

Hurricanes and corals in Southern Belize: from science to management and policy development

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Abstract. Although capacity building can potentially empower local communities with the ability to tackle socio-economic impacts of environmental change, evaluations of Integrated Coastal Zone Management (ICZM) performance can reveal limited interests in advancing community developments. This weakness has been apparent in Southern Belize ICZM, where there has been lack of communication between government ministries, local Non-Governmental Organisations (NGOs), and local communities. To address this, we undertook a capacity building exercise which involved all these sectors in Southern Belize, and developed a series of learning outcomes, linked to scientific goals. Surface areas of 523 individual coral specimens were measured, and recruitment dates were then modelled. We showed that hurricanes and severe storms limited the recruitment and survival of massive non-branching corals of the Mesoamerican barrier reef and on patch reefs near the Belize coast in the Caribbean, and suggest that marine park managers may need to assist coral recruitment in years where there are hurricanes or severe storms. From this scientific base, our project successfully engaged government and community-based partnerships in delivering realistic goals for the future of ICZM in the region.

Key words: tropical storms, cyclones, climate change, global warming, coral growth, fisheries, conch, lobster, snapper, community education, empowerment.

Introduction

Capacity building by engagement has been used in many communities where there are inherent and long-standing challenges to sustainability (Crabbe 2006), for example in Marine Protected Areas (MPAs) (Chircop 1998). While many, if not all, capacity-building programmes involve building competencies and empowerment in local communities, fewer involve policy makers or government officials (Mequanent and Taylor 2007). Capacity building is widely recognised as a central feature of Integrated Coastal Zone Management (ICZM) (Balgos 2005). However, although increased community capacity can potentially empower local communities with the ability to tackle socio-economic impacts of environmental change, evaluations of ICZM performance can reveal limited interests in advancing community developments. This weakness has been apparent in Southern Belize ICZM, where there has been lack of communication between government

ministries, local Non-Governmental Organisations (NGOs), and local communities.

Since the Rio declaration on Environment and Development in 1992, the emphasis on capacity building and the transfer of technological knowledge and scientific understanding has encompassed four areas: legal and administrative capacity, financial capacity, technical capacity, and human resources capacity (Cicin-Sain and Knecht 1998). We wished to address the last two of these areas in Southern Belize by strengthening local research facilities and developing local communities' capacity to conserve and manage marine living resources (Wescott 2002). While developing capacity for coastal management has been achieved in the absence of government (Jorge 1997), we wished to involve the Belize government fisheries department in our study in order to facilitate future policy development.

This paper describes the development of a series of learning outcomes, which, for the first time, engaged government and community-based partnerships in

delivering realistic goals for the future of ICZM in the region. This paper examines three key areas specific to the Southern Belize MPAs:

1. Needs to address for the marine reserves
2. Tactics for leading, educating and supporting issues regarding sustainable development in Southern Belize
3. Development of policy issues for a better marine resource management zoning plan.

Material and Methods

There are two major coral reef areas in Southern Belize, the Sapodilla Cayes Marine Reserve (SCMR, a World Heritage Site), and the Port Honduras Marine Reserve (PHMR) (Fig. 1). The SCMR is a 125 km² reserve that has been under collaborative management between the Belize Fisheries Department and the Toledo Association for Sustainable Tourism and Empowerment (TASTE) since its declaration in 1996. The PHMR is a 414 km² reserve, and has been managed by the Toledo Institute for Development and Environment (TIDE) since its declaration in January 2000.

figure, is close along the coast near Punta Gorda Town, and includes Frenchman’s Cay and the Snake Cayes. Adapted from Crabbe et al. 2008a.

The key aims and objectives of the capacity building exercise were:

1. To increase the Belizean participants’ capacity to lead, educate and support issues regarding sustainable development in Southern Belize; and
2. To promote networking throughout organizations managing marine resources, enhancing their power to collectively influence policy decisions in Southern Belize.

The capacity building team consisted of one officer from the Belize Fisheries Department, three senior officers from NGOs involved in managing Belize MPAs (TIDE, TASTE and Friends of Nature), and a Facilitator from the UK. These individuals were chosen because they had direct contact with both NGOs (Non-governmental organisations) and CBOs (Community-based organisations), and the government Fisheries Department, thus maximising



Figure 1: Coral reef Marine Reserves in Southern Belize. The Sapodilla Cayes Marine Reserve (SCMR), in dark grey shading to the left of the figure, comprises the southern end of the MesoAmerican Barrier Reef, and includes Seal Cay, Frank’s Cay, Nicholas Cay, Hunting Cay and Lime Cay. The Port Honduras Marine Reserve (PHMR), in dark grey shading to the right of the

exposure of capacity-building while keeping the numbers of participants within workable limits. Scientific measurements on coral reef colonies were conducted by the participants as described (Crabbe et al. 2008a). Daily meetings, lasting between 1-2 h,

took place on Lime Caye in the SCMR, Abalone Caye in the PHMR, and in Punta Gorda Town, over a 10-day period in August 2007 (Crabbe et al. 2008b). Discussions, led by the Facilitator, employed a modified nominal group technique (Sample 1984) to identify priorities related to personal action plans. Four rounds were employed; round one was based on the Delphi technique and further rounds on the nominal group technique approach (McCance et al. 2007). Specifically, after initial meetings which revolved around frank discussions on the interface between the Fisheries Department and MPA management by NGOs, each participant developed a personal action plan to facilitate and improve the sustainability of the MPAs in Southern Belize. There was repeated iteration of these plans between the participants, and the final production of a policy proposal for sustainable management of the marine reserves, Sapodilla Cayes and in Port Honduras.

Results

Our scientific work, described in Crabbe et al. 2008a, showed that for both the PHMR and the SCMR, there were significantly more non-branching massive corals recruited in non-hurricane years (mean 7.7 ± 5.6) than in hurricane years (mean 3.8 ± 2.9 ; $p=0.011$). When years with tropical storms are added to the years with hurricanes, there was significantly lowered coral recruitment (mean 4.7 ± 4.3) relative to non-storm or hurricane years (mean 7.4 ± 5.7 ; $p=0.019$).

The group then went on to develop personal action plans (Crabbe et al. 2009) and a set of learning outcomes by which the partnerships between government, NGOs and communities can improve ICZM. The learning outcomes are itemised below:

1. Management plans need to be passed into law. The involvement of the government fisheries officer as a partner is key to this outcome.
2. Zonation needs to be re-designated to balance stakeholders' wishes and evidence-based fisheries catches.
3. Participants will develop a community-based research programme.
4. Data need to be more accurate in the future.
5. Co-management plans between NGOs, communities and the Fisheries Department need to address the problem of illegal fishermen from outside Belize (Guatemala, Honduras) as well as from Belize.
6. Regular public meetings of stakeholders need to be fostered, as do regular education events.
7. Effectiveness of zoning needs to be quantified.
8. Alternative livelihoods for fishermen (e.g. in the tourist industry) needs to be fostered and maintained.
9. Tourists need to be monitored.
10. Effective management needs to be linked to the Belize economy. Fishing (conch, lobster, snapper,

particularly in Southern Belize,) is an important part of the country's Gross Domestic Product (GDP).

11. NGOs need to link together.

12. Regular information sharing with all stakeholders, from the politicians to the local communities, needs to be maintained.

Discussion

Multiple stressors, hurricanes and bleaching, have caused significant disturbances to populations of coral recruits in Belize (Mumby 1999; Crabbe 2009). While we have not measured coral recruitment directly in this study, our modelling work has shown that hurricanes and severe storms have limited the recruitment and survival of massive non-branching corals on the fringing reefs near Discovery Bay (Crabbe et al. 2002; 2004), and here we show that the same is true for non-branching corals of the Mesoamerican barrier reef in the Sapodilla Cayes, and for corals on patch reefs in the Port Honduras Marine Reserve near the Belize coast in the Gulf of Honduras. What our work suggests is that marine park managers may need to assist coral recruitment and settlement in years where there are hurricanes or severe storms, by setting up coral nurseries (Forsman et al. 2006) and/or natural or artificial high rugosity substrate on the reef (Crabbe et al. 2008a).

Marine Reserves are an important tool in sustainable management of the Belizean coral reefs (Cho 2005; Williams and Polunin 2000). However, it is important that they share regulation, enforcement and conservation, underpinned by scientific research. We have already successfully transferred scientific expertise to Belizean participants for their use in generating scientific evidence to underpin future management and conservation decisions (Crabbe et al. 2009). Here, we have identified a number of key issues in marine reserve management in Belize that need to be addressed. Those issues, and the tactics employed by the participants in this project, will help ensure renewal of policy developments appropriate to the marine reserves in Belize.

The need for case studies in building integrated coastal management capacity has been powerfully made (Hills et al. 2006). Our study reinforced the idea that co-operative research improves capacity building and encourages innovative approaches to management, as has been found in northeastern USA, northwestern Europe, and coral reef MPAs (Johnson et al. 2007; Christie and White 2007). All participants felt that training and capacity building to key staff members are important, since this enables them to enhance their skills in the field and thus raise their standards to a certain level so as to perform better. They felt that this has been lacking in staff members of marine parks in Belize.

To date all 12 learning outcomes have been addressed by the local participants. A key positive outcome is that the NGOs TASTE, - TIDE and Friends of Nature have been incorporated into a single NGO, which spans four MPAs in Southern Belize. This means that areas between MPAs which were subject to illegal fishing activity will now be monitored and policed. The merger will enable assessment and enforcement across four different MPAs (Gladden Spit Marine Reserve, Laughing Bird National Park, SCMR and PHMR).

Developing ethical capacity for collaboration in the future (Coffin 2005) will need both resources and iteration over several years, and will involve a delicate balance of 'top-down' and 'grassroots' participation (McDuff 2001; Wescott 2002; Mow et al. 2007) to enable sustainable management. There were two issues that will need addressing in the future: the lack of involvement from the political arena, and 'local' Universities in the study. This paper shows that in Southern Belize conservation partnerships can come together with government to improve ICZM.

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