MPA Management Challenges Through a Climate Change Lens

Desafíos para la Gestión de las AMPs a través de una Lente de Cambio Climático

Enjeux de la Gestion des Aires Marines Protégées à travers le Prisme du Changement Climatique

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ABSTRACT

The Gulf and Caribbean Fisheries Institute (GCFI), the US National Oceanic and Atmospheric Administration – Coral Reef Conservation Program (NOAA CRCP) are working with a group of nine MPAs in the Mesoamerican Reef Region to strengthen local management capacity to improve and maintain resilience of coral reef ecosystems and the human communities that depend upon them. This involves implementing tools and practices to more effectively observe, predict, communicate and manage climate change impacts within this biologically connected area of the Caribbean. The MPAs are working with partners, including at the Caribbean Community Climate Change Centre, and are actively building on existing experience related to climate change from the Pacific Ocean region.

KEY WORDS: MPA, climate change, adaptation, LEAP, Belize

INTRODUCTION

This partnership aims at addressing priority MPA management capacity-building needs that were identified through a capacity assessment completed in 2011 (Gombos et al. 2011). One capacity gap identified specifically was: integrating climate change resilience into management activities and design. In the assessment, GCFI and CaMPAM with support from NOAA's Coral Reef Conservation Program surveyed 27 MPAs in 10 Caribbean countries and territories about their perceived MPA management capacity and their highest priority needs for capacity building. The assisted self-assessment covered more than 20 indicators of MPA management capacity, including climate change resilience. MPA managers were asked to describe their current capacity based on three tiers (Table 1):

i) Little or no consideration of climate change resilience in the management of the MPA,
ii) Management includes actions intended to increase the resilience of coral reef resources to the effects of climate change, or
iii) Site is designed to increase resilience of coral reef resources to the effects of climate change and management includes actions necessary to avoid or minimize impacts and spread the risk due to climate change.

None of the MAR MPA managers reported that their site was designed to increase resilience of coral reef resources to the effects of climate change, nor did they report that management includes actions necessary to avoid or minimize impacts and spread the risk due to climate change (Table 2). Instead, there was a predominance of Tier 2 rankings among the participating sites, which indicated that there was scope to build MPA management capacity for increasing resilience to climate change. This project sought to help the participating MPAs improve their tiered ranking on this indicator.
GCFI consulted with the MPA managers who reported a need to consider strategies for ecological adaptation to build resilience to climate change by using a variety of approaches (e.g., expanding replenishment zones, incorporating nursery areas into the MPA, identifying the most resilient coral reefs in the MPA). Because enhancing conservation and improving MPA management hinges upon strong community support, the MPA managers also expressed a need to better communicate climate change science and impacts, and possible adaptation responses, in order to build stakeholder engagement and buy-in. Three ideas particularly resonated with the MPA managers:

i) Building stakeholder engagement via communication about climate change adaptation,
ii) Filling gaps in MPA management information through monitoring, and
iii) Shaping management decisions based on planning for resilience to climate change.

They concluded that viewing the management capacity priority needs through a climate change lens was valuable.

In February 2013, The Nature Conservancy (TNC) and NOAA's Coral Reef Conservation Program supported a learning exchange between MPA managers from the Caribbean to Micronesia to learn about a tool for supporting community climate change adaptation called *Adapting to a Changing Climate: Guide To Local Early Action Planning (LEAP) and Management Planning*. Guided by the findings of the capacity assessment (Gombos et al. 2011), the Toledo Institute for Development and Environment (TIDE Belize) was one of two Caribbean organizations that were invited to participate in the exchange. From their participation, they gained skills in how to (1) communicate climate change concepts, and (2) carry out engagement processes that lead to actions that reduce the vulnerability of natural resource and social targets of communities. Additionally the exchange aimed at sharing tools developed in Pacific projects with Caribbean participants to build skills, and collect feedback on how the tools could be used and modified for the Caribbean. As a result of this exchange, Caribbean MPA managers concluded that the Pacific tools were both applicable and needed to support building resilience of

Table 1. Tiered approach to describing MPA management capacity in relation to climate change resilience. (from Gombos et al. 2011)

Are you familiar with climate change resilience principles? YES / NO	
Tier 1	Little or no consideration of climate change resilience in the management of the MPA.
Tier 2	Management includes actions intended to increase the resilience of coral reef resources to the effects of climate change
Tier 3	Site is designed to increase resilience of coral reef resources to the effects of climate change and management includes actions necessary to avoid or minimize impacts and spread the risk due to climate change

communities adjacent to their MPAs.

REGIONAL CAPACITY BUILDING

In February, 2015 GCFI and the Toledo Institute for Development and Environment (TIDE Belize) hosted a 5-day regional workshop on climate change entitled "***Marine Protected Area Management Challenges Through a Climate Change Lens***". Funded by NOAA, the workshop was attended by more than 20 participants from nine marine protected areas in the Mesoamerican Reef region, plus 10 partner organizations including an observer from the Grenadines in the south-eastern Caribbean. Regional and international experts provided guidance on topics including coral reef bleaching, scenario modelling, tools for building resilience, and approaches to local climate change adaptation planning. The presentations and interactive exercises shared approaches to building both adaptive capacity of MPA stakeholders and guiding adaptive management strategies by the MPA managers to respond to climate change impacts. Specifically, the topics included:

i) Observing climate change impacts through coral reef monitoring by Paul Marshall (experience from Australia) –(Figure 1),
ii) Predicting and assessing climate change impacts through scenario planning by Bob Glazer (experience from Florida),
iii) *Communicating* and planning for climate change concepts with communities by Meghan Gombos (experience from Micronesia),
iv) TNC Reef Resilience Toolkit by Petra MacGowen (Global Network Experience),
v) Building MPA communications through Community Stewards by James Foley (Experience from the Toledo Institute for Environment and Development, Belize),
vi) Climate Smart MPAs by Britt Parker (Experience by the US National Oceanic and Atmospheric Administration), and
vii) Regional Climate Change Projections and Initiatives by Ottis Joslyn – (Experience from the Caribbean Community Climate Change Center, Belize).

One of the more confounding issues facing MPA managers is the uncertainty related to climate change impacts, especially as the science rapidly evolves. In part, the workshop focused on clarifying climate-change projections associated with 1.5° C and 2° C global warming for the Caribbean region, as well as the likely scope and scale of ecological and human impacts in the Caribbean under these projections. A key outcome of the workshop was the development of a Caribbean Climate Change Projections Cheat Sheet (Figure 2) which provided up-to-date scientifically-based projections for the region at a glance. This was developed through collaborative efforts

Figure 1. Paul Marshall presenting on Australian Reef Resilience Experience (Photo: P. Etienne, TIDE Belize)

Table 2. Tiered rankings on resilience to climate change from the CaMPAM MPA Management Capacity Assessment for Participating MPAs

Country	MPA Site	Tiered ranking on resilience to climate change
Mexico	Parque Nacional Arrecife Alacranes	1
	Parque Nacional Costa Occidental de Isla Mujeres Punta Cancún y Punta Nizuc	2
	Parque Nacional Arrecifes de Xcalak	2
Belize	South Water Caye Marine Reserve	2
	Blue Hole and Half Moon Caye Natural Monuments	2
	Port Honduras Marine Reserve	2
Honduras	Zona de Protección Especial Marina Sandy Bay-West End, Roatan, Islas del a Bahía	2
	Zona de Protección Especial Marina Turtle Harbour-Rock Harbour, Utila, Islas de la Bahía	2
	Monumento Natural Marino Archipiélago Cayos Cochinos	2

Impacts of 1.5° and 2°C Global Warming in the Caribbean Region
Projections provided are at the regional level

Climate Hazards	Caribbean Regional Projections	Impacts
Sea Level Rise	Studies show that the sea level has already risen around (10 to 20 centimeters) over the past 100 years. The sea level is projected to likely rise by around: • 13 cm (5 in) over the next generation (2030s), • 28cm (11 in) over the next two generations (2050s), • 100cm (40in) or more by the end of the century (2100 or four generations).	• Increased in flooding resulting in damage and loss of coastal homes and infrastructure. • Increased coastal erosion from higher storm surges especially when combined with storms, and/or high wave action. • Saline intrusion into coastal aquifers.*
Air Temperature	Average annual temperatures in the Caribbean will be roughly 1.5°C warmer by 2100*	• Impacts on human health and health systems related to heat stress if working outside or outdoor recreation. • Increased need for cooling systems and energy required for cooling. • Air temperature impacts sea surface, storms, and precipitation. • Increased evapotranspiration resulting in secondary impacts on water resources, agriculture, fisheries, etc.
Sea Surface Temperature	The globally-averaged temperature has risen by 0.74°C in the century (IPCC 2007), and if the current trend of accelerating global GHG emissions continues, a global ocean surface temperature increase of well over 2.0°C is a distinct possibility. Even if greenhouse gas emissions are stabilized in the near future, atmospheric CO2 that we have already placed in	• If temperatures reach 1 – 1.5 degrees higher than the normal maximum for more than 4-6 weeks you can expect to see corals bleaching. • Coral diseases have been a major factor in the decline of coral reefs in the Caribbean since the 1970s (Harvell et al. 1999). Thermal stress has been correlated with infectious disease outbreaks even at temperatures below those
	the atmosphere has committed us to at least 1°C of additional warming (for a total of 1.5 - 2.0°C) in this century.**	required to cause mass bleaching, especially high summertime temperatures (Bruno et al. 2007). • The oceans also absorb greenhouse gases such as CO2 which leads to ocean acidification. Coupled with sea surface temperature, these changes can have severe impacts on marine life (especially corals and organisms that have carbonate shells).
Rainfall Patterns	Total annual rainfall is expected to decrease by as much as 20% in most CARICOM countries	• Increasing demand for water for agricultural and domestic purposes (coupled with increased demand arising from population growth and changing consumption patterns). • Reduction in water quality through increased algal and bacterial growth in surface watercourses. • Reduction in groundwater recharge and river flows due to higher evaporation rates leading to drier soil conditions, exacerbating drought conditions. • Reduced rainfall will reduce the dilution of pollutants and wastes in watercourses and aquifers which could contribute to environmental degradation, health risks and the need for more intensive water treatment. This will be coupled with population growth and potentially increased or reduced environmental pollution depending on Caribbean countries policy choices with respect to water quality management.*
Storm Patterns	General - Storms are likely to get less frequent but stronger when they occur	• Combined with sea level rise - increased coastal erosion from higher storm surges especially when combined with high tides. • Increased in flooding resulting in damage and loss of coastal homes and infrastructure.
El Nino/La Nina – ENSO	El Nino years - Storms likely to get less frequent but more severe when they occur. During La Nina – conditions are wetter, storms are more frequent but weaker. It is unclear how ENSO will change with climate change.	• Impacts vary depending on ENSO years but related to impacts of storm and rain activity.

Figure 2. The Caribbean Climate Change "Cheat Sheet" developed at the GCFI/NOAA MAR Regional Workshop

Notes to Figure 2:

The ecosystem services (fisheries and tourism) provided by coral reefs in the Caribbean are valued at US$ 1.5-3.5 billion/annum. +2.0°C will rapidly degenerate the corals, resulting in the loss of these ecosystems and Billions of US$*

Projections provided are at the regional level. When down-scaled modeling was reviewed at the country under the Australia Caribbean Coral Reef Collaboration there was no significant variation in sea level rise, sea surface temperature, ph, air temperature, and bleaching risk between countries in the Caribbean. Variation in weather patterns are unclear.

*Ottis Joslyn power point *MPA Management Challenges Through a Climate Change Lens* At Toledo Institute for Development and Environment (TIDE). February 23-27, 2015

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of presenters Ottis Joslyn, Meghan Gombos, Paul Marshall and Britt Parker.

SITE-SPECIFIC FOLLOW-UP PROJECTS

Following the workshop, GCFI and NOAA continued to assist six marine protected areas with support for site-specific projects to address local needs related to climate change. In the cases of TIDE and Belize Audubon Society, local communities in the south of Belize (Monkey River and Punta Negra) and in the north of Belize (Chunox and Copper Bank) have had the chance to use the LEAP process adapted to their local conditions; they are the first communities in the Caribbean region to do so. In the process, they have considered future options ranging from retreat from the coast, major infrastructure projects, coastal habitat restoration, enhanced coral reef protection, and alternative livelihoods options. The development of alternative sustainable livelihoods has received further financial support in the form of business training and microgrants for new small enterprise development in these communities, via support from GCFI and NOAA CRCP.

In Honduras, the Marine Natural Monument Archipelago Cayos Cochinos is working towards implementation of a program based on the TIDE community stewards program with the goal of enhancing understanding of the importance of protected areas and to help build compliance with regulations. Roatan Marine Park is using existing data on coral reef health together with climate change projections to prepare a local outlook for climate change and its implications for MPA management to share with decision makers and local stakeholders.

In Mexico, Parque Nacional Arrecifes de Xcalak has teamed with GCFI to understand the effects of climate change on the lobster fishery and implications for management. Off the north of the Yucatan Peninsula, Parque Nacional Arrecife Alcranes is addressing a need for coral reef monitoring data by applying a simple methodology (Rapid Resilience Assessment Protocol) from Australia's Great Barrier Reef in order to prepare a snapshot of climate change vulnerability.

LOCAL EARLY ADAPTATION PLANNING COMMENCED IN BELIZE

Through the regional capacity-building project the participating MPA managers from Belize identified the need for communicating climate change concepts and gaining stakeholder engagement in understanding and planning for a changing climate. A joint project with TIDE and Belize Audubon Society aimed to strengthen stakeholder awareness and community-based engagement in climate change adaptation planning to ultimately improve resilience of coral reef ecosystems and the communities that depend upon them. To do this, the Belize project was designed to train a team of community facilitators and local non-governmental conservation organizations on the use of the LEAP tool being used throughout the Pacific Islands to conduct outreach and adaptation planning at the community level.

A training workshop entitled 'Community-Based Climate-Change Adaptation' was held in Punta Gorda, Belize following the *regional* climate change workshop. This training focused on implementing the LEAP tool and was a collaboration of TIDE Belize, the Belize Audubon Society (BAS), and the Belizean communities of Monkey River, Punta Negra, Sarteneja, Chunox, and Copper Bank. It was funded through the GCFI and the NOAA CRCP. Approximately 15 people attended the workshop held at the TIDE office. Participants included community facilitators from the five partner communities, as well as representatives from the partner organizations such as the Southern Environmental Association (SEA), and Toledo Tour Guide Association (TTGA). The workshop's goals were to 1) provide participants with the necessary skills to effectively communicate climate change concepts and foster adaptation planning, and 2) develop a timeline for participants to complete outreach in at least two communities within six months. The 4-day workshop included training on the use of outreach materials, and participatory activities that support an understanding of various threats to natural resource and social systems including climate change. Key messages included the causes of climate change and how there will be less negative impacts from climate change where there are fewer existing threats to natural and social systems. For example, a community that maintains healthy mangroves and reefs will experience less coastal flooding and erosion from storm surges (that will worsen over time with sea level rise) than a community that has cleared mangroves and damaged reefs. Using this approach, a "local climate story" can be developed through this outreach process to identify which climate change impacts the community is most concerned about and why. Participants visited Monkey River to begin discussions with community members about local planning for climate change and also to better understand non-climate threats the community is facing that could be exacerbated with climate change (Figure 3).

A second phase of the project is planned for November 2015 to develop local early action plans in these communities. These plans will identify priority actions the community wants to take to build resilience to climate change and

Figure 3. TIDE and BAS staff presenting outreach to Monkey River Community. (Photo: M. Gombos)

other threats to their social and natural systems.

DISCUSSION

There is no doubt that climate change will have a profound effect on marine protected areas in the Caribbean. There will be numerous impacts to both coastal and marine resources and to the communities that are tied closely to those resources. How coastal communities respond will be critical to increasing their resilience and ensuring their sustainability. Yet, uncertainty of both the future conditions, and the tools available to confront that uncertainty, is often justifiably a recipe for inaction. Nevertheless, those tools exist. One of the great challenges we face as a network of practitioners is ensuring that the capacity it developed within those communities so they are best able to address the changes that are confronting them. The projects we describe were designed to do just that.

However, as we learned, it was important to use the best tools available which, in some cases, meant adapting tools developed elsewhere to the specific and unique conditions within which this project was conducted. For example, several lessons were learned about adapting the LEAP process from the Pacific region to the Caribbean region. In Belize, a productive starting point for community consultation was to consider extreme local weather events (i.e. hurricanes, extreme tides, drought) from past fifty years. Participants were able to identify some of the major weather events, describe the damages associated with them, and explain how the community was impacted by, and recovered from, these events. In another step, they explored trends they are noticing in climate through changes to normal seasonal events (e.g. wind patterns, precipitation, fruiting, migration patterns). They were able to demonstrate the change on an annual calendar, which the MPA staff had previously learned about through socio-economic monitoring training using the SocMon protocol (Bunce and Pomeroy, 2003). The communities are experiencing changes in seasonal weather patterns but are not consciously looking for actions to adapt to these changes because they (1) focused on the short-term, and (2) the changes are perceived to be fairly minor.

The LEAP project work continues into 2016 and includes discussions about long-term scenarios, a sometimes difficult subject matter for which communities are not necessarily ready to plan. This is common and understandable for certain topics that are extremely challenging and sensitive (e.g. relocating homes to safer locations, changing jobs). For example, when the communities think about opportunities, they often focus on improving household income rather than long-term sustainability. In response to this, the project was designed in part to help promote alternative and sustainable livelihoods thus reducing reliance on natural resources which are threatened under a changing climate. However, these discussions provide a necessary step in raising awareness and speak to the need to continue the dialogue to foster a long-range planning environment. Clearly a change in ethos is necessary.

CONCLUSIONS

Based on the series of workshops, the participating MPAs now have an increased understanding of the tools and resources that are available to help them better understand and plan for an uncertain future. They are now better informed about the range of available biophysical products (e.g., NOAA's sea surface temperature and coral bleaching data) and better equipped to use these for adaptation planning. For example, they can now effectively use NOAA's Coral Reef Watch Bleaching Alerts to aid development of robust response plans. This is particularly timely in the context of the predicted 2015-2016 extreme El Niño. Together with other MPA management capacity-building efforts such as practical law enforcement training for MPA rangers, the community-based activities associated with climate change adaptation are serving to more effectively engage local stakeholders and help build compliance with both MPA and fisheries regulations. These efforts represent an important step forward in identifying and implementing actions to address climate change in the Caribbean, especially considering the intangible benefits of networking among these ecologically connected MPAs.

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