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WORLD MARITIME UNIVERSITY

Malmö, Sweden

**EFFECTIVE MANAGEMENT OF JAMAICA'S
MARITIME RESOURCES:**

The Need for Marine Protected Areas

By

SYDNEY INNIS
Jamaica

A Dissertation submitted to the World Maritime University in partial fulfilment of the
requirements for the award of the degree of

MASTER OF SCIENCE

In

MARITIME SAFETY AND ENVIRONMENTAL PROTECTION

1999

DECLARATION

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University or the Jamaica Defence Force.

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ABSTRACT

Title of Dissertation: Effective Management of Jamaica's Maritime Resources and Environment: The Need for Marine Protected Areas (MPAs).

Degree: **MSc**

The dissertation examines the state of Jamaica's marine resources and environment, and looks at the applicability of a system of Marine Protected Areas as a tool to be used for their management and protection.

Jamaica is an archipelagic state with large marine areas on which it is economically dependent. Some of these areas have been and continue to be subjected to stress from natural and anthropogenic agents. There is an obvious need to protect and manage these areas for the country's well being.

A look is made at the maritime industrial sector in the country, which is largely fishery and tourism based. This look is also done of other land-based activities which impact on the marine environment. The present efforts at management of the marine resources are briefly examined with emphasis on successes and failures, and the difficulties being encountered.

The environmental concerns that give rise to the need for protection of the environment and the historic public policy response to these concerns are shown. The efforts to develop and utilise resources in a sustainable manner, being largely driven by international efforts, are pointed out. The efforts to bring accepted economic principles and analysis to bear on the protection and management of renewable natural resources and the problems that these attempts have in arriving at a consensus on valuation of resources, are briefly analysed.

The international legal principles that support the establishment of MPAs are enumerated along with the pieces of national legislation existing in Jamaica which can be used for this purpose. The scientific basis on which MPAs should be designated are looked at in conjunction with the legal principles.

The criteria for the selection of MPAs and the different types of MPAs that may be designated are described and the reasons for these criteria given. The importance of public participation in the process of identification and designation of MPAs is emphasised. The process of evaluation and recommendation, taking into

account the technical, ecological and socio-economic factors, are outlined. The difficulty in prioritising among the various factors in making a final recommendation is also examined.

The methodology to be followed in designing and implementing a management plan for MPAs is proposed. The components such as co-management, the use of zones in the MPA, funding arrangements, monitoring and enforcement and finally, a provision for a review process for the plan and its implementation and the results are outlined.

The concluding chapter makes recommendations on the implementation of the Programme for MPAs in Jamaica and the components of the policy that should govern this.

KEYWORDS: Conservation, Environment, Management, Marine, Protection, and Resources.

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LIST OF ABBREVIATIONS

CARICOMP	Caribbean Coastal Marine Productivity
CITES	Convention on International Trade in Endangered Species
CVM	Contingent Valuation Method
DBML	Discovery Bay Marine Laboratory
DFO	Department of Fisheries and Oceans
EEZ	Exclusive Economic Zone
FAO	Food and Agricultural Organisation
FIA	Fishing Industry Act
FIP	Fishery Improvement Project
GDP	Gross Domestic Product
IMO	International Maritime Organisation
IGO	Inter-governmental Organisation
IMF	International Monetary Fund
IUCN	International Union for Conservation of Nature (The World Conservation Union)
JNHT	Jamaica National Heritage Trust
MAA	Maritime Areas Act
MAM	Ministry of Agriculture and Mining
MPA	Marine Protected Area
NGO	Non-Governmental Organisation
NRCA	Natural Resources Conservation Authority
PIOJ	Planning Institute of Jamaica
SCOR	Scientific Committee on Ocean Research
TEV	Total Economic Value
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCHE	United Nations Conference on Human Environment
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
UNESCO	United Nations Scientific, Educational and Cultural Organisation
UNGA	United Nations General Assembly

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Chapter 1

Introduction

1.1 Background

The need for marine protected areas is apparent in many countries, including Jamaica. While the general marine environment in that country enjoys some protection through international conventions and some national legislation, there are areas of the coastal and marine environments that due to particular factors such as ecology, socio-economic importance and scientific, educational and cultural values, need added protection. Making adequate provisions for this however, will require an understanding of the geographical, political and social and economic condition of the country.

1.2 Geography

The mainland of Jamaica is an island in the Northwest Caribbean Sea. It is some 235 km long in an east-westerly direction and 82 km wide at its widest point with an area of 11,424 sq. km. There are seven main offshore cays to the south of the mainland and which are in two groups, the Pedro Cays and the Morant cays. The country is an archipelagic state in accordance with Articles 46 and 47 of the United Nations Convention on the Law of the Sea, 1982 (UNCLOS 82). The Government has claimed jurisdiction over an adjacent sea area of 90,000 sq. nautical miles or approximately 285,000 sq. km and has concluded maritime boundary de-limitation agreements with some neighbouring states, in an area from 14° 06'N to 19° 10'N and 073° 30'W to 081° 30'W. See Fig. 1 1.



Figure 1.1 Jamaica's Location in the Caribbean

Source: Pernetta, J. 1994. Philip's Atlas of the Oceans, page 127.

The area in and around Jamaica is influenced by strong prevailing winds and currents systems. The country's waters lie in the path of the North Equatorial Current, which flows from east to west at an average rate of 1 knot. It is also strongly affected by the North East Trade Winds blowing at an average of 20 knots daily, which not only affect the climate on land, but also increases the wind driven current at sea. Jamaica, like other Caribbean countries, experiences a diurnal tide of about 0.5 meters (Caribbean Junior Social Studies Atlas 1997). These current and wind conditions have affected the Island's history and culture by influencing its early settlement by the Spanish, then the British, and the trading patterns and conflicts that ensued in its waters as a consequence.

The mainland of Jamaica and its accompanying offshore islands, the Pedro Cays and Morant Cays and their surrounding banks, rest at the eastern end of the Nicaraguan Rise. To the north and north-west is the Cayman Trench and to the south and south-east is the Colombian Basin. There is a narrow coastal shelf extending about 12 nautical miles offshore on the south side of the main island and numerous shallow banks. The north coast of the island has a narrow shelf made from fringing coral reefs (Pernetta 1997).

The main island is mountainous with a central ridge dividing the country on an east-west axis with narrow coastal plains and numerous rivers and streams. The ridge of mountains with an average height of 1000 metres extends from the east of the country where they rise to 2270 metres at Blue Mountain Peak, to the west where the Dolphin Head reaches 545 metres. The mainland has 795 km (494 miles) of coastline of which 30% is classified as sandy beaches suitable for recreation (NRCA 1997).

The mountainous terrain affects the climactic conditions on the island both by modifying the temperature and the rainfall pattern. The climate is tropical with average temperature on the coastline of 27 °C but is more temperate at the higher elevations, where the average is 18 °C. Most of the rainfall is in the north-eastern end of the country on the windward side of the Blue Mountain Range. The average annual rainfall is 1850 mm and falls mainly in the rainy seasons of March to May and August to November. In 1997 the average rainfall was 1321 mm which caused a severe drought. The offshore Cays are low lying and sandy, and are surrounded by extensive amounts of coral reef. They are covered by scrub vegetation and small trees. The weather patterns experienced mirrors that of the surrounding marine environment.

The country is subjected to the threat of violent tropical storms and hurricanes from May to November each year (Caribbean Junior Social Studies Atlas 1997).

1.3 Political

Jamaica is a constitutional monarchy based on the Westminster model. The country is a fully independent member of the Commonwealth, with its own Constitution. The Government consists of three branches: the Executive, Legislature and Judiciary. The Head of State is Her Majesty Queen Elizabeth II who appoints a Governor-General on the advice of the Prime Minister to carry out the required constitutional duties on her behalf. The Governor-General is advised by a six-member Privy Council on the exercise of the Royal Prerogative of Mercy and on appeals from members of Government Services on matters of discipline arising from actions of any of the Services Commissions.

The Executive arm of the government is comprised of the Prime Minister and the Cabinet. The Prime Minister is appointed by the Governor-General, whom having determined that such a person commands the largest support in the House of Representatives, invites him to form the Government. The Cabinet is also appointed by the Governor-General on the advice of the Prime Minister. The Cabinet comprises members selected from the House of Representatives and the Senate. The Leader of the Opposition is also appointed by the Governor-General and is the person able to command the greatest support of those not supporting the government.

The Legislature is bi-cameral with a House of Representatives consisting of sixty (60) members, directly elected at intervals not exceeding five years and a Senate of twenty-one (21) appointed members. The members of the Senate are appointed by the Governor-General on the ratio of thirteen members on the advice of the Prime Minister, and eight on the advice of the Leader of the Opposition. This ensures the ruling party(ies) never has the two-thirds majority needed to take certain constitutional actions on entrenched clauses of the Constitution without support from the Opposition Party.

The Judicature is made up of the Resident Magistrates and other Special Courts e.g. Family Courts; the Supreme Court and the Court of Appeal. Final Appeal is to the Judicial Committee of the United Kingdom Privy Council. The Governor-General, on the recommendation of the Judicial Services Commission appoints

members of the Judiciary. They have tenure for life or until retirement age, whichever comes earliest.

The Constitution guarantees fundamental rights and freedoms. It safeguards these freedoms regardless of race, place of origin, religious or political opinions, colour, creed or sex, subject only to the rights and freedom of others and the public interest. The rights include the right to life, liberty, freedom of movement and association, enjoyment of property and protection under law.

1.4 Social and Economic

Jamaica had an estimated population of 2,553,600 persons at the end of 1997 with an average growth rate of 1.0%, which has been the average since the 1990s. The aim of the Government is to reduce this to 0.8% by the year 2001 and 0% growth by year 2020. The life expectancy was 70 years for males and 74 years for females, with a crude death rate of 5.9 per 1000 of the population (PIOJ 1998).

In education, 98.1% of those eligible were enrolled in primary schools (age 6-11 years), 64.2% were enrolled in secondary schools (age 12-18 years) with the age group 12-15 years achieving 90%. Another 15% of the age group of 12-18 years were enrolled in other institutions such as vocational training centres or other types of educational facilities. At the tertiary level, only 9.5% of those in this age group of 18 years and above pursued education at this level (PIOJ 1998).

In 1996, unemployment rate stood at 16.5% of the total labour force with female unemployment at 23.5% and male at 10%. The job-seeking rate was 7.3%. Income per capita was US\$2,300.00.

The Gross Domestic Product (GDP) of the country fell by 1.8% and 2.4% in 1996 and 1997, respectively, after growing by an average of 1.0% between 1993 and 1995 inclusive. See Table 1.1. Inflation averaged 17% between 1995 and 1997, with a low of 9.7% in 1997 (PIOJ 1998).

The out turn on GDP and inflation over the period 1996-1997 were largely as a result of the measures taken by government to adjust the economy structurally with import, price and exchange rate deregulation among others. These changes led to a requirement for alternative industries and forms of employment as some of the traditional industries were either scaled down or were discontinued. The aims of these policy initiatives were to curb inflation and achieve a stable, market oriented and

competitive exchange rate and eventually economy. The aim of reducing inflation was achieved as can be seen in Table 1.1, and the currency exchange rate stabilised, however, the economy is still not competitive. The achievements were at a high cost as the monetary authorities had to set tight monetary policies with high interest rates. The result was contraction in the financial and productive sectors as the cost of funds went up and aggregate demand fell. The negative trend in production was further exacerbated by a severe drought in 1997, which caused agricultural output to decline by 17% (PIOJ 1998).

The stabilisation policies attempted by the government also created difficulties in the fiscal situation as its open market monetary operations placed an unforeseen burden on the budget, which meant funds had to be re-allocated from capital or growth oriented programmes to house-keeping or non-productive ones.

Table 1.1 GDP of Jamaica for Years 1993-1997

Year	1993	1994	1995	1996	1997
GDP (J\$M)	18011.2	18210.0	18294.4	17973.4	17548.8
GDP % growth	1.4	1.1	0.5	-1.8	-2.4
Inflation %	22.1	35.1	19.9	26.4	9.7

Source: Economic and Social Survey of Jamaica, 1997.

GDP is measured at 1986 (constant) prices.

Jamaica has a fairly diversified economy with a fair mix of agriculture and fishery, manufacturing, mining and basic services. In fact, the first three accounted for 84% or US\$1,017.4M out of US\$1,200M of merchandise exports (See Table 1.2). These sectors in 1996 accounted for the bulk of economic activity outside of the Community, Social (Government and non-profit activities) and Personal, and Financial Services category. There is also a large informal sector made up of small and micro enterprises that the PIOJ is studying in order to understand its contribution to the economy and then to give governmental support and bring into the formal small business sector.

Tourism is the single largest foreign exchange earner for the country with earning equalling 70% of that of merchandise exports, or with net earnings of US\$840M. The tourism industry is estimated to provide direct employment for 9% of

the labour force and another 18% indirectly (PIOJ 1998). The full impact of the industry is, however, difficult to assess apart from the direct earnings. This is as a result of several activities in the sector being aggregated in other sectors such as Distributive Trades and Transport, Storage and Communications. The importance of this industry to the country cannot be overstated and is one of the important reasons for the protection of the marine environment.

Table 1.2. Major Sectors Contributing to GDP

Sector	% of employment	% of GDP	% merchandise export
Agriculture	21.8	8.2	16
Mining	1.0	9.9	40.1
Manufacturing	9.4	18	27.9
Construction	8.4	8.9	N/A
Transport/Storage/ Communication	5.6	14.9	N/A
Distributive Trades	20.8	23.4	N/A

Source: Compiled from data in Economic and Social Survey of Jamaica, 1997.

The Government of Jamaica has stated in its National Industrial Policy that “exploitation of comparative advantage in areas such as natural resources, cultural products and geographic location” would be a cornerstone of that policy. The strategic plan in that policy states that in order to achieve its objectives, four major components have to be addressed. These are macro-economic policy, industrial policy, social policy and environment policy (PIOJ 1998). Considering the geographic and socio-economic conditions of Jamaica, it is that there will be serious pressures on the coastal and marine environment and problems in addressing these pressures.

Being a mountainous island, more than 80% of the population live in coastal areas. This leads to pressures on the areas and the adjacent marine environment. There are already significant signs of serious degradation in some areas concerning water quality, state of the reefs and fish stocks. The problems are further exacerbated by the effects of development of the tourism infrastructure and the use of the natural coastal resources by the tourism industry. The high level of unemployment, slow economic growth, and a population that has received only a small amount of

education in environmental matters, mean that attempts at environmental management will require patience and hard work to convince those affected, that it is in their interest to protect the environment and its resources. There are also the inevitable adverse effects of the ever-threatening tropical storm systems, which affect terrestrial areas as well as the shallow reefs.

1.5 Marine Protected Area (MPA)

Marine protected areas have been defined by the International Union for Conservation of Natural Resources (IUCN) as, “any area of inter-tidal or sub-tidal terrain, together with its overlying waters and associated flora and fauna, historical or cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment” (Nicholls 1998). There are of course other definitions in use, but this one describes the type of areas envisioned for Jamaica.

There are good reasons for the establishment of MPAs and these can be extrapolated from the definition. The objectives to be achieved can be any one or combinations of the following:

- conservation of fish stocks, especially re-building of depleted ones;
- protection of endangered or threatened species;
- protection of unique habitats;
- protection of diverse and/or productive ecosystems;
- protection for marine research;
- preservation of historical and cultural sites and naturally aesthetic values of marine areas;
- enabling the studying and understanding of marine and estuarine systems for preservation, education and leisure (Nicholls 1998).

The designation of areas for protection will be difficult and, of course, will require input from government and the society at large. Participation in the identification and development of these sectors of the marine environment will be necessary. This will be important, especially from those most directly affected by the closure of areas which had been in some use before, or those who will be affected by the damage to an area if appropriate actions are not taken. Opposition can be expected from some user groups such as fishermen and those who are dependent on fishing activity in some

areas because of the potential loss of livelihood. Challenges can also be anticipated from segments of the tourism industry such as scuba-diving operators for the same reason. Alternatives will have to be considered for such groups in order to gain their support. If transit is prohibited, opposition can be expected from the navigational users, as it will cause inconvenience as a minimum and may even increase costs.

Protection of certain areas must be done however, even sometimes in the face of opposition, as too often efforts at conservation only start when the adverse effects are already obvious. Frequently this is too late. Involvement of all parties from the outset can help to smooth this path and overcome the most common problems.

The most common obstacles that are faced by developing countries, including Jamaica, in their efforts at conservation are:

- outdated or non-existent legislation on environmental conservation;
- organisational difficulties due to the cross-ministerial nature of management of ocean affairs;
- inadequate resources to carry out proper law enforcement and the unwillingness or inability to sanction violators;
- lack of human resources to carry out the technical studies to make proper, balanced decisions;
- low educational focus on environmental issues in the population at large, hence industry and development are stressed over environmental conservation;
- difficulties in resolving multiple use conflicts.

The marine environment has been viewed historically as common property; hence efforts at control lead to conflicts or apprehension. The kinds of concerns in the minds of the public are questions on the equity of the burden to be borne by the different stakeholders; the benefits to be derived and by whom; the alternatives on offer especially if efforts at conservation means a loss of income. Matters of conservation are always easy to accept as long as there are no direct effects on the individual. This creates the need to ensure that the local population that may be affected by the loss of use of an area do not feel isolated and subject to the decisions of 'scientists, bureaucrats and other do-gooders' in some far away place. These all give rise to the need to have a clearly developed, well-articulated regime on MPAs.

A constraint in proposing a system of MPAs for Jamaica is that there are not many well established programmes from which to learn as this is still a fairly new tool being

developed for protecting and managing marine areas. *The Marine Protected Areas Program* of Canada's Department of Fisheries and Oceans, and *Guidelines for Establishing Marine Protected Areas* by Graeme Kelleher and Richard Kenchington, published by the International Union for Conservation of Nature and Natural Resources, will be relied on as major sources for guidance in this paper.

1.6 The Development of an MPA Regime for Jamaica

The development of the regime on MPAs must take into concern the views, through constant dialogue, of all the various interest groups and stakeholders in order for them to have any success. Experience in other countries such as Canada shows this. Any effective policy must address the methods of identification of an area, the legal framework for the designation and management of the areas and clearly outline the end-state to be achieved. Not all areas, for example, may need to be closed forever or to all users. The level of rehabilitation and/or preservation to be achieved must be stated. The policy should aim for a situation where decisions are based on sound scientific data and/or credible local knowledge, keeping in mind the principles of the precautionary approach to environmental management.

Methods of funding for management and enforcement should be clearly stated and various responsibilities allocated. Where there is a requirement for sanctions, the policy should make adequate provisions for this and the methodology to be used, e.g. administrative or judicial ones. The policy will seek to be clear and with goals that are achievable. It should seek to make use of the best available human, scientific and other resources.

It is anticipated that any attempt at environmental management in Jamaica will require allocation of resources. This will be true of the marine environment and a regime for marine protected areas. Government will not have all the resources nor should it be desirable that government should provide all the resources for the management of MPAs. There is likely to be great reliance on the private sector, especially in the tourism and fishery industries, to assist in this effort in collaboration with the voluntary sector. Some expertise already exists especially in educational institutions and some non-governmental organisations (NGO's). Notwithstanding this however, it still leaves government with the role of setting overall policies.

Governmental responsibility for marine environmental policy in Jamaica is fragmented across ministerial and agency lines and therefore is subject to confusion and lack of necessary action. The Natural Resources Conservation Authority (NRCA) under the Ministry of Environment and Housing has the overall responsibility for the management of the environment and natural resources, but there are other agencies of the Government with statutory authority for managing specific types of zones. Examples of this are the Fisheries Division of the Ministry of Agriculture, which is in charge of fish sanctuaries, and the Ministry of Tourism's Sustaining the Environment and Tourism Programme. The NRCA has promulgated a Policy for Jamaica's System of Protected Areas, which includes marine areas but there is room for further development of the ideas it contains. The concluding paragraph in this policy document admits to this by saying: "In order to facilitate the further development of the system, a protected areas system plan will follow this document. This plan will outline the steps and actions to be taken over a period of time".

Given the above and the urgent need to protect the Jamaican marine environment, the purpose of this study is to develop a comprehensive methodology for the design and effective implementation of marine protected areas in waters under Jamaica's jurisdiction. This is essential if the social and economic well being of the country is to be assured taking into consideration the significant part the marine environment plays in contributing to the economy of the island. The government has designated at least one area as a marine park, but many other areas need protection and for reasons other than recreation.

Chapter 2

The Jamaican Maritime Environment

2.1 The Marine and Coastal Environment

Jamaica has an extensive marine area relative to the size of its landmass. The total area under the country's jurisdiction is approximately 25 times larger than the total land area (see Fig 2.1). The total land surface of the Jamaican territory is 11,424 square kilometres, and the Exclusive Economic Zone (EEZ) encompasses an area of 285,000 square kilometres. The marine area is physically diverse, with the north coast of the island having a very narrow shelf extending to about 1 nautical mile (1.6km). This shelf consists largely of fringing reefs with only a few gaps made by submarine gorges cut by rivers in the Pleistocene epoch. Beyond the reefs, the sea floor drops steeply to the oceanic deep.

The south side of the mainland has a shelf, which extends 15 nautical miles (24km) offshore. The bottom 'topography' consists of coral patches, sea-grass beds, extensive sandy areas and more extensive reefs in the eastern portion. The most well developed areas of coral growth are to be found along the edge of the sill reefs on this side of the island.

Further offshore along the south and east coast are nine proximal banks, which together with the shelves make up an area of 4170 square kilometres. Even further from the mainland in the Southwest and Southeast are the Pedro and Morant Banks with areas of 8,040 square kilometres and 100 square kilometres, respectively (See Fig 2.2). These banks rise quite quickly from depths in excess of 500m to form submarine plateaux with depths averaging 25m and with numerous shoals and cays. There are extensive coral formations, sea-grass beds and reefs.

Figure 2.1 Map Showing Jamaica's EEZ

Source: Ministry of Agriculture and Mining, 1997. Plan for Managing the Fisheries of Jamaica, page 7.

**Figure 2.2 Maps of Jamaica Showing the Offshore Shelf, Pedro and
Morant Banks**

*Source: Ministry of Agriculture and Mining, 1997. Plan for Managing the
Fisheries of Jamaica, page 8.*

The banks provide important spawning areas and habitats for the living resources and so are of great importance to the fishery industry. The Pedro and Morant Banks are the most important of these banks.

Along the coastline of the mainland, a total 238.5km of beach is suitable for recreational use; 18.5km are currently put to this use and 11.2km are designated as fishing beaches.

The offshore cays are used mainly for fishing and as wildlife reserves for birds and turtles. There is a Coast Guard Station on the Pedro Cays which also serves as a meteorological observation station and has the capacity to house scientists carrying out research in these areas.

The Jamaican marine environment has been subjected to many influences that have caused varying degrees of degradation. Some of these have been natural, such as hurricanes and diseases and others anthropogenic, mainly due to land based activities but some due to sea-use as well. The most heavily impacted part of the marine environment has been the Jamaican coral reef communities.

The coral reef communities, which are necessary to sustain the fishery by providing habitats, provide barrier protection for the coastline by breaking up high-energy waves and whose erosion gives the white sand for the beaches, are under intense stress. The importance of coral cannot be overstressed. Coral provide habitat support to approximately 33% of fish species and a possible one half million of animal species altogether. They live in warm waters where temperatures are average 25°C, oxygen is abundant and sunlight plentiful. They grow best at depths of about 15-20m. Colonies grow at 1-2cm per year. These colonies help in maintaining the carbon dioxide balance in nature due to their secretion of calcium carbonate. They are also a potential source of pharmaceuticals and several tests are now being carried out with encouraging results (Chadwick 1998).

The Jamaican coral reef has suffered from the effect of two hurricanes, Allen in 1980 and Gilbert in 1988. These two hurricanes destroyed much of the coral on the North Coast. They also created a stratum for the growth of algae. Following hurricane Allen, the corals were subjected to predation, and 'white band' disease, which leads to mortality. The predation was from the coral-eating snail, which became over-abundant due to the lack of a natural predator as a result of over-fishing (Gayle et al 1998). The over harvesting of the herbivorous fishes also caused a growth in algae but

this was more in the deeper water. This was due to the consumption of the algae in the shallows by the sea urchin, which had grown abundant, once again by the harvesting of its predators. The presence of this sea urchin kept the algal growth to a low level and so kept the coral free from their adverse effects. This beneficial situation changed, when in 1983 there was an epidemic disease of unknown origin throughout the Caribbean, which wiped out 99% of the sea urchin population. The presence of the algae is still high in Jamaica's waters, as the sea urchin population is extremely slow in recovering (Gayle et al 1998).

These catastrophes were further exacerbated by the phenomenon of mass bleaching of corals, which can lead to their progressive destruction. This was first seen in 1987-88, then again in 1988, 1990 and 1995. This happened as a result of high sea temperatures (Gayle et al 1998). It should be noted that recovery from mass bleaching is possible as the coral is not at first dead but has expelled the symbiotic zoo-xanthellae, which helps in its food synthesis. This leaves its limestone skeleton exposed, hence the look of bleaching. If the corals are able to recover without the addition of anthropogenic agents, they will survive but any such influence such as silt, pesticides, heavy metals, and algal blooms will cause them to succumb (Chadwick 1998). Unfortunately, the corals were exposed to some of these agents such as silting due to soil erosion on land, pesticides and nutrients from farming and other run-offs, sewage outfalls and the stress introduced by urbanisation.

Surveys done in the 1990s on the north coast of reefs previously surveyed in the 1970s showed the following results: a decline in coral cover from 52% to 3% at 10 metres, and concurrent increase in the cover of fleshy macro-algae from 4% to 92%. In the mixed zones, cover was 10% and at the Montego Bay Marine Park it was 14%. On the south coast around the Port Royal Cays, the cover was 20% (Woodley 1997). Taking data from a study by Hughes, Gayle et al said "Natural and anthropogenic effects have caused a change in the community structure, from high diversity, coral dominated reefs to low diversity, algae dominated system" (Gayle et al 1998).

The other aspect of the Jamaican marine environment of concern is that which bears on the protection of cultural and historical sites. Jamaica's strategic position astride the route of Spanish cargo ships laden with precious metal for that country, and the influence of hurricanes and pirates or privateers during wars between England and Spain, has left many wrecks of significant historical or monetary value in its waters. There are, for example, over 500 documented wrecks in Kingston Harbour

alone. There are also numerous wreck sites on the Pedro Bank and other areas. These wrecks have been left largely unexplored but some of the most well known ones have been the subject of activity by illegal treasure hunters (Ebanks 1998).

The country lies across a fault line and has had devastating earthquakes, which have sunken parts of Kingston and Port Royal in the 17th Century. These sites and others are of great archaeological value to Jamaica and the international community (Ebanks 1998).

2.2 The Maritime Industrial Sector

The two main areas of economic activity in the marine environment in Jamaica are fishing and tourism. Fishing has been an important activity for Jamaicans for many years. It has largely been an artisanal activity using wooden dugout and small 6-8 metres fibreglass canoes. Hand lines and antillean Z-shaped-traps made from mesh wire are the most favoured methods of harvesting, but gill nets, seine nets and spear guns are also employed. In the 1970s the government, in an effort to increase food self-sufficiency in the country, gave extensive subsidies on the purchase of outboard engines, fibreglass and petrol to encourage fishing. This led to rapid growth in the number of fishermen from a few hundreds to where in 1995 there were estimated to be about 20,000 fishermen using 9000 boats (Lodge 1995).

There are about 1,000 fishermen with about 180 canoes on the Morant and Pedro Cays. Larger canoes of 10-20 metres in size support them, by taking supplies to them and transporting the fish to the mainland packed in ice. The balance of the artisanal fishing is based at some one hundred and sixty seven (167) fishing beaches spread around the coast of the mainland (MAM 1998). The bulk of this fishery is for reef fish species, with pelagic species making up a smaller portion (See Table 2.1). The bulk of the catch is sold in local markets or to the hotel sector by the fishermen or by vendors and is consumed domestically.

The early 1980s saw the development of an industrial fishery using larger decked vessels in the size range of 15-30 metres. These are mainly employed in the harvesting of conch and lobster on the Pedro and Morant Banks. A number of these vessels and crew are contracted from the Dominican Republic and Honduras. The method of harvesting is divers with scuba or hookah gear. Most of the catch from the fishery is exported to the United States of America or the European Union.

As can be seen from Table 2.1, the size of the catch of fish has been diminishing recently, with the catch for 1997 being only about half that of 1996 for the same fishing effort. This was largely due to the effect of over-exploitation and degradation of the coral reefs, which are vital to support the spawning and growth of the fish. The 1995 Food and Agriculture Organisation's (FAO) report on Jamaica, said that the entire fishery, but particularly on the shelves in Jamaica, is over-exploited (Lodge 1995).

Table 2.1 Commercial Fishery in Jamaica: 1996-1997

1996				1997			
Species	Habitat	%	Tonnage	Species	Habitat	%	Tonnage
Grunts/ Parrot Snapper	Reef	69	10,001	Grunts/ Parrot Snapper	Reef	51	3922
/Jacks	Pelagic (deep water)	18	2609	/Jacks	Pelagic (deep water)	21	1615
Lobster/ Conch	Benthos	10	1431	Lobster/ Conch	Benthos	28	2155
Other		3	54	Other		0.0	1
Total		100	14495	Total		100	7692

Production value in 1996 =US\$70M

Production value in 1997 =US\$30M

Source: Ministry of Agriculture and Mining Report 1998.

The data has been supported by the research carried out at the Discovery Bay Marine Laboratory of the University of the West Indies (UWI) over a period of twenty years. These studies have concluded that the reef fish population has been over-exploited in Jamaica in general and is almost extinct on the north coast. This is due to the fishing methods used and the great effort concentrated on the large herbivores and predators (Woodley 1988). The herbivores are critical to the growth of corals as they consume the algae and keep the coral clean. When these species, such as the parrotfish are harvested, the algae grow abundantly and so smother the coral,

leading to high levels of coral mortality. Efforts at managing the fishery to reduce these negative effects have traditionally received low priority.

The fishery sector has a chequered record in its effort at management. The Fisheries Division is part of the Ministry of Agriculture and Mining. It is woefully under-funded and under-manned; hence it suffers from a lack of effectiveness. The sector suffers from some organisational difficulties such as not having any formal advisory mechanism to gain public acceptance of proposals and implementation of policy. There is little organisation among the fishers except in the industrial fishery (MAM 1997).

Tourism is the other major industry in Jamaica, which makes extensive use of the sea. There are significant numbers of cruise ships calling at Jamaican ports weekly, with an average of nine weekly. There have been no major incidents of pollution from these vessels to date. The International Maritime Organisation (IMO) has declared the Wider Caribbean, under the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 relating thereto (MARPOL 73/78), as an Annex V Special Area. This Annex lays down strict guidelines on the type of garbage that is allowed into the sea. It prohibits disposal of all plastics, other garbage including paper, rags, glass, metals, bottles, crockery, dunnage and lining material. Food waste is prohibited to be disposed of within 12 nautical miles of land if uncomminuted, or if comminuted, at least 3 nautical miles (IMO 1997). This has reduced the effects of one potential source of pollution i.e. from garbage. There is always the potential however from pollution due to marine casualties and accidental discharges of oils.

Another important aspect of tourism is sports fishing. This activity occurs widely on the north coast, with locally chartered vessels. These vessels operate outside of the reefs and the shelf as they seek the larger game fish such as sailfish, swordfish and marlin. They also leave and return to permanent moorings, so reducing damage to reefs from anchoring. The more significant aspects of the effect of the tourist industry on the marine environment will be dealt with in the section on land based activities.

2.3 Impact of Land-Based Activities

The marine environment in Jamaica is affected by a significant amount of land based activities. The island is small, narrow and quite mountainous. This means that almost all activities on land which generate solid or water soluble waste, will negatively affect the marine environment if proper precautions are not taken. At the world level, it is believed that eighty percent (80%) of marine pollution is from land based activities, ten percent (10%) from marine dumping and ten percent (10%) from marine operations (Pernetta 1995). It is believed that these figures are more or less accurate for Jamaica.

The kinds of land-based activities which affect the marine environment in Jamaica are urbanisation, port development, tourism infrastructure development, agriculture and industry, waste disposal and land reclamation. The impact of these varies and is largely dependent on how much activity there is in that particular sector or area of activity.

Urbanisation has affected mainly the areas around Kingston and Montego Bay and a few selected areas of the north coast. These areas have seen large growth in population without the same growth in the necessary support systems such as housing, sewage and garbage disposal. This has led to 'squatting' on marginal lands, improper collection and treatment of sewage and poor or no garbage collection in some areas. The various wastes end up in the sea whenever it rains, either as solids or leaked in the run-offs. These introduce nutrients, silt and garbage, which lead to overgrowth of algae and smothering of benthic communities. Fortunately, there has been no large-scale eutrophication.

Port development has taken place and there are plans for further development in Kingston, Montego Bay and Ocho Rios. Part of the development is the dredging of channels, placing of piles and retaining walls and the reclaiming of some areas of wetlands. The effect of all these is the disruption of the natural current flows, silting of natural channels and other parts of the seabed as the sea floor is disturbed due to construction activities, and destruction/displacement of some species inhabiting these areas.

Tourism infrastructure development has been a controversial subject in Jamaica for many years, with most new developments having its strong and vocal proponents and opponents. This is because it means the physical changing of some

area, usually along the coastline. The opposition is especially strong if any area of wetland or mangroves are affected, which is frequently the case. The harmful effects are due to destruction of the natural habitats of the fish or birds that live there. They also diminish the natural coastal protection systems.

The building of golf courses is also bad for the marine environment when these are close to the coastline. Maintenance of these facilities requires large amounts of pesticides and fertilisers to keep them in the required standard. When these chemicals are leached into the soil and carried to the sea, they introduce harmful nutrients and toxins into the ecosystem.

Tourism itself places stress on the coastal resources such as beaches where constant human traffic leads to erosion. Diving can also affect the coral reefs by inadvertent trampling or breaking of the delicate branches of the organisms.

A major new project geared at facilitating tourism as well as transportation for the population at large, is the Northern Coastal Highway Project, which extends from the western to the eastern extremity of the island. Most of this highway is being built along the coast and will in some cases pass through wetlands and environmentally sensitive areas. The government however has made great effort to minimise the negative impacts of this project and the Natural Resources Conservation Authority (NRCA) has done environmental impact assessments of all aspects of the project.

Agricultural and other industrial wastes have at various periods affected the marine environment, but recent monitoring and enforcement moves by the NRCA have started to have an effect in reducing the flow of effluent from those activities into the sea.

2.4 Present Management Efforts in the Marine Environment

For many years there was little or no public effort at protecting the natural environment of Jamaica. Several environmental protection laws were passed but were left unenforced, as there was no education of the population as to the reasons they were enacted or to the desired effects. This lack of awareness extended to the enforcement agencies of the government as well; therefore many of those laws were neglected. There was also the problem of different pieces of legislation falling under the responsibility of many different ministries or agencies; some with competing or conflicting interests.

The late 1980s and early 1990s saw changes, however, in the population's awareness of the importance of protection of the environment and conservation of renewable natural resources. Management efforts started to grow in importance, and took on some urgency. Protection of the natural environment became a part of the political debate which caused it to start getting the attention of the highest level of government decision-making, at least as a subject for discussion if not concrete action.

The efforts at preservation of the marine environment and the conservation of the renewable natural resources have been sporadic, and much effort has been only local and community based. There are some laws in place, which can support those efforts, and with better co-ordination these efforts can have positive effects. The Exclusive Economic Zone Act 1991 and the Maritime Areas Act 1994 are pieces of legislation which provide for the making of regulations for the protection and conservation of the natural resources in the sea. They designate responsible parties and prescribe penalties for infringements.

The Fishing Industry Act 1975 makes provision for the licensing and registration of fishermen and fishing vessels, but does not provide any clear direction for the management of the fishery. It gives the Minister the authority to declare an area as a fish sanctuary and to declare closed seasons for specific fishery but is silent on the criterion or mechanisms to be used to make these tools effective.

The Wildlife Protection Act 1945 with amendments of 1997 and the Natural Resources Conservation Acts 1991 make provisions to designate protected species, prohibit certain methods of harvesting and prescribe offences for various activities.

The efforts at management of the fishery at the governmental level have been through the use of closed season for lobster and a combination of closed season and catch limit for conch. The government has also declared two small areas as fish sanctuaries. These are the inner harbour at Port Morant and Bogue Island in Montego Bay. The total size of these areas is less than 10 square kilometres.

The lobster fishery is closed from 01 April – 30 June each year. The Officers of the Fisheries Division, the Jamaican Constabulary Force and the Jamaica Defence Force Coast Guard enforce the closure. It loses some of its effectiveness, as there is no ban on sale or consumption of the meat if it can be demonstrated that it was acquired before the beginning of the closed season. This leaves a large loophole to be exploited by unscrupulous persons who will break the law, claiming that they were in

possession of the meat before the start of the closed period. There is also a minimum carapace size for the catching of individual lobster and a prohibition on the harvesting of berried female lobsters. These measures are aimed at the protection and conservation of the lobster stocks.

The conch fishery is best managed, partly due to the protection given under the Convention on International Trade in Endangered Species (CITES) Annex II. This Convention allows the continuation in trading but makes requirements for issuing of permits based on scientific evidence of stock viability. A permit is also required from the NRCA to export the product. A comprehensive assessment was done of the stock under the supervision of the NRCA in 1995 and a total allowable catch was arrived at which has been adhered to. It should be noted that the quota system established was a voluntary one as there is no legal basis for promulgating one. There is also a closed season from 01 August – 30 November each year for the conch fishery (Lodge 1995). This relatively good situation in this fishery has received a severe blow recently when the Supreme Court of Jamaica allowed an application barring the NRCA from restricting the export of conch from an exporter who had already exceeded his permissible limit for exports given under the auspices of CITES. This development has become a cause for greater concern as this ruling was upheld by the Court of Appeal (McCauley D,1999). The Court in giving its reason, outlined the failure of the Executive and Legislative arms of the government to put in place the enabling legislation to give effect to the CITES Convention and therefore the actions of the NRCA to restrict the exporter from trading was *ultra vires*.

In 1997 the Fisheries Division promulgated a Plan for Managing the Marine Fisheries of Jamaica. Its objectives are to:

- develop and increase the potential of marine living resources to meet food, social and economic development goals;
- ensure that the plan is integrated into the Coastal Zone Management Plan of the NRCA;
- maintain or restore fish populations to sustainable levels;
- encourage the use of selective gear to minimise waste;
- carry out proper monitoring and enforcement;
- protect and restore endangered species, preserve rare and fragile ecosystems and areas;

- encourage scientific research;
- co-operate with other nations in managing shared and/or migratory stocks.

The plan envisions monitoring for both biological and socio-economic effects. Biological monitoring focuses on total catch, catch/effort ratios, species diversity and distribution, size and age, fecundity and potential or maximum sustainable yield. Socio-economic monitoring focuses on total landings, relative contribution to GDP, landing/income ratios per fisher or vessel, awareness of management effort, changes in technology and fishing method.

The general principles to which the plan commits the Fisheries Division are:

- management principles to ensure optimum production;
- sustainable resource exploitation;
- the use of the precautionary approach;
- efforts directed to the economic and social welfare of the population, using rigorous monitoring to ensure adequate protection if necessary;
- to fully implement and support international agreements (MAM 1995).

This is still only a plan and only time will tell if it will be implemented and the degree of success it will enjoy.

Efforts by non-governmental organisations in the management and development of the fishery have been undertaken on a limited scale. The two most notable are the Fishery Improvement Project (FIP) of the Discovery Bay Marine Laboratory (DBML) on the north coast of Jamaica. The other is the effort of the South Coast Development Foundation in the Portland Bight area. The FIP undertaken in Discovery Bay embarked on a project of encouraging the fishermen to change the traps they use. They were offered traps made from mesh of 1½ inch wire. If they turned in their traps of 1¼ inch, they would be given two new traps for every one they gave in. The project has successfully demonstrated that using a larger mesh size has resulted in individual fish caught getting larger. Part of the project was the designation of part of the area as a reserve. This has served to improve the stock of commercially desired species through out-migration from the reserve. The fishermen have become quite enthusiastic about the results, and now surrounding communities are asking to join the project (FIP1998).

The South Coast Development Foundation has been working with the fishermen in the Portland Bight area to educate them on using fishing methods that do

not harm the natural environment. They are encouraged against methods such as using trawl nets on the sea grass beds, which disturb eggs and larvae and destroy juvenile fish. They also encourage voluntary monitoring and self-regulation. There is also a project for the establishment of artificial reefs to increase the available habitats. The main success of this project to date is the heightened positive awareness among the fishermen and the communities in the area.

The management of resources of cultural or archaeological value in the marine environment is done by the Jamaica National Heritage Trust (JNHT). This organisation has steadily worked at this, with established goals, and within a legal framework. It has undertaken surveys in conjunction with other national institutions and international bodies and universities. The JNHT is achieving some success but operates in an environment of limited financial resources. This means that many projects have long time delays and most efforts at protection are in-situ.

The JNHT has established, with the help of UNESCO, a conservation laboratory which is primarily engaged in preservation of objects recovered from the sea. It also has photo laboratories, and archive and storage facilities. The organisation carries out monitoring of marine sites with the help of the Coast Guard. It is also engaged in wide public education activities to sensitise people to the importance of the cultural and archaeological value of these wreck sites.

On the wider scale, the government formally established a Council on Ocean and Coastal Zone Management in 1998. This body had been meeting informally since 1996 to work out ways to manage the country's ocean affairs as the ad hoc and splintered nature of marine resource and environmental management was creating chaos. The council will advise the Cabinet and will have its Secretariat in the Ministry of Foreign Affairs. All Agencies/Ministries with an interest in marine affairs will participate in its deliberations in order that policies would only be arrived at after hearing the views of as a wide cross-section of the government as possible. Each agency will be expected to co-ordinate their efforts with NGOs with interest in their area of responsibility. This is a good start and careful efforts have to be made to ensure it does not get bogged down in institutional inertia inherent in inter-agency committees and councils.

The NRCA has recently promulgated a Policy for Protected Areas in Jamaica, which gives a broad outline of government's intention. This policy includes marine

areas. Like many other broad policies, it lacks specific details but is a good working document, which can be used in developing more detailed plans.

Chapter 3

Economic Aspects of Resource Use and Environmental Protection

3.1 Environmental Concerns and Public Policy Response

The realisation that unbridled exploitation of renewable natural resources could not go on forever without negative consequences has grown sharply in the last half of this century. This is due to the quantum leaps made in scientific knowledge over this period and the growth of mass communication. These developments made people in many countries acutely aware of environmental and other problems in other parts of the world hitherto regarded as remote and distant. Whatever the problem was; drought in Africa, El Nino phenomena effect in the fishery of Peru or destruction of coral reefs in the Caribbean, it became known to the entire world public through the modern media. Concerns grew and led to ideas in search of sustainable development and the need to arrive at agreed values for exploited resources and effective economic considerations for their conservation and sustainable exploitation.

Environmental awareness grew, particularly from the 1970s onwards, and people realised that a number of problems needed to be addressed. The most common of the environmental problems were:

- resource depletion and resource conflicts as demand for the use of resources always exceeded supply;
- pollution of the environment as industrialisation and populations increased;
- the need for conservation of bio-diversity;
- protection against natural hazards such as shoreline erosion and sea level rise;
- hinterland management to reduce the negative effects of land use on the marine environment (Clark JR 1997).

Recognition of these problems was growing as another fundamental change was taking place. This was in public administration.

A new era of public management was beginning in the 1980s, which emphasised value for money, economy, efficiency and effectiveness in achieving public policy and programme objectives. These changes were in response to an end to the period of rapid expansion in most economies, disillusionment with big government, and greater availability of higher education to the population at large. These were accompanied by the election of conservative governments in most of the western industrialised countries, which aimed at reducing public sector participation in the economy (Laubstein 1998).

These changes in public administration were, in some cases, imposed on developing countries through the disbursement and loan strictures of the multi-lateral funding and lending agencies such as the World Bank and the International Monetary Fund (IMF). Other governments in the Third World on their own embraced these new ideas. Jamaica was one country that was both an object of the imposed ideas and later embracing them as the new paradigm for public management.

These changes, while having positive effects on some aspects of public management such as accountability, had uncertain outcomes in others. There are services and activities that governments are obligated to carry out that will never return a profit or even be self-sustaining in the budgetary sense. Notwithstanding this however, there was greater demand by the public for efficiency. The bureaucracies responded by making more and more decisions based on empirical data, cost benefit analysis and opportunity costs. The difficulty of applying these techniques to public administration however is that frequently the things that government manages on behalf of the public are sometimes difficult to quantify in monetary terms and with purely rational cost benefit analysis. This is largely the case with environmental management. The growing recognition of this is leading to some change.

The new thinking in the body politic is for a move back to the centre. It is recognised that there is a significant role that government has to play in partnership with the public to ensure orderly, sustainable development, if humans are to survive and improve their way of life both materially and in their spiritual well-being. The United Nations Conference on Environment and Development (UNCED 92) in Rio de Janeiro, Brazil, was the most significant manifestation of this acceptance of the need

for change and the guardian role that governments have to play to protect the environment and create the atmosphere for orderly development.

3.2 Sustainable Development

The search for a better way of using resources without causing irreparable negative effects occupied the minds of many people. The rate of resource depletion was causing concern and especially as it relates to what would be left to guarantee a reasonable standard of living for future generations. The problem was made acute by the increasing and in many cases, unsatisfied needs of the present generation. The need was for sustainable development. The World Commission on Environment and Development (WCED), chaired by Gro Harlem Brundtland, tried to clarify thinking on the matter. The Commission defined sustainable development in the following manner: “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED 1987).

This noble idea had to be adopted in a situation where knowledge of all the different phenomenon, such as the state of natural resources and the effect of human activities were not fully known as to their effect on the environment. This led to an approach that called for a “precautionary principle” to be applied. The idea being that action should be taken to protect the environment even when the scientific knowledge and other data are neither complete nor certain. It emphasises that the process leaves room for modifications as knowledge increases about the particular situation. Care must also be taken, due to the uncertainties, that the result of actions taken should not lead to irreversible harm or damage.

There are sound reasons for using the precautionary principle and not wait on better scientific or other knowledge. The reasons include ones such as:

- information and technology may be slow in gathering and gaining effectiveness;
- most large-scale projects have a considerable time lag between planning, design and implementation;
- waiting on research does not always help, as it may neither lead to better solutions nor expanded knowledge. It may even give negative results, highlighting further the cost of delay.

The principle emphasises that the actions taken in the context of uncertainty should be hedged and should also take into account outcomes desired for other resources. Tol et al, make the point that delaying action while studying the problem may lead to a finding that aggressive large-scale action is required. If efforts at mitigation start early while evaluation is underway, these massive actions and cost may be avoided (Tol et al, 1996).

The basic tenet to achieve sustainable development is the implementation of policies that would seek, as far as possible, to achieve improvements in resource and environmental management, which, in the worst case, would maintain the status quo. Such policies call for the following considerations:

- ensuring a transfer of capital from one generation to the next, i.e. future generations inherit at least the same amount of capital the present generation has available;
- the natural resources for which there are no substitutes, e.g. clean air, clean water, natural resources that affect the spiritual well-being such as landscape, space, peace and quiet are preserved; and the resources vitally necessary for the life sustaining processes remain pristine;
- policies that reduce vulnerability, irreversible loss of resources, promote food security and ensure the necessary legal inputs in order that under-pricing of resources and over-exploitation does not take place (Turner R.K., 1996).

The above principles are good ones but are increasingly difficult to implement in developing countries. These countries have weak institution of government, are faced with growing populations, often, stagnant economies and finite resource bases. They tend to be primary producers and so depend a lot more on the exploitation of their natural resources or 'natural capital'. It becomes extremely difficult to be saving for future generations when the present one needs the resources for survival. The problem has to be accepted and solutions sought however, in order to break the continuous cycle of degradation and destruction of resources and ever-increasing needs of people.

The WCED outlined the requirements for sustainable development as:

- a political system that secures effective citizen participation in decision making;
- an economic system that is able to generate surpluses and technical knowledge on a self-reliant and sustained basis;

- a social system that provides for solutions for the tensions arising from disharmonious development;
- a production system that respects the obligations to preserve the ecological base for development;
- a technological system that can search continuously for new solutions;
- an international system that fosters sustainable patterns of trade and finance, and;
- an administrative system that is flexible and has the capacity for self-correction.

The Commission report explained that these should be development goals both at the national and international levels. In planning for a system of MPAs, the planners must try and ensure that as many of the requirements outlined above are met, and where there are institutional factors making this difficult, start a sensitising process that will help to overcome the short comings.

A study of the economics of the situation is one way to learn and hopefully help to solve the problem. Economic studies should look at the relationships that exists between conservation and development and see how best they can be made to work together.

The government of Jamaica has committed itself to the idea of sustainable development in its National Industrial Policy, promulgated in 1996 (PIOJ 1998).

3.3 Economic Considerations in Environmental Management

Traditionally economic theory and analysis has concerned itself largely with the efficient allocation of scarce economic resources among people, without paying too much attention to the environmental consequences of resource allocation or the long term sustainability of natural resources. The related concept of `development´ focused on the continuous expansion of the production of economic goods and services to meet the ever increasing needs of the people.

The bringing of economic thought to bear on environmental management is a fairly recent phenomenon. The delay in development of environmental economics is because the monetary value of many of the resources at risk is illusive. It has

developed however as a result of the links being seen between the environment and development.

Natural renewable resources to which man has access are scarce. Application of economic principles to the use and conservation of such resources should be seen as complementary to the moral arguments offered by the most vocal members of the environmental movement for the conservation or protection of the environment.

The suggestion here is not however to become over reliant purely on economic models. Turner, in suggesting a Green Agenda for economic use of resources, made the point that economic efficiency is not enough to guarantee sustainable use of resources. Factors such as equity and environmental quality must also be taken into account. He further suggests three factors for a “green agenda”, which are:

- “...a rejection of the idea that economic systems should be deliberately designed to satisfy the unlimited wants of the ‘rational economic person’ - we need to think more about people’s (collective) needs and less about their individual wants...”;
- “...a green economy is one that has the capability of replicating itself on a sustainable basis”;
- “...a green economy must, over time, evolve in such a way as to de-couple the growth in economic output (activity) from the environmental impacts of that activity...” (Turner 1996).

It is obvious that the economic use of natural resources is linked to the environment from which these resources are taken. The exact relationship therefore has to be understood if over-exploitation is to be avoided. The studies of these relationships should also, where possible, seek to find substitutes for non-renewable resources as they are being depleted. Studies of the relationship of economic activity and the ecology have arrived at a ‘materials balance’ view of this relationship.

The ‘materials balance’ view holds that production and consumption do not destroy matter but transform it into useful goods to be used for human benefit, and with some by-products and wastes. Natural resources are extracted and processed, used and disposed of. Economic systems therefore depend on the ecology, which generates these resources and not the other way around (Turner 1996). The idea that economic systems depend on the ecology would suggest that conservation should not be seen as an impediment to economic growth, but the very means by which it is guaranteed and enhanced. The preservation and conservation of the stock of resources

or its exploitation in a sustainable manner should ensure steady, if not spectacular growth and where carrying capacities are reached, an orderly transition to other beneficial activities by the people involved. Protection of the marine environment in Jamaica, including the designation of marine protected areas is vital to sustaining economic activity in one of the largest sectors of the economy, tourism which directly and indirectly employs some 27% of the population and in the fisheries sector which provides employment and food. It is also important for the protection of the physical coastline and natural coastal processes.

A major aspect of conducting effective environmental economic studies is the ability to value resources. One can understand this if one looks at the difference in the way depletion of a natural resource is looked at versus depreciation of plant and machinery in a factory. No provision is made for the former, while well-established practices exist for the latter. These create the difficulties encountered by environmental economists in making cost benefit analysis or using opportunity costs criteria in aiding environmental decision-making.

3.4 Valuation of Renewable Natural Resources

The natural environment is a complex one whose processes are still, to a large extent, poorly understood. It seems unpredictable and defiant of efforts to study it in a comprehensive way. There are many natural resources which are often treated as “common public property”, hence with many users. For the most part, the policies that govern them in developing countries such as Jamaica, allows for open access and there is neither a charge on the resources exploited nor demand for restoration of any sort. There is also the traditional belief that the resources of the oceans are infinite, both in its ability to provide products and as a repository for waste. All these factors have made attempts at valuation of marine resources difficult and controversial.

Several methods have been attempted with different degrees of success and acceptance. Mention will be made here of the most widely accepted ones. Some of the valuation techniques look at the value as the contribution to the public good while others use a method that is more concerned with the value for protection. King suggests that the method of valuation must take into account the Total Economic Value (TEV) of the marine resource. This includes the components of use value (commercial ones such as fishery and tourism); direct values such as recreation and

health; indirect values such as ecological or coastal protection; and non-use values such as existence (vicarious satisfaction) and option for future use. Using the TEV along with cost benefit analysis, he further suggests that one should be better able to come to decisions on managing the marine environment, regulating maritime activities and deciding compensation arrangements both in terms of use and existence values and clean up and restoration (King OH, 1995).

Bateman advocates a model for valuation of resources as shown in Fig.3.1.

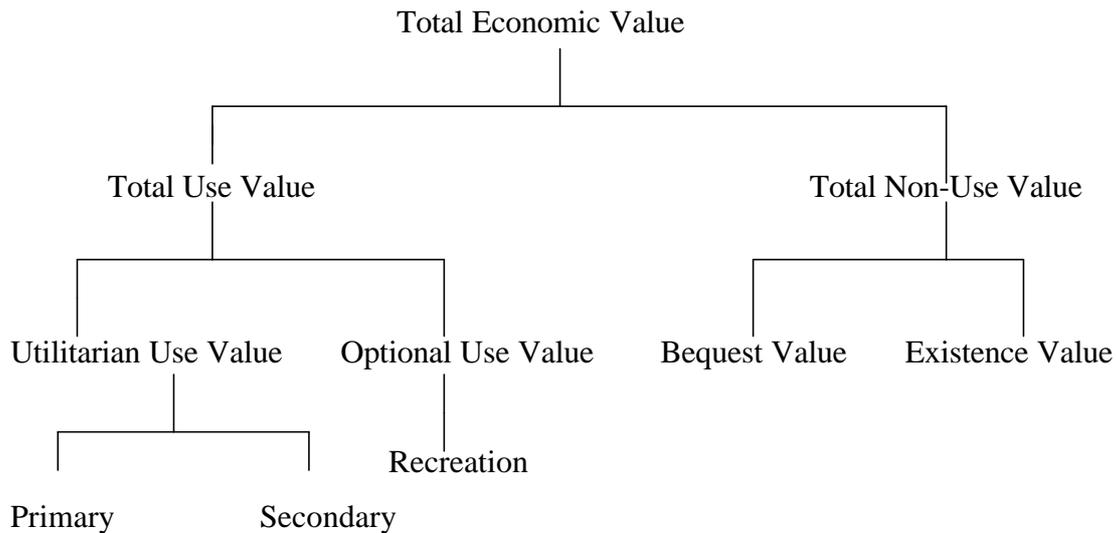


Fig 3.1: Bateman Model for Total Economic Value of Natural Resources

Source: Bateman, I 1996. Environmental and Economic Appraisal. In Environmental Science for Environmental Management, Pages 45-60.

The model suggests a wide variety of attitudes and motivation to the valuation of resources. It not only shows the individualism of each person but also his interest in the society at large. Two common methods are used to arrive at some types of market value. These methods used are the Contingent Valuation Method (CVM) focusing on expressed preference and the Revealed Preference Method. The Contingent Valuation Method of the expressed preference procedure asks people directly what value they place on environmental good, i.e. how much they are willing to pay for preservation or accept for the loss of a resource. The answers generally give the private feelings of the respondents and also an idea of what they think is good for the society at large. This makes it possible to include non-user valuations in the survey.

The Revealed Preference Method uses a technique based on finding out the purchasing patterns of the individuals in their efforts to enjoy the environmental

goods, i.e. how much money they are spending to access the goods. This method includes variables such as ‘travel cost method’ and ‘hedonistic pricing method’, the last being the prices based on landscape, noise levels and air quality (Bateman 1996). Bateman expands the idea to include the sustainable development concerns of ensuring the needs of future generations are taken into account by making provisions for including bequests and existence values in arriving at the total economic value.

Davis et al in looking at the value of these renewable natural resources, divided values into two main ones. These are the “amenity value” of a resource and the “biological value”. The amenity value arises from the recreational use of an area and the satisfaction that the population derives from this use. The biological value arises from the maintenance of the ecological functions and bio-diversity, conservation of rare and/or valuable species and representative habitats. Davis et al admit the difficulty of arriving at market value for these things (Davis et al, 1995).

Another method is advocated by Pendleton. It focuses on the value placed on the resource as it relates to its protection. This method looks at two aspects. The first is to measure the economic benefits of protection of a discrete area to the local economy. It takes into account factors such as its effects on visitor arrivals, hotel occupancy, taxes, divers fees and any income generators. This method is short term, i.e. annual, and its value is questionable as it can be argued that protection could be lost and the money would still flow in at least for the short term. The second method measures the “savings from avoided losses in resource value that would result in the absence of protection, net any cost of protection”. This method not only looks at the present but also at the future (Pendleton, 1995).

As can be seen by the diversity of attempts to place a proper value on marine resources, there is no consensus as yet on the matter, hence the scepticism by some people. There is also the social dimension to the attempts at valuation. The price of a natural resource to a society depends on that society. The factors are the society’s state of economic development, the level of environmental education, hence environmental awareness, the diversity of political opinion and public participation in decision making by the population and the relative strength of the environmental movement vis-à-vis industry. The part the environment plays in the culture of the people can also be important.

Countries like Jamaica have a wide variation among the factors listed above. There are wide income disparities in the population, varying levels of education and

environmental awareness and the level of public participation in policy formulation. This will contribute significantly to the difficulties in arriving at values that reflect the opinion of the population as a whole. Another important matter that arises from valuations is concerned with the forms and levels of compensation to be made for loss of use. These can be in the form of monetary benefits or subsidies, help in accessing other areas which may be used, and alternative employment opportunities for those displaced.

In the identification and designation of MPAs, it is suggested that the Bateman method of valuation be used. The expressed preference or CVM method should be used, through the use of questionnaires and radio call-in programmes to get the views of the general public on the matter. These questionnaires and call-in programmes must be designed and the studies done to ensure that the results are as true a reflection as possible of the views of the entire population. It would be better for the viability of these environmental protected areas if large parts of the population view them positively as this will make their management easier and provide better chances for compliance with environmental regulations.

Chapter 4

Legal and Scientific Basis for the Designation of MPAs

4.1 International Principles and Legal Regimes

The awareness of the need to provide protection for the environment in general and the marine environment in particular, is international in scope. Many of the early attempts at conservation and protection of marine resources were driven by international resolutions, declarations and other treaties, which depended on voluntary compliance. This growing awareness and effort to take action was largely due to the understanding by a part of the community of the physical linkages of all parts of the marine environment i.e., its international nature. The sea and its currents have the ability to move different flora and fauna, in larval, seedling or molecular stages from one part of the world to the other. These same qualities enable it to move pollution from one part of the ocean to another part far away, or from one country to another. The voluntary compliance treaties and declaration were also an admission that mandatory treaties were having difficulty gaining the kind of consensus to be effective, but a start needed to be made.

An early attempt at sensitising governments and peoples to the importance of the protection of the environment and the conservation of its resources was the UN Conference on the Human Environment (UNCHE) Stockholm, 1972. This conference proclaimed, *inter alia*, the fact that “man is both creature and moulder of his environment”. He has the ability to alter the environment for better or worse due to the availability of scientific knowledge and technological development. The harm that man makes to the environment is readily seen in the growth of levels of pollution, and destruction or depletion of resources. The Declaration arising from this conference emphasises that the point has been reached where the wise use of the environment is

paramount if man is to survive with a reasonable quality of life. It calls on governments to harness their resources to develop and implement sound environmental policies with the local and national levels playing the most significant part (UNCHE 1972).

Principles 2-5 of the Stockholm Declaration specifically address the need for preservation, protection and conservation of natural resources, living and non-living. Principles 6 and 7 speak to the need to prevent pollution of the natural environment and in particular the sea. A call was made for the allocation of resources to assist in the development of policies and carrying out of planning and implementation of sound environmental management in Principles 11-17. It requires that due regard be paid to the need for development as well as for protection.

Further requirements were elaborated in Principles 18-20 on the education of the population and the use of science and technology to improve development efforts and the protection of the environment.

Finally, Principles 21-25 stress the importance of international co-operation in environmental management and the need to develop international laws and the employment of the competent international governmental organisations (IGO) in those efforts.

The Stockholm Conference and Declarations were followed ten years later by the UN General Assembly (UNGA) Resolution 37/7 on the World Charter for Nature, 1982. The Charter is divided in sections setting out General Principles, Functions and Implementation.

The General Principles outline, *inter alia*, the need to respect nature and the earth's natural processes, the preservation of the genetic diversity and maintaining the levels of all life forms to ensure survival. It calls for protection of habitats and representative ecosystem, the sustainable use of resources and facilitating the co-existence of species (UNGA, 1982).

The Functions called for, among other things, full recognition of the part played by natural systems in human development. Tangible acceptance of this should manifest itself in the planning and development processes, taking into account the physical limitation of an area, biological productivity and diversity, and the aesthetics. Potentially harmful activities should be controlled and advantage taken of the best available technology that can ensure conservation and protection of the natural environment.

The Implementation Principles encourage states to implement these ideas in the Charter, disseminate information to the widest cross-section of the population and to take conservation concerns into planning processes. They are also encouraged to provide the resources to achieve the aims of environmental protection, and to carry out scientific research and at all times to take effective action to these ends (UNGA, 1982).

The most famous example of a voluntary international agreement is the UN Conference on Environment and Development, Rio de Janeiro, 1992 (UNCED, 92). It is famous because of the level of participation by governments, IGO's, non-governmental organisations and the private sector. It has also produced to date the most comprehensive set of principles on the management of the environment and the linkages with development.

UNCED 92 begins by reaffirming its belief in the principles of the 1972 Stockholm Conference, especially as to the paramount importance of human development. It goes on to stress, *inter alia*, the need for sustainable development, the co-operation of states for the protection of the environment and the earth's ecosystems. UNCED urged states to develop the appropriate environmental legislation, adequate for their needs and with provision for dissemination of information, gaining public support and participation on environmental matters (UNCED 1992).

The Conference codified some new principles in environmental management. These principles include the use of the "precautionary approach" to environmental protection, and the "polluter pays principle" in combating of pollution. It also emphasises the need for environmental impact assessment (EIA) as a mandatory part of the development process.

Also included in the Conference was the promulgation of a Programme of Action, known as Agenda 21 for the earth's environment. Chapter 17 of Agenda 21 refers specifically to the marine environment and outlines the following Programme of Action:

- a) integrated management and sustainable development of coastal areas, including exclusive economic zones;
- b) marine environmental protection;
- c) sustainable use and conservation of marine living resources of the high seas;

- d) sustainable use and conservation of marine living resources under national jurisdiction;
- e) addressing critical uncertainties for the management of the marine environment and climate change;
- f) strengthening international, including regional, co-operation and co-ordination;
- g) sustainable development of small islands (UNCED 1992).

Though at the time not as widely accepted or ratified as the voluntary declarations and principles, mandatory treaties concerning the marine environment were being drafted and adopted. Some of these were global in scope, some regional and some dealing with very specific parts of the world, or species of the marine environment. An early example of this was the Convention on Wetlands of International Importance, Ramsar, 1971. This Convention requires, *inter alia*, that states parties designate wetlands to be included on a list maintained by the Secretariat. It also required that suitable programmes, including the establishment of nature reserves for the conservation of wetlands and the waterfowl that use them, be instituted. The wetlands may include coastal areas adjacent to the wetlands, islands, or parts of the sea deeper than six metres at low tides, if these are waterfowl habitats (IUCN, 1971).

A Convention dealing specifically with conservation was the Convention on International Trade in Endangered Species of Wild Flora and Fauna, Washington 1973 (CITES 1973). This convention aims to regulate the trade in species that are presently endangered or which may become endangered without the proper controls being put in place for their conservation. It mandates the use of permits for export and import of endangered species and parts from them. The species so protected are listed in three Appendices, depending on the level of threat of extinction or danger (CITES 1973).

A Convention of importance to Jamaica in the protection of certain marine areas is the United Nations Educational Scientific and Cultural Organisation (UNESCO) Convention for the Protection of the World Cultural and Natural Heritage, Paris, 1972. The reason for this is the large number of wrecks of historical importance which lie in Jamaica's waters and which need protection from treasure hunters or casual sports divers. This Convention mandates, *inter alia*, that states identify, protect, conserve, rehabilitate and present and transmit for future generations, its cultural and

natural heritage. The Convention encourages states parties to do this by implementing policies that involve the communities and integrate them in the planning process. The necessary legal, scientific and technical steps are to be taken and suitable administrative and financial allocations made to achieve the objectives (UNESCO 1972).

At the regional level, action in the formulation of international treaties was also taking place. The most important of these was the United Nations Environment Programme's (UNEP) Regional Seas Conventions. The applicable treaty for Jamaica is the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, Cartagena de Indias, 1983 and the Protocol Concerning Specially Protected Areas and Wildlife, Kingston 1990. Article 10 of this convention mandates states to designate protected areas for the protection of "rare or fragile ecosystems, habitats of depleted, threatened or endangered species" (UNEP 1983). The Protocol elaborates on this requirement and outlines among other things, the obligations of the country to protect areas and species that need added protection. It outlines the purposes of the added protection, which include conservation, preservation and restoration of representative coastal and marine ecosystems, biological diversity, habitats and areas of special scientific, educational, historical, aesthetic or economic value (UNEP 1990).

The types of protective measures to be instituted in the protected areas, include, but are not limited to, regulation of the passage of ships and shipping activity in accordance with international law. The Protocol also makes provision for regulating and controlling fishing activity, modification to the sea floor, exploration and exploitation of resources, archaeological and tourist matters (UNEP 1990).

The Protocol mandates development of planning and management regimes to efficiently carry out its aims. These plans must contain the management framework to be applied, as well as the scientific research and monitoring to be done. The plans must include provision for the involvement of the public and education to enhance the best use of the resources. These plans should include buffer zones around protected areas where applicable, both within exclusively national waters and where these are contiguous to international boundaries, are also to be used, subject to international agreement (UNEP 1990).

Over time general consensus has developed in favour of mandatory international environmental treaties, and this is reflected in the UN Convention on

Biological Diversity, Nairobi, 1992. It not only encourages, but also requires state parties to carry out its aims. The preamble sets the broad objectives, which are, *inter alia*, to preserve biological diversity, ensure sustainable use of resources and co-operation among states in these endeavours. Actions to be taken include identification and monitoring of components of biological diversity in order to know the species most at risk and where necessary, to institute corrective action for restoration. In-situ conservation is strongly recommended and in particular the use of protected areas for these purposes (UN 1992).

The Convention requires that the involvement of the private sector and the general population be garnered and incentives given for conservation and sustainable use of components of biological diversity. Public education and training should be instituted to assist these efforts (UN 1992).

The most important international law on the marine environment is the UN Convention on the Law of the Sea 1982 (UNCLOS 82). This convention is akin to a constitution for the sea, and all other treaties or conventions are subject to its provisions. It has nearly universal acceptance and even where countries have not ratified it; its provisions have been incorporated into state practice and sometimes even into state legislation. While not being as detailed on marine conservation and protection as other conventions which deal with these matters specifically, it gives the broad outlines that aid in fostering the creation and/or implementation of these conventions. There are two parts that speak directly to the issue of conservation and protection against pollution.

Part V on the Exclusive Economic Zone emphasises the need for sustainable use of the living resources in the zone and requires “proper conservation and management measures” to be in place. It also allows for regulating seasons and closing of areas to fishing, and other control measures for the management of marine resources (UN 1982).

Part XII on the Protection and Preservation of the Marine Environment deals *inter alia* with protection from pollution from ships, installations and devices used in the marine environment. The measures include those “necessary to protect and preserve rare or fragile ecosystems, as well as the habitats of depleted, threatened or endangered species and other forms of marine life”.

UNCLOS 82 mandates states to carry out scientific research to monitor the effects of activities in the marine environment. It requests that they should use

scientific criteria in the drafting of regulation for the prevention, reduction and control of pollution.

International principles, declarations and conventions outline broad requirements and suggestion for states to follow but most have no more force than moral suasion until states ratify them where applicable and incorporate them into national laws to give them true meaning and effect. Some conventions are mandatory upon ratification and the state parties are obligated to observe their provisions. The parties, however, to be able to carry out enforcement within their jurisdiction must implement them through enabling legislation which will make violations into offences. Examples of these types of conventions are the IMO Conventions and the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982, relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks 1995.

4.2 National Legislation and Policy

The Jamaican marine environment is regulated by several pieces of legislation. The most important ones dealing with conservation and protection of the marine environment are the Fishing Industry Act (FIA) 1975, the Natural Resources Conservation Authority (NRCA) Act 1991, the Exclusive Economic Zone (EEZ) Act 1991 and the Maritime Areas Act (MAA), 1994. These Acts all make provision for the declaration of marine protected areas. An older piece of legislation which can still be used is the Beach Control Act, 1956, which provides for, *inter alia*, the declaration of protected areas and prohibition of fishing, waste disposal, dredging and removal of coral; however, many of these provisions are now incorporated in the more modern legislation.

The Fishing Industry Act, (FIA) 1975 makes provision for protected areas for the conservation and protection of fish, by empowering the Minister to declare an area a fish sanctuary, thus prohibiting fishing. The Act also makes provision for the use of closed seasons, or closed areas for specific species of fish and also regulates the type of gear and fishing methods to be used. It also empowers the Minister to prescribe other measures for conservation of fish stocks (FIA 1975).

The NRCA Act, 1991 empowers the Authority to, among other things, manage Jamaica's natural resources and see to the protection of the environment. The

Authority is to advise on the areas to be declared protected areas for reasons of conservation of living or non-living resources, aesthetics, educational, historic or scientific value and thereafter to oversee their management. It is authorised to prescribe the rules and regulations, set boundaries and zones, specify the types of activities allowed and formulate codes of practice and standards to be observed. The Act requires the NRCA to promote research and investigate the effects of activities on the marine environment (NRCA 1991). The Authority is required to make and implement a plan for all protected areas to include the type of protection, method of conservation and rehabilitation.

The Exclusive Economic Zone Act, 1991, was written to reflect the provisions of Part V of the UNCLOS 82. It specifies, *inter alia*, the rights to explore, exploit and manage the living and non-living resources of the zone and the making of regulations to this end. The Act gives jurisdiction in respect of the authorisation and control of scientific research and the preservation or recovery of archaeological or historical objects. It makes provision for regulations for the preservation and protection of the environment and the control of pollution. Importantly, the Act requires that proper conservation measures be taken to ensure the maintenance and the optimum utilisation of the resources of the zone (EEZ 1991).

The last of the national legislation to be looked at for applicability to marine protected areas is the Maritime Areas Act, 1994. This Act establishes Jamaica as an Archipelagic state and makes provision, *inter alia*, for regulating any economic activity with regard to exploring or exploiting the resources of these areas. The Act allows for the making of regulation for the preservation and protection of the environment, the control of pollution, safety of navigation and regulation of vessel traffic, conservation of living resources and the general use of the areas (MAA 1994).

All the above-mentioned Acts make provision for control through use of licences and permits. They also set penalties for contravention, and redress under law.

Thus, Jamaica has several pieces of legislation which allow for the creation of marine protected areas; however, they are very general in scope. To ensure the best results, Kelleher et al suggest that each designated area be covered by subsidiary legislation. This could be an order under the NRCA Act, 1991. This order should include boundaries, types of allowable activities, zones for multiple use if applicable, public participation and responsibility for the area. Provisions should be made for research, monitoring and review in order to know the level of success in achieving the

protection or conservation aims and to implement any desirable changes on a reasonable time scale. It is also desirable to outline in these orders, the type of compensation to be made to those who may be displaced or suffer loss of livelihood by the creation of these areas. Finally, the methods of enforcement and the penalties for infringement should be stated (Kelleher et al, 1991).

The Government of Jamaica has promulgated a Policy for Jamaica's System of Protected Areas, including marine ones. Its goals are set out below.

- Economic development – improvement of the livelihood of the population, protecting the supply of natural resources to support economic activity, and research into better methods to ensure sustainable resource use. It also pinpoints the resources that contribute to the viability of the tourism sector such as beaches, coral reefs, mountains and forests for specific protection.
- Environmental Conservation – to preserve biological diversity, representative stocks, habitats and the cultural heritage of the nation.
- Sustainable resource use – to protect areas and resources essential for sustaining economic activity and to protect and/or rehabilitate important ecosystems and those that help in the maintenance of essential natural processes.
- Recreation and Public Education – to preserve areas and resources for the enjoyment of the public in a sustainable way and to promote educational opportunities both for research and general understanding of ecological systems and processes and historical or cultural sites.
- Public participation and local responsibility – to involve the public in the planning and management of designated protected areas.
- Financial sustainability – to ensure that protected areas become economically self-sustaining by generating their own funds through collection of fees, fundraising efforts or endowments.

The goals set out in the Government of Jamaica's Policy on protected areas, combined with the existing laws, make it possible for marine areas to be designated for protection, however, there needs to be some scientific basis for this that either show the need for protection and/or indicate that the desired results are achievable.

4.3 Scientific Basis

To gain wide public support, the designation of a marine protected area must be based on credible scientific data which support the need for protection of the area, either for conservation, preservation or restoration. This could apply to living or non-living natural resources or objects of a historical or archaeological value. In some areas this will be difficult due to a dearth of knowledge, but in other areas there will be an extensive body of research data to support the establishment of MPAs. This suggests that there will be a need for ongoing research, both for the initial designation and for review of the results of protection.

For most cases, it will be difficult to have the full data for basing the selection of an MPA on bio-geographic information. This may be due to the absence of full information on marine community structures, life history bio-geographic patterns, socio-economic resource use parameters and the biogeography of the general area. To overcome these difficulties, Nicholls suggest that the precautionary approach be used and that careful monitoring take place (Nicholls, 1998).

To carry out scientific monitoring, Jacoby et al suggest that baseline data must be gathered against which future observations can be evaluated or comparisons made. Monitoring will be primarily for human impact on the areas. These impacts manifest themselves in greater than natural variations, occur in areas of high human activity or after human activity begins. To be reliable, monitoring must fulfil the following:

- make good scientific judgement;
- identify changes correctly;
- be done over a wide area with good sample size (Jacoby et al 1997).

Among the principal tools of environmental monitoring, are environmental indicators. These are observations made from special tests on samples of species or habitats or the media of transportation, and the compilation of statistics from these observations. They focus on looking for changes and their causes. Detailed use of indicators should eventually show the response of the ecosystems and the efforts at either mitigation or elimination of the anthropogenic agents or other cause. Good indicators as suggested by Jacoby et al, should meet the following criteria:

- accurately measure the performance of major ecosystem components;

- be readily measurable;
- identify and respond quickly and unambiguously to different inputs;
- integrate the effects of a number of inputs without confounding the identity of the source;
- be distributed over a wide spatial scale that includes areas not likely to be affected by the identified threat;
- have a reasonably well understood ecology and response to impacts (Jacoby et al, 1997).

In the case of the Jamaican marine environment, there is considerable data on the state of the coral reefs ecosystems and the reef fishery. Both are in grave danger if immediate action is not taken to protect and restore them.

Coral reefs, sea grass beds and mangrove ecosystems are the basis for present and future yields of shallow water marine resources in the Caribbean. Research has shown that on the north coast of Jamaica the key to the recovery of the reef systems and the protection of their biomass requires control of over-fishing (Ogden 1998). One method has to be the designation of MPAs of a sufficient size in areas of productivity to allow for regeneration of the reefs and hence the fish.

The state of the reef communities around Jamaica was highlighted in Chapter 2. There is good knowledge to show that coral reefs are in fact highly adaptive and robust to most of the climatic and other natural changes, even if they show short term negative effects. They however lose this ability to protect themselves and regenerate rapidly due to the scale and variety of the anthropogenic agents to which they are exposed. This is due to the time scales of exposure, which do not allow for the adaptive processes to take place. Only large scale protection can ensure their survival (SCOR, 1998).

Studies have also shown that regions with isolated reef communities, where the mobility of genes is restricted, where there is limited dispersal and few areas of refuge are the ones most vulnerable to change. Bearing in mind the restricted areas and conditions in which coral grow, that is, bright sunlight, warm temperatures, shallow calcium carbonate saturated waters, it becomes obvious that they are geographically marginalised and are therefore very vulnerable to changes. The available data also show that the symbiotic relationships that exist within coral communities help in their sustenance. It is believed that these partnerships are

important elements of the organisms' process of adaptation to survive rising stresses (SCOR, 1997).

This abundance of knowledge on factors affecting coral reef communities should demonstrate the need for giving added protection to these ecosystems. Data available point to the need also to protect non-living resources in Jamaica's waters that presently need protection at sites of shipwreck. They need to be protected for their historical and archaeological value. Because most of these wrecks are known to have been ships carrying treasure from the Spanish Main to Spain, they are a magnet to treasure hunters.

Driven purely by economic incentives, treasure hunters often use the quickest methods in searching a wreck. This frequently involves explosives and cutting machines. They therefore destroy the "physical inter-relationships" of the artefacts. These relationships are of great importance in the gathering of information and interpretation of matters such as levels and type of technology, goods in existence for trade, crew and passengers; by historians, social scientists and archaeologists. Haphazard exploration of sites can totally destroy the historical and archaeological significance that they might otherwise have in imparting information (Migliorino L. 1995).

There is also the need to take particular care in removing and preserving artefacts from the sea. Proper handling and treatment must be made to prevent disintegration, rapid corrosion on mixing with air and other forms of degradation. Recovery, preservation and restoration of historical artefacts at the sites should only be undertaken by those trained and skilled in the knowledge necessary to properly do this, using the correct technology.

To conclude, there are international principles and laws to support the designation of marine protected areas in Jamaica. There is also national legislation, which allow for this, and in addition allows for the making of rules and regulations to properly manage these areas. The scientific data exists in some cases for the consideration of areas for added protection. However, until now the Government of Jamaica has not promulgated the criteria and the methods for the identification and designation of marine protected areas in the country.

Chapter 5

The Designation of Marine Protected Areas

5.1 Criteria for the Designation of MPAs

The selection of marine protected areas should be based on definite and relatively precise criteria. This will enhance the ease with which areas can be nominated and the final designation of these areas by the NRCA. The types and degree of protection also have to be decided on, depending on the specific objectives to be achieved for the area. The amount of resources available to implement any management plan for a protected area might also have some influence on its designation. There are some accepted criteria for the policy instruments to be used in environmental management including protected areas. Turner suggests some that may be used such as:

- economic efficiency, i.e. they should use the most cost effective methods available to achieve the desired results;
- low information requirements in order to start efforts at management i.e. minimal amounts of accurate information required and the cost of updating this information should be low;
- low administrative costs in order to avoid failure due to lack of funds;
- a high level of equity, i.e. the burden or costs should not be only on a selected group, but as wide a cross section of stakeholders as possible;
- dependable, reliable and with enough in-built caution due to uncertainties, to prevent unwanted effects;
- adaptable to changing knowledge, technology and prices in order to exploit improvements in any of these factors;

- dynamic incentives, i.e. the system gives continuous encouragement to pursue improvements and innovations;
- political acceptability, i.e. it must not be too revolutionary to be acceptable and with the potential to have negative effects on future actions that may be desirable (Turner 1996).

The types of areas that may be designated in a marine protected area programme are ecological reserves, marine conservation areas, wildlife management areas, and marine parks.

Ecological reserves are areas managed to preserve the flora and fauna, geological or physiological features. It may also serve the purpose of preserving an area for scientific research and the educational opportunities it offers. In this type of MPA, all types of exploitation of the resources are prohibited. The orders or legislation promulgating the designation of these areas must make provision for the control of entry, prevention of disturbance, destruction, molestation, removal of objects, or the addition of others.

Marine conservation areas are those MPAs that are designed to protect specific species and their habitats, and to prevent pollution of these habitats. They are also used for the preservation of areas for their historical and cultural significance. Other activities that are compatible with these aims can be permitted. These areas are most often used to regulate fisheries, and to conserve and protect fish.

Wildlife management areas are those areas that have an overlap with the land and where there are close links with species that spend a part of their time in the marine environment and part on the land, such as seabirds, and turtles. These areas may be designated to protect resident or migratory species of animals of national, regional or global significance.

Marine parks are those MPAs that due to their natural beauty and the access they afford to the population for the enjoyment of this beauty, both for recreation and education, makes it important to preserve and protect them. They require very careful systems of control as their designation suggests that all efforts should be made to facilitate public access and enjoyment of these areas. Constant monitoring must be part of the management efforts to prevent the carrying capacities from being exceeded and degradation taking place. The types of activities allowed must be clearly listed and must correspond to the objectives for the marine park.

The difference in designation between some of these areas will be based on the level of protection required and the diversity of the ecosystem, i.e. the variety of species and natural and physiological features, and the extent to which they meet the criteria for selection as outlined at Table 5.1. This table outlines the different objectives to be achieved in marine protected areas, the different designation and the criteria to be used in consideration and selection of these areas.

Table 5.1 Criteria for the Designation of Marine Protected Areas

MPA Objectives	Type of MPA	Criteria for selection
1. Conservation of fish stocks and rebuilding of depleted ones. 2. Protection of endangered or threatened species.	-Ecological Reserve -Marine Conservation Area	-Areas of high bio-diversity and or productivity. -Rare or endangered species. -Vulnerability. -Areas of rare or unique marine habitats. -Areas of high spawning activities. -Areas of importance for the viability of populations and genetic stocks. -Areas supporting critical species, life stages and environmental support systems.
3 Protection of unique or diverse habitats and or essential productive ecosystems and natural features.	-Ecological Reserve -Marine Conservation Area -Marine Park	-Degree of representativeness. -Areas of high bio-diversity or biological productivity. -Rare or endangered species. -Unique natural phenomena. -Ecological viability. -Areas that are vulnerable. -Unique habitat.

<p>4 Protection for marine research.</p>	<ul style="list-style-type: none"> -Ecological Reserves -Marine Park -Marine Conservation Area. -Wildlife Management Area. 	<ul style="list-style-type: none"> -Value for use as benchmark site. -Value for use in development of greater understanding of ecosystem functions and interactions. -Use to evaluate the impact and results of marine management efforts.
<p>5 To protect historical and cultural sites and naturally aesthetic values of marine areas.</p>	<ul style="list-style-type: none"> -Marine Conservation Area -Marine Park 	<ul style="list-style-type: none"> -The presence of significant cultural heritage values such as shipwrecks artefacts and structural features such as sunken or buried buildings.
<p>6 To protect for educational use and to increase awareness of the marine environment and human relationship to them and to use for leisure and tourism</p>	<ul style="list-style-type: none"> -Marine Park 	<ul style="list-style-type: none"> -The area provides opportunities for use, enjoyment and learning about the marine environment. -Easily accessible. -Adequate suitability and carrying capacity. -Naturalness. -Have significant recreation and tourism value. -Ability to attract and sustain recreational use. -Aesthetically attractive. -Possess rare, scarce, outstanding, unique marine recreational features.

Adopted from: Marine Protected Areas – A strategy for Canada’s Pacific Coast, 1998: Published by Government of British Columbia, Canada, and Guidelines for Establishing Marine Protected Areas: A Marine Conservation and Development Report by Graeme Kelleher and Richard Kenchington: IUCN.

5.2 Input from Interested Parties

The success of marine protected areas will depend on the level of both government and public support. Governmental support requires that all ministries and agencies with an interest must have the opportunity to provide their input and support the effort to achieve the objectives of the MPA.

Public support is also important and therefore the public must have input in the proposal of MPAs, their consideration and designation. Strong public support, especially by those groups directly affected by the designation of an area for protection, will help in achieving compliance with the regulations set for the areas.

The Marine Protected Areas Program of the Canadian Department of Fisheries and Oceans highlights some of those parties who should have input. These include the ones outlined below.

- Coastal communities and NGOs interested in conservation. These groups can be involved in the nomination of areas of interest and co-management of these areas if accepted. They are also a valuable source of information and a resource to help in the public education process.
- Fishing Interests. These have direct financial interests in areas that may be considered for declaration as MPAs. The persons involved or interested in the fishery will be very concerned with changes to the status of an area. Their interests are strong as the effects of designation of an area as an MPA could vary from, in the short term, the negative effect of robbing them of a livelihood, to the long term beneficial effect of the development of a sustainable fishery. They are also an important source of knowledge on the state and functioning of some aspects of the marine system.
- Ocean and Coastal Industries such as tourism, mining, shipping, etc. Some industries which depend on the sea may be displaced or have to find alternative resources, sites or methods of production. Their input into the consideration of MPAs should be allowed and their concerns taken into account. It is important that their support is garnered and efforts should be made to enlist their help in managing the MPAs.
- Other Governments and International Organisations. Where Jamaica shares boundaries or maritime space with other countries, such as the Joint

Area with Colombia, joint efforts must be made for protection and management. Where the life patterns of species create common interests and suggests the need for international efforts at their protection, the country should consult with other governments and organisations to work out effective and mutually acceptable solutions for managing and protecting the joint resources. MPAs in Jamaica alone might not be enough to protect a species and so joint areas for this purpose may have to be developed.

Consultation and interaction to gain the inputs of the interested parties will frequently delay implementation of designation of MPAs, but it is better to wait and go through this process and have public support than rush the process and end up with a situation marked by apathy or hostility. This process will also help in ensuring that better solutions, of a more practical nature, are found early in the planning stages. It is important that criticisms and opposition be carefully examined to see their value. These may in fact, be only questions seeking clarifications and not the strong opposition they frequently seem to suggest.

Government agencies or any of the groups listed before should be allowed to nominate areas to be considered for designation as MPAs by the NRCA, using the applicable criteria. The nominations should include data such as:

- the location of the area;
- the reasons for nomination and the objectives to be achieved;
- information on the bio-physical and socio-economic conditions of the area;
- the management measures envisaged and desired regulations;
- suggestions for involvement of the communities or interested groups in the management of the area;
- contact persons, group or agency leading the proposal;
- Any other relevant information (DFO 1998).

Given the above data, the NRCA can make an initial assessment of the merits of the proposed MPA site. This initial assessment is to see if the site should be rejected, studied in more detail; or provided interim protection, until a final decision can be made after further studies. These studies should be based on more detailed information, outline example of which is given at Annex A (Information to be Included in the Proposal of a Marine Protected Area). This information should be

based on the best knowledge available, and where studies are in progress to improve this, an appropriate notation should be made. The reasons for the added information and how it will help the decision efforts should also be stated. If there are merits in the proposal, some of the actions that can be taken immediately or in a short time period are as listed.

- Public notices of the possible declaration of the area for protection. This will aid in getting public input for consideration. It can also be used to discourage activities that are inimical to the reasons for consideration of the area as a candidate for MPA.
 - Begin to solicit inputs for co-management by interested parties.
 - Restrict the granting of licences or permits for activities that may conflict with the need for protection.
 - Restrict activities that can do harm to the area such as fishing, anchoring of vessels, mining, diving and land based activities that can create harm.
- (DFO 1998)

5.3 Evaluation and Recommendation

The evaluation of an area nominated for consideration as an MPA will take into account the ecological, technical and economic factors of the area as outlined in the criteria in Table 5.1. This will ensure fairness in consideration of all the areas nominated. Further inputs should be garnered from the stakeholders along with gathering of as much scientific knowledge as possible.

The ecological assessment should focus on the level of the need for protection and the impact that protection can make on the preservation or restoration of the ecosystem. This evaluation should also take into account the type and number of activities which may need to be restricted in the area (DFO 1998).

The technical assessment will seek to answer questions and determine the following:

- the managerial and technical feasibility of the proposal and the area;
- should the proposal not meet the feasibility criteria, how it can be improved on to meet the criteria;
- size of area and boundaries;

- the level of public support and possibilities for management;
- the existence of prior recognition or acceptance of the need to conserve the area, nationally or internationally;
- the way the area will enhance, or be compatible with, other efforts at managing the coastal or marine areas;
- the availability of the area in situations of traditional usage that may be displaced, and suitability of protective measures proposed, and the limit of the area;
- the level of impact on use of nearby areas and frictions this might cause due to adverse impacts such as limiting access by users;
- the value of the area as a site for research and monitoring (DFO 1998).

The process of making the technical assessment will highlight shortcomings in the proposal and help in the eradication of these from the proposal, should the site be found suitable for designation.

The socio-economic assessment is primarily concerned with the effect of the MPA on human activities in the area i.e. the positive effects that can be gained and how to mitigate any negative effects. The focus is on traditional users such as fishermen, boaters, shipping and transportation operators and recreational users. It will extend to wider economic activities such as mining, drilling for oil, and construction of dock and harbour facilities. Its impact on wider national interests such as defence and national security will also be assessed. The assessment will also be concerned with the scientific and educational values of these areas and how they will be affected (DFO 1998).

Prioritising among these three types of assessment will be difficult. For the purpose of protection of natural resources, the ecological assessment seems the most important but the others have to be taken into account. Alternative sites that can offer the same degree of protection or achieve the same objectives may have to be looked at, or alternate sites found for activities and users that will be displaced by designation of an area as an MPA. The recommendation should take these into account.

The NRCA should then make a recommendation for the designation or rejection of an area as an MPA. It may also make recommendation, for protection short of designation as an MPA if the Authority thinks that the objectives can be substantially achieved by those means. This will be important where the socio-

economic assessment shows that the dislocation of some users will be severe and where some level of accommodation can be given without adversely affecting the desirable goals.

The recommendations arising from the overall assessment may therefore be:

- rejection of the proposal of an area as an MPA;
- other protective measures than designation as an MPA;
- defer for further study and evaluation;
- designation as an MPA and the development of the management plan for the MPA (DFO 1998).

This paper is concerned with areas designated as MPAs and therefore will only look at the last of these possible proposals, i.e. designation as an MPA and the appropriate management of such an area.

Chapter 6

Management Plan for Marine Protected Areas

6.1 Plan Proposal

The management plan for an MPA should be clear about the objectives to be achieved and how it is proposed to achieve these objectives. The plan should refer to the assessment techniques to be used to measure the degree of success of the management efforts and the criteria for claiming success. Plans for conservation tend to fall into two broad types. The plan can be a supportive one, i.e. it seeks to encourage, enhance or co-ordinate positive actions; or it can be regulatory, i.e. it seeks to prescribe, curtail or limit certain actions. Ideally, a properly developed plan, done with adequate consultation, should be both supportive and regulatory.

Such plans will tend to be successful if they have a constituency, political support, financial backing and be seen to achieve results. The progress of the plan should reflect phases such as an initial phase of institutional building, where persons are trained, infrastructure put in place and the public is educated on the necessity and requirements of the MPA. The next or intermediate phase seeks to correct bad practices where these exist, implementing the plan and the beginning of observable, quantifiable improvements in social and or environmental conditions. The final phase is where there is a sustained improvement of environmental conditions. Olsen et al outline the plan processes as follows:

Steps	Priority Action
 <p data-bbox="288 248 810 291">1. Identification of Issue and Assessment</p> <p data-bbox="496 309 520 459">↓</p>	<p data-bbox="834 248 1544 398">Rapidly assess existing condition, consult key stakeholders and identify priority issues.</p>
<p data-bbox="288 465 810 508">2. Programme Preparation</p> <p data-bbox="496 526 520 676">↓</p>	<p data-bbox="834 465 1544 840">Select issues to be addressed and geographic focus, conduct public education programme, define boundaries of management area, define management objectives, strategies and actions, start early implementation actions.</p>
<p data-bbox="288 683 810 725">3. Formal Adoption and Funding</p> <p data-bbox="496 743 520 893">↓</p>	<p data-bbox="834 683 1544 1108">Adopt formal management plan and governance process, secure adequate funding for implementation.</p>
<p data-bbox="288 902 810 945">4. Implementation</p> <p data-bbox="496 963 520 1113">↓</p>	<p data-bbox="834 902 1544 1496">Construction/operation of infrastructure, promote compliance to regulations and agreements, implementation of sustainable development practices.</p>
<p data-bbox="288 1122 810 1164">5. Evaluation</p> <p data-bbox="480 1182 520 1332">↓</p> <p data-bbox="480 1570 520 1601">↶</p>	<p data-bbox="834 1122 1544 1825">Evaluation of governance process and outcomes, re-assess issues and strategies, select adjustments to plan and governance process.</p>

It should be noted that the last stage, Step 5, is the evaluation stage at which adjustments to the plan should be made if necessary. This leads to an iterative process, which should be flexible and lead to regular corrections if these are needed.

The management plan for any MPA must take into account the socio-economic situation of the area in which it is to be implemented. The level of education, and access to print and electronic media by the population will affect the ease with which the educational and sensitising process can be done. In Jamaica, where radio is one of the chief means of informing the public about issues, and to which almost the entire population has access, this means should be used.

The traditions of governance, i.e. the way government interacts with the population, can be important. If government tends to be unresponsive and applies rules through a top down management process, the planning process must account for this. The planners should try to gain the support of the top levels of decision-makers such as government ministers, as early as possible in the education process. This task of gaining support is best done by showing the advantages to be gained by the communities in the area.

The support of influential persons in the private sector and by senior civil servants whose area of responsibility includes or touches on environmental or marine issues must be gained. Planning to overcome the institutional difficulties that may be encountered at an early stage is better than trying to change the methods of operation of the relevant government bodies. Jamaica has a long tradition of top down method of governance with a generally unresponsive bureaucracy. The planning efforts must proceed with this in mind, to minimise any negative effects of the governmental structure.

Kelleher et al suggests that to achieve success in the designation of an MPA without having to face some of the institutional barriers most likely to be encountered, one should:

- avoid if possible the creation of new agencies or bodies, therefore use those already in existence;
- minimise disruption to uses, especially traditional ones, that will not do any harm to the environment or degrade the aims for which the MPA is being established;
- enlist the help of personnel already working in the field;
- ensure that there are no conflicts with existing administrative instructions or laws and where conflicts are inevitable, resolve these at an early stage. (Keller et al 1991).

The proposal of a plan for an area to be designated as an MPA requires thorough, detailed work by the proponents. A plan with enough detail will most likely get quick action with little of the delays due to questions for clarification and elaboration. Its weaknesses will be seen more quickly by the NRCA when making its decision for acceptance of the proposal; and suggestions for improvement can be more easily made where these are required. The kinds of detailed information that are required are listed at Annex B (Detail of Content of Management Plan for MPA). More information may be added to this if it is relevant and helpful in the protection and management effort for a particular MPA.

6.2 Public Participation and Co-management Arrangements for MPAs

The involvement of the public, both direct users and non-users, in the designation and management of an MPA is very important. Early involvement of these persons will contribute significantly to efforts at education, conflict resolution and the establishment of the MPA, and monitoring of the area. The population must get a chance to know of the impacts on their lives, the benefits to be derived and any changes they might have to make to accommodate the establishment of the MPA.

Countries such as Canada and Australia, which have been at the forefront in the use of MPAs as a method of conservation and protection, have seen the benefits of public participation in those efforts. There are sound reasons for this. The main argument for a participatory approach to management efforts for conservation and protection of coastal and marine areas is that it is an integral part of resource development. Proper resource development needs reliable information, discussion among all affected parties, and a legitimate process for arriving at the final decisions. It is to be further noted that those who will be most affected tend to have the widest and best knowledge of the state of the resource and its users. Users have valuable information that is very useful to augment scientific data (Dahl C 1997).

Ellsworth et al, addressing the same point of public participation, state that public involvement runs the gamut from giving of public information, through various levels of public comment, consultation and advise, all the way to joint planning. This last, joint planning, offers the best method of public involvement, as it is by nature open and transparent. This gives legitimacy to the process. It reduces conflicts and is

educational. Joint planning offers the opportunity for early development of trust among stakeholders.

There are direct benefits to be derived from the participatory approach and the use of co-management for an area needing protection. Ellsworth et al see the following advantages of such an approach:

- creation of an appropriate, representative organisation;
- achieving common understanding of the environmental, social and economic visions and aims;
- help in assessment of the state of the environment, data gathering and the factors impacting the environment;
- identification of the tasks that may be carried out to rectify or mitigate environmental degradation;
- scheduling of tasks in a realistic, achievable way.

The authors see the results of co-management as the enhancement of the community's ability to sustain and diversify its livelihood by looking at alternative activities such as ecotourism and sports fishing. The benefits of conservation of biological and cultural diversity will be enhanced. There will be beneficial effects such as improvement in water quality of beaches and estuaries. Major social benefits will be an informed public, better able to take charge of their environment; achieving continuous efforts at restoration and sustainable development based on common understanding and with sound knowledge; and finally, popularisation of science and a belief in government generated data.

Achieving effective public participation will not always be easy, as some cultures may not have strong traditions for this. There may also be adversarial tensions between different users on one hand, and users and the government on the other. There are some groups that simply resist efforts that suggest to them imposition of any form of control. Such a group in Jamaica is fishermen. This will be the largest group likely to be affected by the creation of MPAs in that country and every effort has to be made to ensure their active involvement. Large parts of this effort have to be to show them the long-term benefits to themselves from the establishment of MPAs, as people tend to respond positively if they can see their personal gain. Another group is the people involved in the tourism industry who may face restrictions on areas

traditionally open to their use. The same level of involvement as for fishermen should be undertaken.

Luttinger, using his experience in the establishment of a marine protected area in the Bay Islands of Honduras, an area socio-economically similar to parts of Jamaica, noted some key factors that spurred the community to support the establishment of the MPA. These were:

- the local economy was becoming more dependent on the resources of the area;
- a recognition of the link between economic and social issues, and the health of the marine ecosystem;
- recognition that the methods of exploitation of marine resources were unsustainable and therefore had to be changed;
- recognition of the advantages of an MPA, through education;
- trust in those local persons who spearheaded the idea as they were also being affected economically;
- development of a policy of finding alternative sources of income for those displaced or adversely affected by the MPA;
- limiting the size of the area to that which was essential to achieve the aims of the MPA.

Luttinger saw the benefits of public participation and co-management of the MPA as providing a basis for continuous education of the stakeholders on the importance of monitoring the MPA. He saw another benefit of co-management as a means of getting a wide cross section of persons contributing financial and other resources to the management efforts. This reduced dependency on any single source of funding and also ensured greater desire and interest in its success by the stakeholders.

6.3 Zoning

An MPA may be designated for a single purpose and have one set of control or rules applying uniformly throughout the area. This is most often the case in small areas that are easily managed and that have little disruptive effects on surrounding activities. Large multiple-use MPAs, due to the management complexities and the possible disruptive effects they may have on traditional users, will require a system of

delineation into different zones with different rules, depending on the purposes of the areas and the permissible activities within those areas.

The use of zones for allowing different uses of an area is one of the management tools used in management of MPAs. In Jamaica, there are many areas needing protection, where a single type of protective zone can be used due to the environmental condition and economic use to which the area is put. There are other areas however, where multiple use zones may be better to achieve the best results for conservation and protection, having regard to the socio-economic conditions of the country.

The five most broadly recognised zones used in coastal and marine management are general use, sustainable use, seasonal preserve, species preserves and marine park (Dahl 1997). The protective zones among this group, i.e. sustainable use, seasonal preserve, species preserve and marine park broadly correspond to the ecological reserves/marine conservation areas, wildlife management area and marine park used in Table 5.1 (Criteria for Designation of MPA).

The types of management measures that may be instituted in the various zones include permit procedures, water and environmental quality monitoring, fisheries monitoring, facilities siting, emergency planning, land use management and hazardous substances management (Dahl 1997). These management measures are largely dependent on the type of use to which the areas were traditionally used, the type of allowable activities once management measures are in place, and the activities in surrounding areas that may impact on the zone.

The zoning plan to be developed must take into account and plan for prescribed and proscribed activities. The allowable activities within zones should be specified, such as navigation, anchoring, diving and fishing for example. Periods of fishery closure can also be specified for areas or zones at critical times in the life cycle of species. Limits on the maximum size of fish and, maximum harvest for a period, and the regulation of equipment used, can be specified by zones. Access to zones can be controlled by measures such as permits and limitations of participants (Kelleher et al 1991).

Kelleher et al outlined the main reason for using multiple use zones in some types of situations. They recommend using large multiple use MPAs with varying types of protective systems or methods. These areas can be divided for research, full protection as reserves, non-extractive uses, recreation and use for the subsistence of

the population. Experience has shown that small MPAs in conjunction with conventional fisheries management frequently lead to over-exploitation and collapse of stocks and eventual degradation of the MPA (Kelleher et al 1991).

Where multiple use zones are necessary to achieve the objectives of an MPA, a zoning plan must be developed. The purposes of this zoning plan are:

- long term conservation and maintenance of the MPA;
- protection of the critical systems such as habitats, ecosystem and the life sustaining ecological processes;
- provide separation of possible conflicting uses;
- provide a basis for protection of natural or cultural aspects, and at the same time allowing for continued sustainable use;
- provide areas for certain specific human activities and at the same time minimising harmful effects on the MPA;
- provide areas in a natural state for use in scientific studies, research and education (Kelleher et al 1991).

The zoning plan should be developed in a systematic way, using the inputs from all interested parties. It is an integral part of the management plan and where one is used, the thoroughness with which it is developed will affect the success of the management plan for the MPA.

The main considerations and stages in the development of a zoning plan are:

1. Gathering information and data on the use of the area, success or failure of previous management efforts, the nature of the area, the population and the best methods to ensure public participation;
2. Public consultation to check on the accuracy of information, suggestion for improvement, informing the public of the drafting of a zoning plan and solicitation of inputs;
3. Design of draft plan, taking into account public comments. This draft should be disseminated for further public comment. It will have the objectives envisaged for the various zones. The draft plan should be simple and cause as little disruption as possible on human activity that will not harm the overall objectives of the MPA. The objectives may vary from one that is highly restrictive such as “To provide for the preservation of the area in its natural state, undisturbed by human activity”, to one less restrictive such as “To provide opportunities for general use, consistent

with the conservation of the Marine Protected Area”. Public Consultation is necessary to review the draft plan. This might include community meetings, questionnaires sent out by mail and advertising in the mass media, including radio, outlining the contents of the draft plan and requesting comments.

4. Plan Finalisation after a review of the public response and comments on the draft plan. Changes should be considered to reflect new knowledge and the comments of the public. Final consultation should be held with the affected users to assess the impact of changes and to alert them before the final plan is formulated (Kelleher et al 1991).

The zoning plans, as far as is practicable, should seek to minimise disruptions to use, avoid sudden changes from areas of high protection to low protection if such a system was in place before. It should try to site around distinct, easily identifiable geographic areas such as reefs, islands, coves or estuaries (Kelleher et al 1991). This will help in societies where traditional line of sight methods of navigation are used widely, as in Jamaica. Every effort must be made to gain public acceptance and support for the objectives of the specified zones and support for the conservation and protection measures introduced for them.

Areas in Jamaica that could be considered for multiply use zones are the Pedro Bank and Morant Bank areas. This is due to the ecological importance of these areas as spawning areas and habitats for marine living resources and the economic importance as major areas of the fishery. The Pedro Bank is also important for the number of wrecks of historical interests lying in its waters.

6.4 Funding

It is not likely, nor is it necessarily desirable, that government is asked to provide all the funding for the management of an MPA. For the long term, every MPA should seek to be financially self-sustaining. This is the best guarantee for successes in an environment where public funds are always in short supply. The Government of Jamaica’s Policy for the Country’s system of Protected Areas allows for, in addition to allocations from the national budget, the use of trust funds, fundraising campaigns, user fees and concession licences to provide the financial support for MPAs.

Allocations from the national budget should help carry out the initial work necessary to designate an MPA and would be part of the NRCA’s budget allocation.

These funds would be available for only a limited time. It would then be incumbent on the other stakeholders to provide the funds through endowments and fundraising efforts, to continue the support of the MPA. User fees can be charged to persons for diving, sightseeing or making other recreational uses of the area; and where concessionaires such as diving operators use the areas, the licensing fee revenues can go towards supporting the MPA.

Hotel operators and industrial users of the coastal and marine environment should also be asked to help in the co-management and funding of the MPA. One advantage of getting stakeholders, including local businesses, to participate in the co-management and funding of MPAs, is the direct interest that this will engender in them for monitoring and enforcement. They will have a natural interest to see that their money is well-spent and therefore not only will they tend to comply with rules and regulations, but they will be pro-active by preventing or reporting breaches by others where they observe such breaches.

The management plan must stipulate the size of staff, infrastructure needed and the budget. Volunteers should be used where possible to reduce the burden on what will, in almost all cases, be limited financial and other resources. All attempts should be made to prevent dependence on one or a small group of persons for the major funds. This can greatly increase the influence these people will have on the management efforts. This influence in most cases will be positive, however, it may be abused in seeking special concessions to carry out activities that are in conflict with the aims of the MPA. Having a large amount of contributors will reduce this likelihood even though it may create administrative difficulties in collection and proper programme budgeting. Firm commitments should be sought from stakeholders early in the planning stage to reduce some of the uncertainties.

6.5 Monitoring and Enforcement

The ability to maintain an effective MPA will depend to some extent on the ability to carry out adequate surveillance, monitoring and enforcement of activities in the area. Good-will alone will not ensure compliance by all, and failure to enforce laws and regulations will tend to create a situation where the requirements of MPAs are simply ignored.

Monitoring and enforcement activity in a MPA require the following:

1. Control to regulate people's activities. Laws, rules, standing orders and standard operating procedures are needed for this purpose;
2. Establishment of the administrative structures and arrangements to carry out the activities required;
3. Planning for schedules and procedures for controlling the use of the environment; and plan to counter negative changes;
4. Implementation of the plan through provision of resources, administrative system, management and supervision;
5. Monitoring in order to detect changes, auditing activities and publishing the data from the observations and investigations. It also includes an examination of the strategies being used to carry out the processes (Jacoby et al 1997).

Before proper enforcement can be carried out in the MPA, certain rules and regulations have to be in place in order that the general public is aware of the rules and what constitutes breaches, and that those tasked with enforcement can carry out their duties with confidence. The most important thing should be the legislation for the establishment of the MPA. Proper legislation will help to ensure proper implementation and garner compliance, properly delineate boundaries, and provide adequate statements of authority and precedence among agencies. The legislation should also make provision for acquisition of adequate infra-structural support and resources to ensure that the necessary tasks can be carried out. It must include strong and reasonable penalties for breaches, incentives for self-regulation or compliance, and provide adequate authority for persons involved in enforcement. This is to ensure that they can take effective action such as pursuit, apprehension, identification and gathering of evidence. Enforcement personnel should also be authorised to confiscate equipment and other material evidence and be able to lay charges in a court of law. If possible, members of the local population should be involved in enforcement activities (Kelleher et al 1991).

The types of sanctions can be administrative for minor breaches of the regulations, and administered by the NRCA, or judicial ones for more serious breaches. The traditional enforcement agencies in the country such as the Jamaica Constabulary Force, The Jamaica Defence Force Coast Guard, Fisheries Inspectors and Game Wardens should be further sensitised to the protection and management efforts in the plan, and their support for training and enforcement assistance sought.

6.6 Re-evaluation and Re-designation

The management plan for MPAs must have provision for review of the degree of success of the process. This review will take into account the results of monitoring activities using environmental indicators, sampling, interviews and other pertinent matters that aid in the assessment of the state of the marine environment in the area. This review and evaluation process may lead to the extension of present management efforts, introduction of new measures or an easing of the measures that have been put in place, depending on what the situation warrants. For example, if restoration of fish stocks to a certain level by prohibiting fishing was the aim, when that level is reached then fishing may resume within certain guidelines. On the other hand, if limited fishing was allowed and the stocks are still at the same level, then a total prohibition may be called for.

In addition to the expertise which reside in the NRCA for environmental monitoring, there are many highly qualified and able persons in the UWI Centre for Marine Sciences and the DBML who can help in the scientific assessment of areas for degrees of success.

The management plan should outline the period for review. The period set should be such that the review can be done within the resource constraints of the management body, and also taking into account that the time lag should not be so great that the management efforts are seen as inflexible and unwilling to respond to changes. The review must look at socio-economic and environmental impacts of the efforts, the effectiveness of the management methods and new scientific data bearing on the efforts. The period for review will to some extent depend on the speed with which implementation of the plan for a particular MPA was achieved, and five to seven years have been suggested (Kelleher et al 1991). A plan that was implemented fairly quickly with the necessary institutional support in place should be ready for review in about five years. One that had a longer period of implementation may require a longer period of up to eight years before review to show any results that can be used for reassessment and modification.

The re-evaluation of an area for continued protection or re-designation in the context of a developing country must look at the state of the economy, the environment and the equity of the management measures and their effects on the population. The need for conservation and protection of the environment and the

socio-economic needs of the users in the area should be looked at just as in the initial planning stage. There must also be participation by stakeholders in the review process to ensure trust and transparency. This will ensure that any decisions arrived at will be supported by the people affected as well as others. Changes and modifications will be more easily communicated and where benefits are obvious, enthusiasm will grow for similar measures in the future.

Chapter 7

Conclusion and Recommendation

7.1 The Importance of Marine Environmental Protection in Jamaica

Jamaica is an archipelagic state with a marine area several times larger than its landmass. It is heavily dependent on the resources of these areas for its economic wellbeing. The country's tourism industry, which employs 27% of the population, is directly dependent on the marine resources of the country. The fishery sector is a major source of employment and food. Any dislocation of these sectors could have adverse effects on the well being of the population; and the economy in general, which has been going through a period of stagnation.

The Government of Jamaica has stated its commitment to the development of a well-structured, properly implemented environmental policy as a major part of its efforts to develop the country. This is very important, as most forms of development will lead to increased stress on the marine environment. This will happen whether the development is of tourism infrastructure, ports, land-based industries or agriculture, due to the proximity of all areas of the country to the sea.

There have already been noticeable declines in the state of the marine environment of Jamaica. This has been particularly marked on the coral reef communities and the reef fishery, to the point where the catch in this fishery has declined significantly by approximately fifty percent for the same effort over the period 1996-1997. The fishery has suffered from poor management and over-exploitation and every effort must be made to reverse this situation.

The coral reef communities have declined to where the coral cover is less than 10% of what it used to be in some areas. The reasons for the decline are both natural and due to anthropogenic agents. The coral have been affected by natural processes such as hurricanes, and also suffered mortality due to sea temperature increases. They

have also been affected by anthropogenic agents such as the run-off from land of silt, addition of sewage and other harmful nutrients.

Non-living resources such as historic shipwreck sites have been subjected to interference by treasure hunters, so diminishing their value for archaeological research. This emphasises the need for their protection and preservation.

Land-based activities such as growing urbanisation, infrastructure development of various types and industrialisation have contributed to the ingress of silt and garbage, sewage and other nutrients that have all had a negative effect on the marine environment. Recent efforts at monitoring and regulation of these land-based activities by the NRCA are having positive effects, but more effort is required in this area.

Some of the difficulties Jamaica is experiencing with the management of its environment and renewable natural resources are that many laws are enacted but are left unenforced. Recent actions in the highest court in the land, which pointed at weaknesses in the government's efforts at environmental protection and sustainable development, have also called into question the degree of sensitivity and commitment to environmental protection by the government. Public education must be undertaken and special efforts made to increase the awareness of the relevant law enforcement authorities to the importance of enforcing environmental laws.

The Fisheries Department of the Ministry of Agriculture has promulgated a plan for managing the fishery of Jamaica. This needs to be backed up by action such as giving the Department the necessary human resources, legislative tools and material resources to improve the management of the fishery. There are NGO's that have also taken positive action on their own with some success in aiding the recovery of the fish stocks and sensitising some of the people in the industry to the need for better practices.

The JNHT is dutifully carrying out its work in difficult financial circumstances to protect the areas of the marine environment of historical or cultural significance. Protection of these areas would give the Trust the added time to be able to properly research sites and where necessary recover artefacts.

The government has established the Council on Ocean Affairs to advise it of pertinent matters in the marine environment and to encourage exchange of views and provide a Secretariat for matters impacting on this. Its effectiveness is yet to be seen.

The economic aspects of resource use and environmental protection pose difficulties for policy makers. Environmental economics is at best a fledgling area of study and there is no consensus as to the best methods to be used. The need to ensure sustainable use of resources is frequently in conflict with satisfying the urgent needs of the present generation. This dilemma is especially marked in developing countries such as Jamaica. There are also significant difficulties in placing values on some environmental renewable natural resources. These problems are increased by the historic way renewable marine resources are viewed, i.e. as public property, with little charge for use or demand for restoration. There is also a social dimension to the valuation of renewable natural resources. This will often be affected by the level of environmental education, income disparities among the population and the dependency of some groups on the resources for sustenance, and the level of public participation in policy making. The social and economic difficulties suggest that someone must take the initiative for environmental protection. This should be the government, which has an obligation to ensure the well being of the population.

There is recognition that government has the major part to play in ensuring protection of the environment. There are many international conventions and charters that seek to achieve protection of the environment and ensure sustainable development and they frequently speak directly to the part the government must play. The earlier conventions and charters were of a nature that sought voluntary compliance and were more to encourage governments to take action for protection of renewable natural resources, than to try and compel them to do so. More recently, the Environmental Conventions are of a more mandatory nature. Some of these conventions are global in scope, some regional, and some for the protection of specific habitats or species. Jamaica is a party to all of the most important of these conventions.

7.2 The Necessity of an Effective Programme of Marine Protected Areas (MPAs)

A Marine Protected Area is one of the tools available to countries for the protection and management of their coastal and marine resources. The protection of these renewable natural and other resources is important for ecological, socio-economic, scientific, educational or cultural reasons.

There will be difficulties and in some cases, opposition to the designation of MPAs. Notwithstanding this, efforts should be made to implement this programme for the management and protection of the marine environment. Difficulties will arise due to competing demands on the marine sector and a historic mind-set that has emphasised industry and development over protection of the environment. The NRCA tries to monitor development but their efforts need to be strengthened and a requirement for environmental impact assessments put in place and enforced for all construction and development in the coastal and marine environment.

The development and implementation of a regime for MPAs should include the provisions for direction and control over activities or the resources in these areas. It should also provide guidelines that include a requirement for public participation in the process of identification of these areas, their designation and management.

The constituent parts of the policy on MPAs must include the methods of identification of the areas, the legal principles under which they may be designated and managed, and the goals to be achieved. The policy must require that credible scientific knowledge be used, or in the absence of this, sound local knowledge, always keeping in mind the need for the precautionary approach to environmental management. Funding of the areas and the monitoring and enforcement of activities must also be provided for.

Jamaica also has several pieces of legislation under which marine protected areas for different purposes can be declared. These pieces of legislation make provisions for the regulation of these areas and in some cases, outline the penalties and sanctions for breaches. These laws must be implemented and enforced.

Designation of MPAs require credible scientific data and/ or local knowledge, notwithstanding the existence of laws. This is to ensure that these areas are not created or imposed for spurious reasons. The state of Jamaica's marine environment is well known, both from scientific studies done over an extended period of time in some areas, such as the coral reefs on the North Coast and because of good local knowledge of the state of the fish stocks. The interference with historic shipwreck sites is also well documented. This suggests that there is no shortage of information on which to begin the examination of sites for possible designation as MPAs.

The different types of MPAs to be designated should be dependent on the objectives for the areas. The designation may be as ecological reserves, marine conservation area, and wild life management area or marine park. There should be a

requirement for public input in the proposal of an area, its consideration and designation. Public participation will aid in gaining a high level of compliance with the regulations, as the population will be aware of the objectives for the area and it will reflect their views.

The assessment for the candidate sites must be based on ecological, technical and socio-economic factors. Ecological assessment should look at the need for protection and the beneficial effects to the ecosystem from this. The technical assessment should focus on the managerial and technical feasibility of the proposal for the area, including such matters as boundaries, size, and scope for co-management and compatibility with other coastal or marine area management efforts. It should also look at possible conflicts that may arise. Finally, the technical assessment must look at the value of the area for research and education or recreation. The socio-economic assessment should concentrate on the effects the MPA is likely to have on human activity. As protection of the environment and the renewable natural resources is the main aim, the ecological assessment should have the highest priority, but the others must also be taken into account.

The management plan for the MPA must have the details of the objectives to be achieved and how these objectives are to be achieved. It should show the phases of implementation of the management programme. The plan must take account of the socio-economic condition of the area and seek to minimise conflicts and disruptions.

The need for public participation cannot be over-emphasised due to the significant effect it has on achieving the goals set out. It helps in educating the public, garnering support for establishment, including funding, and can play a critical role in aiding efforts at monitoring and enforcement.

Where MPAs must be divided into zones because of the environmental or economic conditions in the area, the public should be involved in deciding on these. Zones may be for research, full reserves, non-extractive use, recreation, or subsistence of the local population. There are areas, especially along the coast of the mainland where single purpose ecological reserves may be established. These areas should be of a size to achieve the aims of protection without causing too much disruption to the local population. Single purpose zones in these coastal areas also make it easier to carry out monitoring, as any activity that is not in accordance with the rules would be easily seen.

The Pedro and Morant Banks should be made multiple use MPA's with different zones for different uses and for levels of protection. This should take into account their significant contribution to the fishery and also their importance as significant spawning areas and habitats. The Pedro Bank also has a large number of important historic wreck sites.

The management measures in the plan for an MPA should include use of permits, monitoring systems and restrictions on activities. Traditional use must be taken into account and where it will do no harm, be allowed.

The establishment of an MPA will not succeed without adequate financial, human and infra-structural resources. Government alone will not provide these resources and every effort must be made to achieve financial self-sufficiency in the shortest time. The government should normally provide the initial funds to study an area for designation, but the public should pay for its continued sustenance. The private sector bodies making the greatest use of the marine environment, such as hoteliers and tourism related interests and the fishing industry should be tapped for help in providing funds. This may be through endowments or user fees.

Monitoring and enforcement are essential elements of the efforts at managing MPAs. The rules and regulations, which are to be put in place, have to be enforced and monitoring done to observe changes and patterns that exist or develop. Persons involved in enforcement must have the authority to investigate breaches and take the appropriate actions for correction.

Finally, there must be provision for review of the management effort to measure the degree of success. This must be at appropriate intervals, taking into account the resources of the management body and ensuring that the management efforts are not seen as being unresponsive to change. An interval of five to eight years is suggested.

The need for marine protected areas in Jamaican waters is very apparent. There are enough laws to support the designation of these areas and enough knowledge as to their need. It is now necessary that a programme be put in place for their establishment. The government has promulgated a Policy for Jamaica's System of Protected Areas, which gives the broad outlines of the direction that is intended to be followed but does not focus on marine areas specifically. This policy acknowledges the lack of a plan with the steps to be followed. This paper with its two Annexes outlines some of the considerations and detailed requirements that must be

met in the designation of an area and the plan to be submitted to the NRCA for approval.

A system of Marine Protected Areas in waters under Jamaica's jurisdiction is an important tool to be used to protect the environment and manage the living and non-living resources in these areas.

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Annex A

Information to be Included in the Proposal of a Marine Protected Area.

1. The proposing organisation or agency and its contact information.
2. A statement of significance which indicates:
 - why the proposed area merits MPA status
 - how the proposed area meets the purposes defined for MPAs under the Government of Jamaica Policy on Protected Areas
 - how the proposed area meets the purposes of other marine protected area legislation, if applicable
3. Suggested location, boundaries and current status of the area
 - analysis of all applicable jurisdiction, including municipal, national and international ones
4. Environmental and ecological information such as:
 - significant species present, their status and ecological requirements
 - important ecosystem and habitat characteristics, including environmental status and known threats
 - special features (e.g., upwellings, rivers and estuaries, land-based runoff, and nutrient areas)
 - important abiotic processes (e.g., physical, chemical, climatic, and geological processes)
5. Social and economic characteristics within and near the area, such as:
 - present and historic uses
 - human activities with actual or potential impacts on the area such as mining activities, shipping, aquaculture, tourism, recreation, and food gathering
 - past and present commercial, recreational, and traditional fishing activities and opportunities
 - potential socio-economic impacts
6. Alternatives to MPA protection, such as:
 - Protection mechanisms already in place within area of interest
 - Other types of designation.

- Other types of regulation or conservation measure, e.g., fisheries closure
7. A list of groups and individuals interested in the development of the MPA including proposed partnering arrangements.
 8. Proposed management strategies and regulations inside the MPA and associated rationale for each, such as:
 - suggested management objectives, zoning, and other controls
 - suggestions or arrangements for research and monitoring, surveillance and enforcement
 - suggestions for marking, signage and public awareness

Adopted from Marine Protected Areas Program, published by Communications Directorate, Fisheries and Oceans Canada: Ottawa, Ontario.

Annex B

Detail of Content of an MPA Management Plan

All the information listed in the following example should be provided in one document.

TITLE PAGE

This includes:

- . The name of the area subject to the plan and its status;
- . The words – MANAGEMENT PLAN;
- . The name of the agency/agencies responsible for implementing the plan;
- . The date when the plan was prepared and the expected date for review;

EXECUTIVE SUMMARY PAGE

On this page are summarised:

- . the reasons why the plan was prepared;
- . the period of time for which it applies;
- . any special conditions which controlled its preparation including the legislative basis and authority for plan development;
- . the principal provisions of the plan;
- . the estimated budget; and
- . acknowledgements.

CONTENTS PAGE

The headings of the body of the plan are listed here against the appropriate page numbers. It may be preferable to list only the main headings, but sub-headings are usually included.

BODY OF THE PLAN

1. Objectives for Management

The goal and objectives for management are stated in this section. They will reflect the purpose(s) for which the area is protected and the use(s), which will be permitted.

2. Resource Description

This section provides information on the following categories for the areas to be protected. Maps will be an important feature of this section.

2.1 Name of Area and Location

To include the geographic location (Parish, district, etc.); latitudes and longitudes (preferably on a map); surface area (square kilometres, hectares or other units of area).

2.2 Geographic and Habitat Classification

The area should be categorised according to a habitat classification scheme to identify its geographic zone, substrate type(s) and major biological feature(s).

2.3 Conservation Status

This should indicate the area's degree of naturalness, aesthetic values, degree and nature of threats (if any), jurisdiction(s) and present ownership. The degree of habitat representativeness should also be indicated.

2.4 Access and Regional Context

The regional land and sea surroundings and access routes to the area are described, in addition to the character and use of contiguous areas, emphasising their effectiveness as buffer zones.

2.5 History and Development

This section contains a summary account of direct and peripheral human involvement in the area. This section may be divided into several sub-sections e.g.:

2.5.1 Archaeology

A summary description of the people who used the area before historical times, including any known areas of religious significance, species taken and if closed seasons or closed areas were ever used as management techniques. Archaeological information could also provide clues to species that were found in the area

2.5.2 Historical relics

This sub-section should identify submerged wrecks and any submerged structures.

2.5.3 Written and oral history

2.5.4 Recent developments

Give a brief history of fishing and other human use of the area and developments on the land, which may have had a major influence on the area.

2.5.5 Current human use of the area by subsistence, artisanal, commercial and recreational fishermen, tourists and others is discussed. It is most important to establish who the users are, where they conduct their activities, at what times of the year, and for how long, and the social and economic importance of their use. A user survey may be helpful. This information is just as important as biophysical data.

2.6 Physical features

In this section the non-living features of the area are described. Maps in addition to descriptions should be included.

2.6.1 Coastal landforms

Nearby landforms should be described together with islands and underwater formations.

2.6.2 Bathymetry

A map showing isobaths is needed. The depth of water can provide an important insight into the dynamics of the system. Major trenches, canyons and shallows should be described in as much detail as is available.

2.6.3 Tides

A description of the tidal regime and resultant currents and water movements associated with phases of the tidal cycle.

2.6.4 Salinity and turbidity

Measurements of salinity and turbidity in all seasons are desirable.

2.6.5 Geology

A description in geological terms about how the area was formed and how that process is continuing with the deposition of present day substrates and by erosion processes observable in the area.

2.6.6 Dominant currents

A description of physical oceanographic features of the area, wind-driven, tidal and residual currents, on a seasonal basis.

2.6.7 Freshwater inputs

Major river and estuarine areas should be noted.

2.7 Climate

2.7.2 Precipitation

Annual precipitation figures and a chart to indicate average precipitation on a monthly basis should be included.

2.7.2 Temperature

Monthly charts for both air and average sea temperatures (surface and at given depth). If possible include a monthly chart of solar radiation received.

2.7.3 Winds

Monthly charts of rose diagrams plus a description of any unusual feature of the local winds.

2.8 Plant Life

This section should contain at least a description of dominant marine plant life, and wherever possible a comprehensive summary of the plant community and related environmental factors such as the depth of occurrence, together with any botanical features that may have special scientific, recreational or other interest. Phyto-plankton could be included if information is available. Plant species identified in the area should be listed in an appendix.

2.9 Marine fauna

As a minimum, a description of the dominant marine or estuarine fauna is required, with an account of their ecological relationships if known. Include sections on Mammals, Reptiles, Amphibians, Fish, Birds, Invertebrates and Zoo-plankton as appropriate. A separate appendix should list the species.

Note: Sections 2.8 and 2.9 could be amalgamated to one section entitled "Marine Wildlife". Wildlife would be defined as animals and plants that are indigenous to the nation, to its coastal sea, to its continental shelf or its overlying waters; migratory animals that periodically or occasionally visit it's

area; and such other animals and plants, not being domesticated animals or cultivated plants, as are prescribed by legislation.

2.10 Miscellaneous

This can be a varied section that includes those matters, which do not fit under any of the other descriptions of the plan. Each plan will be site specific and could therefore have features or problems, which are not encountered in other plans.

3. Description of Management Issues

A summary of past, present and possible future threats and management conflicts should follow.

3.1 Historic and current conflicts

A brief statement of any historic or current conflicts between uses or user groups.

3.2 Pollution

Include point and non-point sources of external pollution within the area and in nearby areas, especially those upcurrent, e.g. runoff, sewage inputs, fish processing, industrial pollution and pollution from tourism and shipping.

3.3 Future demand

Estimate future demand for recreational and other uses, and if applicable, future pollution loading and proposed developments.

3.4 Potential conflicts

Potential conflicts specific to the area within and close to the boundary of the MPA should be described. Any potential conflicts due to more distant regional influences should also be identified. This should include review of sectoral development plans and propose projects for, or likely to influence, the area in question.

4. Management policies

In this section the management plan comes to grips with the threats and conflicts and prescribes solutions.

4.1 Objectives

The goal of protecting the area is briefly reiterated. The objectives of management are stated clearly. If the area is to be subdivided, sub-

objectives should be stated for each zone or subdivision of the managed area.

4.2 Resource units

It could be useful to divide the area into resource units.

4.2.1 Natural

Each MPA will have unique characteristics and the resource units will be site specific. An area could be divided into resource units such as beaches, islands, deep-water trenches, turtle or manatee rookeries etc.

4.2.2 Development areas

Another category could be areas that are either developed or proposed to be developed.

4.2.3 Areas of impact

Areas showing marked impact from human activity could be identified.

4.3 Zoning

The resource units defined above may provide a basis for zoning, which should be kept as simple as practicable, consistent with avoiding unnecessary restriction on human activities. Zoning must be easy to understand both from the point of view of the manager and the managed. This section should explain why a particular area has been given a zone classification and what activities are permitted and prohibited within each zone.

Special habitats or wildlife areas such as a seagrass bed or a turtle rookery, may require additional management provisions such as seasonal closures or permanent restrictions to human access. Unusual prescriptions may be needed in the short term and these should be described in this section.

4.4 Management policies for resource units

In the draft management plan a list of management options can be presented in this section and a choice made between them in the final version of the plan.

5 Surveillance

This section should describe any programmes proposed to assess movement of people, vessels and aircraft within and through the area and the use made of the area.

6 Monitoring

This section should describe any biological, environmental and usage-monitoring programmes proposed for the area, when these programmes will be completed and how they are to be used in reviewing the management plan. It may also identify other monitoring programmes to be initiated during the first stage of the plan and who could carry them out. Some of the results from monitoring may eventually be included in the appendices.

7 Education and Interpretation

This section should describe programmes and co-operative arrangements with educational institutions, public associations and community groups to promote protection, wise use, public understanding and enjoyment of the MPA.

8 Enforcement

This section should outline the arrangements, which will need to be made to detect apparent offences and to apprehend and prosecute offenders in order to achieve an acceptable level of adherence to MPA regulations. No nation could afford to manage primarily on the basis of enforcement in the face of general public hostility or to apprehend every breach of regulation. Education is therefore the primary management tool.

9 Maintenance and Administration

A section will be required to address the subjects of budget, staffing, etc.

9.1 Budget

Anticipated costs should be identified so that adequate funding may be arranged.

9.2 Staffing

The management plan should indicate staffing needs and identify major functions. Volunteers, consultants and head office staff involved in the planning process should also be identified, as this will provide a more accurate indication of staffing levels. Staffing deficiencies can be predicted and recommendations suggested. Section 9 should be updated and released as part of an annual report.

10 Information Sources

Information regarding the area will come from sources outside the manager's regular information base. These should be identified and listed wherever possible, and include those other government agencies, non-government organisations, individuals, consultants, overseas sources etc. that were consulted.

A bibliography should be appended.

11 Appendices

Appendix 1: Boundary and Area Description

This should provide the legal description of the area including any outstanding legal tenure or matters of existing interest, which might have become clear during the development of the management plan. These problems should be highlighted and, if appropriate, solutions suggested. One solution is to have complementary legislative, planning and management provisions to facilitate resolution of the problems.

Appendix 2: Legislation

All legislation and regulations relating to the area and their interactions, should be noted and explained. Where feasible, the legislation that prevails in the event of conflict between the provisions of different enactments should be identified. Implications for the protective status of the area should be identified.

Appendix 3: Plant Species

A comprehensive list of plant species should be attempted for the first management plan. As the process continues over the years, it is very likely that new plant species will be discovered in the area. Plant names should be listed in broad taxonomic groups, with botanical and common names where possible.

Appendix 4: Animal Species

Animal species should be listed in broad taxonomic groups: e.g. Mammals, Reptiles, Amphibians, Fish, Birds and Invertebrates and common names provided where possible.

Appendix 5: Special Features

This section could describe unusual or outstanding features of the area and could range from whale stranding, waterspouts, oil slicks to spiritual revelations and cultural beliefs.

Appendix 6: Past, Present and Proposed use

This section should attempt to provide more detail on uses, identify key user groups and assess the social and economic significance of areas.

Maps

The following are suggested as a minimum number of maps required.

- Map 1 - Location
- Map 2 - Land/water tenure and jurisdiction
- Map 3 - Land topography and seabed Bathymetry
- Map 4 - Geology
- Map 5/6 - Dominant plant and animal communities
- Map 7/8 - Major uses
- Map 9 - Major use conflicts and threatened resources
- Map 10 - Zoning

Where practicable the use of overlay presentation is recommended in order to illustrate the associations between such factors as topography, biological communities and uses.

Adopted from *Guidelines for Establishing Marine Protected Areas: A Marine Conservation and Development Report* by Graeme Kelleher and Richard Kenchington, IUCN, 1991: Cambridge, UK.