide organizations through the developmental steps of change and selected references are presented in the organizational development section of Appendix C: For More Information.

The development of a customized plan is recommended which identifies an institutional “home” and most accountable person for overseeing implementation of capacity building efforts. Such a strategy should feature a detailed budget, timeline, milestones, and contextually relevant principles for capacity building within Guam and across

all other coral reef management agencies. The strategy document should be distributed widely and feature clear opportunities and specific budget justifications that could become part of external funding requests to federal implementing partners and foundations. Such a strategy should include a detailed directory of capacity building training modules that currently exist and those that need to be developed (Appendix E: Portfolio of Training Modules).

## 5.2 Building a Long-Term Action Plan

While there are no panaceas or “silver bullets” for building capacity for coral reef management, an action plan is needed to guide involvement of multiple implementing partners. Capacity building for improved coral reef management is a long-term process and no one group alone will have the power, resources or skills to respond to the increasing issues, challenges and degree of complexity. Likewise, there is no single group that is expected to provide the wide portfolio of tools, methods, trainings, etc., to support adaptive capacity and more effective coral reef management. Therefore, a distributed approach to capacity building is needed that features both short- and long-term investments. It takes a village.

Less expensive tactical capacity building is needed to build momentum, adding building blocks that address some aspects of the current challenges of coral reef management. Long-term sustained strategies are also needed to address operational issues of staff turnover and retirement, changing political administrations, as well as dynamic trends in social and biophysical health and well-being. Blending strategies that address both short- and long-term capacity building issues can guide an action plan.

To develop this action plan, the recommendations within this document have been divided into three groups based upon their complexity, scale, practicality and control of implementation. The first group is a set of essential recommendations that are complex largely because they are highly political in nature and therefore decisions regarding the timing and strategy must be made by upper-level administrators and officials who will factor in a wider range of issues. The second group involves implementing a more collaborative and coordinated approach to management at select focal areas and involves interconnected systems and engagement with resource users, other managers and funders of coral reef management. Implementing these recommendations will require a significant degree of coordination, formal commitment and adaptive implementation. To assist in this process, a common management framework is featured to underscore the importance of tracking both process and outcomes to help map the development of this action plan. The third and final group is a prioritized range of recommendations that are designed to build capacity at an organizational scale where leadership and control over implementation is relatively high. This final group of capacity building recommendations is important, but likely will not be as effective without progress made in the first two groups.

The process of building and maintaining adaptive capacity, as a key function of the ecosystem approach, takes far longer than one might expect and is a long-term commitment. It requires the development of an action plan, adaptively implementing and experimenting, and seeking out leaders across the implementing partners who can carry forward its importance. The action plan requires an honest assessment of what can actually be done in a given timeframe and at what scale, constantly assessing and reassessing where the power is in the system and how power may be shifting, where the threats are and how they are shifting, where the windows of opportunities are and how they are



opening and closing. Building a shared understanding of these dynamics and acting upon them is a process that develops over time, ideally across organizations. This section of the report provides a preliminary strategy, or the beginnings of a “road-map”, for the development of an action plan that ultimately can only be developed by the implementing partners based on the shared commitment to build adaptive capacity.

### 5.3 Lessons-learned in Building Adaptive Capacity

To more effectively manage collaboratively, emphasis should be placed upon building the enabling conditions of improved capacity, supportive and informed constituents and formal commitment through capacity building structures, processes and tools, and could including the following:

- Building values and attitudes among the managers that lead toward a desire to solve problems collaboratively, across a nested system, to clarify how to approach and solve persistent problems and more clearly define the appropriate institutional responses;
- Working with the media to share positive stories as case examples of successful management, describing the challenges and most importantly the benefits of what happens when collaboration across agencies and organizations works well;
- Building a knowledge base that is easily accessible and provides sound, honest and diverse information that can be easily communicated, exchanged, widely shared and debated;
- Recognizing the importance of informal and formal social networks and partnerships that are specifically intended to cross up and down scales of the nested system and horizontally across specific agencies;
- Encouraging the use of market-based instruments to promote the adoption of BMPs as well as increasing the diversity of economic activities at scales of stakeholders and at the scale of the whole watershed; and,
- Encouraging the use of predictive tools and scenario thinking to better understand potential impacts of ecosystem change at the global scale - specifically climate change and its impacts on the coral reefs as well as potential changes in weather patterns that influence many economic activities.

Management tends to be reactive rather than proactive in response to ecosystem change. Catastrophe and crisis are required to make the shift to new operational modes and more appropriate governance structures. In other words, capacity is needed to both react to the issues of the day and to consider changes in the overall system of management.

Building adaptive capacity cannot isolate a specific scale or organizational level to exclusively focus capacity building efforts. This can be seen in how recommendations in Section Four in the three groups must be carried out in a sequenced and prioritized manner to encourage momentum builders (Group 2 and 3) that support high-level commitment to continued capacity building efforts (Group 1). Action plans for building adaptive capacity also must go beyond individual specific assets and processes that can “guarantee” emergence of adaptive capacity. There are no single types of barriers in complex systems that can be responsible for lack of capacity.

Instead, policy makers and practitioners are better served to recognize bundles of attributes, processes and practices that support and link adaptive capacity and ecosystem governance. Paying attention to patterns in the system can prove worthwhile. In Guam, paying close attention to DoD buildup, Endangered Species Act listing of coral species

and effects of climate change will prove important for scenario planning into the future. Important components of such a new approach to adaptive capacity include the critical importance of champions or leaders to effect this change, the importance of education and access to information (e.g., the lack of a sufficient number of well-trained extension officers) and integrated social science and biophysical research to more effectively inform policy. Many practitioners around the world have noted two key uncertainties of scientific information needed to both understand and guide action. The first is the nature and timing of climate change impacts and therefore the lack of any clear guidance on the nature and timing of response to the impacts. The second involves the type and fit of governance structures and the uncertainty of the extent to which they are influenced by local and regional leadership or global and regional economic forces.

A key lesson is that many practitioners fear that it will require a crisis to move from the status quo of capacity building (through more traditional trainings and skill development) to a comprehensive and focused long-term commitment to building adaptive capacity that looks at management and governance systems. Such a reality of waiting for catastrophe to strike for real commitment to building adaptive capacity is unsettling and reversing this trend is a pressing and complex challenge (Bohnet et al., 2008).

## 5.4 Key Considerations for Developing a Post-Assessment Action Plan

The following is a set of key considerations in the capacity building action plan/implementation process that can help define the necessary logistics, whom to include, networks and norms for communication, and proper methods for information management (Stevahn & King, 2010):

### **Involvement in a Capacity Building Action Plan:**

Involvement in the process of defining the capacity building action plan and overseeing its implementation should be carefully considered. Major tasks may include the development of an action plan, making final decisions about when to implement which specific actions, and monitoring progress and evaluating the effectiveness of the plan as it relates to goals for building capacity. The first major step is circulating the document and seeking input. The J-CAT members are ideal distribution channels but distribution should not end with them. A distribution strategy and possibly convening a listening session to review responses may elicit useful feedback. Ideally, a small representative group that is invested in seeing resources directed to address persistent capacity issues, barriers, etc., should oversee implementation. While it does not need to be precisely the same members as the J-CAT, it serves as a logical starting point from which to build and make recommendations for a longer-standing structure. A capacity building committee could nest within an existing committee structure, such as a coral reef committee within BSP, and could routinely report out to the All Islands Committee of the Coral Reef Task Force. However, capacity building should be a shared responsibility and needs to have appropriate authority from upper-level administrators to assign activities and delegate tasks so that implementation is a distributed and shared process. A specific individual should be designated as the coordinator for arranging the efforts to craft the capacity building action plan, with additional technical assistance likely needed.

## Logistical Concerns

A series of logistical concerns should be attended to that includes maintaining calendars, scheduling committee meetings, preparing agendas, and documenting completion of capacity building activities. A major step is defining who is responsible for managing logistics. One additional staff member (or full time equivalent) would likely be sufficient to oversee this work and could be blended with other related tasks and responsibilities of coordinating capacity building for resource management in Guam.

## High Quality Communication

The culture and quality of communication around the importance of building capacity defines the spirit and intent. Ideally, communication around capacity building is appreciative, open, honest, responsive, and culturally appropriate. Unfortunately, breakdowns and other issues associated with communications are at the heart of organizational conflicts, interpersonal challenges and program difficulties. Establishing agreed upon communication protocols and adhering to them can improve the communications process.

- **Communication within committees:** Good committee behavior is the responsibility of all involved and will only become a norm if it is established from the start and reinforced through periodic reflection. A brief list of best meeting practices should be identified and customized to fit the cultural context, agreed upon and distributed and could include the following: engage all voices, listen respectfully, explore alternatives, raise issues constructively, appreciate each person's skills, unique histories, perspectives, and talents. Assume confidentiality unless otherwise defined, and mutually agree on what information is to be shared with others outside the meeting.
- **Communication among committees:** Since there is a growing range of committees that are associated with coral reef management, defining the general guidelines for how to track their progress and ways to best communicate among them is an essential element of capacity building. Once established, a short and simple protocol may be needed to ensure that this level of communications sharing is maintained.
- **Communication beyond committees:** It is often not made clear what information can be shared outside of coral reef management committee structures such as other administrative hierarchies, governing or advisory boards, private sector operations, program funders, etc. The leadership team should define policies, guidelines and procedures for communication beyond the coral reef management committees.
- **Electronic communication:** Sharing information electronically is rapid, efficient and inexpensive, with quick turnaround potential. Given that e-mail and technology overload is a possible downside, set guidelines for electronic communications such as a file-naming convention, use shared directories or a shared project website to host information in one location, and describe the situations where e-mail is preferred or face-to-face communication is preferred.
- **Confidentiality:** Transparency fosters trust but can work against confidentiality. It is helpful to appreciate the tension between confidentiality and transparency and by agreeing within the group what information and documents can be shared and what should remain confidential. Be clear and direct on matters regarding confidentiality.

## Information Management

Document and keep records of significant capacity building actions that have been taken so there is an easy to follow trail that documents the degree to which resources have been allocated to this end. Such a document trail is useful for reflecting on actions taken and the level of investment allocated. Examples include chronological timetables of various steps in the capacity assessment and capacity building program, records of training, assessment reports and findings, and evaluations of coral reef management and capacity building efforts. Such information is the basis for high-quality lessons learned and ensures that a knowledge base is maintained in the face of unexpected events such as staff turnover, new leadership, new budget priorities, and program audits.

## 5.5 Acting on the Grouping of Recommendations

As presented in Section 4, the recommendations that serve as the basis for an action plan are divided into three groups. The first group involves recommendations that require decisions that are political in nature and requires decision-making from senior administrators. The timing, control and ultimate direction taken all need to be decided at the highest levels within territorial government. These actions are the most critical for long-term adaptive capacity to be built into the system of coral reef and other Ecosystem-based Management practices. The second group requires the collaborative force of implementing partners working closely with funding partners to model a customized form of Ecosystem-based Management that is based on a shared language and process of management at priority sites. The outcomes of these actions are in the hands of the implementing partners and can be accomplished largely within a relatively small segment of the coral management network. This set of actions is largely independent of progress associated with the first group, although they would be greatly enhanced by accomplishing recommendations within Group 1. Together, the recommendations in Group 2 promote the collaborative use of a common management framework to sequence and prioritize implementation in select priority areas. To be effective, this would require linking with funding partners such as DoD, NPS and NOAA in the short run to tie funding to the strategy for implementation and adaptive learning at locations such as Piti-Asan Watershed. Ideally there are additional federal partners in the future, but in the near-term, this would be applied at a demonstration scale, with select partners that are tied to specific funding opportunities such as the NOAA Cooperative Agreement and DoD and NPS support for priority watershed investments. As a condition of the grant, the recipients would track progress of implementation through a simplified monitoring and evaluation process. Since this strategy pertains to the preparation of proposals, including how they are written, the setting of priorities and how they are administered, this action requires strong commitment, partnership and a shared agenda among funders and the recipients. In the short run, it is our advice to keep it as simple of a process as possible, provide clear guidance and training for those who are preparing proposals so they are clearly identifying what part of the Management Cycle they are contributing to, and how they will track progress along the way.

The third group of recommendations includes a range of actions that can be done at the scale of committees, task forces, within organizations, and by groups of individuals. These are important, but their overall impact will only be realized if there is significant progress with capacity building in the other two groups. Actions within this group can be

controlled by one or a few organizations and generally don't require significant resources. We believe these are good places to build capacity momentum as long as attention is paid to implementing the first two groups described above.

## 5.6 Building Adaptive Capacity

As has been shown in this analysis, increasing adaptive capacity for coral reef management requires competencies in at least four key decision environments: the ecological system, the political system, the organizational system and the community system. As a manager, the work requires winning support among a diversity of stakeholders, engaging effectively within one's own organization, securing formal commitment from the political process, and then implementing a plan of action over the long-term. Given this level of complexity, team-based management competencies are required to address a growing range of cross-scale issues outlined in this report. Competencies include, but are not limited to the following:

- How to engage local communities in the analysis of long-term changes in condition and use of coral reef ecosystems;
- How to analyze the governance structures and processes that encompass values, policies, laws and institutions that determine how coral reef ecosystems are conserved and used;
- How to build leadership required to excite "political will" to design, adopt and implement plans of action that address complex challenges posed by coral reef ecosystem change;
- How to build strength in facilitation, mediation, stakeholder engagement and public education;
- How to strategically design a transformative program or plan of action that fits within the existing governance dimensions; and,
- How to design and implement a monitoring and evaluation program in support of adaptive management.

In practical terms, this means moving beyond BMPs and focusing on building high-quality collaboration, building bridges between scientists and policy makers, and using a common language to build common ground across diverse perspectives. The modern-day adaptive manager must display competency as a scientist, collaborator, politician, humorist, evaluator, and strategist. The manager must pay attention to his or her home agency, and back up the formal commitment expressed higher up the chain. At the same time, the manager must create an individual identity and build social capital across different organizations, engage stakeholders and avoid moving in isolation or moving too quickly and losing support from constituencies (Westley, 2002). Adaptive management requires control of emotions, great humility, little fear of conflict and being able to capitalize on the energy and movement of others. Rather than pulling strings or moving levers, effective and adaptive management is more like being in the right place, with the right skills, attitude and desire, to adjust to challenges of managing ecosystems.

While many of these basic elements can be taught, the integration and application of these diverse and somewhat paradoxical competencies are built through experience, persistence, strong values and relentless commitment. Frances Westley (2002) described natural resource management as juggling four balls at once: bureaucratic process, political process, adaptive science-based process and community process. In her 2002 book [Panarchy](#), she writes:

*Depending on his or her values and skills as well as his or her formal position and contextual factors, it is easy to drop one or more balls. Extending the metaphor, surprise may act like a sudden wind, looping the ball into a new dynamic, or like a sudden shift in terrain, which causes the juggler to lose his footing and his balance. The trick is to keep the eye on these four balls and somehow, with peripheral vision, adjust to those surprises as they unfold, or, even better, use them like the good golfer or tennis player uses the wind. In complex, adaptive systems, disequilibrium and surprise are the rule, and failure is as instructive as success.*

Building adaptive capacity to manage effectively requires paying attention to both the theoretical and operational implications of the holistic “ecosystem approach” when responding to the challenges brought by accelerating societal and environmental change. Management requires looking ahead, watching for and nurturing the conditions that enable change and can lead to tipping points. Building this capacity will require scenario thinking, sharing information on how to build momentum, how to see opportunities, how to select a strategic and politically viable management agenda. The work requires sharing lessons learned on how best to excite the “political will” and maintain it for addressing complex ecosystem management challenges. Connecting with others, building more effective collaborations, paying attention to enabling conditions, committing to a common language across a wide network to sequence and prioritize collective action might feel like luxuries, valued, to be sure, but easily put off until the crisis of the day is past. Unfortunately, unless there is a commitment by political leadership to build this adaptive capacity with competent and well-trained leaders, the challenges escalate. Forces of fragmentation create new crises, things never quite get under control with a local management approach and the regional and global drivers of coral reef decline accelerate to a point where the goods and services of coral reefs are no longer abundant. Building adaptive capacity for improved ecosystem management is the challenge of our time.



*Woman and child recreating in the waters off of the PAG property in Apra Harbor. (Photo credit: Glenn Page, SustainaMetricx)*

## Appendix A: Glossary

**Adaptive Management:** A central feature of the practice of any form of Ecosystem-based Management is that it must respond positively to changing conditions and to its own experience. In other words, the practice of coral reef management must be grounded in a process of learning and adaptation. Adaptive management is not reactive management whereby the practitioner simply responds to the unexpected. It is rather a conscious process of examining the course of events as they unfold at larger, or smaller, spatial and temporal scales, and being cognizant of future projections and developing adaptation options in consideration of these dynamics. In other words, in the face of uncertainty, this includes being able to change or redirect decision-making based on the evolving outcomes.

**Actions:** Projects, procedures or techniques intended to implement an objective as defined in the PSD.

**Best Management Practices:** Management measures or practices that are established and widely accepted as meeting the intent of coral reef conservation in a variety of disciplines (fisheries management, watershed management, biophysical monitoring, etc.)

**Capacity:** The overall ability of the individual or group to perform their responsibilities for coral reef management. It depends not only on the capabilities of the people (their knowledge, abilities, relationship and values), but also on the overall size of the task, the resources which are needed to perform them, and the framework within which they are discharged.

**Capacity Building:** Programs that are designed to strengthen the capacity (knowledge, abilities, relationship and values) to reach the goals as defined in the PSD. This includes strengthening the institutions, processes, systems, and rules that influence collective and individual behavior.

**Capacity Development:** A widely recognized definition of capacity development was published by the United Nations Development Programme in 1997 as: “the process by which individuals, organizations, institutions and societies develop abilities (individually and collectively) to perform functions, solve problems and set and achieve objectives.” We expand this definition to put greater emphasis on the strategic role of a facilitator in helping this process in an uncertain and changing environment. Our suggested definition is: “Externally or internally initiated processes designed to help individuals and groups to manage coral reefs and to enhance their abilities to identify and meet coral reef management challenges in a sustainable manner.”

**Capacity Strengthening:** Capacity strengthening is part of the capacity development process and is set within a dynamic context and involves individuals, networks, organizations and even societies who have a stake in functioning coral reefs. It involves such processes as continuous learning, adaptation and innovation in dealing with unanticipated problems or issues. A central feature of capacity strengthening is assessing and reacting to current and future needs in order to improve the ability to learn and solve problems in the long-term.

**Commitment:** In the case of coral reef management and governance, commitment often refers to governmental commitment to the policies of a program and expressed by the delegation of the necessary authorities and the

allocation of the financial resources required for long-term program implementation. When commitment is used in a different context it will be defined.

**Conservation Action Plans (CAPs):** TNC’s process for “helping conservation practitioners develop strategies, take action, measure success, and adapt and learn over time.” From Conservation Action Planning: Developing Strategies, Taking Action, and Measuring Success at Any Scale--Overview of Basic Practices. TNC 2005. Available in English and Spanish at:

[http://conserveonline.org/workspaces/cbdgateway/cap/resources/1/TNC\\_CAP\\_Basic\\_Practices.pdf/download](http://conserveonline.org/workspaces/cbdgateway/cap/resources/1/TNC_CAP_Basic_Practices.pdf/download)

**Constituencies:** While constituencies can be broadly defined, we use the word to define active support of the coral reef management program by a core group of well-informed and supportive people composed of stakeholders in the private sector, civil society and government agencies.

**Coral Reef Management Priorities:** Those goals and objectives that have been defined by a core group of coral reef managers and stakeholders in each of the seven jurisdictions and identified through a voting process as those that require immediate attention over the short term of 3-5 years. For the purposes of the capacity assessment, the term goals will refer to the highest-level results the jurisdiction seeks to achieve (e.g., stable, sustainable coral reef ecosystems), as articulated in the jurisdictional PSD. These goals in general refer to efforts to understand and address the three major threats to reefs; impacts from climate change, fishing, and LBSP as well as other identified jurisdictional priorities.

**Coral reef resilience:** According to the Reef Resilience Toolkit (<http://www.reefresilience.org/>) website, resilience is more than being able to recover from a major disturbance, surviving bleaching, or resisting bleaching. For a coral community to be resilient, it must also be able to continue to thrive, reproduce, and compete for space and resources. For example, coral communities that have experienced bleaching but not mortality may be weakened and less able to thrive, grow, and reproduce in the competitive reef environment. Multiple factors contribute to resilient coral communities, some of them known and others to be discovered. Scientists are working to identify important factors (biological, physical and ecological) that managers can evaluate to determine the health or resilience of a coral community. It is important that managers build the capacity to be able to identify and better understand these factors, so management strategies can be focused on maintaining or restoring communities to more optimal conditions to maximize coral survival after stressful disturbances.

**Core managers group:** This term refers to the agencies/organizations involved in management of coral reefs in a jurisdiction not just a geographic site within a jurisdiction. Most locations have a core group like this and will be the central focus of the capacity assessment process.

**Ecosystem approach:** According to the COMPASS Scientific Consensus Statement, Ecosystem-based Management emphasizes the protection of ecosystem structure, function and key processes; is place-based in focusing on a specific ecosystem and the range of activities affecting it; explicitly accounts for the interconnectedness among systems, such as between air, land and sea; and integrates ecological, social, economic and institutional perspectives, recognizing their strong interdependences.



**Local Action Strategy (LAS):** LAS's are a U.S. Coral Reef Task Force led initiative to identify and implement priority actions needed to reduce key threats to valuable coral reef resources in each U.S. coral reef jurisdiction. In 2002, the Task Force adopted the "Puerto Rico Resolution" which calls for the development of three-year LAS by each of the seven U.S. jurisdictions containing coral reefs: Florida, Puerto Rico, the U.S. Virgin Islands, Hawai'i, Guam, American Samoa, and the CNMI. These LAS's are locally driven roadmaps for collaborative and cooperative action among federal, state, territory, and non-governmental partners.

**MPAs:** Any area of the marine environment that has been reserved by federal, state, territorial, tribal or community law, mandate, regulation or declaration to provide lasting protection for part or all of the natural and cultural resources therein.

**Nested Systems:** Thinking in terms of nested systems is essential because issues of coral reef management impact upon, and are impacted by, conditions and actions at both higher and lower levels in an ecosystem and governance hierarchy. Some issues of coral reef management can be addressed more effectively at one level, and less effectively at another. The choice of the issue or set of issues to be addressed must therefore be made in full knowledge of how responsibility and decision-making authority is distributed within a layered governance system. Planning and decision-making at one scale, for example within a jurisdiction, should not contradict or conflict with planning and management at another – for example, at the scale of the nation. The reality is that such contradictions and conflicts are common across the world. A major challenge for the coral reef manager is to recognize these differences and work to either change them or select goals and strategies that recognize that such contradictions must be accommodated or resolved. In practical terms this means that a central feature of ecosystem approach is that all planning and decision-making must recognize and analyze conditions, issues and goals at least at the next higher level in the governance system. Thus, the ecosystem approach at the jurisdictional scale must – at a minimum – be placed within the context of governance at the smaller scale of the village or municipality while governance at the scale of a state/territory – at a minimum – be analyzed with an eye to governance at the scales of the village/municipality as well as that of the nation.

**Objectives:** The environmental, social, and institutional outcomes the jurisdiction must achieve to reach the end goal, generally actionable within a three to five-year time frame.

**Participation:** One of the defining characteristics of the practice of the ecosystem approach is its emphasis on participation and its relevance to the people affected by its practice of coral reef management. The ecosystem approach recognizes that the support of those whose collaboration is needed if a program is to be successfully implemented must be won by involving them in the processes of defining the issues that the program will address and then selecting the means by which goals and objectives will be achieved. Both individuals and members of institutions are more likely to comply with a management program when they feel that it is consistent with their values, responds to their needs and to their beliefs of how human society should function. Voluntary compliance by a supportive population lies at the heart of the successful implementation of a program. A participatory approach helps stakeholders and the public to see the efforts of a program as a whole.

**Site managers:** A person or persons designated with authority to manage the marine protected area at any level be it community, agency, state or federal.

**Situation Analysis:** A preparatory document for the priority setting process that summarized coral reef threats, condition and trends, key management issues, and goals of management agencies.

**(Key) Stakeholder:** A person, group, or organization that has direct or indirect stake in an organization that is involved with managing coral reefs.

**Stewardship:** Where equitable and sustainable forms of development are the ultimate goals of ecosystem approach, the practices of stewardship is the path to that destination. Ecosystem stewardship is an ethic practiced by individuals, organizations, communities and societies that strive to sustain the qualities of healthy and resilient ecosystems and their associated human populations. Stewardship takes the long-term view and promotes activities that provide for the well-being of both this and future generations.

## Appendix B: Guam Timeline

Event	Start Date	End Date	Event Detail
Magellan made landfall on Guam	1521		
Spaniards establish a permanent settlement on Guam	1668		In an effort to convert the Chamorro people to Catholicism, the Chamorro's were forced to the island of Guam. Under Spanish rule, the Chamorro population was reduced to 2,000.
Spaniards crushed the Chamorro resistance	1720		Forcibly evacuated all Chamorros to Guam from all of the Northern Marianas.
A Typhoon Hits the Caroline Islands	1810		A typhoon devastated the Caroline Islands and the survivors sailed to Guam, but only half of the population have survived. The Spanish authorities sent the survivors to Saipan and Tinian as labor to manage the cattle herds.
The Spanish allow the return of the Chamorros to the Northern Mariana Islands	1880	1889	The Spanish began to allow the Chamorros to return to their home.
Spain Cedes Guam and Sells the Marianas	1898		During the Spanish-American War on the way to the Philippines to fight the Spanish, the U.S. Navy cruiser Charleston seized the island of Guam. The next day, Guam becomes a U.S. territory. Six months later, the Spanish cede Guam to the U.S. and receive \$20 million to vacate Cuba, Guam, Puerto Rico, and the Philippines.
Treaty of Paris	1898		The United States and Spain signed the Treaty of Paris, ending the Spanish-American War. This ceded Puerto Rico, the Philippines and Guam to the United States. The U.S. Senate ratified the treaty February 6, 1899.
U.S. Develops a Naval Base on Guam	1898		
USDA Agricultural Experimentation Station established in Piti	1902		
First Cross-Pacific Cable	1903		Jul 4, Pacific Cable (SF, Hawaii, Guam, and Philippines) opened, and Pres. Teddy Roosevelt sent a message.
Honduran Mahogany planted at Piti	1928		Introduced species, created large plantations
Japanese Troops Invade and Overrun Guam	1941		Just three days after the attack on Pearl Harbor, on December 10, Japanese troops invaded the Filipino island of Luzon and overran Guam.
Guam Falls to an Overwhelming Japanese Force	1941		December 18, Defended by 610 fighting men, the American-held island of Guam fell to more than 5,000 Japanese invaders in a three-hour battle.
Glass Breakwater built	1941		1/2 mile structure built over coral reefs
U.S. Return to Liberate Guam as a Military Stronghold	1944		During the occupation, the people of Guam were subjected to acts that included torture, beheadings and rape, and were forced to adopt the Japanese culture. Guam was subject to fierce fighting when U.S. troops recaptured the island on July 21, 1944, a date commemorated every year as Liberation Day.

Event	Start Date	End Date	Event Detail
The Brown Tree Snake arrives in Guam	1946		The brown tree snake, <i>Boiga irregularis</i> , arrived on Guam shortly after WW II and began to feed on the native bird population. By 1998 an estimated 9 of 11 native birds were eliminated.
Carlton Skinner Becomes First Civilian Governor of Guam	1949		Pres. Truman appointed Carlton Skinner (d.2004) as the 1st civilian Governor of Guam. Skinner established the island's 1st university and wrote a constitution.
Submarine Geology of Pago Bay, Guam, Mariana Islands	1957		Describes the reef and associated features, discusses waves and currents, reef sediments, beach sediments, channel sediments, oceanography of the channel, and the factors which affect reef growth. 109p.
Guam's Population was roughly 67,000	1960		
Typhoon Karen	1962		
Guam Tourist Commission established	1963		
Nixon Doctrine on Guam's Military Defense	1969		July 25, The Nixon Doctrine was put forth in a press conference in Guam. He stated that the U.S. henceforth expected its Asian allies to take care of their own military defense.
Guam's Population was roughly 85,000	1970		
University of Guam Marine Laboratory established	1970		
A Study of Ecological Succession Following Natural and Man Induced Changes on a Tropical Reef	1971		A progress report on studies underway to investigate the effect on marine ecology of the Tanguisson Power Plant.
Final Japanese Soldier Surrenders	1972		January 24; In Guam Shoichi Yokoi (d.1997 at 82), a WWII Japanese soldier, was found by hunters near the Talofofo River. He had survived since 1944 in adherence to his army code of never surrendering. Yokoi returned to Japan as a national hero: "It is with much embarrassment that I return."
Coral Reef Recovery Following Extensive Damage by the "Crown-of-Thorns" Starfish, <i>Acanthaster Planci</i> (L.)	1973		A study of the Tanguisson Point fringing reef which was heavily infested by an <i>Acanthaster planci</i> population from June 1968 to September 1968. The infestation resulted in the death of more than 95 percent of the reef building corals. This study is an analysis of the state of the extant coral community, documenting the early stages of coral community recovery at Tanguisson Reef.

Event	Start Date	End Date	Event Detail
General History of Guam Environmental Regulation	1973	2012	Efforts have been made to protect Guam's coral reef habitats from pollution, eroded silt and overfishing, problems that have led to decreased fish populations. (Since Guam is a significant vacation spot for scuba divers, this is important.) In recent years, the Department of Agriculture, DAWR has established several new marine preserves where fish populations are monitored by biologists. [50] Prior to adopting U.S. Environmental Protection Agency standards, portions of Tumon Bay were dredged by the hotel chains in order to provide a better experience for hotel guests.[51][52] Tumon Bay has since been made into a preserve. A federal Guam National Wildlife Refuge in northern Guam protects the decimated sea turtle population in addition to a small colony of Mariana fruit bats
Coastal Survey of Guam, Technical Report No. 14, University of Guam	1974		A general assessment of the major structural elements comprising the environment of the coastal regions of Guam. In assessing these elements, the following specific items are included: major vegetation zones; rivers, estuaries; bays; beaches and other coastal areas of unconsolidated materials; rocky coastlines; reef zones, water masses and circulation patterns; climatic zones; geology and soil types; development areas and use patterns; and areas of rare or unique animals and plants. These items are discussed in a systematic way around the island and are augmented by illustrations, maps, charts, tables, and photographs. In the assessment of the major structural elements, areas where knowledge is weak or lacking are pointed out. Special attention is given to the following: the presence of rare or endangered species; unique botanical elements; wetlands habitats, fisheries; culturally important areas--sanctuaries, park lands, cemeteries, and so forth. There are five reports in this series.
A Marine Biological Survey at the Proposed Umatac Sewer Outfall Site, Marine Laboratory Environmental Survey Report No. 15; Richard H. Randall and Michael Gawel, University of Guam; July 1974.	1974		A biological survey along the proposed outfall route and in the immediate area of the outfall diffuser, including a zonal analysis of the reef corals, fishes, benthic algae, and dominant macroinvertebrates, and a quantitative evaluation of the percent of substrate covered by reef corals and density values for the dominant coral species. It provides a vertical depth and zonation profile along the proposed outfall route to the 60 foot depth level. A statement is given as to the probable effect of the sewage effluent on the biological environment.
Nearshore Currents and Coral Reef Ecology of the West Coast of Guam, Mariana Islands	1974		Nearshore currents at select locations on the West Coast of Guam are described. The plants and animals attached to the shallow coral reefs at eight stations, each ten meters by ten meters in area, are described and illustrated by photos and photo mosaics.
Nearshore Currents and Coral Reef Ecology of the West Coast of Guam, Mariana Islands	1974		This report investigates the nearshore currents and coral reef ecology of the West Coast of Guam to assist in planning the locations of proposed sewer outfalls. Analyzes the various locations to determine the level of sewage treatment required to prevent toxic levels of pollution on the beaches of Guam and ecological damage to the surrounding coral reefs.
Refugees from Vietnam War entered Guam through ports by the 10s of thousands	1970s		Increased use of marine resources; Vietnamese immigrants credited with starting commercial fishing on Guam
Guam Seashore Protection Act	1974		Set up reviews and approvals of proposed developments within 10mi inland (the seashore reserve)

Event	Start Date	End Date	Event Detail
A Candidate Marine Environmental Impact Survey for the Potential Development of the Uruno Point Reef Area on Guam, Mariana Islands, Marine Laboratory Technical Report No. 19	1975		An evaluation of the potential environmental impact of the proposed development of the Uruno Beach area. The report includes a biological survey of the impact of construction of three swimming pools on the reef flat, a marina, and a sewage outfall for discharge of secondary treated effluent at 60 feet. The eight- hour current studies were also conducted.
Commercial Potential of Precious Corals in Micronesia: Part I. The Mariana Islands, Technical Report No. 18, University of Guam	1975		Presents the results of an exploratory survey for precious coral in the Mariana Islands. This report contains data from a survey designed primarily to locate pink coral between Guam and Saipan.
Resurvey of Cocos Lagoon, Guam, Territory of Guam, Marine Laboratory Technical Report No. 80; Richard H. Randall and Timothy S. Sherwood, University of Guam, for the U.S. Army Corps of Engineers.	1975		Updates the "Marine Biological Survey of the Cocos Barrier Reefs and Enclosed Lagoon" done by the Marine Lab in 1975. The purpose of this survey was to ascertain if any changes in hard and soft coral, fish, algae, seagrass and other macroinvertebrates occurred since 1975; determine if increased tourist traffic and housing development affected the marine communities in the lagoon area; and measure currents in the lagoon. 104 p.
Typhoon Pamela	1976		
Thermal Simulation Experiments, Biological Impact Caused by Changes on a Tropical Reef	1976		Results of a study to provide information on upper thermal tolerance limits of various coral species on Guam.
Development and Environmental Quality of Coral Reef Communities Near the Tanguisson Power Plant, Marine Laboratory Technical Report No. 41	1977		This is a continuation of previous studies. It compares the standing crop of biomass accumulation and species diversity on the upper and bottom surface of the thermal discharge zone and the zone unaffected by the thermal discharge. Also included is the University's summary and conclusions based on their findings over the 1975-1977 study period.
The Extent of Coral, Shell and Algal Harvesting in Guam Waters, Technical Report No. 37	1977		The scope of work for this report includes determining which species are being harvested, and to what degree, locating and mapping where harvesting is being done, a review of existing laws and their enforcement, and recommendations regarding the protection of certain species. The report is divided into four sections: coral, shells, algae, and laws and their enforcement.
Life On Guam: Coral Reef; Richard H. Randall and L.G. Eldredge; 1977	1977		Explains class, lab, and field projects in ecology and social studies used by Guam's junior and senior high schools. Fully illustrated with drawings and photographs. Other volumes in the Life on Guam series available.
Guam Coastal Management Program established	1978		
Atlas of the Reefs and Beaches of Guam	1978		Provides baseline information on Guam's coastal region by detailed coastal mapping of the beaches, rocky shorelines, mangrove swamps, river mouth areas and upstream navigated areas, and reef-flat platforms. Also maps the general distribution of corals, sea grasses, and sediments on the reef- flat platform. Contains an appendix on "Mangroves and Estuaries" by Wilder (1977). More intensive regional studies were conducted in later years and published as "Guam's Reefs and Beaches Part II", 1978.

Event	Start Date	End Date	Event Detail
Guam's Reefs and Beaches Part II: Transect Studies, Technical Report No. 48; Marine Laboratory, University of Guam, for the Bureau of Planning; July 1978.	1978		A continuation of the investigation of Guam's reefs and beaches initiated in May 1976 and published as an "Atlas of Reefs and Beaches of Guam". The transect studies constitute the first part of a second phase of reef investigations which encompass more intensive regional studies. This report provides general information on the coastal region, including mangrove swamps, river mouths, and estuaries. Data were collected from transects in five bays (Tumon, Agana, Agat, Fouha, and Ylig), and consists of the quantitative distribution and community structure analyses of benthic organisms, including corals, algae, and other macroinvertebrates. Available: Bureau of Statistics and Plans' Library.
Guam's Reefs and Beaches Part II: Sedimentation Studies at Fouha Bay and Ylig Bay, Technical Report No. 47; Richard H. Randall and Charles Birkeland, Marine Laboratory, University of Guam, for Bureau of Planning; August 1978.	1978		Analyzes the results of sedimentation studies conducted at the mouths of two rivers. Assesses the impact of terrestrial run-off sedimentation on the diversity of corals within offshore reef communities. Develops data that can be used to establish performance standards for allowable sedimentation rates in reef environments.
Studies on the Biology of the Reef Fishes of Guam, Technical Report No. 49	1978		A two-part study of the distribution of fish and other marine life at selected sites. Part I - Distribution of Fishes of the Reef Flat on Guam and Part II - Distribution of the Eggs and Larvae of Fishes at Selected Sites on Guam.
Historical Significance of Guam Moving to Protect the Sea Turtle Populations	1978		Guam's DAWR will continue to give sea turtle presentations for community awareness, especially through the elementary-secondary school system and University of Guam. In addition, the recommendation to produce and distribute sea turtle posters and pamphlets would help to enhance conservation and recovery awareness within the local community. The DAWR Sea Turtle Recovery Program (STRP) is funded in part by the NMFS Honolulu PIAO to determine the extent of Guam's resident/nesting sea turtle populations and nesting habitats by conducting beach surveys and satellite tracking. ComNavMarianas has funded part of the satellite telemetry portion of the project through the purchase of satellite tags and satellite time.
Green Sea Turtles Were Added to the Endangered Species List and Begin to be Protected Under Guam Law	1978		Prior to the 1978 Endangered Species Act listing of green sea turtles, there were no regulations controlling the taking of the turtles on Guam, although regulatory measures had been under discussion by the local government since at least 1973. When the Endangered Species Act of Guam was passed in 1979, green sea turtles were given full legal protection at the local government level consistent with Federal regulations.
Background Materials and Discussion on the Environmental Features, Historic Values and Land-Use Controls Affecting: Luminao Reef; Western and Jade Shoals; Piti Channel, Tidal Flats, and Islets; Sasa Bay; SMS Cormoran	1979		A review of literature and field studies of the natural areas of the northern half of Apra Harbor, Glass Breakwater, Cabras Island, Sasa Bay and Drydock Island. Existing land-use controls which manage these areas are also outlined. 87 p.

Event	Start Date	End Date	Event Detail
Literature Review and Synthesis of Information on Pacific Islands Ecosystems; USFWS, U.S. Department of the Interior; October 1979	1979		A collection of ten papers describing and synthesizing facets of extant ecological knowledge about Pacific islands under U.S. jurisdiction. The papers cover topics of interest and relevance to wildlife management and protection of endangered species: wildlife refuges and endangered species; terrestrial botany; birds; freshwater macrofauna; marine plants; coral reefs; marine macroinvertebrates, excluding corals and reef building organisms; reef and shore fishes; harvested marine resources; and socio-economics of Pacific islands. The study includes a large (15,000 citations) indexed and computerized reference system to natural resource literature pertaining to Hawaii, Guam, American Samoa, and the Trust Territory. The data base is available for public use. Information about access can be obtained from the USFWS Regional Office in Portland, Oregon; Attention: Biological Services.
Preliminary Summary of the Management and Development of Harvesting Reef Fish on Guam; Bureau of Planning, for Guam Marine Fisheries Advisory Council; February 1980	1980		Recommends guidelines and policies for the preservation of reef fish. 19p.
Preliminary Summary of the Management and Development of Harvesting Aquarium Fish on Guam; Guam Coastal Management Program, Bureau of Planning, for the Guam Marine Fisheries Advisory Council; March 1980	1980		Investigates the harvesting of the smaller species of reef fish by commercial and private aquarium interests. This report discusses current harvesting practices and legal regulations, recommends management policy, and purpose revised regulations. 23 p.
Guam's Population was about 106,000	1980		
Guam's Coral Reef; DAWR, Department of Agriculture; 1981	1981		An eighty-one frame color filmstrip prepared for elementary and junior high school use. Discusses the origin of coral reefs, biology of reef animals, and the impact of man on the reef. Includes a teacher's guide with complete English and Chamorro script, selected references and questions, and an accompanying cassette tape in English and Chamorro complete with beeps.
Long-Term Recovery Process of a Coral Community After A Catastrophic Disturbance, Technical Report No. 76; Mitchell W. Colgan, Marine Laboratory, University of Guam, for Bureau of Planning, Government of Guam; December 1981	1981		This study documents the ability of coral communities to recover from natural catastrophic disturbances. The Tanguisson Reef area was chosen as the study site because of extensive damage to the reef by <i>Acanthaster planci</i> during 1968 and 1969, which was documented in earlier studies.
Pollution on Guam; DAWR, Department of Agriculture; 1981	1981		A seventy frame color slide show. Includes air, water pollution, littering, the effects of pollution, both natural and man-made, on the reef and its animals. Emphasizes man's impact and future recommendations. Suitable for third grade and up.



Event	Start Date	End Date	Event Detail
Guide to the Coastal Resources of Guam: Volume II The Corals; Richard H. Randall and Robert F. Myers, Marine Laboratory, University of Guam, for CZM Program, Bureau of Planning; 1983	1983		An illustrated reference source for over 200 species of corals in various reef habitats around Guam. Extensive photographs with an annotated key.
"Guam: Paradise Lost for Wildlife"; Julie A. Savidge, Division of Aquatic and Wildlife, Department of Agriculture, In Biological Conservation	1984		Discusses wildlife problems on the island of Guam. This article cites over-exploitation of native natural resources; introduced plants, mammals, reptiles, and possibly disease; intensive coral and shell collecting; and habitat destruction. Recommendations are made for improving monitoring, legal protection, and public awareness.
Report on the Marine Benthic Algae and Coral Communities at Nine Biological Stations Around Guam; Dana Marie Rowley; December 1984.	1984		First Annual Report October 1981.
Orote Peninsula Ecological Reserve Area and Haputo Ecological Reserve Area established by the Navy Guam	1984		Mitigation measures for construction of Kilo Wharf in Apra Harbor
Cotal Conservation Reserve established	mid 1980s		600 acres transferred to the Department of Agriculture to manage; Large-scale watershed restoration, around 1 million trees planted
Baseline Marine Environmental Surveys for the East and West Agana Bays and Piti Bay, Guam	1986		Pacific Basin Environmental Consultants, Inc., for William A. Brewer and Associates. Describes the marine resources of East and West Agana Bay and Piti Bay. This report includes site description of the beaches and shoreline, reef-flat platform, currents, flora, fauna, and fishing and harvesting.
DAWR notices decline in fisheries, conducts management study, and drafts proposed regulations including Marine Preserves	1986	1990	
First issue of Man Land and Sea Newsletter	1989		News on Guam's natural resources, published by GCMP
Guam's Population was about 134,000	1990		
Guam/UOG hosts the International Coral Reef Symposium	1992		
1st Set of 3 Hearings for the Marine Preserves	1993		
Revision of Marine Preserve Proposal	1993	1995	Reviewed comments, worked with community to revise regulations for the Marine Preserves - Reduced to 5 permanent preserves

Event	Start Date	End Date	Event Detail
Guam Attempts to Limit the number of incoming Brown Tree Snakes	1994		Guam began to use Jack Russell terriers to check outgoing cargo for brown tree snakes.
Coral Bleaching Event	1994		
Baseline Assessment of Ecological Resources conducted for American flag Pacific Islands	1995		
1st Annual Guam International Coastal Cleanup	1995		
In May, a Kmart Store Opens on Guam	1995		
2nd Set of 3 Hearings for the Marine Preserves	1995		
Life and Death of Coral Reefs; Charles Birkeland, University of Guam; 1996.	1996		Contains papers on the value and present conditions of coral reefs. It discusses coral erosion and reef destruction and identifies ways to manage coral reefs and its interaction with neighboring habitats.
Land Use Plan passed	1997		Over 100 public meetings in 19 villages were held to develop the plan, which addresses environmental issues, landscape, water use needs, etc. - it was passed in 1997, but cancelled the year after
Coral Reefs Their Health, Our Wealth	1997		This video is a joint effort between University of Guam and Department of Agriculture to educate and provide public awareness on the value of coral reefs. Video is made available to all schools, public and private.
Guam Coral Reef Initiative: Background and Briefing Book	1997		The Coral Reef Initiative establishes a policy development mechanism for the protection of Guam's Coral reefs. This document contains the Executive Order adopting the CRI, describes the vision and strategies of the CRI, and compiles a variety of documents pertaining to the Year of the Coral Reef.
Student Scholarship Program	1997		Jun 10, It was reported that Gov. Froilan Tenorio and Rep. Heinz Hofschneider had proposed a Parental Choice Scholarship Program that would be implemented in the fall. Every student would get a \$1500 scholarship for the school of their choice.
Public Law 24-21	1997		Legislation passed to create 5 permanent preserves: Pati Point, Tumon Bay, Piti Bomb Holes, Sasa Bay, and Achang Reef Flat
Pacific Year of the Coral Reef	1997		Under Secretariat of the Pacific Regional Environmental Program (SPREP)
Navy Orote landfill cleanup studies on PCB pesticide pollution in Agat Bay as well as surveys on marine resources and local consumption	1998		Partners included ASTDR and USCDC
Land Use Plan is cancelled	1998		

Event	Start Date	End Date	Event Detail
Coral Reef Policy	1998		The President of the United States; June 16, 1998. Executive Order 13089 creates the Coral Reef Policy to preserve and protect the biodiversity, health, heritage and social and economic value of U.S. coral reef ecosystems and the marine environment. Pertains to Guam.
Guam Coral Reef Initiative	1998		Guam Coastal Management Program, Bureau of Planning; August 1998. Briefly discusses specific issues; projects and programs regarding coral reef and reef ecosystem protection on Guam.
Guam Hydrologic Survey made permanent by statute	1998		
Mooring Buoys installed at popular sites on the western side of the Island	1999		
U.S. All Islands Coral Reef Initiative Strategy	1999		Coral Reef Initiative Coordinating Committee (USAICRICC) with assistance from the Office of Insular Affairs, DoI and the National Oceanic and Atmospheric Administration; 1999. This document reflects the island visions for coral reef management strategies through projects and programs that are jurisdiction specific, as well as regional, national and international scope. It includes summary of priority projects, description, benefits of the project, and budget for the areas of American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands, Hawaii, Puerto Rico, and the U.S. Virgin Islands.
New Methods to Control the Brown Tree Snake Population	1999		Guam now tries to use Aspirin (toxic to the Brown Tree Snakes) embedded in dead mice
Guam EPA Guam Watershed Management Plan	1999		
Guam's Population was about 155,000	2000		
Full enforcement of Marine Preserves begins	2001		
Coral Transplant and Follow Up Monitoring of Transplanted Coral at Tepungan Piti, Guam	2001		The U.S. Army of Engineers and the Guam Seashore Protection Commission approved permit requests from TyCom Networks to undertake construction activities at Tepungan reef flat to accommodate the installation of a ductible iron conduit raceway and landing of fiber-optic cables within the Guam Seashore Reserve and coastal waters in Piti. Transplanting selected corals was mandated in the permit approvals. This report presents the results of 29 coral colonies transplanted at Tepungan, Piti for the TyCom Networks (Guam) LLC fiber-optic cable landing site.
Typhoon Pongsona Hits Guam	2002		December 8, Typhoon Pongsona hit Guam with wind gusts of more than 180 mph. The U.S. territory was declared a federal disaster area.
Beginning of the LAS Process in Guam	2002		Guam Coral Reef Initiative Coordinating Committee (GCRICC) begins the process of selecting and prioritizing the main threats to local coral reefs on which to focus LAS efforts for the next three years

Event	Start Date	End Date	Event Detail
GCRICC identifies local navigators and drafts Local Action Strategies (LAS) for four of the five chosen focus areas	2003		
Guam hosts the 19th Annual Pacific Islands Environment Conference	2004		
Executive Order 2004-04	2004		Strengthened the Guam Watershed Planning Committee and instituted a comprehensive planning process to address negative impacts in each watershed
Biological and Chemical Survey of the Lower Pago River, Estuary, Nearshore Reef Channel and Adjacent Inner Reef Flat, Pago Bay, Guam, Technical Report No. 109	2004		This report presents the results of an environment assessment conducted over a five month period in 2004 during the dry months of May and early June and the wet months of August and September along the lower 1 km Pago River, and its estuary, and in the remnant of the nearshore reef channel and on the adjacent inner reef flats within Pago Bay, municipalities of Chalan Pago and Yona, Guam. The biological and chemical surveys of the above identified area are of special interest because of: 1) the area at and adjacent to the Pago River serves as a sink for leachates from the Ordot Dump, effluent from construction projects and sewage waste from leaching fields along the Lonfit-Sigua-Pago River system; 2) baseline ecological information on the inner reef flat, near- shore reef channel, estuary and the lower Pago River is scarce and additional biological and chemical data will be useful, if either the Lonfit or Sabanan Batea is selected as the new landfill site; and 3) the closing of the Ordot Dump will mandate the monitoring of environmental conditions along the Lonfit and Pago rivers during and after the capping of the dump.
Planning document is produced for five of the Local Action Strategies	2005		Recreational Misuse/Overuse, Lack of Awareness, Fisheries Management, Land-based Sources of Pollution, Disease/Climate Change/Coral Bleaching
Atlas of the Shallow-Water Benthic Habitats of American Samoa, Guam, and the CNMI	2005		U.S. Department of Commerce, National Oceanic and Atmospheric Administration; February 2005. The National Oceanic and Atmospheric Administration (NOAA) National Ocean Service initiated a coral reef research program in 1999 to map, assess, inventory and monitor U.S. coral reef ecosystems (Monaco et al. 2001). These activities were implemented in response to requirements outlined in the Mapping Implementation Plan (MIP) developed by the Mapping and Information Synthesis Working Group of the Coral Reef Task Force. This atlas provides detailed maps depicting the GIS benthic habitat data produced and outlines the benthic habitat classification scheme and protocols used to map American Samoa, Guam and the CNMI.
Status of the Coral Reef Ecosystems of Guam: Technical Report No. 113	2005		This plan addresses the loss and degradation of Guam's coral reef ecosystem.
Citizens Security Bank Ends Services to Guam	2005		February 15, The Guam-based Citizens Security Bank (CSB) ended credit card and other services to the Bank of Marshall Islands. Residents of the Marshall Islands will be unable to use their credit cards after the central Pacific nation's leading bank was cut off from a U.S. partner by the anti-terrorist Patriot Act.

Event	Start Date	End Date	Event Detail
Haggan Watch Sea Turtle Protection Project	2005		The Government of Guam Department of Agriculture, Division of Aquatic & Wildlife Resources (DAWR) is responsible for performing baseline population studies on the sea turtles. Additionally, a Haggan Watch volunteer project was created in 2005 to minimize the threats to sea turtles and enhance successful nesting events by having volunteers sit on the beach and keep a protective eye on the turtles as they nest.
Update of the Fisheries Management LAS	2005		
Micronesia Challenge signed by each of the five Micronesia Chief Executives, including Guam	2006		
Largest Military Exercise in Decades Occurs off of Guam	2006		
GUAM-Air Force Begins Urunao Dump Site	2007		Air Force begins cleanup of the formerly used Urunao dumpsite at Andersen Air Force Base on the northern end of Guam.
U.S. All Islands Coral Reef Committee Strategic Action Plan, 2008-2013	2007		U.S. All Islands Coral Reef Committee and Secretariat; 2007. This plan provides a developed policy framework and road map to strengthen the conservation and protection of coral reef ecosystems in the U.S. It identifies local action strategies, threats, goals and objectives to coral reef conservation in the territorial and commonwealth jurisdictions.
Expansion of Kilo Wharf	2007	2012	
Indigenous Fishing Bill introduced - Public Law 29-127	2008		
Long-Term Coral Reef Comprehensive Monitoring Program initiated	2008		
1st Guam Coral Reef Symposium	2008		
Year of the Reef	2008		
Masso River Reservoir Project started in Piti	2008		Impound water to increase native freshwater fishery stock, reforest the slopes (Moorhen habitat created), dredged to 10ft deep and stocked with native flagtail fish, shrimp and eel, tillapia and hydrilla removal via volunteer groups, reforestation, etc.
Sea Grant Needs Assessment	2008		Shaped goals and priorities for the next 4 years
Monitoring Strategy and Preliminary Survey Design for Guam/CNMI Coral Reef Ecosystem Studies with a Focus on Apra Harbor and Kilo Wharf Final Report	2008		
Revision of the Guam Global Climate Change and Reef Resilience LAS	2008		

Event	Start Date	End Date	Event Detail
8,000 U.S. Marines Move to Guam	2009		February 17; In Japan, U.S. Secretary of State Hillary Rodham Clinton warned North Korea against following through on a threatened missile launch, saying it would damage its prospects for improved relations with the US and the world. Clinton also signed an agreement with Japan that will move 8,000 Marines off the southern Japanese island of Okinawa to the U.S. territory of Guam.
Center for Island Sustainability created at UOG	2009		
10-volume EIS on Projected Military Build-up on Guam	2009		Provides much information on the associated impact to coral reefs in Guam
BSD/LID Workshop	2009		Better size design/low impact development to protect water quality on Guam - done by the Center for Watershed Protection and Horsley Witten - 80 participants
Large-scale tree planting in Cetti Bay	2009		Offsite out-of-kind mitigation project - partnership between the Navy and Gov. Guam - 160 acres total
The EPA Declares the Military's Expansion Policy "Environmentally Unsatisfactory" and Halts Development	2010		The U.S. recently proposed plans to expand military operations in Guam, by adding a new base, airfield, and facilities to support 80,000 new residents. Dredging the port alone will require moving 300,000 square meters of coral reef. In February 2010, the U.S. Environmental Protection Agency rated the plan as "Environmentally Unsatisfactory" and suggested revisions to upgrade wastewater treatment systems and lessen the proposed port's impact on the reef.
Koko's for Cocos program started	2010	2011	Rodent eradication, monitor lizard control, reforestation, reintroduction of Koko
Guam's Population was about 182,111	2011		
U.S. Military changes the planned location of its firing range in Guam	2011		National Trust for Historic Preservation, the Guam Preservation Trust, and the We Are Guahan group brought suit and won; their goal was to protect the cultural aspects of the original site
Rising petroleum prices - changes that cost of living will increase as well	2011		
Humatak Foundation started	2011		Introduction of coral reefs to children (elementary to high school), growing coral, introduction of the environment and relationship to Chamorro culture, relationship between land and ocean, hands-on experience for children, trips to outer islands to show and experience reef conservation
Humatak Watershed Restoration Project begins	2011		
Western Pacific Coral Reef Initiative started by UOG and CRCP	2011		
Formal Closure of the Ordot Dump	2011		

Event	Start Date	End Date	Event Detail
Ayuda Foundation partners with Tetra-Tech for complex environmental projects	2011	2012	
Ayuda Foundation seeks projects to work on soil erosion with the Guam Coastal Management Program	2011	2013	
U.S. Military buildup in Guam is reduced	2012		The investment price decreased from \$10.27 billion to 8.6 billion; marine transfers decreased from 8600 to 5000
Sea Grant applies for Coherent Area Program status	2012		Awarded seed money for research
ESC Workshop	2012		Guam erosion and sediment control training for contractors, designers, and site inspectors by CWP/HW venue; 85 participants
First Annual Pig Hunting Derby and Cook-off held by GCMP	2012		
Ayuda Foundation's division 'Island Girl Power' begins to make rain gardens and earth buckets	2012	2013	Mission to foster community gardens and advocate for reef stewardship
The debt ceiling is raised in order to give tax refunds	2013		The debt in Guam reaches about \$2 billion
2nd Coral Reef Symposium held on Guam	2013		
Guam hosts the 27th Annual Pacific Islands Environment Conference	2013		First time Guam hosted since 2004
Joint Region Marianas' Integrated Natural Resources Management Plan (INRMP)	2013		

# Appendix C: For More Information

## Climate Change

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## Appendix D: Interview List

Name	Institutional Affiliation and Title	Method
<b>PRE-SITE VISIT</b>		*dates based on EST
Adrienne Loerzel	NOAA OCRM, Coral Management Liaison and Coastal Specialist for Guam	Phone (2/4)
Evangeline Lujan	Bureau of Statistics and Plans, Administrator	In-Person (2/25)
Adrienne Loerzel	NOAA OCRM and NOAA CRCP	Phone (3/21)
J-CAT Meeting #1	J-CAT Members	Phone (4/8)
Valerie Brown	NOAA PIRO, Coral Reef Habitat	Phone (4/23)
Joseph Artero-Cameron	Department of Chamorro Affairs, President and POC	Phone (4/25)
Evangeline Lujan	Bureau of Statistics and Plans, Administrator	Phone (4/29)
Brent Tibbatts	DOA, Department of Aquatic and Wildlife Resources, Fisheries Biologist	Phone (4/30)
Dave Burdick	Guam Coastal Management Program, Coral Monitoring Biologist	Phone (5/1)
Adrienne Loerzel	NOAA OCRM, Coral Management Liaison and Coastal Specialist for Guam	Phone (5/1)
Lorilee Crisostomo	Bureau of Statistics and Plans, Director	Phone (5/3)
J-CAT Meeting #2	J-CAT Members	Phone (5/6)
Adrienne Loerzel	NOAA OCRM, Coral Management Liaison and Coastal Specialist for Guam	Phone (5/16)
J-CAT Meeting #3	J-CAT Members	Phone (5/28)
<b>MONDAY 6/10/13</b>		
Joseph Artero-Cameron	Department of Chamorro Affairs, President and POC	In-Person
Franklin Arriola	Governor's Chief of Staff	In-Person (Executive Level Briefing)
Lorilee Crisostomo	Bureau of Statistics and Plans, Director	In-Person (Executive Level Briefing)
Eric Palacios	Guam Environmental Protection Agency, Administrator	In-Person (Executive Level Briefing)
Raymond Blas	Department of Parks and Recreation, Director	In-Person (Executive Level Briefing)
Manny Duenas	Department of Agriculture, Deputy Director	In-Person (Executive Level Briefing)
John Rios	Bureau of Budget and Management Research, Director	In-Person (Executive Level Briefing)
Joanne Brown	Port Authority of Guam, General Manager	In-Person (Executive Level Briefing)
Laurie Raymundo	University of Guam, Marine Lab	In-Person (Executive Level Briefing)
John Peterson	University of Guam, Western Pacific Coral Reef Institute	In-Person (Executive Level Briefing)
Felix Pangelinan	Port Authority of Guam, Harbor Master	In-Person (Executive Level Briefing)
Benjamin Cruz	Vice-Speaker, Senator	In-Person
Angel Sablan	Executive Director of the Mayors	In-Person
Joann Blas	Mayor of Asan	In-Person
Vicente Gumataotao	Mayor of Piti	In-Person
Ernest Chargualaf	Mayor of Merizo	In-Person
Louise Rivera	Mayor of Tamuning-Tumon	In-Person
Esther Taitague	Guam Coastal Management Program, Watershed Coordinator	In-Person
Tom Quinata	Guam Coastal Management Program, Program Coordinator	In-Person
Christine Camacho	Guam Coastal Management Program, Special Projects Coordinator	In-Person

Name	Institutional Affiliation and Title	Method
<b>TUESDAY 6/11/13</b>		
Mike Gawel	National Park Service	In-Person
John Lawrence	U.S. Department of Agriculture, Natural Resources Conservation Service	In-Person
Gretchen Grimm	Department of Defense	In-Person
Jay Gutierrez	Department of Agriculture, Fisheries Chief	In-Person
Trina Leberer	The Nature Conservancy	In-Person
<b>WEDNESDAY 6/12/13</b>		
Justin Santos	Department of Agriculture, Acting Chief of the Forestry Division	In-Person
Jeffrey Quitugua	Department of Agriculture, Biologist in the Department of Aquatic and Wildlife Resources	In-Person
Jon Nathan Denight	Guam Visitors Bureau, Deputy General Manager	In-Person
Antonio Muña	Guam Visitors Bureau, Public Information Officer	In-Person
Eric Palacios	Guam Environmental Protection Agency, Administrator	In-Person
Angel Parquez	Guam Environmental Protection Agency, Engineer	In-Person
Carlotta Leon Guerrero	Ayuda Foundation	In-Person
Fred Gofigan	Humatak Foundation	In-Person
Champ Quinata	Humatak Foundation	In-Person
Shahram Khosrowpanah	University of Guam, Western Pacific Coral Reef Institute	In-Person
Joseph Rouse	University of Guam, Western Pacific Coral Reef Institute	In-Person
<b>THURSDAY 6/13/13</b>		
Laurie Raymundo	University of Guam, Marine Lab	In-Person
Peter Houk	University of Guam, Marine Lab	In-Person
Laura Biggs	University of Guam, Sea Grant	In-Person
John Peterson	University of Guam, Western Pacific Coral Reef Institute	In-Person
Ansito Walter	University of Guam and Former Governor of Chuuk	In-Person
Bo Baba	BABA Corp	In-Person
Mike Duenas	Guam Fishermen's Cooperative Association	In-Person
Tom Camacho	Guam Organization of Saltwater Anglers	In-Person
Tim Perez	Coral Reef Marine Center	In-Person
John Jocson	Guam Community College, Hydrogeologist, Farmer and Fisherman	In-Person
Victor Torres	Recreational Local Action Strategy, Lead	In-Person
<b>FRIDAY 6/14/13</b>		
J-CAT Meeting #4	J-CAT Members	In Person
<b>POST-SITE VISIT</b>		
J-CAT Meeting #5	J-CAT Members	Phone (7/17)
J-CAT Meeting #6	J-CAT Members	Phone (8/26)

## Appendix E: Portfolio of Training Modules

Long-term capacity building requires an explicit focus on systematic learning. While there are a wide range of potential training modules, a defined set of in-person training courses, distance learning modules, and methods to cultivate local leaders are suggested below to focus on current and emergent topics. A key feature of these trainings and continuing education courses should be the building of a common management framework built around the Management Cycle and the Orders of Outcomes framework.

### Recommended Standard Guam Coral Reef Management Training Course

On-site training courses are recommended to be conducted every two years, to respond to the staff turnover rate, including the following modules:

- Modules on the causes and drivers of reef decline, including land-based sources of pollution, fisheries impacts and effects of climate change and ocean acidification;
- Modules on the Management Cycle, and the steps needed to build political will;
- Modules on sustainable financing and coordination of funding across agencies, and grants management;
- Modules on fostering high quality collaboration that includes essential elements of effective meetings, including effective dialogue, conflict resolution and decision-making;
- Modules on codification of good practices for CZM, marine protected areas etc. that are made available to staff and the subject of mini-courses and trainings (e.g. Code of Conduct for Responsible Fisheries (FAO, 2007)); and,
- Modules on dealing with persistent administrative barriers such as staff turnover, improved collaboration, and integration across agencies, and writing standard operating procedures.

Routine trainings are a well-established practice for building knowledge and skills for effective coral reef management and could feature a formal process for new staff (at all levels) to build a basic understanding of coral reef management issues and convey current knowledge and lessons learned so as to retain institutional knowledge. Here are many sources available for building a custom curriculum and lessons learned for structuring training modules. For example, the Coastal Resources Center at the University of Rhode Island is developing a set of modules for the certification of professionals involved with MPAs. Custom modules for three levels of participants (field operations, management staff and policy and decision makers) have been prepared, applied and tested in East Africa. The CRC/WIOMSA certification program is one source of training materials that may be appropriate for Guam.

### Produce Modules for Distance Learning

A set of pre-produced modules and resources are available from a wide variety of sources including Sea Grant, NOAA's Coastal Services Center, Center for Watershed Protection, International Waters Learning Exchange and Resource Network (IWLEARN), and UN Train Sea-Coast. There are a growing number of publications that would be useful in developing these modules to build capacity such as Reef Resilience Tool Kit, How's My MPA Doing,

Healthy Reefs Healthy Communities, International Waters Experience Notes, World Fish Centers Lessons Learned

1804, Great Barrier Reef 2009 Baseline, and GEF's capacity building programs.

## Strategies for Cultivating Local Leaders

To more effectively practice the ecosystem approach, the following six core competencies are necessary for practitioners:

- Competency in facilitation, mediation, stakeholders engagement, and public education;
- Competency in strategic design/improvement of stewardship initiatives;
- Competency in design and implementation of monitoring and evaluation in support of adaptive learning and acting;
- Competency in analysis of long-term changes in condition and use of ecosystems;
- Competency in analysis of governance structures and processes; and,
- Competency in building leadership required to influence political will.

Traditional approaches of peer-to-peer exchanges, learning journeys, and further investment in professional development is a worthwhile investment for leadership development. We recommend specific criteria to guide, encourage and reward emerging leaders. While a wide range of literature exists, the following set of leadership characteristics is useful to consider (NRC, 2008):

- Critical and reflective thinking and a willingness to challenge the status quo and invite inquiry into potential new ways of doing and seeing;
- Ability to see the big picture, as well as the parts and their interrelationships;
- Skillful and honest communication, including listening skills and the ability to speak and write with clarity, vision and purpose;
- Openness to the diversity of world views and perspectives and ability to make choices, especially when a decision goes against popular thought or opinion; and,
- Ethical foundation of word and action to navigate the political arena without susceptibility to corruption.

## Principles for Building Adaptive Capacity

- **Issues Drive Need for Building Capacity.** Building adaptive capacity needs to be directed at a set of issues, as described in this and earlier reports on coupled social biophysical issues relating to coral reef health. There should be direct links between the issues and this strategy. Issues should matter most to the people of the place and represent both challenges and opportunities. Issues change and may become more or less important over time and new ones will form in the coming years, some through crisis and others gradually over time. Therefore an adaptive strategy is needed to respond to the range of issues associated with management of coral reefs.
- **Define the Audience:** Once the issues are identified, an assessment of capacity needs should follow that is directed at the appropriate “levels” in the management system (field operations, managers, decision makers).

Capacities can be directed at an individual, groups, teams, organizations, and across networks. What matters most is defining who currently needs the capacity and who may need such capacity in the future.

- Focus on the Purpose of Building Capacity: Once the audience has been identified, the questions center around defining what capacity is needed and what it will accomplish. Identifying the competencies that are desired in precise terms is essential and best accomplished with clear and unambiguous goals.
- Context is Key: There is no “one” strategy to build capacity, and if one strategy works well in one location, it may or may not work well elsewhere. Given the complexities in coral reef management, bundles of capacity building strategies are needed that fit in the local context, are timely, appropriate and balanced across audiences. While basic capacity building needs in Guam are mostly similar across the territory, issues play out differently across the mosaic of contexts on Guam.
- Long-Term and Sustained Action, Built on Success: A long-term and sustained commitment to building capacity must address frequent staff turnover, shifts in the social, political and environmental issues, ongoing learning and the need for adaptation. Fortunately, such a long-term perspective seems to be evidenced across current federal, territorial and NGO partners. A long-term strategy must be built on successes within Guam to keep momentum strong.
  - Evoke purpose: “To build capacity to cope with and adapt to the long-term pace of ecosystem change that’s likely ahead and still have functional reefs to support a tourism economy, fishing communities and a unique way of life.”
  - Must understand current governance structures – what does exist – and what does not yet exist but may be needed.
  - Great progress has been made in developing a range of management responses to coral reef condition but the proper fit, interplay and scale of governance response to ecosystem change will be an issue into the future. We recommend using a range of effective diagnostic methods<sup>1</sup> to periodically assess the capacity to manage coral reefs and the governance structures within which they fit as a central feature of a long-term strategy.
  - Periodically review the issues (every three to four years) and the degree to which the issues are important to key stakeholders. Such an assessment should include a review of the power relationships, effectiveness of enforcement and compliance, BMPs and the degree to which there is formal commitment and supportive and constituencies for sustained coral reef management. Excellent facilitation is needed to host the dialogue and invite other key stakeholders from across civil society, market forces such as tourism and other forms of government to engage

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