

Capacity Development and Management of Coastal Waters in the Caribbean Region

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1. Context

The Wider Caribbean region, as defined in the Cartagena Convention, includes those countries and overseas territories that border the Caribbean Sea, the Gulf of Mexico, and parts of the western Atlantic immediately adjacent. These 36 entities range from the United States to small, impoverished developing countries, and include a group of 13 continental, and 23 island states and territories (Barker, in press). The latter may have bountiful or very limited supplies of freshwater, while the former are generally adequately to well supplied.

The region's population of over 100 million is predominantly coastal, usually urban or suburban, and characteristically used to relying on the ocean's capacity to dilute as a way of dealing with biogenic, agricultural and industrial wastes. The coastal waters contain a rich diversity of life, and, while the Caribbean is not highly productive, its waters provide very important protein-rich food for local populations, economically important commercial fisheries, and environments that support a widespread coastal tourism industry. Tourism ranks, for all these countries, at or close to the top in importance as an industry. It brings an additional 100 million people to the region annually (Barker, in press) to enjoy the coastal marine environment, including the beaches and coral reefs that can only be sustained if that environment is sustainably managed.

The strong concentration of human population and economic activity along coastlines, and the tendency to dispose of wastes in the ocean, ensure that there are major challenges faced by those charged with managing the coastal marine environment in all these countries.

These challenges include 1) the sustainable management of multi-species, multi-gear, multi-landing-site fisheries (the most difficult type to manage), 2) the protection of endangered or threatened species and their sometimes fragile coastal marine habitats, and 3) the maintenance of high water quality. A satisfactory solution to challenge 3) is vitally important to solving challenges 1) and 2).

The nations and territories of the Wider Caribbean vary greatly in their capacity to achieve sustainable environmental management, as well as in the extent of their coastal ocean problems. However, few if any can afford to be complacent about their relative success in this sphere. The Mississippi River drains 40% of the landmass of the United States into the Gulf of Mexico, and is responsible for a "dead zone" 20,000 km² in area where the ocean floor is devoid of living organisms. In the Florida Keys, with an economy driven by coastal tourism, and with major efforts in environmental management in progress, concerns about the ability to maintain/improve water quality are never far away. Parenthetically, efforts now under way to restore the Everglades, by increasing the flow of freshwater through this 600,000 ha wetland towards historical levels, are causing new concerns because the lowered salinity of Florida Bay that will result will have unknown impacts on the coral reefs and other environments of the Keys. Many island nations in the region, with far fewer economic and technical resources at their disposal than the United States, nevertheless, have problems that are no worse than those in Florida because they are "blessed" by lower population density, less extensive tourism, and (in some cases) freshwater supplies so limited that they demand conservation, ensuring that the transport of wastes to the ocean is lessened.

The current patterns that generally move water through the Caribbean Basin from southeast to northwest, with meanders and gyres along the way, and those that circulate some of this water into and around the Gulf of Mexico, ensure that water quality and other environmental problems do not respect national borders. The dispersal of pelagic larval stages of many marine organisms, and the extensive migrations of some, also ensure that problems of environmental quality in one location can have important effects in distant locations. Fishing, the principal resource-extractive activity in these coastal oceans is international in scope, whether through recognized granting of fishing rights or through poaching. Fishing activities have, of course, many environmental impacts, including habitat alteration and reduction of standing stocks of important predators and herbivores. Predicting where “downstream” consequences of poor environmental quality will emerge to affect fisheries, tourism or

conservation efforts is very difficult. Only now are biologists beginning to develop the necessary tools to determine the degree of inter-connection among populations of economically important or rare and endangered species (Sale and Ludsin, in press).

Governments in the region, as well as United Nations and other international agencies, early recognized the interdependence of Caribbean nations when it comes to managing coastal ocean waters (Barker, in press). The result has been the development of a network of organizations, multinational agreements, and other legislative instruments that support the sustainable management of the coastal seas (Table 1). Despite this framework, limits of human and other resources, the rapid pace of development, population growth, and, often, lack of political will all conspire to limit the ability of individual nations to live up to the agreements that they have signed.

Table 1. Multilateral Environmental Agreements in the Wider Caribbean

1971	Convention on Wetlands of International Importance especially as Waterfowl Habitat (RAMSAR Convention) (Global)*
1973	International Convention for the Prevention of Pollution from Ships (MARPOL Convention) (Global)
1975	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Global)
1976	UNEP Regional Seas Programme for the Wider Caribbean Region
1979	UNEP Caribbean Environment Programme (CEP)
1982	United Nations Convention on the Law of the Sea (UNCLOS) (Global)
1983	Cartagena Convention, and its First Protocol: Co-operation in Combating Oil Spills in the Wider Caribbean Region
1990	Protocol concerning Specially Protected Areas and Wildlife (SPAW Protocol of the Cartagena Convention)
1992	United Nations Conference on Environment and Development (UNCED), Rio Declaration and Agenda 21 (Global)
1992	Convention on Biological Diversity (CBD) (Global)
1995	Global Programme of Action for Protection of the Marine Environment from Land-based Activities (GPA) (Global)
1999	Protocol Concerning Pollution from Land-Based Sources (LBS Protocol of the Cartagena Convention)

* Global agreements are noted, others are specific to the Caribbean region.

2. Current State of the Coastal Environment

Throughout the region, efforts to manage coastal ocean environments sustainably arise for four reasons: to manage fisheries sustainably, to protect endangered species, to protect/conservate biota and ecosystems more generally, and to ensure that tourism, based on access to a clean, coastal environment, can be sustained or grow. These efforts are usually driven by NGOs, including small local organizations that are formed to tackle specific perceived problems, and large, international NGOs such as The Nature Conservancy (TNC) and the World Wildlife Fund (WWF) that frequently form partnerships with local NGOs when tackling local problems. Less commonly, they are driven by governmental management agencies charged with managing fisheries or environment. Seldom are they driven by industry (whether fisheries or tourism), although enlightened views are becoming more common, particularly in the tourism sector.

The most commonly used approach for sustainable management is the creation of Marine Protected Areas (MPA) of various types, analogous to protected areas on land that serve to conserve and preserve examples of high quality ecosystems. A more ambitious but still spatially explicit approach is to begin by delineating and ranking coastal systems in terms of priority for conservation action, and then progress to the development of management proposals. An example of this approach is the effort by WWF to set priorities for all of Latin America and the Caribbean (Sullivan Sealey and Bustamante 1999). Both of these approaches begin by identifying locations worthy of conservation, and these are usually locations that are not already heavily impacted. This is conservation, not remediation.

The site-specific, conservation approach does not address impacts at a location due to events happening upstream. Far less common are actions that serve to restore quality by changing the way in which waste products are handled, so that they do not get flushed into the coastal ocean in excessive quantities. This

is true despite the existence of agreements such as GPA, and the LBS Protocol (Table 1) to which these countries are signatories. Reasons for this evident failure are not hard to find, and they are common to developed as well as developing countries well beyond the Caribbean. That wastewater management, agriculture, and industry are usually the responsibility of governmental departments with no particular relationship to those responsible for coastal marine environmental management and fisheries management is contributory to this lack of attention. So is a 2000 year-old Western tradition of seeing waste disposal as a health and safety rather than an environmental management problem.

The marine management challenges in the Caribbean Region are diverse. In addition to a need for conservation of diverse but fragile ecosystems including rare and endangered species, and the need to sustainably manage intensive fishing activities, there are needs relating very directly to water quality. Establishing an MPA does not directly protect that site from poor, or deteriorating, water quality, and efforts to address remote sources of contaminants have been few.

In pointing out the deficiencies of MPAs, I am not advocating that MPAs should be avoided. There is no doubt that greater efforts to protect coastal marine environments and their biota are needed. There is abundant evidence that MPAs, provided there is adequate enforcement and compliance, do result in heightened abundance and biomass, and greater longevity of many species (Murray et al. 1999). These factors should correlate with heightened fecundity within the MPA, and therefore with subsequent enhancement of populations outside the MPA borders. This is due to two processes: spillover of animals moving out across MPA borders, and recruitment subsidy of other populations through the export of larval stages (Sale and Ludsin, in press). Nevertheless, it would be wrong to pretend that MPAs are a mature tool in the kit of environmental managers, or the only tool required. Far from it. As well as not addressing such things as poor water quality arriving from

Table 2. The Four Pillars of Capacity Building

The capacity to educate, train and raise awareness
The capacity to measure and understand aquatic systems and the environmental impacts on them
The capacity to legislate, regulate, and gain compliance for environmental protection
The capacity to provide services, support, and products necessary for sustainability

outside the protected area, few MPAs are established on the basis of sound scientific data concerning their location, size, and specific biota or habitats to be protected (Sale and Ludsin, in press). Instead, they are usually established through the advocacy of NGOs and/or individual conservationists, at sites selected for their specific features, frequently on aesthetic grounds.

Throughout the Caribbean region, sewage treatment is usually primary only, and there are many rural communities still relying on septic tanks (at best) that are not always in compliance with best practices. Agricultural chemicals are a major problem in regions of higher rainfall and the presence of chemical-intensive banana, citrus, sugarcane, and oil-palm agriculture. Heavy industry, including oil extraction, refining and shipping, causes problems in specific locations. Tourism, where it is highly developed, such as in Cancun (2,500,000 visitors per year, generating 25% of Mexico's tourist income), greatly increases the delivery of freshwater to the ocean, relative to the situation prior to development. The consequences vary depending on whether the water is derived from desalination, or is imported by pipeline from distant sources.

3. Assessment of Capacity Needs

To explore capacity needs, an example is taken from the western Caribbean, namely Belize, bordered on the north by Mexico, and on the south by Guatemala and Honduras. It is neither the best nor the most deficient case in the region. Capacity needs are assessed using the UNU-INWEH 'four pillars' of human and

institutional capacity (Table 2) that form the basis for the Managing Shared Waters Conference. Much of the following is drawn from information in Jacobs and Castañeda (1998), Sale et al. (1999), and Wilkinson (2000). Other information is taken from various web sources.

3.1 Belize

Belize is a small, developing country on the western Caribbean coast with an excellent reputation in conservation of marine and terrestrial ecosystems. Basic economic, demographic, and political facts are provided in Table 3. The country has responsibility for territorial seas equal in size to its land area, and boasts the largest barrier reef in the Caribbean — the Belize Barrier Reef. This is the primary, central part of what is now being termed the Mesoamerican Barrier Reef System, stretching over 1000 km south from Isla Contoy on the northeastern Yucatan Peninsula of Mexico, through Belize and Guatemala, and on to the Bay Islands of eastern Honduras. Tourism is the major industry, now outstripping fisheries, forestry and agriculture combined. Eco-tourism is an important sub-sector. Belizeans definitely do not want to see their country become a "Cancun South," although they also worry that they are being 'left behind' by other countries willing to offer foreign tourism operators greater inducements to develop hotels and other infrastructure. The largest city (60,000 population), Belize City, is situated on the delta of Stan Creek, inshore from the coastal lagoon and the barrier reef. Other urban centers are small and 52% of the population is rural. In contrast to most Caribbean countries, only about 50% of

Belizeans live on the coast. There is one tertiary educational institution (University of Belize) that was elevated from College to University status only in 2000, and a history of talented individuals leaving the country to obtain higher education, and remaining for better employment opportunities in Mexico or outside the region.

Responsibility for marine environmental management falls to the Department of Fisheries, within the Ministry of Agriculture; however, because some MPAs were created around significant terrestrial sites, they have been established under a variety of legislative acts and many are the management responsibility of other departments, such as Department of Forestry.

Despite Belize's 'green' reputation, its MPAs (ca. 21) have been established almost entirely through the advocacy of NGOs such as the Belize Audubon Society, and management of many of them has been ceded back by government to the NGOs that fought for their establishment. Whether managed directly by governmental agencies (Department of Fisheries) or by NGOs, MPAs are severely underfunded, partly because while the 'user pays' principle is broadly accepted, there is considerable reluctance to levy taxes on hotel use because of the fear that this will drive tourists to other destinations. The country's airport departure tax of US\$20 purports to

provide 50% for support of environmental conservation, but flow of these funds towards MPAs is not transparent (Sale et al. 1999).

The Coastal Zone Management Institute developed initially as a grant- and contract-funded agency promoting coastal zone management projects. In 1998, the government established the Coastal Zone Management Authority, of which the Institute became the technical and research arm (together: CZMAI). This small governmental unit is the only agency dedicated to coastal marine management in the broadest context, and is unique in the western Caribbean. However, CZMAI is poorly funded, dependent continuously on securing international grants and contracts to continue its technical work, and has very limited authority. Its role is to work with, encourage, and persuade line management agencies to act in ways that promote sustainable coastal management. Despite its funding limitations and limited authority, however, CZMAI is a crucial element in the furtherance of sustainable coastal zone management in Belize. Its modest monitoring program for water quality is the only systematic, sustained attempt to monitor water quality in the western Caribbean region (Sale et al. 1999).

Problems impinging on the coastal waters of Belize that cannot be controlled by the declaration of more MPAs are 1) the unknown effects of agricultural chemicals and other

Table 3. Belize — A Small, Developing Nation

Area	22,960 km ²
Coastline	386 km shoreline, and 23,660 km ² of territorial seas
Population (2001 data)	256,000, about 50% coastal (lowest density in Central America) Growth rate 2.7%, 43% of population < 14 years Life expectancy 71.9 years Literacy rate 70%
Economy (2000 data)	Agriculture, Forestry, and Fisheries 20% of GDP Tourism 19% of GDP Manufacturing 17% of GDP
Political system	Stable parliamentary democracy
Responsibility for coastal management	Department of Fisheries Coastal Zone Management Authority

pollutants flushed out into the large coastal lagoon by the several major rivers in the country, 2) the impacts of pollutants impinging from Chetumal Bay to the north of Belize, and from the Gulf of Honduras to the south, and 3) broad-scale impacts on the coral reef biota due to global warming, various coral diseases, hurricanes, and the slow degradation of ecosystems stressed by a broad range of human activities, ranging from overfishing to inadequate environmental control over coastal construction.

3.2 International Agreements and Programs

Belize has been an active participant in the various international efforts in the Caribbean region. It is a signatory to all agreements listed in Table 1, and completed its National Biodiversity Strategy and Action Plan in 1998. It is an active participant in a number of international development projects relating to coastal marine management, including CARICOM Fisheries Resource Assessment and Management Program (CFRAMP), Caribbean Coastal Marine Productivity Program (CARICOMP), Caribbean: Planning for Adaptation to Climate Change (CPACC), and, most recently, Conservation and Sustainable Use of Mesoamerican Barrier Reef System (MBRS/SAM).

CFRAMP, a 10-year project established in 1991 with Canadian and local support, aimed to enhance basic information and institutional capacity for fisheries management in the 12 English-speaking CARICOM nations. Its headquarters was within the Fisheries Department, Belize, and a broad range of activities were carried out to build skills and awareness of the fishing communities in all 12 countries, and to improve fishery data collection and management in the region.

CARICOMP is a financially more modest, but continuing, undertaking that commenced with meetings in 1982 and 1985. Its goal is to build a Caribbean-wide environmental monitoring network by taking advantage of the existence of research facilities, parks and reserves

throughout the Caribbean. CARICOMP's data management centre was established at University of the West Indies, Jamaica, in 1992, and the program currently has some 29 sites in 22 countries at which basic environmental monitoring of reef, seagrass, and/or mangrove communities is done. The lack of secure funding, particularly in the first few years, combined with the usual ebb and flow of people and resources at small, underfunded facilities, has meant that CARICOMP has not been fully successful in sustaining monitoring activity at each of its sites. Nevertheless, a growing database is emerging.

The Belize Department of Meteorology is the lead agency in the country for its participation in CPACC, a World Bank/OAS funded project to improve the capacity to monitor climate, sea level, and the coastal environment. Other Belize agencies participating are the Department of Fisheries and the Coastal Zone Management Institute. As with other international projects, human capacity building is an important part of CPACC, which includes four regional components in which all member countries participate: 1) to install a number of tide gauges and weather stations, 2) to establish a regional data center, 3) to compile an inventory of coastal resources and uses, and 4) to formulate policy for coastal and marine management. Belize also participates, with Jamaica and the Bahamas, in a fifth component — coral reef monitoring. (In Belize, reefs at Hol Chan Reserve, Glovers Reef Reserve, and the coastal community of Dangriga are being monitored for CPACC.)

MBRS/SAM entered its implementation phase only in 2002. It includes Belize, Mexico, Guatemala and Honduras in a project designed to improve environmental management of coastal waters throughout that region. Again, the project includes efforts to build monitoring programs and regional data, while also building human capacity in each country. Each of these international programs also helps to build a broader, regional perspective among participants, in contrast to the very local perspectives that tend to develop when projects are focused on a single MPA or other local site.

3.3 *The Capacity to Educate, Train and Raise Awareness*

Belize has very limited capacity for tertiary level technical training, although the University of Belize may be able to grow to fill this role with time. At present, there is a shortage of highly trained individuals in the country, and considerable difficulty in retaining individuals who get the opportunity for advanced education outside its borders. In this respect, typical international development projects that take small numbers of gifted individuals away for advanced training may not be of much value to Belize, unless there are rules in place, and enforced, requiring individuals, once trained, to return to Belize for a specified period of service. The current lack of qualified individuals in all technical fields (water quality analysis, environmental assessment, database management, etc.) impacts the capacity of governmental agencies to fulfill their responsibilities.

3.4 *The Capacity to Measure and Understand*

The Belize management and conservation community includes a number of individuals with some expertise in routine environmental assessment procedures, and considerable enthusiasm for implementing monitoring programs. What is lacking are 1) individuals with the skills necessary for more complex environmental assessment tasks, 2) modestly sophisticated instrumentation, 3) adequate computer systems and data management software, and 4) individuals who understand and can articulate the reasons for monitoring environmental quality, the kinds of measurements to make, and the ways in which accumulated data can be used in decision support for improved environmental management. The Belize Ministry of Natural Resources and Environment includes the small Land Information Center (LIC) with expertise in geo-referenced environmental data, and a growing database. However, the LIC limits itself to the lands of Belize, and has no expertise in marine environmental assessment. Only CZMAI, with limited personnel and funding, has some capacity of the type needed.

3.5 *The Capacity to Legislate, Regulate and Achieve Compliance*

Like most developing countries, Belize has more problems than it has funds and people to solve them. The governmental agencies concerned with environmental management contain a number of dedicated, hard-working individuals, and some who have little interest in what they are doing. Much of the needed legislation is in place, and there are continuing efforts to amend legislation to eliminate overlapping responsibilities, and build more effective sets of administrative instruments. Still, capacity to regulate and gain compliance is weak, and political will to improve this situation may be weaker still. Some senior individuals in government agencies give the impression that environmental management and conservation is the responsibility of the NGOs and the international community rather than the government. They express interest in having environmental management improved, and claim a strong commitment to environmental sustainability, knowing that someone from outside may step forward with funding and expertise. One must be careful not to judge such people too quickly because governments of developing nations usually struggle from one crisis to another, and sustainable environmental management does not get much of a hearing in such circumstances. Nevertheless, in a country in which tourism accounts for almost 20% of GDP (a growing proportion, and one equal to that for agriculture, forestry, and fisheries combined), and depends strongly on the attractions of the natural environment, it is short-sighted to not see the importance of effective environmental management.

3.6 *The Capacity to Provide Appropriate, Affordable Services, Infrastructure, and Products*

The capacity to provide services needed for sustainable coastal environmental management is sorely stretched, and often woefully inadequate. The few technically skilled individuals move to the private sector or out of the country, rather than remain in government agencies. Equipment, whether

boats and motors or computers and laboratory instruments, is scarce, old, and subject to breakdown. Buildings are in poor condition, and inadequate in many ways. The situation does not appear to be much better in other areas of Belize's environmental management — i.e., there is little to choose between the Fisheries Department offices in Belize City, and the Environment Department offices in Belmopan.

In April of 1999, the Manager of the Bacalar Chico Marine Reserve told me three things: 1) He routinely recruited one or two student interns from Britain each year to help staff the reserve because although they knew nothing about coral reefs on arrival, the funds they paid for the privilege enabled him to hire a Belizean. 2) He had suspended an environmental monitoring program, and all on-water patrols at the reserve because his only boat no longer had an operable outboard motor and there

were no funds to repair it. 3) He and his staff had not been paid since January, but he was sure funds would turn up eventually. The Bacalar Chico Marine Reserve is managed by the Belizean Department of Fisheries, and the privations this manager reported are typical of what all parts of the marine environmental management community face (and similar tales can be told of other Caribbean countries). Whether environmental management is of insufficient priority, whether funding gets diverted inappropriately, or whether these are simply insufficient financial resources available to meet government responsibilities is unclear. The irony is that the tourists who flock to Belize (and to other similar countries) would not notice a couple of dollars extra per day added to the hotel bill, the restaurant meal, or the dive trip. Yet those dollars would have a substantial impact if they were funneled towards sustainable environmental management.

4. Conclusions

The problem of achieving sustainable environmental management in the coastal waters of the Caribbean is largely one of lack of skilled personnel, and lack of funding to keep programs going. The capacity to measure and understand the environmental systems also needs to be increased, in particular, by building a better understanding of the interconnectedness of coastal marine systems, both with each other and with the freshwater and terrestrial systems that lie upstream (Sale and Ludsin in press). However, there is already considerable receptivity to these ideas by individuals within the environmental management community, and particularly within the NGO community, so growing this capacity can be relatively straightforward if training programs are in place giving individuals the skills they need, and if funding to support environmental management adequately is present. Legislative and regulatory capacity is often sufficient, although enforcement is frequently severely lacking. This lack may be due to a lack of political will, or to corruption, but it is just as often due to lack of funds to sustain programs of adequate strength.

Building educational capacity is difficult in small developing countries with relatively few opportunities, especially when these countries are on the doorstep of the richest 'land of opportunity' on the planet. However, programs that build capacity by working within the

country to build the skills of the people already working in environmental management are likely to be far more effective than those that seek to take the most talented away for more high-level training. Marine environmental management does not require more holders of Ph.D. degrees. It requires individuals with the skills that often, but not always, come with those degrees.

Funding to build and sustain the capacity to do environmental monitoring and management, to enforce environmental regulations, and to educate the public so as to build compliance is the second primary need. In many Caribbean countries, much of the wealth generated by tourism has already left the country as profits for the international hotel chains. There needs to be greater awareness by governments that their coastal environments are highly valued for tourism, and that both the individual tourists and the international hotel chains and other tourism suppliers will be willing to pay more than they now do to have access to these environments. It is also important for governments to ensure that environmental taxes are raised openly, and uniformly, and that they are delivered transparently to the environmental management sector charged with maintaining the quality of the coastal seas. International development projects can help with both of these needs, although some ways of operating will be more effective than others.

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