

Chapter 2

Local Needs and Interventions for Management of Coral Reefs in the Developing Tropical Americas—The Montego Bay Marine Park Case Study

Stephen C Jameson

Coral Seas Inc. – Integrated Coastal Zone Management, The Plains, VA, USA

Jill Williams

Montego Bay Marine Park Trust, Montego Bay, Jamaica

The coral reefs, mangroves, seagrass beds, and other ecosystems of coastal zones in the developing tropical Americas are a source of diverse, unique, and useful economic and ecological goods and services. These ecosystems serve as the backbone of local and regional economies, providing services such as filtering organic waste and mitigating coastal erosion, potentially yielding medicines and compounds for biomedical research, and forming an irreplaceable source of biodiversity, educational and scientific knowledge, and aesthetic pleasure.

Montego Bay (Figure 2.1) is one of the Caribbean's leading tourist centers (Taylor 1993) and, largely as a result of this, has one of the most threatened near-shore coral reef ecosystems in the region (Hughes 1994, Jameson *et al.* 1995). Natural and anthropogenic forces over many years have combined to inflict a deadly blow (Figure 2.2). Water pollution, in the form of nutrient enrichment from municipal raw sewage discharges, household waste, associated leaching, and sedimentation, has been especially devastating to the near-shore coral reef ecosystem (Hitchman 1997; Jameson 1997; LaPointe *et al.* 1997; see also Chapter 1). Oil pollution and runoff of agricultural fertilizers and pesticides continually add to the problems. Once luxuriant near-shore coral reefs are now smothered by macrophytic algae and struggling for survival (Sullivan and Chiappone 1994; Williams and Polunin 1999).

In Montego Bay, significant changes in land use and hydrology have been occurring for the past 500 years. Several events in the coastal ecosystem most likely had the largest impacts on marine communities:

- The development of the Freeport and Seawind Island resort area by the filling in of mangrove forests and islands in 1967 and the reclamation of the entire waterfront area in the 1970s;

- The change in drainage patterns and nutrient loading of coastal rivers and estuaries associated with a growing human population and inadequate infrastructure;
- The bulkheading of coastlines, loss of coastal vegetation, and changes in the quality of storm-water runoff; and,
- Natural impacts such as Hurricane Allen in 1980, Hurricane Gilbert in 1988 and the sea urchin *Diadema antillarum* die-off in 1983-84.

The high relief spur and groove area of the fore-reef illustrates the dramatic nature of these impacts. Here, once luxuriant coral communities are now dominated by frondose brown algae—algae cover is over 70% of the reef surface, coral cover is less than 15% of the reef surface, coral rubble is abundant and colonized by algae, sponges consist of boring and encrusting species, and octocorals are rare or absent (Sullivan and Chiappone 1994).

Montego Bay Marine Park (the Park; Figure 2.3) is a mosaic of marine communities that includes seagrass beds, mangrove islands, beaches, and some of Jamaica's best coral reefs. The land is joined to the ocean through rivers, wetlands, and coastal watersheds. Jamaicans have benefited in the past from this ecosystem through the provision of fishes, conch and lobster. Montego Bay can be recalled as a scenic coastline with beautiful beaches, near-shore reefs, freshwater wetlands, and mangrove islands. The Park is the focal point of the economic and social health of Montego Bay and its environs.

Two watersheds drain into the Park—the Great River and the Montego River. These carry the inland pollutants to the Park waters. Coastal mangroves, other wetland areas, and seagrass beds that provide breeding, feeding and nursery grounds for fish and shrimp, are being destroyed. Harbors and near-shore water bodies are becoming more

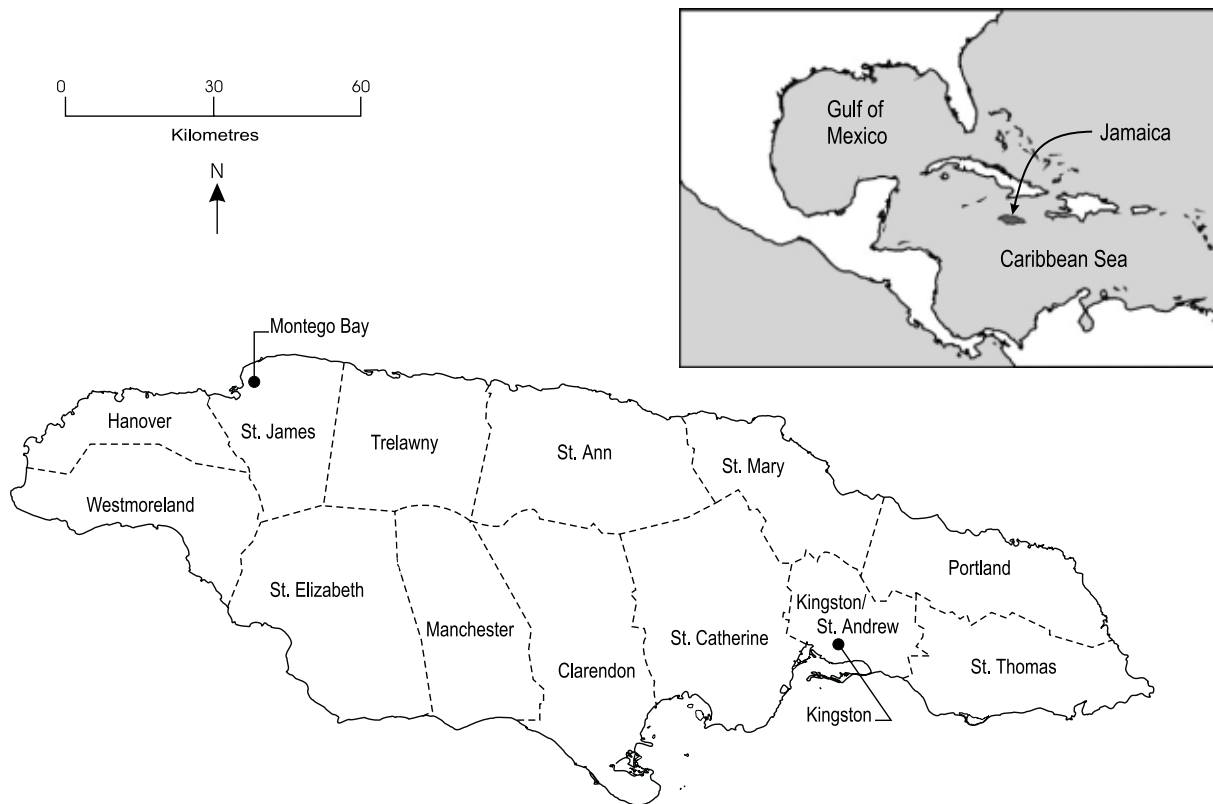


Figure 2.1. Jamaica, showing parishes and the locations of the urban centers of Kingston and Montego Bay (adapted from Gustavson 1999).

polluted from raw sewage discharges. Coral smothering algal cover has increased from about 36% in 1992 to about 84% in 1997, confirming eutrophication (Sullivan and Chiappone 1994; Williams and Polunin 1999). Impacts from wind blown dust and illegal sand removal are causing loss of aesthetic value and failure in the rehabilitation of coastal areas. The Montego Bay Marine Park Trust, charged with conserving this valuable national resource, is now faced with a long-term and expensive restoration project.

Originally under government jurisdiction, a bold experiment was undertaken when the Park was transferred to non-government organization (NGO) management (private) in 1996. A group of concerned citizens who had earlier formed the Montego Bay Marine Park Trust in 1992, obtained responsibility from the Government of Jamaica (public) to manage the Park under the authority of the Natural Resources Conservation Authority (NRCA).

In the early 1970s, local dive shop operators noticed the deterioration in the coastal marine environment and started lobbying the Ministry of Tourism for establishment of a marine protected area. In July, 1974, a 59ha

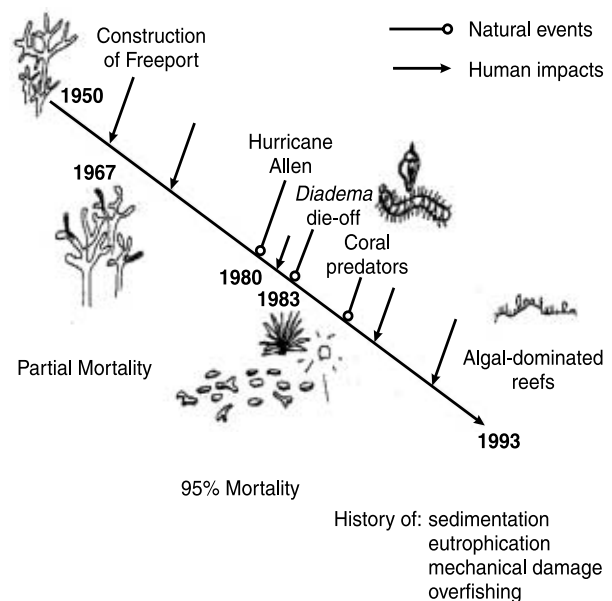


Figure 2.2. Natural and anthropogenic impacts to the coral reef ecosystem in Montego Bay, Jamaica (adapted from Sullivan and Chiappone 1994).

protected area off Cornwall Beach was created by the Government of Jamaica under the Beach Control Act and the management responsibility given to the Jamaica Tourist Board. The area was called the Cornwall Beach Marine Park. The boundaries were never marked, although the marker buoys had been purchased, and the regulations were never enforced although five wardens had been appointed. Similar to the Ocho Rios Marine Park that was created in 1966, the Cornwall Beach Marine Park was only a “paper park”.

In 1986, the Minister of Tourism formed the Marine Park Action Committee to act as a catalyst for the development of marine parks in Jamaica. The committee initiated the preparation of a project proposal for the development of the Montego Bay Marine Park. The study was incorporated by the Government of Jamaica and the United States Agency for International Development (USAID) into the proposal for the establishment of a Jamaica National Parks System, which was implemented as the Protected Areas Resource Conservation (PARC)

project in August 1989, with funding from the Government of Jamaica and USAID, and technical assistance from The Nature Conservancy (TNC) and the Jamaica Conservation and Development Trust.

In August, 1989, the Montego Bay Marine Park became a reality. The steering committee evolved into the Local Advisory Committee (LAC), which was responsible for the hiring of the first members of staff and offices being established at Cornwall Beach. Further legislation was put in place under the Natural Resources Conservation Authority Act, Natural Resources (Montego Bay Marine Park) Order, 1991, for the governance of the Park. Initially, the Project Management Unit (PMU) for the PARC project was based at the Natural Resources Conservation Authority (NRCA) before moving to the Planning Institute of Jamaica. Under an agreement between the United States and the Government of Jamaica, a “debt for nature swap” created the capital for the Jamaica National Park Trust Fund to provide perpetual funding for the two national parks, the Montego Bay Marine Park

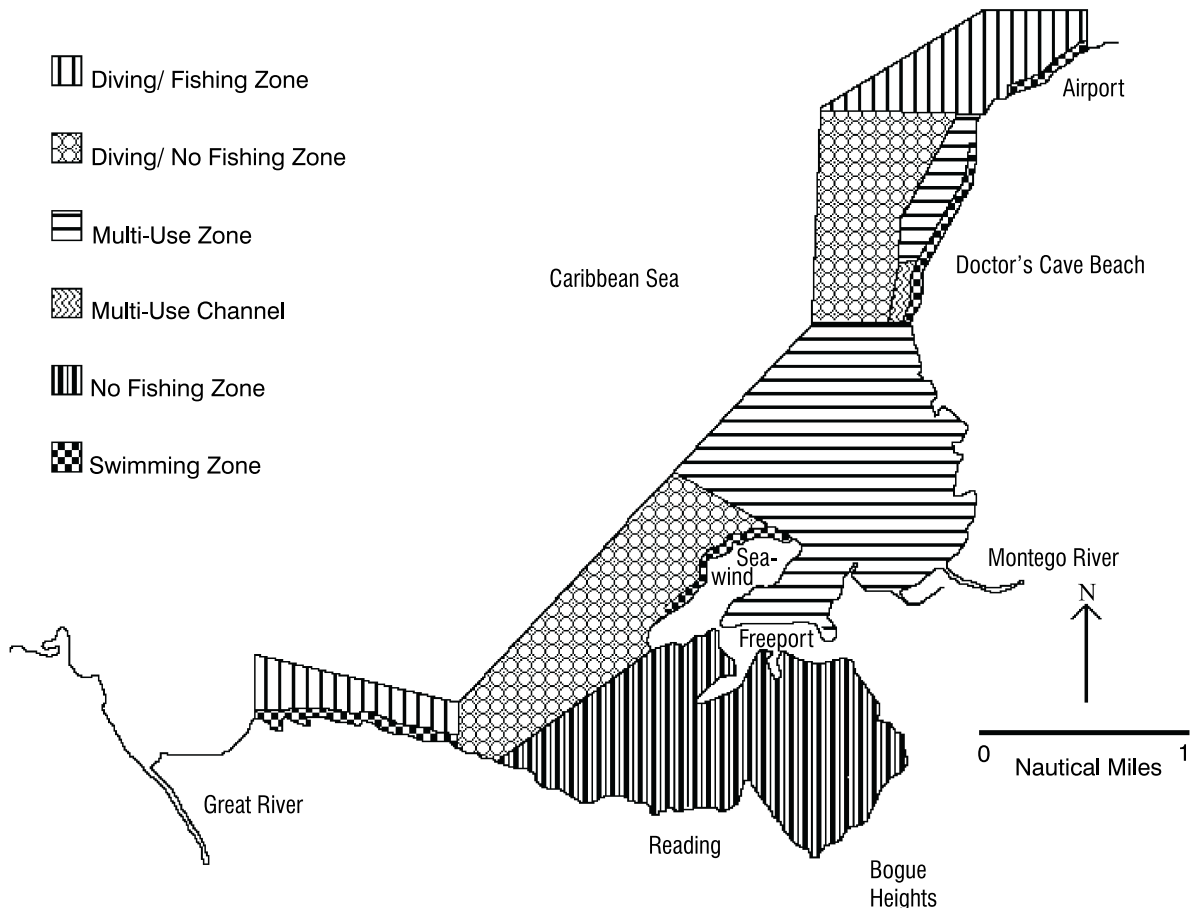


Figure 2.3. The Montego Bay Marine Park and the new zoning plan.

and the terrestrial Blue and John Crow Mountain National Park. Park staff reported to the government and the manager met regularly with the LAC. A group of members of the LAC went on to incorporate the Montego Bay Marine Park Trust as a membership organization for Friends of the Park in 1992.

The PMU managed the park until April, 1996, when funding under the PARC project came to an end and responsibility for the Marine Park reverted to the NRCA. On September 20, 1996, the NRCA delegated management for the Park to the Montego Bay Marine Park Trust (MBMPT) under an innovative co-management policy adopted for Jamaica's National Parks and Protected Area System.

The Montego Bay Marine Park's purpose is embodied in its mission statement: "To conserve, restore and manage marine coastal resources in Montego Bay for the maximum sustainable benefit of traditional users, the community, the nation, and the enjoyment of all mankind, by providing effective programs for public education, technical support, monitoring and interpretive enforcement". The MBMPT embarked on a management program for increased effectiveness. A five year management plan for the expansion of the ongoing science, education and enforcement program and a business plan which outlined costs for equipment and personnel requirements were prepared. This nation-wide experiment in public-private management of national marine and terrestrial parks is starting to show signs of fruit in Montego Bay.

The purpose of this chapter is to:

1. Characterize local needs for coral reef ecosystem management in the developing tropical Americas by using the Montego Bay Marine Park as a case study example. Local needs for management are identified and addressed through ReefFix, a specially designed watershed management and coral reef restoration program designed to implement the International Coral Reef Initiative (ICRI) Framework for Action in the Tropical Americas. ReefFix is also the implementation phase of the COral reef COasts in MOntego Bay (COCOMO) integrated coastal zone management decision support modeling program (Huber and Jameson 1999; Chapter 10).
2. Outline ongoing Park interventions to address local needs for management, as well as interventions involving public-private partnerships to prevent and manage water pollution in this valuable coral reef ecosystem.
3. Elucidate some of the social and poverty related issues that make coral reef ecosystem management and water quality improvement extremely challenging in Montego Bay.

Local Needs for Management Using ReefFix to Implement ICRI and COCOMO

Jamaica is a key player in the International Coral Reef Initiative (ICRI). They were one of the original eight founding countries of ICRI and Montego Bay hosted the ICRI Tropical Americas Regional Workshop where management, capacity building, and research and monitoring priorities were outlined for implementing ICRI in the region (Woodley 1995).

Continuing their leadership role, Jamaica—via the Montego Bay Marine Park—is setting the example for ICRI implementation in the tropical Americas through the new ICZM coral reef restoration, watershed management and capacity building demonstration project called ReefFix. ReefFix is also the implementation phase of the World Bank coral reef ecosystem decision support modeling project for Montego Bay, the results of which are reported elsewhere in this publication (specifically, see Chapters 9 and 10).

Rationale

The International Coral Reef Initiative *State of the Reefs* report (Jameson *et al.* 1995) concludes that the coral reef ecosystems at greatest risk around the world are in South and Southeast Asia, East Africa, and the tropical Americas (see Chapter 1). The Caribbean Sea contains some of the world's most productive and biologically rich marine environments, including the world's second largest barrier reef—the Belize Barrier Reef. Unfortunately, reefs and other coastal environments throughout the region are under increasing assault. Pollution from sewage wastes and fertilizers, coastal erosion, overfishing, and unmanaged coastal development are contributing to coastal decline. Recognizing the magnitude of these threats and the need for counter measures, the International Maritime Organization declared the Caribbean a "particularly sensitive area" (Jameson *et al.* 1995).

The goal of ReefFix is to design and implement a least cost ICZM coral reef ecosystem restoration and watershed management project and then transfer the information and technology to 20 other tropical American countries facing similar challenges. At present, no country (or any of the over 100 marine protected areas) in the tropical Americas is taking an integrated model-driven approach to watershed management for coral reef protection and management.

Unlike most marine projects that strive to do research in areas with good environmental conditions, ReefFix will take a more management related approach. It will work

in an area that suffers from many, if not all, of the watershed and marine ailments of Tropical American countries—an area that desperately needs ICZM and restoration—Montego Bay, Jamaica.

Major Components

The two integrated components of ReefFix promote the restoration, conservation and sustainable use of biodiversity in the region and promote the sustainable use of coral reefs, watersheds and international waters. Specifically, these include:

1. An ICZM Coral Reef Restoration and Watershed Management Demonstration component that will restore a coral reef ecosystem and manage a watershed at Montego Bay, Jamaica.
2. An ICZM Capacity Building component that will transfer the information and technology from the demonstration component to 20 countries (as identified in an ICRI report; see Woodley 1995) throughout the tropical Americas with coral reef eutrophication and sedimentation problems. These countries potentially include the Bahamas, Barbados, Brazil, Cayman Islands, Colombia, Costa Rica, Cuba, Curaçao, Dominica, Dominican Republic, Ecuador, Grenada, Guadeloupe, Haiti, Martinique, Nicaragua, Panama, St. Lucia, Trinidad and Tobago, and Venezuela.

The ICZM Coral Reef Restoration and Watershed Management Demonstration component is the operational aspect of ReefFix. In this component, ReefFix will use and develop cost-effective techniques that can be replicated throughout the tropical Americas. These include:

- Marine protected area management;
- Management of land-based activities and coastal development;
- Resource assessment, monitoring, restoration, and database creation;
- Environmental impact assessment;
- Community development;
- Tourism and recreation management;
- Economic incentives;
- Regulation and enforcement;
- Legal and institutional restructuring; and,
- Public education and outreach.

Combining these management approaches is critical for success. If used alone, these approaches tend to be ineffective over the long-term. They must be strongly supported at scales ranging from the village to nation, and often at the regional scale as well. They must be oriented towards long-term sustainability of coastal resources and designed to be adaptive to different cultures and govern-

ments, as well as changing situations, without compromising effectiveness.

The ICZM Capacity Building component will focus on regional capacity building and will draw on the successes of the Montego Bay Marine Park Coral Reef Restoration and Watershed Management Demonstration project. Capacity building includes establishing and strengthening human resource and institutional capabilities for integrated coastal resources management, science, training and education. A concerted effort must be made to enhance the capacities of countries responsible for valuable coastal resources to conduct science-based research and to design and implement informed, effective integrated management systems. This implies not only the transfer of information, but more importantly, the exchange of experiential learning among countries of the region. ReefFix will design and implement a program to build expertise in coral reef management and integrated coastal resources management. Presently, the shortage of trained personnel on many islands in the region requires the sharing of limited expertise through networking. The project will draw on the talents and experience of other regional institutions and facilities in the design and implementation of its capacity building program.

ReefFix will also encourage the private sector's role in ICZM by seriously engaging them in the management of coral reefs and related coastal ecosystems by demonstrating to them, via workshops, educational material, media products and technical assistance, the benefits of:

- Using appropriate technologies;
- Developing a trained and educated workforce; and,
- Using innovative approaches to improve environmental operating standards.

Objectives and Outcomes

ReefFix will meet its goals by accomplishing the following objectives:

1. Develop a generic least cost ICZM decision support model template that can be custom tailored for any coral reef ecosystem in the tropical Americas;
2. Develop a least cost ICZM coral reef decision support model for the Montego Bay Marine Park (COCOMO; Chapter 10);
3. Develop and implement a Montego Bay Watershed Management Action Plan that will, over time, improve water quality for the coral reef ecosystem (reduce eutrophication and sedimentation), improve water quality for human users (reduce fecal coliform), and increase coral cover and decrease algal cover on the Park's reefs;

4. Develop and implement a Montego Bay Marine Park Fisheries Management Action Plan, including eco-tourism alternative income programs for retrained fishers in Montego Bay that will, over time, increase fish abundance, improve economic conditions for fishers, and help make Montego Bay Marine Park financially self-sustaining; and,
5. Implement a Tropical Americas Demonstration Action Plan that will improve ICZM capacity for restoring coral reef ecosystems in 20 tropical American countries as a result of the demonstration program that includes a ReefFix coral reef watershed restoration handbook, a video, and workshop materials.

Links to National Priorities

On the national level, ReefFix is directly linked to priority programs of Jamaica's Natural Resources Conservation Authority (NRCA) to manage watersheds and to establish and restore marine protected areas under the management of local NGOs. As outlined above, the NRCA delegated authority to manage the Montego Bay Marine Park to the Montego Bay Marine Park Trust. ReefFix also meets many of the objectives outlined in the Montego Bay Marine Park Management Plan (Tables 2.1 to 2.6).

On the regional level, ReefFix is linked to the Regional International Coral Reef Initiative (ICRI), the UNEP Global Program of Action for the Protection of the Marine Environment from Land-Based Activities, and the IOC Global Coral Reef Monitoring Network (see Chapter 1). ReefFix addresses the specific needs identified in a survey of the 25 tropical American countries participating in the 1995 ICRI Regional Workshop (Woodley 1995). These include a need for ICZM planning approaches (i.e., restoration, mitigation of specific impacts, and determination of carrying capacities), capacity building in coastal and marine resource management, and increased research and monitoring capabilities. Workshop participants also identified a series of initial steps required to provide a basis for increased regional collaboration, including initiatives to strengthen management capabilities in special area management planning, education and environmental awareness programs, and increased capacity at regional marine institutions.

Stakeholders Involved

In the ReefFix demonstration phase, stakeholders include Montego Bay businesses, community groups, NGOs, residents, educational institutions, and national and local government agencies (i.e., Montego Bay Marine Park,

Natural Resources Conservation Authority, Water Resources Authority, National Water Commission, Montego Bay Sewage Treatment Plant, Ministry of Agriculture's Fisheries Division, Jamaica Tourist Board, Montego Bay Resort Board, Tourism Product Development Company, Jamaica Hotel and Tourism Association, Greater Montego Bay Redevelopment Company, St. James Parish Council, and United States Agency for International Development). In the capacity building phase, stakeholders include the 20 countries where workshops are held, and will be similar to those listed for the demonstration phase but with a local and national focus specific to the country involved.

Interventions

To address local needs for management, the Montego Bay Marine Park Trust is implementing a variety of low cost and effective programs that can be called "soft interventions". These soft interventions focus primarily on education, enforcement, public relations activities, research and monitoring, and volunteer programs (Tables 2.1 to 2.5). In addition, the Park, in partnership with various public entities, is implementing a variety of programs to mitigate water pollution impacts to the coral reef ecosystem (Table 2.6).

Education Strategies and Activities

One of the primary mandates of the Montego Bay Marine Park is to provide the public with information about environmental issues that surround and affect the Park. The diverse habitats and resources and the setting of the Park offer unique educational opportunities for the interpretation of tropical marine environments for Jamaicans and visitors alike. Educational strategies fall into two distinct categories—community participation and product development (Table 2.1). The community participation program encompasses all projects that involve direct interaction with the public by Park officials, including training workshops, exhibit production, special events, environment watch clubs, and fishing trap mesh exchange programs. The product development strategies include production of displays, signs, and printed materials, as well as media programs.

Montego Bay Marine Park Education Goals and Objectives

The Montego Bay Marine Park, as an integral part of the Jamaican National Park System, reflects a unique and important aspect of Jamaica's natural heritage. Hence,

Table 2.1. Education interventions for the Montego Bay Marine Park—agencies, organizations, and staff identified for implementing strategies and activities (EWO = Environmental Watch Organization; NEST = National Environmental Societies Trust; JCDDT = Jamaica Conservation Development Trust; NRCA = Natural Resources Conservation Authority of Jamaica; MBMP = Montego Bay Marine Park; JTB = Jamaica Tourist Board; EE = environmental education).

Interventions	Agencies and organizations						MBMP staff					
	EWO	NEST	JCDDT	NRCA	Hotels	Water sports	Media	Education coordinator	Enforcement coordinator	Volunteer coordinator	Research and monitoring	Director coordinator
COMMUNITY INVOLVEMENT												
Training, workshops, and schools												
EE in schools	●	○	●	○	○	○	○	●	○	○	○	○
Sponsor and support adult EE	●	○	○	○	○	○	○	●	○	○	○	○
Establish a certification program	○	○	○	○	●	○	○	●	○	○	○	○
Regular educational tours	○	○	○	○	●	○	○	●	○	○	○	○
Public forums												
Lecture series	○	○	○	○	○	○	○	●	○	○	○	○
Poster and photo contest	○	○	○	○	○	○	○	●	○	○	○	○
Special events												
Maintain exposition booths	○	○	○	○	○	○	○	●	○	○	○	○
Organize environmental expositions	●	○	○	○	○	○	○	●	○	○	○	○
Earth Day and other events	●	○	○	○	○	○	○	●	○	○	○	○
Summer youth program	○	○	○	○	○	○	○	●	○	○	○	○
PRODUCT DEVELOPMENT												
Printed material												
Reproduce brochure	○	○	○	○	○	○	○	●	○	○	○	○
Produce a quarterly newsletter	○	○	○	○	○	○	○	●	○	○	○	○
Maintain a internet web page	○	○	○	○	○	○	○	●	○	○	○	○
Shipping to businesses	○	○	○	○	○	○	○	●	○	○	○	○
Provide information to user groups	○	○	○	○	○	○	○	●	○	○	○	○
Periodicals and publications	○	○	○	○	○	○	○	●	○	○	○	○
Produce a fact-sheet for JTB	○	○	○	○	○	○	○	●	○	○	○	○
Provide information to service industry	○	○	○	○	○	○	○	●	○	○	○	○
Audio-visual materials												
Audio-visual library	○	○	○	○	○	○	○	●	○	○	○	○
Theme oriented slide presentations	○	○	○	○	○	○	○	●	○	○	○	○
Displays												
Develop mobile displays	○	○	○	○	○	○	○	●	○	○	○	○
Public service announcements												
Develop a program of announcements	○	○	○	○	○	○	○	●	○	○	○	○
Staffing levels												
Hire staff	○	○	○	○	○	○	○	○	○	○	○	●

● lead
○ assist

Table 2.2. continued

<i>Interventions</i>	<i>Agencies and organizations</i>											
	Resort Patrol	JDFCG	Marine Police	NRCA	MBMP	JCF	JMI	MBFD	Education coordinator	Volunteer coordinator	<i>MBMP staff</i>	
										Secretary	Rangers	Enforcement coordinator
Enforcement action code												
Construct code A				○							○	●
Construct code B				○							○	●
Implement use of codes				○							○	●
Deter breaches of codes				○							○	●
Develop code designation	○		○	○							○	●
TRAINING STRATEGIES												
Enforcement training												
Implement HAZMAT training		○		○							○	●
Acquire oil spill training				○								●
Acquire conflict resolution training		○		○								●
Acquire weapon handling training				○			○					●
Develop self-defense capabilities											○	●
Improve outboard motor repair training		○									○	●
Improve marine fire fighting capabilities											○	●
REGULATION STRATEGIES												
Regulation amendments												
Increase fines				●								○
Acquire seizure and confiscation powers				●							○	
Hire legal advisor				●							○	
ZONING STRATEGIES												
New zoning plan												
Obtain approval of plan				○								●
Install and maintain demarcation buoys					●						○	●
Install and maintain mooring buoys											○	

● lead
○ assist

Table 2.3. Public relations interventions for the Montego Bay Marine Park—agencies, organizations, and staff identified for implementing strategies and activities (MBMP = Montego Bay Marine Park).

<i>Interventions</i>	<i>Agencies and organizations</i>		<i>MBMP staff</i>					
	MBMP	Media	Administration coordinator	Education coordinator	Volunteer coordinator	Research & monitoring coordinator	Enforcement coordinator	Director
Park identity								
New park logo	●							○
New uniforms	●			●	●	●	●	○
Membership								
Begin membership	○		●	●	○	○	○	○
Newsletter								
Produce quarterly newsletter (see Table 2.1)								
Mailing list database			●	●	●			○
Media								
Newspaper articles (see Table 2.1)								
Press releases		●		●	○	○	○	○
Radio program		●		●				○
Television program		●		●				○
Staff levels								
Hire staff								○
Public service announcements (see Table 2.1)								
	●	lead						
	○	assist						

it is of the utmost importance to educate the public concerning the natural treasures at risk to ensure that this heritage is preserved for future generations. These goals respond to the specific environmental education needs of the Montego Bay community and include:

- Promoting the awareness of and support for the Montego Bay Marine Park;
- Encouraging and promoting a sense of stewardship regarding the marine environment;
- Facilitating environmental education opportunities for all segments of society;
- Promoting a clear awareness of the economic, biological, recreational, educational, and cultural values of the marine ecosystem, as well as the interdependence of these factors upon one another; and,
- Providing income generating training opportunities for individuals displaced by the enforcement of Park regulations.

To achieve the goals defined above, the following objectives should be met:

- Increase community cooperation and participation in the management of the Park;
- Increase understanding of and voluntary compliance with regulatory requirements of the Park (e.g., zoning regulations);
- Develop, support, and maintain cooperative educational programs with the community (e.g., turtle watches with hotels; tours with boat operators);
- Provide the public with information gained through research within and about the Park and relevant resources;
- Increase public awareness about the cumulative environmental impacts degrading the Park and provide relevant solutions to the problems addressed;
- Provide opportunities for individuals to become “stewards of the environment”;

Table 2.4a. continued

Interventions	Agencies and organizations													
	MBMP	NRCA	FD	NWC	UWA	NEST	TPDCo	PIOJ	PCD	CDC	UWI	GMRC	JTB	RB
Index of park health	●	○	○											
Volunteer program	●													
Socio-economic monitoring														
Fishing gear survey	○		●											
License program	○	○	●										○	
Control area monitoring														
Develop baseline data	●	○	○											
Monitor control area	●	○	○											
FISHERIES IMPACTS														
Aquaculture alternatives														
Assess, develop, and promote alternatives	●	○	○											
Artificial reefs														
Assess impacts	●	○												
ENVIRONMENTAL ASSESSMENT														
Habitat restoration														
Program of restoration research	●	○												
Carrying capacity														
Assess impacts	●	○	○											
Leachate transport														
Research on leachate transport	○	○			●									
Global change														
Research on global change	○	○									●			
PREDICTIVE STRATEGIES														
Predictive models														
Predictive modeling workshop	●	○										○		
Water quality impact research														
Water quality impact research	○	○												●
STAFFING STRATEGIES														
Staffing levels														
Hire staff														
●	lead													
○	assist													

Table 2.4b. Research and monitoring interventions for the Montego Bay Marine Park – staff identified for implementing strategies and activities (MBMP = Montego Bay Marine Park; QA/QC = quality assurance/quality control).

<i>Interventions</i>	<i>MBMP staff</i>				
	Education coordinator	Research and monitoring coordinator	Volunteer coordinator	Secretary	Director
RESEARCH MANAGEMENT					
Park database					
Assess user needs		●			○
Implementation plan		●			○
Disseminate findings					
Information exchange	○	●			○
Sponsor conferences	○	●		○	○
Journal publication	○	●			○
Advisory committee					
Establish committee		●		○	○
MONITORING STRATEGIES					
Water quality monitoring					
Historical assessment		●			○
Circulation studies		●			○
Water quality standards		●			○
Inter-park laboratory		●			○
Runoff practices	○	●			○
Monitoring implementation plan		●			○
Select organization		●			○
QA/QC authority and protocols		●			○
Implement monitoring		●			○
Indicators					
Develop and evaluate indicators		●			○
Ecological monitoring					
Hire coordinator					●
Ecological information system		●			○
Status and trends assessment		●			○
Fisheries ecological monitoring		●			○
Sampling protocol		●			○
QA/QC protocol		●			○
Index of park health		●			○
Volunteer program		●	○		○
Socio-economic monitoring					
Fishing gear survey		●			○
License program		●			○
Control area monitoring					
Develop baseline data		●			○
Monitor control area		●			○
FISHERIES IMPACTS					
Aquaculture alternatives					
Assess, develop, and promote alternatives		●			○
Artificial reefs					
Assess impacts		●			○

Table 2.4b. continued

<i>Interventions</i>	<i>MBMP staff</i>				
	Education coordinator	Research and monitoring coordinator	Volunteer coordinator	Secretary	Director
ENVIRONMENTAL ASSESSMENT					
Habitat restoration					
Program of restoration research		●			○
Carrying capacity					
Assess impacts		●			○
Leachate transport					
Research on leachate transport		●			○
Global change					
Research on global change		●			○
PREDICTIVE STRATEGIES					
Predictive models					
Predictive modeling workshop		●			○
Water quality impact research					
Water quality impact research		●			○
STAFFING STRATEGIES					
Staffing levels					
Hire staff		○			●
●	lead				
○	assist				

- Provide and support multi-disciplinary environmental education experiences;
- Provide information at high profile locations;
- Provide and support training opportunities for resource users (e.g., training programs to retrain displaced fishers);
- Provide informative educational programs to school systems;
- Provide sequential exposure to environmental education, allowing for the construction and understanding of an ecosystem approach over time (e.g., weekly media articles);
- Provide educational information at technical and scientific meetings; and,
- Provide environmental education opportunities for adults and those not attending school.

Existing Education Programs

The following programs are currently being operated by the Montego Bay Marine Park:

- *Promoting and supporting environmental education in schools.* The Park currently works closely with five

area high schools and conducts trips and presentations for other schools whenever possible, including the University of the West Indies at Mona. Past programs have dealt with rural schools and teacher training. The Education Coordinator also facilitates the organization of poster contests in Montego Bay schools during special events such as Earth Day.

- *Presenting information to user groups and community members.* The Education Coordinator currently gives presentations on request to various community and school groups. The Park also organizes boat trips and writes weekly articles and press releases for local newspapers (i.e., the *Western Mirror* and the *Jamaica Observer*) and other periodicals.
- *Conducting educational tours.* Currently, the Education Coordinator provides at least one tour per month to schools or other groups. Tours include site visits and descriptions of coral reef ecology and mangrove ecology. A tour guide is currently being trained so that four trips per month can be arranged.
- *Maintaining displays at local and national events.* The Park currently maintains a presence at most regional and some national events.

Table 2.5. Volunteer interventions for the Montego Bay Marine Park.

<i>Strategy</i>	<i>Activity</i>	<i>Description</i>
Boating	Boat access	Assist in public access survey
	Habitat restoration	Serve as “buddy divers” and underwater assistants
	Derelict vessels	Assist in a survey of abandoned and derelict vessels
	Mooring buoy and reef marking	Assist with mooring buoy and reef marking projects
	Visitor registration	Serve as registrars for the Park
	Damage assessment	Assist the damage assessment team
Fishing	Artificial reefs	Assist in reef construction, data collection and monitoring
	Gear removal	Assist in gear removal, particularly “ghost traps” (abandoned or lost fish traps)
	Gear and method impacts	Assist with research on low-impact fishing gear
Recreation	Recreation survey	Assist in implementing the recreation survey
Research and monitoring	Water quality monitoring	Provide monitoring assistance
	Ecological monitoring	Assist in the monitoring program
Education and outreach	Printed materials	Assist Park staff in developing and distributing printed materials
	Audio-visual materials	Assist in developing the audio-video library and audio and video products
	Signs, displays, and exhibits	Assist in developing and installing Park signs, displays, and exhibits
	Training, workshops, and school programs	Assist in training, workshops, and school programs
	Public service announcements	Assist in developing public service announcements, particularly local press releases
	Promotional	Assist in developing promotional materials
	Public forum	Assist in preparing for public meetings, volunteer speakers bureau, and bay watch hotline
	Special events	Assist at trade shows and special events
General support	Office support	
	Computer support	
	Marine and dock maintenance	
	Fund-raising	
	Inter-organizational volunteer coordination	
	Group leaders	
	Boat captains	
Special project		

- *Organizing environmental events.* The Education Coordinator currently organizes activities and displays for events, including park related expositions, mangrove replanting projects and beach clean-ups.
- *Summer children’s programs.* The Park staff has traditionally organized a summer camp for kindergarten and primary school age children. The program has primarily focused on making crafts from reused materials. The traditional camp did not take place in 1997, but swimming and snorkel lessons were provided to members of environment watch clubs.
- *Quarterly newsletter.* The Education Coordinator is currently producing a quarterly newsletter and seeking funding for production.
- *Internet website.* A webpage is currently on-line and is updated periodically. The newsletter is in the process of being posted on the site.
- *Writing articles for publication in newspapers and magazines.* The Education Coordinator currently publishes weekly articles in local and national papers. Specific user groups are also being targeted, as articles are also being sent to international scuba magazines such as *Skin Diver*.

Enforcement Strategies and Activities

The enforcement program of the Park is an essential component of resource protection (Table 2.2). Adequate

Table 2.6. Public-private partnerships in water pollution prevention and management in Montego Bay, Jamaica (MBMP = Montego Bay Marine Park; NWC = National Water Commission; NRCA = Natural Resources Conservation Authority; JDFCG = Jamaica Defence Forces-Coast Guard; UWA = Underground Water Authority; SJPC = St. James Parish Council).

<i>Public-private partnership</i>	<i>Pesticides and oil</i>	<i>Sediments</i>	<i>Nutrient enrichment</i>	<i>Program status</i>
CORAL modeling (World Bank/MBMP)		Provides least cost solutions	Provides least cost solutions	Model operational early 1999
ReefFix restoration program (World Bank/MBMP)	Watershed management component	Watershed management component	Watershed management component	ReefFix proposal submitted for GEF approval
Sewage treatment and effluent disposal (NWC/MBMP)			Ideas for design of new plant and disposal methods submitted	Periodic interactions during new plant construction
Artificial wetlands program (NRCA/MBMP)		Critical for removing sediments from sewage effluent	Critical for removing sediments from sewage effluent	Under consideration by NWC and NRCA
Water quality enforcement (NRCA/NWC/JDFCG/MBMP)	Oil spills (park rangers, coast guard and marine police operations)		Ships and hotels (park rangers, coast guard and marine police operations)	Ongoing
Mangrove reseeded program (NRCA/MBMP)		River bank and shore stabilization/sediment filtration	Aids in removal of nutrients from polluted runoff	Ongoing, with school participation
Green certification (NRCA/Hotels/MBMP)			Hotels must meet sewage treatment and disposal standards	Under development
Hydrology assessment (NRCA/NWC/MBMP)		Examines effects of structural modifications	Clarifies role of inflows from land-based sources	Historical hydrological assessment requires funding
Circulation studies (NRCA/NWC/MBMP)	Estimates long-term and episodic transport	Estimates long-term and episodic transport	Estimates long-term and episodic transport	Requires funding
Water quality standards (NRCA/MBMP)	Pesticide and oil standards created	Sediment loading standards created	Nitrogen and phosphorous standards and biocriteria created	Under development
Inter-park laboratory (NRCA/NWC/MBMP)	Processes monitoring samples	Processes monitoring samples	Processes monitoring samples	Requires funding
Storm water runoff practices (UWA/SJPC/MBMP)	Collection locations and education programs	Street sweeping and litter control programs	Ordinances aimed at controlling application on public and private landscapes	Ongoing (requires funding to expand reach and intensity)
Water quality monitoring program (NRCA/NWC/MBMP)	Relevant parameters monitored	Relevant parameters monitored	Relevant parameters monitored	Plan requires development and funds required for implementation
Indicator species program (NRCA/NWC/MBMP)	Indicators require calibration and statistical framework	Indicators require calibration and statistical framework	Indicators require calibration and statistical framework	Requires funding; indicators incorporated into biocriteria program

financial support, effective supervision and a supportive judicial system, combined with proper ranger recruitment, training and equipment, form the basis of a professional enforcement operation. The goal of Park enforcement is to prevent negative resource impacts through full compliance with the Natural Resources (Marine Parks) Regulations, 1992, under the Natural Resources Conservation Authority Act, as well as relevant sections of regulations under other government acts (i.e., the Fisheries Act, the Tourist Board Act, the Wildlife Protection Act). A new zoning plan for the Park also helps achieve enforcement goals and objectives (Figure 2.3).

Successful enforcement relies on frequent land and water patrols, along with routine vessel inspections. Park rangers ensure that users are familiar with regulations. An interpretive style of enforcement seeks voluntary compliance, primarily through education (e.g., rangers speak with users and distribute brochures in the field). This allows rangers to make direct, informative contact with the Park users while conducting routine enforcement activities. In addition, rangers are called upon to give presentations both on site and within the community.

In Montego Bay, the success of enforcement efforts also depends on how well the enforcement bodies are coordinated. Because of limited resources, current enforcement assets must be targeted and used in an efficient and directed effort to be effective. Agreements among NGOs and government organizations in the Park service, Coast Guard, Fisheries Division, and Wildlife Division are being established to ensure a cooperative and integrated enforcement operation. In addition, local residents and frequent Park users are assisting by detecting and reporting violations.

Montego Bay Marine Park Enforcement Goal and Objectives

The goal of enforcement in the Park is to protect the resources by achieving full compliance with all applicable laws. Effective enforcement of these laws, which seek protection of the natural, cultural, and historical resources within the Park, is required. The principal objectives associated with Park enforcement include:

- Increasing the public's understanding of why it is important to comply with Park regulations;
- Achieving voluntary compliance with applicable laws; and,
- Promoting public stewardship of the marine resources through interpretive enforcement efforts.

The mechanisms for accomplishing these goals include the following.

1. *Inter-agency agreements and cooperative strategies to:*
 - Strengthen the existing enforcement efforts with other agencies;
 - Develop partnerships with other enforcement agencies in order to provide a strong enforcement presence in the Park;
 - Maintain an active relationship internally among Park staff members and with other enforcement agencies to identify areas of mutual concern and develop cooperative responses to enforcement issues;
 - Explore cooperative relationships with foreign governments;
 - Enter, if necessary, into memoranda of understanding (MOUs), cooperative enforcement agreements, and joint operation plans with other enforcement agencies as appropriate;
 - Facilitate communication among agencies to avoid duplication of efforts;
 - Promote cooperation, standardization of gear, and coordination of limited resources such as vessels, radios, radio frequencies and training; and,
 - Promote training and deputation among enforcement agencies.
2. *Community involvement strategies to:*
 - Encourage public involvement through site specific interpretive patrols by volunteer groups;
 - Involve Jamaican Defence Forces-Coast Guard, Marine Police, resort patrols, charter boats, Fisheries Division, fishing organizations and game wardens in promoting compliance with Park regulations;
 - Maintain an active relationship with citizen groups interested in compliance with Park regulations;
 - Conduct community outreach programs to encourage compliance with Park regulation and citizen involvement in reporting violations; and,
 - Establish a volunteer ranger program and train and engage the volunteer services in enforcement.
3. *Education strategies to:*
 - Emphasize education as a tool to achieve compliance with legislation;
 - Promote voluntary compliance and stewardship by the general public through specific outreach programs regarding enforcement of Park regulations;
 - Train user groups about regulations and procedures for reporting violations (e.g., witness statements forms); and,
 - Identify major user groups and develop and disseminate educational material through semi-annual meetings and workshops.

4. Operational strategies to:

- Maintain an investigative capability to ensure quick response to purposeful unlawful acts;
- Develop and maintain the capability to effectively respond to violations of the Park regulations and to emergencies;
- Establish an enforcement advisory committee consisting of relevant law enforcement organizations; and,
- Develop enforcement operation plans that identify specific enforcement strategies and priorities, and outline the best means of achieving them.

Public Relations Strategies and Activities

Community involvement and support are the centerpiece of the Montego Bay Marine Park's success. Historically, the Park has had tremendous support from certain aspects of the Montego Bay community. The Public Relations Action Plan seeks to strengthen support in traditional sectors and expand into sectors where Park support has traditionally been weak. The Public Relations Action Plan will focus on Park identity issues, membership strategies, newsletter distribution and media campaigns (Table 2.3).

Montego Bay Marine Park Public Relations Goals and Objectives

The Montego Bay Marine Park seeks to maximize community support for the Park and other areas of valuable natural heritage by sensitizing the community to various aspects of efforts to preserve the environment. The goals are designed to maximize awareness of the Park and its regulations and community involvement in the Park. Goals include:

- Creating a strong identity for the Park and its staff;
- Establishing a membership program; and,
- Increasing community participation, awareness, and support for Park programs.

The Park will meet the above goals by accomplishing the following objectives:

- Providing the staff with uniforms;
- Creating a new Park logo;
- Establishing a passive membership;
- Maintaining a quarterly newsletter; and,
- Establishing media campaigns.

Existing Public Relations Programs

The following programs are currently being operated by the Montego Bay Marine Park:

- *New staff uniforms.* Marine Park staff was recently outfitted with new uniforms designed to enhance the image of and respect for the Park.

- *Membership.* A passive membership campaign has been organized and will begin with the distribution of the first newsletter.
- *Newspaper articles and press releases.* Currently, the Education Coordinator submits weekly newspaper articles and press releases to regional and national newspapers.

Research and Monitoring Strategies and Activities

Research and monitoring are critical to achieving the Park's primary goal of resource protection. The Park's ecosystem is diverse and complex, and many of its processes and their interrelationships are not well known. Also, while many resource impacts are obvious and severe, they are often not documented or quantified. The causes of impacts may be even less clear or completely unknown. The purpose of research and monitoring is to establish a baseline of information on the resource and the various components of the ecosystem and how they interact. In this way, research and monitoring can ensure the effective implementation of management strategies using the best available scientific information.

Research and monitoring activities must focus on fundamental processes and specific management driven topics (Tables 2.4a and 2.4b). Information generated from such activities will be used to:

- Provide a means to evaluate the effectiveness of the Park;
- Provide a means to distinguish between the effects of human activities and natural variability;
- Develop hypotheses concerning causal relationships which can then be investigated;
- Evaluate management actions; and,
- Verify and validate quantitative predictive models used to evaluate and select management actions.

Research and monitoring efforts in the Park must be focused on priority issues, and various symposia and reports (i.e., coral reef modeling workshops and rapid ecological assessments; see Sullivan and Chiappone 1994; Chapter 13) have helped to define those issues. Park management will work to improve and enhance the funding, focus and quality of research and monitoring, as well as the free exchange and discussion of research and monitoring information. It will influence research and monitoring by establishing priorities, encouraging open communications among researchers and managers, and allowing Park staff to work closely with researchers to accomplish mutual goals.

Both research and monitoring activities are included in this discussion of local needs for management because

they employ similar methods, are often conducted by the same people and agencies, and must be linked to one another. Research is goal orientated with well-defined, testable hypotheses, and is of finite duration. Monitoring involves systematic long-term data collection and analysis to measure the state of the resource and detect changes over time. Detecting such changes can prompt management decisions, can be used to evaluate the success of management strategies, or to focus research on determining the reason for the change.

Montego Bay Marine Park Research and Monitoring Goals and Objectives

The primary goal of a research and monitoring program is to provide the knowledge necessary to make informed decisions to protect the biological diversity and natural ecosystem processes within the Park. Park goals include:

- Identification of priority areas for research;
- Establishment of an ecological monitoring program;
- Development of standards based on biological monitoring or assessment to ensure the protection and restoration of water quality, coral reefs and other marine resources;
- Establishment of a comprehensive water quality monitoring program to determine the sources of pollution and evaluate the results of pollution reduction efforts;
- Evaluation of progress in achieving water quality standards and protecting and restoring the Park's coral reefs and living marine resources;
- Establishment of strong communication and cooperation between the scientific community and resource managers;
- Coordination of research efforts to achieve the most beneficial results; and,
- Promotion of public awareness and resource stewardship.

To achieve these goals, the following objectives must be accomplished:

- The Park program's role in research and monitoring efforts must be well-defined;
- The Park and regional ecosystem must be understood and managed in a holistic manner;
- Managers, educators, and researchers must communicate effectively regarding issues and the results of studies;
- Data and other information should be shared among researchers and managers and should be easily accessible;
- Multi-agency research efforts should be coordinated for the greatest efficiency, including the definition of common priorities;

- Research funding should be sufficient, predictable and competitive;
- Research permitting should be coordinated among agencies;
- Management goals and objectives should be based on sound science; and,
- Sites protected from disturbance must be designed for sustained ecological research.

Existing Research and Monitoring Programs

Much research has been done in the Montego Bay Marine Park. Research is conducted by many groups, including local and federal agencies, public and private universities, private research foundations, environmental organizations, and independent researchers. While productive, research efforts are driven by diverse goals, vary in available resources and quality, and do not effectively share results. Leading research groups include The Nature Conservancy (rapid ecological assessment; Sullivan and Chiappone 1994), the United Kingdom Department for International Development (benthic and fish survey; Williams and Polunin 1999), the NRCA in conjunction with the Park (assessment of the Park's impacts on local fishers; Nicholson 1994), Harvard and Radcliff College (benthic survey and water nutrient analysis; Hitchman 1997), and the World Bank, along with various consulting firms, universities, and government organizations (see other contributions to this publication).

A number of monitoring activities are occurring in or near the Park. Specifically, these include Montego Bay water quality monitoring (National Water Commission and Louis Berger International Inc.), fisheries catch and effort data collection (Fisheries Division), and visual surveys of fish populations (Montego Bay Marine Park).

Volunteer Strategies and Activities

Volunteer activities and programs are decisive to the success of the Montego Bay Marine Park (Table 2.5). Available to implement a variety of strategy components, volunteers are seen as a valuable human resource. In addition to supporting management activities in the Park, the volunteer program will also coordinate assistance in other Park operations, mainly in the areas of enforcement, education and research.

The volunteer program is the focal point for determining the timing, source, type and degree of volunteer assistance provided for each Park strategy. The program is used to develop an organized method for providing volunteer assistance to the various public and private institutions involved in implementing strategies within the Park. Accordingly, volunteer efforts are planned and

deliberate actions designed to accomplish specific management objectives. Each volunteer receives a handbook that provides information regarding his or her role while assisting the Park. The handbook includes all relevant documentation for monitoring the volunteer program's impact on attaining the Park's overall management plan objectives.

The success of the volunteer program is dependent on the involvement of the local and national community and the diversity of that involvement. Volunteers are recruited for the program and encouraged to participate in continuing recruiting efforts. Diversity among volunteers will be encouraged and emphasized in the recruiting efforts. This is to ensure that volunteers will be available to assist in the various programs where special technical skills are required. For example, volunteers that are certified divers may be asked to be "buddy divers", boat owners may be asked to help implement certain on-water activities, and volunteers with a science background may be asked to assist with the research and monitoring programs.

Montego Bay Marine Park Volunteer Program Goals and Objectives

The Park's volunteer program goal is to provide a mechanism for involving the community in a variety of Park activities. Specific objectives include:

- Support efforts to improve public education and awareness about the Park;
- Provide information to Park managers to allow them to make more informed decisions; and,
- Develop a strategy to target the recruitment of volunteers.

The Park volunteer program strategy to target the recruitment of volunteers proposes approaches to generate interest in the program; explore sources to recruit from community groups, churches, neighborhood associations, and other volunteer groups and government agencies; encourage schools to start nature clubs from which volunteers may be recruited; and explore ways to appeal to potential volunteers with a diversity of interests and skills. The strategy will provide the new volunteers training, incentives and recognition. In doing so, the Park hopes to help keep volunteers involved and interested by providing them with a sense of stewardship and responsibility.

Existing Volunteer Programs

The Park has a history of using volunteers to assist with activities ranging from beach clean-ups and mangrove tree planting sessions, to maintenance tasks and public education programs. Volunteers currently help with office

support, vessel and vehicle maintenance, underwater clean-up efforts, data entry and data base development, festival and special booth interpretive activities, mooring buoy installation and maintenance, and a variety of other Park projects. In addition, they act as visiting group leaders, boat captains and on-water interpreters. Based on the success of these existing programs, it is expected that volunteers will be an integral part of the Montego Bay Marine Park success.

The Park's volunteer coordinator is currently working with Park management to establish a framework for implementing education and outreach, research and monitoring, and other management strategies with a volunteer component. Volunteers are also visiting business and other sites in Montego Bay to determine their interest in displaying Park materials, interviewing businesses about their knowledge of the Park program, and developing a list of questions commonly asked about the Park. Existing volunteer programs that contribute to Park management but are not specific Park programs include boat and marina surveys and the monitoring of corals, rocky intertidal areas, sponges, algae, mangroves and water quality.

In addition to these activities, the volunteer program is currently being developed further. It is a cooperative effort between the Park and the local dive community using their expertise to develop a more comprehensive training program that will lead to improvements in environmental monitoring techniques. Programs currently being considered would focus on fish identification, artificial reef monitoring and reef clean-ups.

Public-Private Partnerships for Water Pollution Prevention and Management

The Montego Bay Marine Park Trust, in partnership with various public entities, is in the process of implementing a variety of low cost and effective programs ("soft interventions") to mitigate water pollution impacts to the coral reef ecosystem (Table 2.6). These interventions form the basis of a comprehensive water quality management program for the Park.

Caught in the Poverty Cycle

Implementing the necessary management measures to ensure a healthy coral reef ecosystem will not be quick or easy. In about five years, 60% of the population in Jamaica will reside in urban areas, such as Montego Bay, and a third will be located in squatter communities not served by adequate household waste disposal (Huber and

Jameson 1998c). Only 25% of the country's households are connected to sewer systems, and even where such connections exist, wastewater treatment is inadequate (Huber and Jameson 1998c). The lack of a comprehensive waste management policy and clear lines of government responsibility delay implementation of effective waste management.

Taking all factors together, tourism is the largest economic engine in Jamaica today. In 1992, Jamaica received US\$1,009.1 million in foreign exchange earnings (Johnson 1998). Government direct revenues from tourism for 1992 were US\$89.87 million against expenditures of US\$58.57 million. Tourism depends on the quality of the natural environment and, at the same time, can support protection of the environment. However, in Montego Bay, tourism impacts itself, local residents and water quality (Taylor 1993). The tourism industry makes many demands on the marine environment such as pressure on the beaches, use of precious resources for craft items, use of wetlands and outfalls in the sea for waste disposal, removal of seagrass for swimming beaches and blocking of visual and public access to the coast. Other negative environmental externalities, which have all been slowly working together to reduce the charm and quality of Montego Bay as a tourist destination, include upland sources of pollutants and soils washing down into coastal ecosystems from squatter settlements originating from increased tourist-based employment; overpumping and contamination of aquifers and aquifer recharge areas; disappearing beaches due to encroachment of structures and groynes; foreclosed public access and recreational opportunities in the coastal zone; threatened artisanal and small scale commercial fisheries from over harvesting; and degraded marine ecosystems. The result is reduced water quality, beach erosion, flooding and coral reef die back that threaten the sustainability of the tourist industry—an industry which is the most important foreign exchange earner in Jamaica.

While Montego Bay has the potential to create vast wealth and has had a measurable degree of success to date, little of this wealth has filtered down to the residents. All-inclusive hotels generate the largest amount of revenue but their impact on the economy is smaller per dollar of revenue than other accommodation subsectors (OAS 1994). For 1997 in Jamaica, Johnson (1998) estimates that the all-inclusive hotels attracted about 40% of all stop-over visitors and captured about 60% of the total accommodation revenues. Unfortunately, only about 23% of this revenue stays in Jamaica (Johnson 1998). The trend towards the all-inclusive concept is increasing. Guests are discouraged from leaving the all-inclusive hotel property because of harassment and crime. Over recent years, this

has led to poor earnings by local restaurants, sidewalk vendors and shops. The non-all-inclusive accommodations import less and employ more people per dollar of revenue than the all-inclusives (OAS 1994). For the entire tourism industry in 1997, the percentage of revenue remaining in Jamaica is about 43% (Johnson 1998).

The hotel industry should be a sector where linkages between economic development and environmental protection can enhance the well-being of the local community and maintain options for present and future generations. Unfortunately this is not the case and living conditions in Montego Bay are eroding. Over one third of Jamaicans live below the poverty line and many survive on remittances from 4.8 million Jamaicans living abroad. Women's unemployment rate was more than twice as high as men's but this has changed. Female unemployment is still higher but decreasing faster, and more young men are unemployed. People flock to the tourist centers for jobs. However, upon arrival, they find there is no affordable housing provided at these locations and, therefore, squatter communities are expanding. Visitor harassment is increasing as more people move without jobs from the countryside to tourism centers. The adult and juvenile crime rate is high and illegal spear fishing (mainly for subsistence) has helped to remove all breeding size fish from snorkel depth waters in the Park. Funding from the Government of Jamaica is totally inadequate to restore marine life. Gustavson (1998; Chapter 5) estimates that the net present value of local uses of the marine Park is US\$489 (US\$420 million for tourism, US\$4.75 million for fisheries, and US\$65 million for waterfront land storm protection) but government only contributed US\$52,000 in 1997 (and less in 1998) to the marine Park budget. Government funds are scarce when 56% of GNP goes to pay off IMF and other foreign debts incurred as a consequence of the 1973 OPEC crisis. Therefore, unless the tourism sector becomes more proactive and puts money into the environment, the Montego Bay Marine Park Trust will have to go overseas or directly to the 1.2 million annual visitors for assistance. Population growth, without providing adequate housing and water, waste management, roads, schools and other services, is resulting in a vicious cycle of poverty related environmental degradation. It is likely that human impacts will continue to prolong the recovery period of coral reef communities.

In recent months, the economic environment has worsened. Inflation is down and interest rates are falling but bankruptcies and emigration are rising. Banks are repossessing small hotels and other businesses. Two of the five independent dive shops closed recently.

Breaking the Cycle

Early Park management was by central government and the style was classical based on the following model: science knows best, science informs regulations, regulations will be imposed, education will teach the children. In a society with low levels of education, high unemployment and little discipline, the result has been low awareness, low compliance, and public ignorance, apathy and criticism. The Park was seen as a discrete scientific and/or regulatory body that people did not understand and to which people did not pay much attention, with the exception that they expected the marine park to stop fishing activities and clean up others' wastes. Staff were becoming demoralized and defensive. In terms of economics, what rent was being captured was going to the private sector or the public purse and, while everyone claimed to be supportive, the support was moral rather than financial. The Park depended on government for funds but the environment was always low on the list of national priorities that had more pressing needs such as education, poverty, unemployment and child welfare.

The Montego Bay Marine Park Trust had been delegated management responsibility just over a year before the timing of the rapid socio-economic assessment of primary user groups (Bunce and Gustavson 1998a; Chapter 11), which was most helpful in informing a new management plan, guiding policy and shifting management style. The Park recognized the limitations of this assessment but, although "rapid" and subject to debate and further validation, provided useful feedback from users. What we learned from this study fell into two main categories—how the user groups felt about the Park, and the value of the Park to them.

Awareness among some user groups was lower than the Park had previously recognized and reflected a need for more information, not just in the formal school system, but also to user groups and the general public. Opinions varied along a spectrum ranging from unaware to apathetic to confrontational. The fishers were defensive towards Park enforcement personnel. The Park responded by becoming less authoritarian and listening more to their problems and concerns about being singled out as the main problem when land-based pollutants are not being addressed. Park management is now offering practical assistance in addressing their particular issues and needs and assisting them with advocacy. Water sports operators were supportive of Park objectives but critical of enforcement efforts. They wanted to become more involved in monitoring and wanted mooring buoys installed. Tourism players were generally supportive but critical of enforcement efforts to date. They also wanted more

information for staff and guests who were largely ignorant of Park regulations.

Five guiding principles emerged (Bunce and Gustavson 1998a; Bunce *et al.* 1999; Chapter 11) which were implemented effectively in the following ways.

1. *Increasing user awareness:*

- Expanding "education" to "community relations";
- Holding workshop with fishers to discuss issues;
- Appointing fishers liaison officers;
- Attending fishers' meetings;
- Developing assistance for fishing improvement and alternatives;
- Maintaining hotel representation on management board;
- Presenting to hoteliers, staff and guests;
- Involving water sports operators in mooring buoy installation and maintenance;
- Holding a photo exhibition and competition;
- Turning the Park office into a resource centre, making it more interesting, inviting and entertaining;
- Revamping web page to be more entertaining;
- Involving divers in reef monitoring and fish counts; and,
- Training user groups to educate tourists.

2. *Promotion of conservation benefits:*

- Starting an aggressive outreach program;
- Developing public relations literature to promote benefits from the Park;
- Using economic values in presentations;
- Promoting operators of approved uses;
- Starting annual awards program;
- Advocating responsible fishing methods;
- Identifying opportunities for eco-tourism;
- Promoting financial savings from changing behavior; and,
- Using computer program to demonstrate cause-effect of coral conservation in Montego Bay (COCOMO; see Chapter 10).

3. *Increasing user involvement:*

- Listening to user issues to get support;
- Holding discussions and regular meetings with user groups;
- Increasing involvement with clean-ups and other projects; and,
- Changing "enforcement" to "compliance".

4. *Promotion of the "community resource" concept:*

- Changing language in materials (e.g., be a sea fan; national treasure and community resource; Mo Bay, My Bay; Wet, Wild and Wonderful);
- Creating brochures, bumper stickers and posters;
- Encouraging civic pride and sense of ownership;

- Forging linkages (e.g., farmers and fishers; hotels and schools);
- Involving the Chamber of Commerce and other groups in projects; and,
- Participating in more community events.

5. *Improving inter-sectoral coordination:*

- Starting network with enforcement agencies;
- Sitting on local government committees;
- Becoming agents for the Fisheries Division;
- Bringing different groups together;
- Influencing government ministers;
- Getting hotels to assist fishers;
- Bringing fishers into water sports and tourism;
- Holding regular meetings with tourism and development agencies to address land-based issues; and,
- Bringing private and public sectors together.

The data from the economic assessment (Gustavson 1998; Chapter 5) gave management a good picture of the financial value of the Park to the primary user groups, which was useful in designing implementation of a user fee system to be promulgated by government. The impressive figures added drama to public presentations in showing the importance of the Park. These figures are also useful to justify budget requirements to government, which made an impression even though national budget constraints prohibited adequate assistance. The data also suggested areas with potential for generating revenue through the other user groups as opposed to fees on direct use, such as hotels, beach fees and mooring buoy fees.

Attitude Adjustment

Management realized that a major attitude adjustment was necessary. If problems are human made, solutions must be as well. If solutions require change in behavior, then the motivations that govern behavior must be understood. Behavior is basically driven by the two opposing forces of reward and punishment. Traditionally, punishment has been used with less and less success. It is time to try incentives. Maslow defined an ascending hierarchy of universal needs that drive the human spirit, but one must start at the bottom and work up. So while universal, people (whether as individuals or in groups as nations) will be at different stages depending on their education and economic situation. Therefore, it is necessary to observe, assess and listen to what makes user groups “tick” before making recommendations, as well as to consider the conflicting perceptions and needs of different groups. Advocacy and negotiation between groups becomes important to success. The attitude adjustment had to start on the part of management itself.

Management style is now based on a multi-disciplinary team approach. Science recommends management interventions and monitors results. Regulations must be justifiable and promoted to all concerned to achieve compliance rather than enforcement. Education goes “on the road” and takes the message to the primary user groups, community at large and the general public. Regular interaction with user groups was strengthened on issues such as the system of permits, to collect fees and data to inform carrying capacity assessment. Outreach efforts show the Park as a repository of useful information for the community, act as a conduit for information from abroad, central government and local government agencies, and provide feedback from the community. The Park must promote the importance of a healthy environment using all available tools such as the internet, mass media and community associations to improve public awareness and change behavior. In terms of economics, we can now demonstrate that the marine environment supports the economy with figures to “prove it”. We can show that the Park is of primary importance to the economic health and welfare of the entire community, and can change the perception that Park management is a hindrance to development and oppressive to fishers. Now we can begin the real work to involve all sectors in understanding, taking ownership responsibility and moving away from the “tragedy of the commons” towards equitable use of resources. Only then will we have sustainable resource management and begin to attack the cycle of poverty.

We’re All on the Same Team

The local communities are the principle force behind the need for reef conservation, standing to benefit considerably by protection, but also being the principle cause of reef loss. Notwithstanding these threats, the natural areas in Montego Bay remain in sufficient condition that, if properly managed and rehabilitated, they will provide substantial opportunities for economic growth, poverty alleviation and the maintenance of globally important biodiversity.

However, given the economic trade-offs and local awareness of environmental issues, coral reef ecosystem preservation and associated water quality is presently seen as a luxury. Until public relations and education efforts take root and *informed government policies and programs* dealing with pollution and poverty issues are enacted, coral reef managers will continue to be caught in a downward spiral of poverty that will defeat them. In any case, resource managers must demonstrate short-term economic benefits from conservation. Long-term payoffs mean nothing in an economy where subsistence is of primary concern.