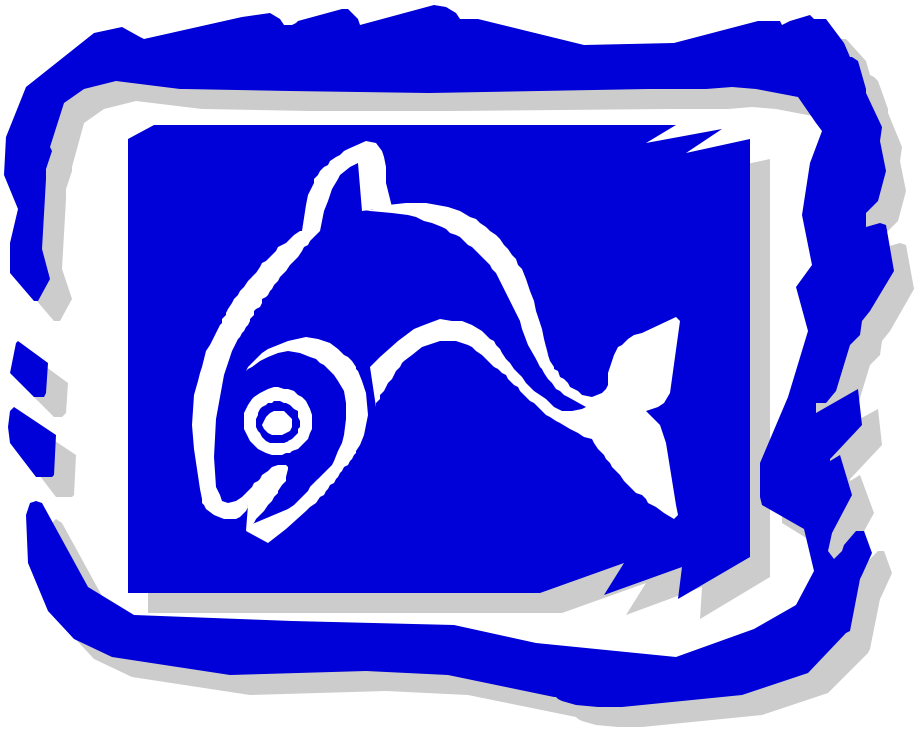
# Socio-Economic Valuation Study of the Ocho Rios Marine Park



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## EXECUTIVE SUMMARY

The declining state of coastal resources has become a major issue of global concern in recent years. In 1999 coastal resources were identified as key ecosystems to be accorded priority for protection and the year was declared Year of the Oceans. In the context of Jamaica where coastal resources play an important role in the provision of recreational activities for the tourism industry, coastal protection is an important aspect of maintaining a sustainable tourism product which in turn will ensure economic viability of Ocho Rios. This applies, by extension, to all of Jamaica since Ocho Rios is a resort town with the largest portion of Jamaica's Tourism Final Demand and greatest contributor to GDP (Jamaica Tourist Board, 1998).

The preservation of an ecosystem at optimal level often requires an evaluation of the economic benefits that accrue to society from it. Quantification of the value of an ecosystem to society can help ensure that sufficient resources are allocated towards its protection, and allows for a balance to be maintained between the benefits gained from preservation and the cost incurred.

This study provides a rapid assessment of the coastal and marine resources in Ocho Rios and utilizes economic valuation techniques to quantify the economic benefits received from maintaining the marine and coastal resources of Ocho Rios at an acceptable level.

From the rapid assessment the key marine and coastal resources were found to be as follows:

- Coral reefs - which in general can be described as being degraded since most of the reefs sampled had less than 10% live coral cover
- Fisheries - which are presently under threat associated with increased fishing pressure
- Beaches – some of which are man-made
- Reptiles such as the Hawkbill turtles that are currently protected under the Wildlife Protection Act.

These resources were found to be threatened by the impacts of:

- Improper solid and sewage waste disposal
- Over-fishing
- Shipping
- Construction activities on the coast
- Global warming

The total economic value of the marine and coastal resources assessed in the Ocho Rios Marine Park was found to be US $ 245.2 million per annum. Through the Travel Cost technique the study also provides estimates of the change in demand for Ocho Rios as a vacation resort that would be associated with the changes in quality of the town's coastal and marine resources. The calculation reveals that Ocho Rios stands to lose an estimated 58,504 stop-over visitors annually if marine and coastal resources were degraded to an unacceptable level. This translates into US $60.824,908 dollars annually.

Based on the distribution of expenditure for stop-over visitors it can therefore be estimated that hoteliers and guest house owners stand to lose US $ 35,886,696, restaurant owners and other food and drink providers US $ 3,711,144, taxi operators and other transportation providers US $3,953,619, those in the entertainment sector US $ 6,264,965.5 and in 'bond store' operators and craft vendors US $ 5, 900,016.

Since these estimates are only based on numbers of stop-over visitors they are conservative in terms of the total potential loss of business revenue if all visitors including cruise-ship visitors, were included. It is not difficult to foresee the tremendous socio-economic repercussions on the town of Ocho Rios should this tourism revenue be lost. Further, it is known that Ocho Rios generates the highest level of GDP of all the tourist regions in Jamaica so that a loss of tourist revenue in Ocho Rios will have far reaching economic and social impacts for the entire island.

In addition, one cannot underestimate the role that marine resources play in sustaining the productivity of the near shore fisheries and thus the livelihood of a significant number of persons. The coastal protection they offered by the marine resources are also important and is especially relevant to small islands such as Jamaica, where land space is in high demand and significant portions of the 'prime lands' are coastal areas which are vulnerable to storm surges.

In the calculation of resource value economists are increasingly aware that the value estimate is incomplete without an assessment of the non-economic/social value of the resource to users. This integration of economic and social estimates of value complement each other by examining different aspects of benefits derived through resource use (Taylor, 1999)[1]. The social value, and therefore potential social impacts of the resources was estimated for the key coastal and marine resources of Ocho Rios.

Questionnaires administered to resource users assessed user-attitude through measures of the user demand on the marine and coastal resource for recreational purposes, and the ratings of user satisfaction, importance and preferred environmental quality.
The social importance of the resources to visitors and local community members was found to be high, supporting the findings of the economic valuation where the resource functions provide significant economic contribution to the town of Ocho Rios and Jamaica as a whole. This high social value is reflected in the ratings given by user groups to measures of resource demand, importance and preferred environmental quality.

In the light of this, protecting the marine and coastal resources in Ocho Rios is of paramount importance and must be considered in the planning and decision- making process as it pertains to the sustainable use of these resources.

[1] It is important to note that the attitudinal estimates of value compare negatives and positives associated with resource use, however, the value obtained is useless for making monetary estimates.

## 1.0 INTRODUCTION

The marine and coastal ecosystems of Jamaica provide a coastal resource base that contributes significantly to the economic well being of the country through tourism (NRCA, PIOJ 1995). More so, the coastal zone area houses the majority of the island's economic activity, and a significant amount of human settlements. However, many sensitive ecosystems and associated natural resources are presently under threat.

This finding was also supported by a recent environmental study commissioned by the Organisation of American States (OAS) which concluded that the natural resource base which supports tourism in and around Jamaica's three main tourist centres is 'heavily stressed' (Jamaica Tourism Impacts, 2000).

The awareness of the need to protect these very important resources has led to the creation of a number of marine parks – the Montego Bay Marine Park, the Negril Environmental Protection Area and the recently established Ocho Rios Marine Park. With the creation of these parks, the resource managers aim to encourage sustainable use of the resources (satisfying the country's need for economic growth) without compromising the vitality of these coastal and marine resources.

Effective execution of this objective is often severely hampered by inadequate financial and human resources available to manage the area and enforce regulations. Increasingly, decision and policy-makers are moving towards community involvement as a key component in any effective resource management strategy. However, achieving community interest and involvement will be unsuccessful in the absence of a concerted effort, ensuring that community members understand and appreciate the importance of the resources to their community and the country as a whole but more so to them as individuals.

One effective method of encouraging and justifying the protection of natural resources (such as those that are to be found in the Ocho Rios Marine Park) is to determine the economic benefits that society and individuals gain from them if resources are properly managed, as well as the economic losses that will be incurred if they are degraded. This informs stakeholders of the value of the ecosystem to society and allows managers to allocate sufficient resources towards its protection (Wright, 1995). It further allows for a balance to be maintained between the benefits accrued and the costs incurred to users.

It is against this background that Friends of the Sea (FOTS), Discovery Bay Marine Laboratory (DBML) and The Coastal Water Quality Improvement Project (CWIP) commissioned this resource valuation exercise.

### 1.1 Aims and Objectives of the Study

The purpose of the valuation exercise is to **quantify the economic and social value of the marine and coastal zone resources** within the boundaries of the Ocho Rios Marine Park (Figure 1.1). The park lies between the border of Drax Hall and Mammee Bay to the west, Frankfort Point to the east and out to sea as far as the 1000 m contour line.

The resource valuation will be the basis for a management plan and will be used to design an appropriate environmental education and awareness programme. This study would therefore allow for the valuation of critical resources in need of conservation so as to ensure their effective and sustainable management.

Insert Figure 1.1

Figure 1.1 Location of the Ocho Rios Marine Park

## 1.2 Methodology

In order to determine the resources to be targeted in the valuation exercise, the direct and indirect uses of the Ocho Rios Marine Park Resources were identified during a site visit in August 2000. These uses are listed below:

- Tourism
- Fishing
- Recreation
- Coastal Protection
- Biodiversity

These uses were selected as the focus of this study because of their social and economic importance to the town of Ocho Rios. This approach was adopted to avoid detailed examination of other less significant local uses for which there was less information available. This was in keeping with the procedures adopted in other local valuation studies, allowing for a more detailed analysis of a few direct and indirect use values which can provide a benchmark from which others can be examined (Gustavson, 2000).

For the purpose of value estimation two categories of resource users were generated after assessment of the targeted resource uses:

1. Direct Users (derive direct local use benefits from the coastal and marine resources e.g. recreational users and fishermen)

2. Indirect Users (derive benefits from the presence of the resource through indirect linkages e.g. hoteliers, and the business community)

Both user groups were made up of local community members or residents, fishermen, the commercial and industrial business community, recreational users and watersports operators and tourists. Direct and indirect use values attributed to benefits achieved through use of the park coastal and marine resources were estimated on an annual basis for the near-shore fisheries, tourism, coastal protection and recreation.

### *1.2.1 Valuation Methodology*

Three main techniques were used to assign economic value: existing markets[2]; surrogate markets[3]; and hypothetical markets[4]. The valuation methods used for each resource use is summarised in Table 1.1

**Table 1.1 Economic Valuation Techniques Employed in the Ocho Rios Marine Park Valuation**

| Valuation Technique | Resource Use | Comments |
|---|---|---|
| Existing Markets | Tourism | Analysis of Tourism Revenue Data |
| | Fisheries | Analysis of Fishing Effort Data |
| Surrogate Market Techniques | Recreation | Travel Cost Calculation |
| | Coastal Protection | Analysis of local land value information |

[2] Using direct market prices, e.g. fish prices

[3] Used in the absence of direct markets, but where demand can be derived, e.g. the demand for the recreational size

[4] Used in the absence of direct or surrogate markets for example in valuing biodiversity

| Valuation Technique | Resource Use | Comments |
|---|---|---|
| Hypothetical Market | Biodiversity | Benefit–Transfer Method |

## 1.3 Information Sources

Although, both primary and secondary data were used in the valuation study, the principal method of data collection was document analysis and database searches. The information used in the calculation of the total economic value of the Ocho Rios Park is summarised in Table 1.2. The study also benefited from the information made available through a concurrent study – The Atlantic Gulf Reef Rapid Assessment, which focused on assessing the environmental status of coral reefs by means of three main factors regarded as signs of coral reef degradation - corals, fishes, and algae.

**Table 1.2 Secondary data sources used to estimate resource values of the Ocho Rios Marine Park**

| Use Value | Information Source |
|---|---|
| Tourism | Jamaica Tourist Board (1998) |
| | Annual Travel Statistics (1989 – 99) |
| Near-shore fisheries | Registration of Fishermen Database, Fisheries Division, Jamaica Ministry of Agriculture |
| Coastal Protection | Real Estate Agencies |
| | Government Land Valuation Dept. |
| | Office of Disaster Preparedness and Emergency Management (ODPEM) |

Primary data used in the socio-economic analyses of local communities and the fisheries were obtained from questionnaire surveys and site visits and informal interviews conducted in August and November 2000. The questionnaire administered to tourists had an additional socio-economic section to allow for a preliminary analysis of travel cost information.

### *1.3.1 Social Survey of the Ocho Rios Marine Park User Groups*

Three hundred questionnaires were administered to sample populations in the following user/stakeholder groups:

- The Accommodation Sector (Hotels, Guest houses)
- Fishers
- Members of the business community (craft and refreshment vendors, in-bond store owners/managers, restaurateurs)
- Watersport Operators
- Hospitality Workers
- Taxi Drivers
- Recreational Users

The questionnaires (Appendix 1 & 2) aimed to collect social data on user activities, recreational and quality preferences, acceptance and satisfaction levels, views on resource importance and the observed changes in resource quality/quantity. These are discussed in Chapter 6 of this document.

### *1.3.2 Socio-economic Assessment of Fishing Activities in Ocho Rios*

The unavailability of detailed fisheries data specific to the two main Ocho Rios fishing beaches led to the need to conduct a socio-economic assessment of the fishery. This was obtained through a questionnaire survey administered to 35 fishers on the White River and Sailor Hole fishing beaches. The questionnaire (Appendix 3) sought to obtain fishing effort and catch composition data for the Ocho Rios fishery.

## 1.4 Limitations of the Study

Some of the limitations associated with this study are limitations common to Resource valuation exercises in general. First, resources have non-use values that cannot be correctly estimated and so the total economic values calculated are usually incomplete. Second, it must be appreciated that the whole of the environment is greater than its parts. The environment therefore cannot be correctly valued simply as a collection of discrete individual pieces of real property (Abelson, 1996).

Other limitations of the study follow as a result of the fact that the primary data were collected from one-off surveys due to time and budgetary constrains. This limited the extent to which the various groups interviewed could be representative of the total population of residents and visitors in Ocho Rios. Despite every effort in the conduct of the interview it is possible that the accuracy of the information collected as primary data may have also been affected by the respondents perception of what he/she may gain or loose as a result of the responses given.

The study also relied heavily on secondary data from different sources, which had to be combined for use in some cases or used together with primary data in others. Very little information was available on the methods of data collection used by the different Agencies from which the data were obtained and this lack of standardization could have introduced some level of inaccuracy in the dependent calculations and conclusions.

# 2.0 OVERVIEW OF THE STUDY AREA

## 2.1 Physical Background

As indicted in Figure 1.1, the Ocho Rios Marine Park lies between the border of Drax Hall and Mammee Bay to the west, at approximate geographical co-ordinates of Latitude 18 26.15 N and Longitude 77 10.19 W and Frankfurt Point in the east which has approximate geographical co-ordinates of Latitude 18 25.11 N and Longitude 77 03.17 W, then north to a point in the sea having a sea floor elevation of 1000 m below Mean High Water (FOTS, 2000). The park is bordered by 13.5 km of shoreline (FOTS, 2000).

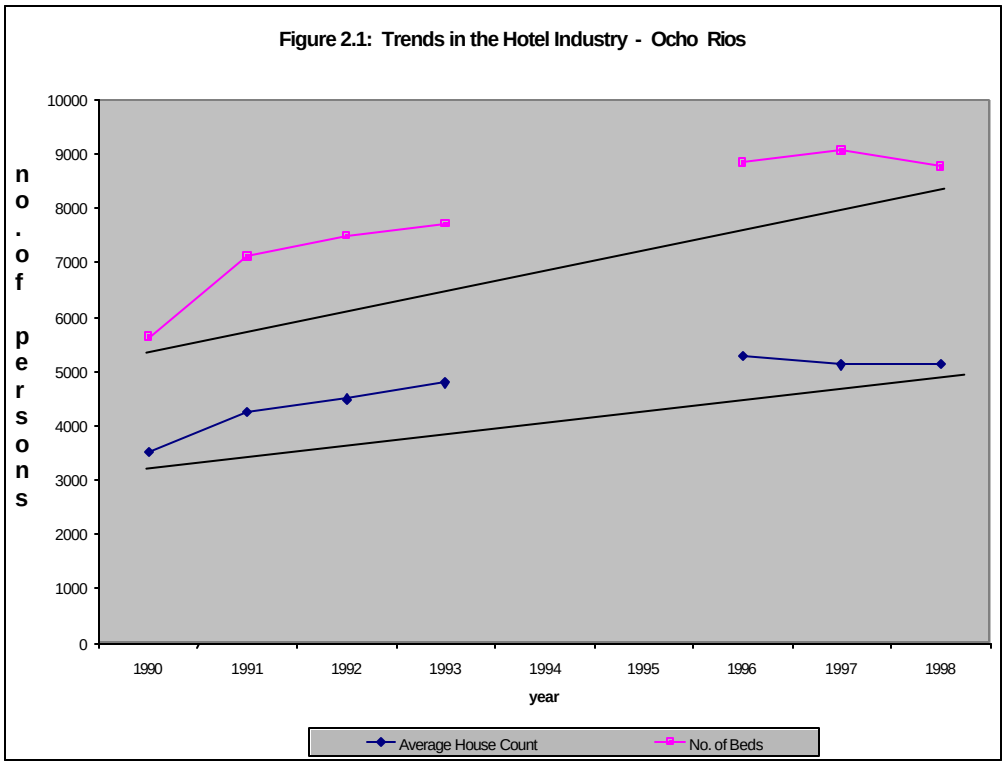
Along most of the length of the park there is a continuous reef crest, through which, natural and man-made breaks allow ships and other vessels access to near-shore areas. The coastline is marked by the presence of both natural and man-made beaches as well as several developments such as hotel and resorts and entertainment facilities, restaurants and villas. From the coastline, the land rises towards the limestone hills, where there are human settlements and other coastal zone developments. A few coves can be found along the coastline, including the one that was earmarked as a site for the Ocho Rios Dolphin Park.

Several waterways discharge into the park area. These include rivers (Dunn's River, Roaring River, Turtle River and White River), storm drains, gullies and sewage outfalls from treatment facilities.

The main ecological communities found within the boundaries of the park include coral reefs, sandy shores, sea grass beds, rocky shores, and small stands of mangroves. These communities not only provide food and shelter to marine and terrestrial organisms, but also resources and functions that sustain the neighbouring coastal and inland environs and are integral to the social and economic life of the area, namely the town of Ocho Rios.

## 2. 2 Socio-economic Overview

The town of Ocho Rios was a small isolated fishing village up to the 1950s and since then has grown to be a major resort town, with high-rise hotels and a plethora of tourist activities. The population now stands at 8,400 (Statistical Institute of Jamaica (STATIN) 1991). Tourism, the major industry in the town of Ocho Rios, has grown steadily over the years as is reflected in the rise of available bed numbers from 5, 640 in 1990 to 8, 778 in 1998 (Figure 2.1). A number of smaller scale commercial activities, for example, fishing, art and craft and refreshment sales, thrive from the indirect influences of this major industry.




Source: Annual Travel Statistics, 1990 - 98

In 1999, a total number of 883,940 tourists visited Ocho Rios with 66% being cruise ship passengers from a total of 269 cruise ship calls over the period. At present, there is an estimated 3,936 hotel rooms available to visitors. Hotels offer a variety of services ranging from bed and breakfast to all-inclusive packages that organize entertainment and water sport activities for their guests, Table 2.2 provides an overview of the services offered which are linked to coastal resources. Ocho Rios, like most other resort areas in Jamaica mainly attracts those tourists principally interested in the beach and sea.

**Table 2.2: List of Hotels Within the Marine Park Boundaries**

| Name of Hotel | No. of Rooms | Beach | Water Sports |
|---|---|---|---|
| Ciboney Ocho Rios | 289 | X | X |
| Club Jamaica Beach Resort | 95 | X | X |
| Comfort Suites | 90 | | |
| Enchanted Gardens Hotel | 113 | X | X |
| Grand Lido San Souci | 146 | X | X |
| Hibiscus Lodge Hotel | 26 | X | |
| Jamaica Grande Hotel | 725 | X | X |
| Jamaica Inn Hotel | 45 | X | |
| Ocean Sands Resort | 28 | X | |
| Little Pub Inn | 22 | | |

| Name of Hotel | No. of Rooms | Beach | Water Sports |
|---|---|---|---|
| Plantation Inn Hotel | 80 | X | X |
| Pineapple Penthouse | 23 | | |
| Sandals Dunns River | 256 | X | X |
| Sandals Ocho Rios | 237 | X | X |
| Sand Castles | 174 | X | |
| Shaw Park Beach Hotel | 127 | X | X |
| Village Hotel | 34 | X | |
| Silver Seas Hotel | 74 | X | X |

Source: Jamaica Tourist Board

In addition to the hotels, there are also entertainment facilities such as bars and restaurants that impact on the resources.

Some of the recreational services offered in Ocho Rios are:

- Jet skiing
- Para sailing
- Diving (including night diving)
- Glass bottom boat tours
- Deep sea fishing
- Guided tours on the White and Dunn's River
- Helicopter tours by Helitours Jamaica

The Jamaica Tourist Board provided the following list of licensed watersport operators:

1. Calski
2. Chris Watersports
3. Ciboney Resorts
4. Enchanted Gardens
5. Five Star Watersports
6. Fun Seekers Watersports Ltd.
7. Garfield Dive Station
8. Hope Watersports
9. Jamaica Fun Cruises
10. New Wave Watersports
11. Pocket Change
12. Rampage Aqua Sports Ltd.
13. Robert Marsh
14. Sail or Swim
15. Sandals Dunn's River Resorts
16. Sandals Ocho Rios Watersports
17. Trax Watersports
18. Watersports Enterprise

Despite the change in the economic focus of Ocho Rios, fishing is still an important livelihood activity with an estimated total of 258 registered and a number of unregistered[5] fishers making 3 – 7 fishing trips per week. This is the sole income source for the majority of the fishermen interviewed. Survey findings revealed that of the total fishers interviewed 42% have skills or trades that supplement their income (Environmental Management Unit (EMU), 2000). However, only 27% of this group would be able to support themselves and their households with this alternate skill/trade.

Marl and Sugar are also shipped from the Reynolds Pier in the Ocho Rios Bay. Approximately 170,000 tonnes of sugar and 110,000 tonnes of limestone will be shipped for the year 2000, bringing 19 – 20 additional cargo ships into the Ocho Rios harbour per year[6].

[5] Determining the number of unregistered fishermen was beyond the scope of this study since it would require repeated surveying of the fishing beaches over an extended period of time.
[6] Personal Communication with official of Reynolds Jamaica Mines, Port Office – Ocho Rios

The economic survival of Ocho Rios, like many coastal towns in Jamaica, is intricately linked to its marine and coastal resources.

## 3.0 BIO-PHYSICAL RESOURCES IN THE OCHO RIOS MARINE PARK

### 3.1 Coral Reef and Other Marine Communities

The NRCA Coastal Atlas 1997, estimates coral reef and sea-grass cover within the Ocho Rios Marine Park boundaries to be 398,529.5 and 145,775.6 $m^2$ respectively. Two species of black coral were found on the reef however, large colonies were found to be rare (Discovery Bay Marine Lab, 1984).

An estimate of the current status of coral reefs within the new park boundary was conducted by the Atlantic Gulf Reef Rapid Assessment (AGRRA) as a part of a wider study to characterise reef status for the entire northern coast of Jamaica. The three sampling points within the boundaries of the protected area were:

Dicky's Reef - Lat. 18 25.143 Long. 77 4.708
Sewage End - Lat. 18 25.159 Long. 77 7.092
Double Reef - Lat. 18 25.892 Long. 77 6.086

Site data showed very low percentage **live coral cover** in the areas sampled, low **grazer number** (fish and sea urchin) and very little recruitment in the colonies (number of recruits are below 3 per $m^2$ as Table 3.1 shows). With the exception of the Dicky's Reef sample site, many indicators of coral reef health were significantly below the overall mean for Jamaica, for example at Sewage End, the percentage coral cover was approximately ½ of the overall mean for Jamaica.

Site data from AGRRA indicated that Dicky's Reef may be presently undergoing stress since although it showed the highest level of live coral and the number of new dead coral was also the highest of the three sample sites.

**Table 3.1: Results of the AGRRA Coral Reef Survey in Ocho Rios Marine Park at Three Selected Sites**

| Parameters | Dicky's Reef | Sewage End | Double Reef | Jamaica Overall Mean |
|---|---|---|---|---|
| # of Transects | 5.0 | 7 | 5.0 | 288 |
| Depth (m) | 9.7 | 14.39 | 1.3 | 9.13 |
| Total # of colonies | 57 | 31 | 12.0 | 3140 |
| Total # of quadrats | 25 | 25 | 25.0 | 1324 |
| Colony/m | 1.14 | 0.46 | 0.24 | 1.11 |
| **Live Coral Cover (%)** | **9.10** | **4.89** | **1.88** | **11.76** |
| Diameter (all> 10cm) | 40.63 | 35.35 | 92.1 | 40.44 |
| Height (all > 10cm) | 21.19 | 23.48 | 44.6 | 26.66 |
| %Old Dead (all) | 45.62 | 45.03 | 80.7 | 37.99 |
| **% Recent Dead (all)** | **4.50** | **0.54** | **1.14** | **2.63** |
| **Damselfish (#/10$m^2$)** | **1.2** | **0.29** | **0.20** | **0.48** |
| % Crustos | 3.92 | 3.96 | 20.60 | 14.47 |
| % Macro Fleshy | 22.52 | 46.28 | 11.60 | 34.53 |
| % Macro Calcareous | 14.60 | 6.16 | 16.44 | 17.96 |
| Macro/Crustos | 5.74 | 11.69 | 0.56 | 2.39 |

| Parameters | Dicky's Reef | Sewage End | Double Reef | Jamaica Overall Mean |
|---|---|---|---|---|
| Fleshy Macro Height (cm) | 5.00 | 4.12 | 1.36 | 4.11 |
| Calcareous Macro Height (cm) | 7.13 | 3.19 | 3.59 | 3.93 |
| Fleshy Macro Index | 112.60 | 190.67 | 15.79 | 141.85 |
| Calcareous Macro Index | 104.03 | 19.65 | 59.03 | 70.58 |
| **Recruits (#/m$^2$)** | **2.56** | **0.64** | | **3.44** |
| **Diadema (#/10 m$^2$)** | **0.50** | | | **4.45** |

Source**:** AGRRA Study 2000

An assessment of the fish types on the reef was also carried out by the AGRRA team of researchers at the reef sites previously mentioned. Six fish types were targeted as important species, both ecologically and economically. These included **Surgeon, Parrot, Grunt, Grouper, Yellowtail Damselfish** and **Spanish Hogfish**. The findings are summarised in Table 3.2.

**Table 3.2: Results of Fish Survey Conducted in Ocho Rios Marine Park at Three Selected Sites**

| Fish Specie | Measured Parameters | Dicky's Reef | Sewage End | Double Reef | Jamaica's Overall Mean |
|---|---|---|---|---|---|
| Surgeon | Density (#/100 m$^2$) | 3.1 | 1.2 | 4.6 | 5.3 |
| | Average size (cm) | 13.3 | 14.3 | 8.2 | 11.1 |
| Parrot | Density (#/100 m$^2$) | 20.6 | 10.5 | 13.1 | 18.0 |
| | Average size (cm) | 11.0 | 13.8 | 12.0 | 12.7 |
| Grunt | Density (#/100 m$^2$) | 0.2 | 0.2 | 2.4 | 2.1 |
| | Average size (cm) | 8.0 | 15.5 | 14.3 | 15.4 |
| Grouper | Density (#/100 m$^2$) | 0.9 | 1.0 | -- | 1.1 |
| | Average size (cm | 15.5 | 13.6 | -- | 13.9 |
| Yellowtail Damselfish | Density (#/100 m$^2$) | -- | -- | 3.5 | 2.1 |
| | Average size (cm) | -- | -- | 15.3 | 12.9 |
| Spanish Hogfish | Density (#/100 m$^2$) | 0.9 | -- | -- | 0.6 |
| | Average size (cm) | 15.5 | -- | -- | 11.8 |

Source: AGRRA Study 2000

Three fish species were found to be dominant at the three sampling sites. These were Surgeon, Parrot and Grunt. Parrotfish were found to be the most abundant specie with the highest density per 100 m$^2$ at each of the studied areas. An average size of 11, 13.8 and 12 cm was found at Dicky's Reef, Sewage End and Double Reef respectively.

The maximum-recorded lengths of Caribbean Parrot fish ranges between 27.94 cm for Redband Parrot, 60.96 cm for Spotlight Parrot and 45.72 cm size for Pink and Redtail Parrot (Henmann, 1994).

At each of the sampled sites, fish size was approximately one-third of the maximum size in each specie type. This reflected the dominance of juvenile fish populations on the marine park reef, linked primarily to increased fishing pressure and poor breeding and nursery areas for juveniles.

***Other Key Marine Resources***

The Milk Conch was also reported to be present in some areas north of Bently Point (Discovery Bay Marine Lab, 1984). This specie is edible but normally not collected due to its small size and thick shell.

Hawsbill turtles were found to be numerous in the park in some areas of the park, namely the fore-reef (Discovery Bay Marine Lab, 1984).

No new data were collected for conch, lobster and turtle; however, all turtles are now protected under the Wildlife Protection Act. In addition, there are closed seasons for conch and lobster, geared towards maintaining the sustainability of these resources. The black coral is also listed as an endangered specie.

At present, there is a small amount of mangrove at the mouth of White River.

## 3.2 Fisheries

The Ocho Rios fisheries are operated from two main fish landing beaches. These are the Sailor Hole and White River beaches. The Fisheries Division of The Ministry of Agriculture reported 135 registered fishermen at the Sailor Hole fishing beach and 123 at White River (Fisheries Division Ministry of Agriculture, 2000). These figures did not include the growing number of new and transient fishers currently operating off the Ocho Rios coast.

Interviews on the two main fishing beaches within the boundaries of the Ocho Rios Marine Park establish that fishing is concentrated off the Ocho Rios coast in the vicinity of White River and Ocho Rios Bay (EMU, 2000). Fishing methods include pots, nets, hook and line and also spear fishing. These fishers target fish on the reef and adjacent coastal waters. There is also commercial and recreational deep-sea fishing by fishers and water-sport operators (EMU, 2000).

Fish species generally caught by fishers at Sailor Hole include Snapper, Jack, Mackerel, Grouper and Barracuda (Fisheries Division 1997-1999). In addition, conch, crab and octopus were found in the catches. A similar trend was noted at the White River fishing beach. Interviews with fishers on both fishing beaches confirmed these findings and gave additional fish types also caught by fishers[7]. These are:

- Bonita
- Butterfish
- Doctorfish
- Dolphin
- Grunt
- Marlin
- Moonshinefish
- Mullet
- Parrot
- Shad

## 3.3 Beaches

Within the park boundaries, several beaches (man-made and natural) are used for recreation as well as landing areas for fishermen. These include:

[7] Survey conducted by the Environmental Management Unit, November 2000.

- Frankfurt beach
- White River Beach (fishing only)
- San Souci Hotel Beach
- San Souci Nude Beach
- Shaw Park Hotel Beach
- Jamaica Inn Beach
- Plantation Inn Beach
- Sandals Ocho Rios Hotel Beach
- Ciboney Hotel Beach
- Mahogany Beach
- Jamaica Grande Hotel Beach
- Inn on the Beach
- Turtle Towers Beach
- Sailor Hole Beach (fishing only)
- Roaring River Beach
- Dunns River Beach
- Sandal Dunns River Beach
- Mammee Bay Beach

### 3.4 Marine Water Quality

Assessing and evaluating water quality, especially in the coastal zone area, is important for assessing the threats to coral reefs and fisheries. Some key parameters include, nitrate, phosphate, Total Suspended Solids (TSS) and Total and Faecal coliform levels.

Coastal water quality is being monitored under the Coastal Water Quality Improvement Programme (CWIP). To date, five sets of samples have been collected during the period January to September 2000, at twenty-five monitoring sites including rivers. Below is a listing of the monitoring sites along with site descriptions (see Table 3.3).

The parameters examined include faecal coliform, total suspended solids, dissolved inorganic phosphorus and dissolved inorganic nitrogen.

**Table 3.3: List of Sampling Sites being monitored by CWIP**

| Site No. | Sample Site | Site Description | Type |
|---|---|---|---|
| 1 | West of Dunns River | 50m to sea of house by end of reef crest | marine |
| 2 | Dunns River Beach | mid point by swimming rope | marine |
| 3 | Dunns River Falls | Middle of falls at the beach | river |
| 4 | West of Dolphin Park | East of Chico Falls 50m to sea of reef crest | marine |
| 5 | Bull Point | 50m to sea of reef crest | marine |
| 6 | Fishermans' Beach Bay | On line from main cruise ship pier to silo; mid point of bay | marine |
| 7 | Fishernans' Beach River | 20m upstream of seawater | river |
| 8 | Turtle River | 30m upstream of seawater | river |
| 9 | Ocho Rios Bay | Sand Castles Beach swimming rope | marine |
| 10 | Ocho Rios Bay | Swimming rope at Jamaica Grande tall building | marine |
| 11 | Jamaica Grande wall | 30m to sea at fence around gas tank coming from west | marine |
| 12 | Mallards Bay | 30m to sea of Hibiscus Lodge by stairway | marine |
| 13 | Mahogany Beach | At swimming rope | marine |
| 14 | Carib Ocho Rios Hotel | Half-way to Ciboney outside reef by white house & pier | marine |
| 15 | Plantation Inn Beach | 50m to sea of bar | marine |
| 16 | White River Bay | Between ends of two long middle piers from Shaw Park Hotel | marine |
| 17 | White River | 50m upstream of sea water | river |

| Site No. | Sample Site | Site Description | Type |
|---|---|---|---|
| 18 | White River Point | | marine |
| 19 | West of Mammee Bay | | marine |
| 20 | Centre of Beach | By new pink house adjacent to sea grass bed | marine |
| 21 | Sandals Dunns River | Centre of beach | marine |
| 22 | Centre of Beach | Below Steer Town community inside swimming rope by kayak operation | marine |
| 23 | Gully | Leading from Steer Town community adjacent to Bicknell residence | river |
| 24 | Beach | West of Roaring River | marine |
| 25 | Roaring River | 50m upstream of water | river |

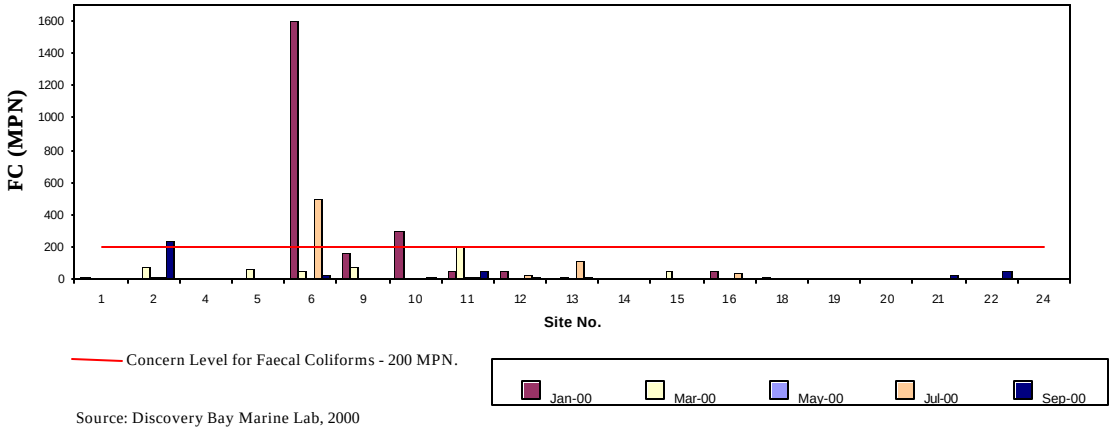
Source: Discovery Bay Marine Lab. 2000

### *3.4.1 Faecal Coliform (FC)*

Faecal coliform represents a group of bacteria associated with the intestines of warm-blooded animals. Data collected at the sample sites was compared to the USEPA concern level of 200 MPN/100ml.

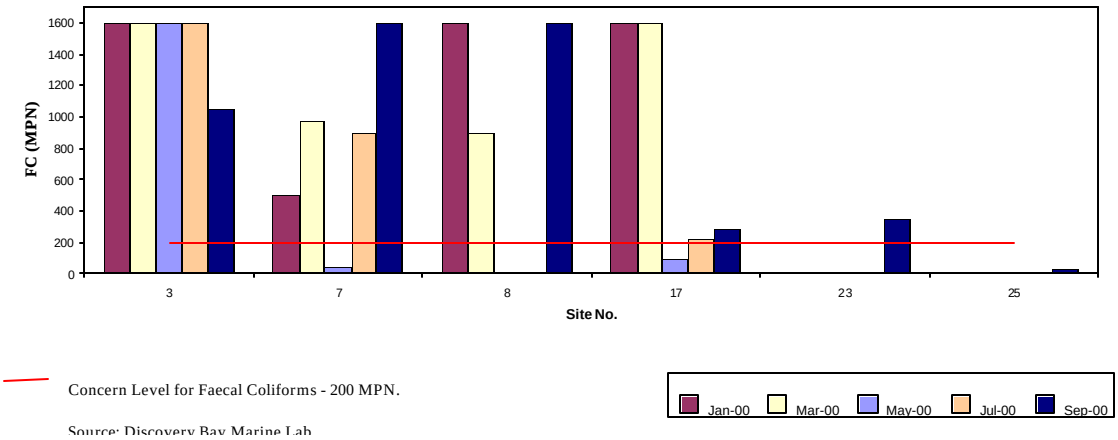
Although the 200 MPN limit was rarely exceeded in the marine sites, however, there were a few exceptions, such as Dunns River (site #2), Fishermans' Beach Bay (Site #6) and Ocho Rios Bay (site #10) (Figure 3.1). Most of the river sites exceeded the USEPA limit. Roaring River (site #25) was the only site that did not exceed the limit (Figure 3.2).

**Figure 3.1: Faecal Coliform Levels in Marine Sites**




Source: Discovery Bay Marine Lab, 2000

**Figure 3.2: Faecal Coliform Levels in River Sites**



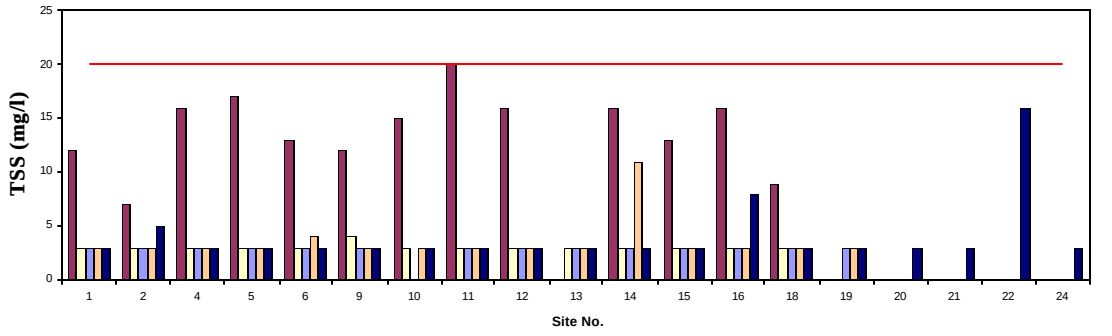

Source: Discovery Bay Marine Lab

### *3.4.2 Total Suspended Solids (TSS)*

Total suspended solids consist of particles greater than 0.45 um. Wastewater is regulated at a concentration not exceeding 20 mg/l in discharge effluent.

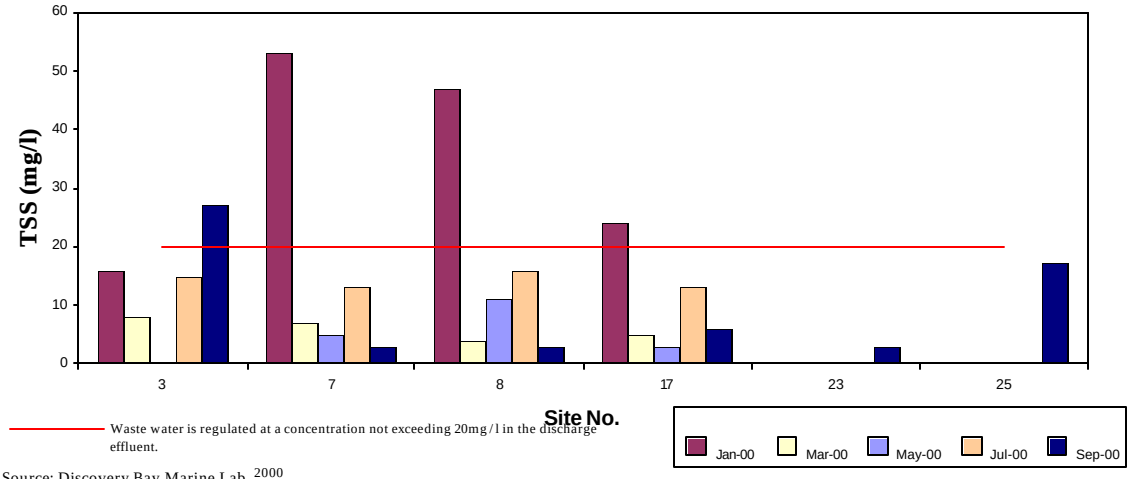
At the marine sites, the 20 mg/l limit was not exceeded, however all river sites except the Roaring River (site #25) and the Gully (site #23) exceeded the limit in January 2000 (Figures 3.3 and 3.4).

**Figure 3.3: Total Suspended Solids (TSS) - Marine Sites**




Source: Discovery Bay Marine Lab, 2000

**Figure 3.4: Total Suspended Solids (TSS) - River Sites**




Source: Discovery Bay Marine Lab 2000

A high observed TSS level in rivers is an indication of sedimentation due to human activities further upstream, primarily from agricultural activities and human settlements. Increased amounts of suspended solids screen the passage of light needed for photosynthesis, reducing the productivity of coral reefs and sea grass beds.

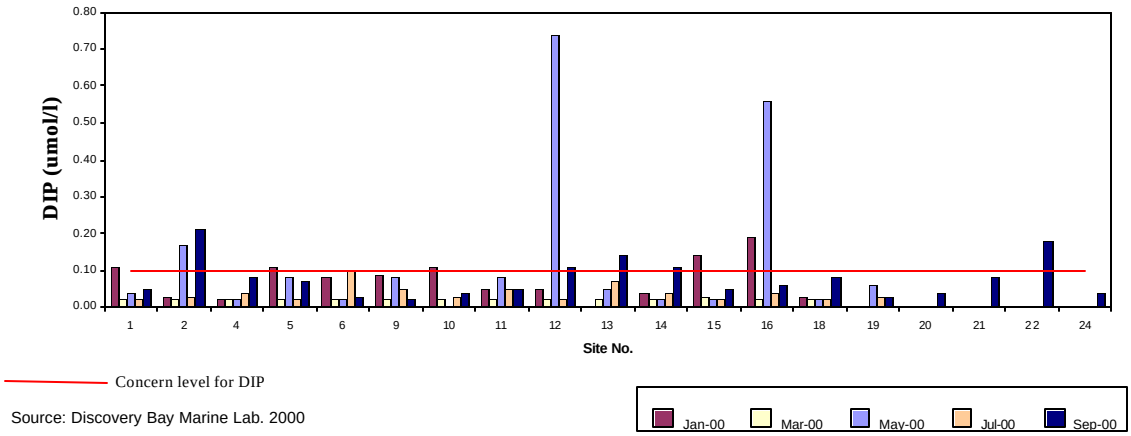
*3.4.2 Dissolved Inorganic Nitrogen (DIN) & Phosphorus (DIP)*

Both dissolved inorganic nitrogen (DIN) and dissolved inorganic phosphorus (DIP) are readily available to plants. In marine water, when dissolved inorganic phosphorus exceeds 0.1 umol/l in the presence of DIN, this can lead to an overgrowth of algae on coral reefs causing destruction of the reefs (Lapointe, 1997). A similar result is obtained when dissolved inorganic nitrogen exceeds 1 umol/l in the presence of DIP (Lapointe, 1997).

***Dissolved Inorganic Phosphorus (DIP)***

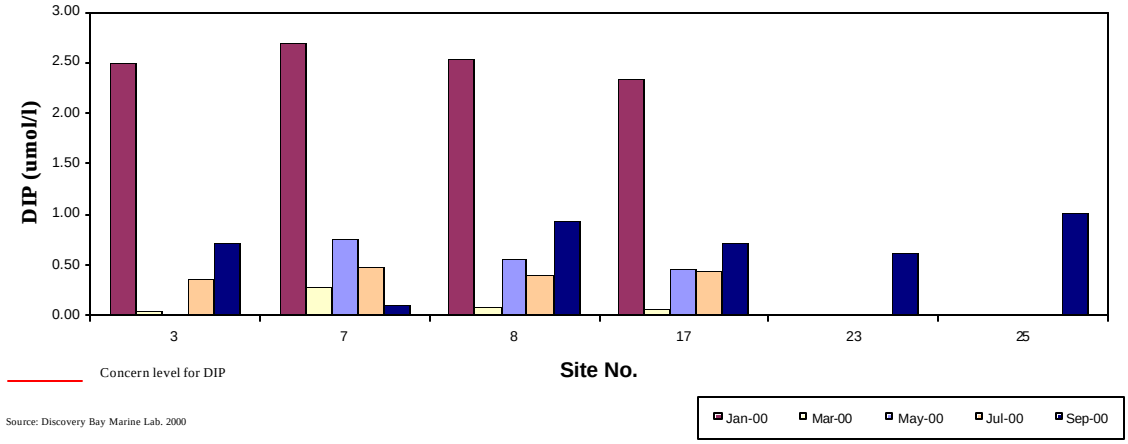
As Figure 3.5 shows the 0.1-umol/l limit for DIP was exceeded in January, May and September at some of the marine sites. CWIP data showed DIP concentrations at the river sites were higher than the marine sites (see Figure 3.6). In January most of the river sites recorded concentrations in excess of 2 umol/l, in September the values were also above 0.5 umol/l.

**Figure 3.5: Dissolved Inorganic Phosphorus (DIP) - Marine Sites**




Source: Discovery Bay Marine Lab. 2000

**Figure 3.6: Dissolved Inorganic Phosphorus DIP - River Sites**

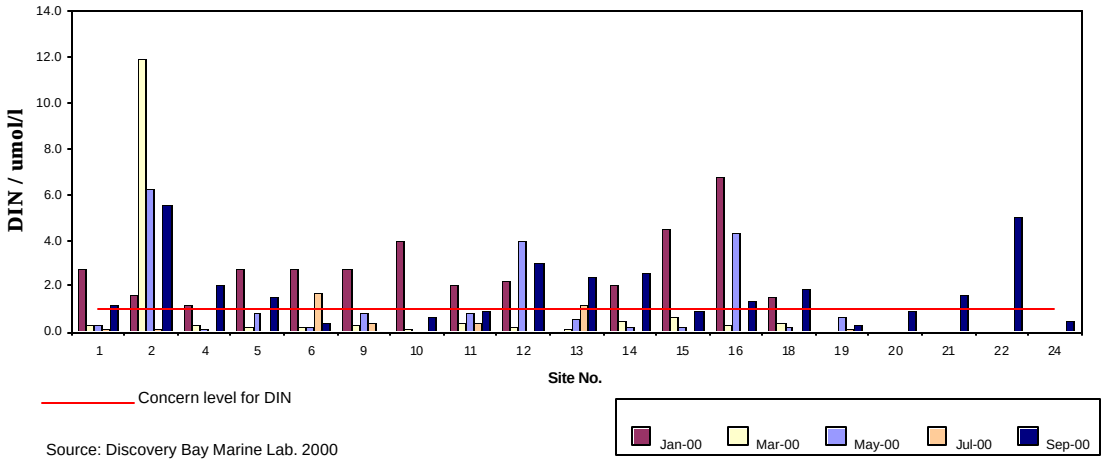



Source: Discovery Bay Marine Lab. 2000

### *Dissolved Inorganic Nitrogen (DIN)*

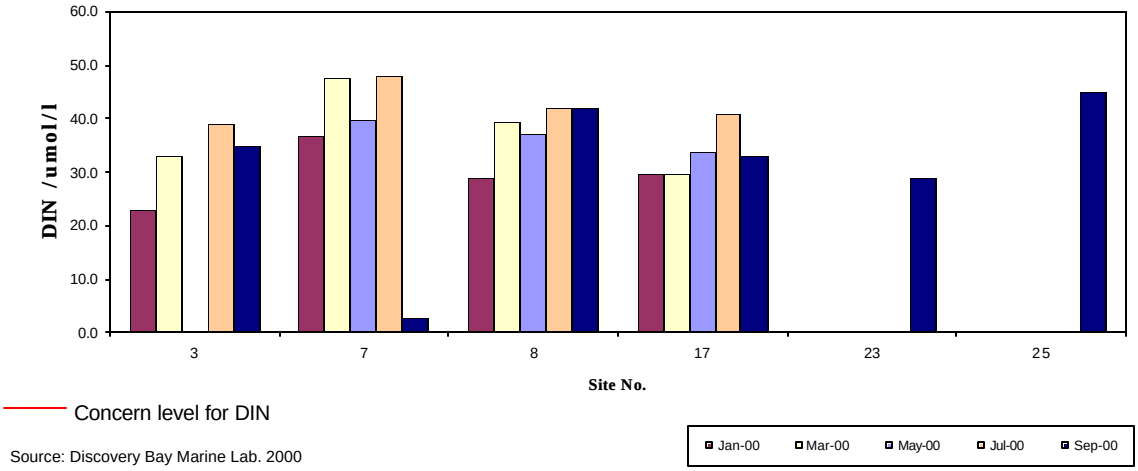
The concern level for DIN in marine water is 1 umol/l. This limit has been exceeded at all the marine sites except Mammee Bay (site #19), Centre of Beach (site #20) and the beach west of Roaring River (site #24) (Figure 3.7). In the case of the river sites, the DIN concentrations were higher than those obtained at the marine sites and were above 10 umol/l (Figure 3.8).

**Figure 3.7: Dissolved Inorganic Nitrogen (DIN) - Marine Sites**




Source: Discovery Bay Marine Lab. 2000

**Figure 3.8: Dissolved Inorganic Nitrogen (DIN) - River Sites**




Source: Discovery Bay Marine Lab. 2000

High DIN levels in rivers will contribute to increased levels at marine sites in excess of the 1 umol/l limit. For example, at Dunns River Beach (site #2), Fishermans Beach Bay (site #6), White River Bay (site #16) and Centre of Beach below Steer Town (site #22), the DIN levels exceeded the 1-umol/l limit (Figure 3.7). This corresponded to high levels in the associated river sites seen at sites #3, #7, #17 and #23 respectively (Figure 3.8).

# 4.0 THREATS TO THE COASTAL AND MARINE RESOURCES

There are several resource-uses that must be given consideration in any management plan for the protected area since their unmanaged impacts can lead to the deterioration of the resource base. The sections below discuss some of the principal sources of environmental degradation in the study area, namely inadequate waste disposal, over fishing, tourism related activities, and shipping.

## 4.1 Waste Disposal

Proper disposal of solid and liquid waste is essential to the ecological integrity of natural resources within the marine park boundary especially coral reefs and other key aquatic plants and animals. Waste deposited in the wrong place also has health implication for locals and tourists alike.

The water quality data presented in Chapter 3 highlight the importance of containing sources of contaminants in the areas of generation (i.e. at source). The chief potential contaminants in the Ocho Rios area are sewage and municipal solid waste.

### *4.1.1 Sewage*

Inadequate treatment and disposal facilities are primary sources of sewage contamination to rivers, gullies and eventually coastal waters.

Many of the hotels bordering the marine park operate their own sewage treatment systems, and are not connected to the National Water Commission (NWC) system. The discharge of the effluent from these independent systems is a source of potential concern should systems not meet specified standards. The potential underground seepage of untreated sewage from poorly constructed sewage facilities (namely pit latrines and septic tanks) in human settlements along the coastal zone and immediate watershed is also a source of concern.

If the required quality of the effluent as indicated in the proposed NRCA standards are not met, the probable outcome is increased nutrient loading that would lead to eutrophication. These changes in the environmental conditions along with over fishing and *Diadema* die-offs lead to coral reef degradation. Degradation of coral reefs will result in reduced habitat for fishes, reduction in the areas for fish nurseries, erosion of the coastline and also limited attractions for snorkellers and divers.

Hotels connected to the NWC system include Jamaica Grande, Turtle Towers, Club Jamaica Beach Resort, Fisherman's Point and Sand Castles Resort.

### *4.1.2 Municipal Solid Waste*

Solid waste collection and disposal systems in the town of Ocho Rios and its environs is inadequate, hence the disposal of garbage into rivers, gullies and storm water drains leading into the Marine Park. In addition, the potential exists for solid waste disposed at sea to be brought to shore by wind and wave action.

The presence of garbage in the coastal areas has negative impacts on coastal aesthetics as well as being potentially harmful to human and marine life due to the concentration of bacteria encouraged and the physical danger of sharp or bulky material.

## 4.2 Tourism Activities

The environmental impacts of coastal tourism are mainly from services provided for tourists such as water sports activities, sport fishing, scuba diving and snorkelling, as well as from there refuse from hotels, clubs, resorts and restaurants. Within the park boundaries both the beach and water resources are being heavily used by tourists.

Of the list of hotels provided in Table 2.2, more than 80% of these hotels offer beach facilities and approximately 50% offer water sport activities. If unmanaged within the protected area, impacts from this group of user along with other sources will result in increased stress on coastal and marine resources, as users and user-activities increase.

The anchoring of small boats and yachts as well as cruise ships also impact on the sea grass beds and coral reefs. Some of these impacts are unintentional, such as oil from jet skis, careless behaviour by users, and activities associated with coastal developments. Intentional impacts include illegal harvesting of the resources for example, black coral as well as from waste dumping from cruise ships.

The disposal of fats and sewage from restaurants and hotels is also a source of concern. Further investigation is needed into the present disposal practices of such operations within the park boundaries.

Dredging of shallow coastal waters to construct and maintain shipping lanes causes re-suspension of sediments and increased turbidity. General coastal construction is also a source of impact especially with regard to the disposal of construction 'spoils'.

## 4.3 Fishing

Fishing effort within the park boundaries, as in most of Jamaica's coastal waters is high as fishing gear becomes more efficient and the number of fishers increase. These changes impact negatively on the fisheries. For example, the majority of pot fishers on the Ocho Rios beach use inch and a quarter mesh, which tend to retain all but the most immature fishes; spear fishing can cause damage to reef structure and net fishing tends to be unselective.

## 4.4 Shipping

The total number of cruise ship calls in 1999 was 269 (Jamaica Tourist Board, 1999). Cargo vessels also enter the park waters as sugar and marl are exported from the Reynolds Pier[8]. There is therefore the risk of pollution from ship-generated activities from oil spills as well as the disposal of bilge water and solid waste within coastal and territorial waters. Furthermore, at the Reynolds Pier, the washing of the pier and/or water run-off from the pier causes increased turbidity of adjacent coastal waters[9].

## 4.5 Global Warming and Sea Level Rise

With the use of models, it has been estimated that temperature change and sea level rise would be 0.70 - 0.79 $^{o}$C and 18 cm respectively by the year 2025 (Ministry of Water and Housing 2000). Coastal resources are particularly vulnerable to the effects of sea level rise, as the potential exists for the following:

- An increase in flooding and frequent storm damage

[8] Telephone interview with personnel at the Reynolds Pier.
[9] Personal communication with Ms. Cathy Byles, Friends of the Sea

- Erosion of beaches and shoreline
- Bleaching of corals
- Changes in biochemical and biophysical properties of the coastal zone.

The management plan for the marine park system in Ocho Rios must address these environmental indicators in order to sustain the resources.

The environmental parameters measured, indicated definite sources of threat to the health of key resources within the park boundaries, which have implications for the economic sustainability of a coastal and marine resource-dependent local economy. In view of these existing and potential threats the economic and social value of the resources to Ocho Rios and Jamaica must be examined.

# 5.0 RESOURCE VALUATION – ECONOMIC

## 5.1 Methodology for the Economic Valuation

The economic valuation of the marine park was based on measures of **direct and indirect economic contributions** of marine ecosystems **to the value of output in a produced good or service** (Figure 5.1). The assumption was made that marine or coastal resources within the Ocho Rios Park boundaries contribute to an economic productive process. This contribution to economic production was expressed through the Cobb-Douglas Production Function as:

$$Q = Q\{L, K, R\}$$

Where
***Q*** = marginal change in the resource
***L*** = labour
***K*** = capital; and
***R*** = resource base (or biodiversity)

This model was previously used in the Economic Valuation of the Coral Reef Ecosystems in the Montego Bay Marine Park Jamaica (Gustavson 2000).

Applying the Cobb-Douglas model to the Ocho Rios valuation exercise involved expressing the **value** of the marine park resources through the marginal change in ***Q*** as the resource (***R***) improves or declines in quality or quantity. For example, the economic value of the contribution of the near-shore fishery in Ocho Rios associated with one unit of a given quality or quantity is the change in the value of the output that is achieved in a one-unit increase in the fishery, **holding all other inputs constant**. This facilitates the examination of **economic efficiencies**[10] associated with management decisions for the marine park.

[10] Efficiency is a relative term. The criterion for "economic efficiency" is value. Hence a change which increases value is an efficient change and any change which decreases value is an inefficient one. It is important to note that a situation that is economically efficient may be inefficient when judged with different criteria.

Insert Figure 5.1 – USE VALUE DIAGRAM

In the resource valuation exercise, the **Net Present Value** *(*NPV*)* of each indirect and direct benefit or use was calculated. This measure looks at the **value that stands to be lost if the resource was completely degraded**. The **NPV*s*** calculated can be represented in the following equation:

$$NPV = \frac{(R - C)}{i} = \frac{NV}{i}$$

Where
***R*** = revenue
***C*** = cost
***i*** = discount rate (5%, 10%, and 15%)
***NV*** = annual net value

Source: Gustavson, 2000

It must be emphasised that the derivation of *NPVs* in this exercise was not a **cost – benefit analysis**[11] (**CBA**) since this analysis would involve comparison of the economic value of the resource after the implementation of a park management plan, the details of which are not available at this time.

For this calculation it was assumed that for a single year the current level of use can be sustained and that the total value in which we were interested takes into account an infinite stream of net annual benefits.

The calculation of the **annual net value *(*NV*)*** represented in the NPV equation, estimates the net value or earnings of the resource-use activities (represented in Figure 5.1) after operating and capital cost deductions were made. Here net value refers to the remainder of the total monetary value of the functions or benefits once all existing economic claims to the production have been deducted. The remainder is the economic production claim that can be attributed to the marine park system.

The costs considered in the **annual net value** calculation include the **cost of utilities, operating services sold to businesses, repairs and maintenance, goods and material, government license and registration fees and the opportunity cost of labour**[12]. To complete the analysis the resulting net value must then be subjected to capital cost deductions (**annual capital cost**), generating the final net value estimate after operating costs have been deducted is then subjected to capital cost deductions.

The **annual capital cost** can be estimated through the use of an annuity factor:

$$E = \frac{C}{AF} = C \times i$$

Where
***E*** = equivalent annual capital cost;
***C*** = value of capital at cost
***AF*** = annuity factor; and,
***i*** = discount rate

Source: Gustavson, 2000

[11] The CBA is the estimation of the extent to which a commodity is made better off or worse by a resource re-allocation change.
[12] Business operating costs

An infinite time horizon is assumed, such that AF = 1/*i* where *i* is the discount rate used in the specific value calculation.

Capital cost estimates considered, where available, values of **building, equipment (e.g. fishing gear) and land costs**. However, in some instances it was difficult to obtain reasonable estimates due to the unavailability of accurate or reasonable value data. In these instances it is noted in the results. Where it was necessary to convert Jamaica dollars to US, the conversion rate of $42.72 was used, based on the average exchange rate for the months January to December supplied by the Bank of Jamaica.

## 5.2 Direct Use – Fisheries

Fishing effort data was used to estimate the economic value of fish harvesting activities. It was assumed that the fishers were primarily near-shore fishers; hence their harvesting would have some impact on the resources of the marine park.

Data used in the valuation of the Ocho Rios fishery were obtained from two main sources: the Registration of Fishermen database at the Fisheries Division of the Ministry of Agriculture and a socio-economic assessment of fishing activities in the Ocho Rios Marine Park conducted by the research team of the Environmental Management Unit, UWI (August 2000). Studies done by the Centre for Marine Science, UWI on the north coast fisheries were also used to establish a longitudinal profile of the fisheries in the absence of reliable historic information. In the 1984 management plan for the original protected area, an assessment of fishing activities in the neighbouring coastal waters of Ocho Rios was conducted. These assessments, along with data from the Fisheries Division, represent the only source of historical data on the Ocho Rios fisheries.

The estimate of revenue from fishing was calculated using the information listed below:

- The estimated number of fishers and boats by landing beach using the park waters
- Number of fishing trips per week, by fishing method
- Average price of fish per pound
- The boat sharing arrangements
- The total operating cost of the fishers using park waters by fishing method/gear type
- The quantity of fish consumed by the fisher and his household

Income data[13] obtained from the socio-economic survey of fishing activities in Ocho Rios (2000) were used to calculate the average weekly earning for each fishing method (Table 5.1).

**Table 5.1 Estimates of catches and individual incomes of fishers by method 0f fishing 2000**

| Method of fishing | % Fishers by method | Number of outings per week by fishing method (average given in brackets) | Average catch per outing (lbs.) | Average weekly earning assuming $J100 / lbs. (current J$) | Value of fish consumed by household/week | Total average weekly earning assuming $J100 / lbs. (current J$) |
|---|---|---|---|---|---|---|
| Hand Line | 58.54 | 3 to 7 (5) | 20.46 | J$ 8,101.50 | J$13,255.00 | J$21,356.50 |
| Net | 24.39 | 3 to 7 (5) | 26.20 | J$ 10,375.20 | J$ 5,005.00 | J$15,380.20 |
| Deep Sea Fishing | 2.44 | 3 (3) | 40.00 | J$ 13,200.00 | J$600.00 | J$13,800.00 |

[13] Calculated from catch size and outings per week for each fishing method, assuming the average selling price across fish types was $100.00 per pound.

| Method of fishing | % Fishers by method | Number of outings per week by fishing method (average given in brackets) | Average catch per outing (lbs.) | Average weekly earning assuming $J100 / lbs. (current J$) | Value of fish consumed by household/week | Total average weekly earning assuming $J100 / lbs. (current J$) |
|---|---|---|---|---|---|---|
| Pot | 39.02 | 1 to 7 (4) | 11.07 | J$ 4,383.72 | J$6,710.00 | J$11,093.72 |
| Spear | 26.83 | 3 to 7 (5) | 24.00 | J$9,504.00 | J$4,455.00 | J$13,959.00 |

Source: Environmental Management Unit, 2000

The estimated number of boats using Park waters for each fishing method was obtained by applying the 2000 survey statistics for the total number of fishers by fishing method by beach, proportionately to the Fisheries Division total number of boats, by beach column of Table 5.2.

**Table 5.2 Total Number Of Registered Fishers And Boats Using Ocho Rios Marine Park Water, 2000**

| Landing Beaches | Number of Boats (by beach) | Number of fishers |
|---|---|---|
| White River | 36 | 123 |
| Sailor Hole | 56 | 135 |
| Total | 92 | 258 |

Source: Registration of Fishermen Database, Fisheries Division, 2000

The indicated operating costs for each fishing method was used in the calculation of the net operating value shown in Table 5.3, i.e. the operating surplus after cost deductions[14]. The cost data obtained from interviews with the fishers estimated the total operating costs at 12% to 50% of gross revenues, depending on the fishing method employed.

**Table 5.3 Annual Net Operating Values (current J$) by method of fishing for 1998**

| Method of fishing | Average weekly earning assuming $J100 / lbs. (current J$) | Estimated Total number of owners by fishing method | Estimated weekly operating cost by fishing method | Weekly net operating value per owner | Total annual net operating value (million $J) |
|---|---|---|---|---|---|
| Hand Line | J$ 21,356.50 | 39 | J$ 17,048.38 | J$ 4,308.12 | J$ 8.6 |
| Net | J$ 15,380.20 | 9 | J$ 8,299.01 | J$ 7,081.19 | J$ 3.3 |
| Deep Sea Fishing | J$ 13,800.00 | 3 | J$ 9,537.00 | J$ 4,263.00 | J$ 0.6 |
| Pot | J$ 11,093.72 | 30 | J$ 12,313.05 | -J$ 1,219.33 | J$ -1.9 |
| Spear | J$ 13,959.00 | 12 | J$ 12,691.00 | J$ 1,268.00 | J$ 0.8 |

Source: Environmental Management Studies, 2000

[14] Capital cost deductions have not yet been made at this point

Assuming a 40-hour workweek, the average weekly wage across a number of producing sectors in Jamaica is J$4,283 (PIOJ 1998). As an estimate of the **opportunity cost of labour** this average weekly wage was discounted by 25% to yield a final figure of J$ 3212 per week per individual, reflecting the value of the marginal **product of labour**[15]. The **opportunity cost of labour** was then estimated to be **J$6424** per boat for net, trap, and line fishing (assuming an average of one captain and one crew member per boat), and **J$ 3212** per spear fisher. These costs were deducted from the **gross fishing earnings** along with the **operating expenses**, to arrive at the overall **net operating values** shown in Table 5.3.

From the findings of the socio-economic survey, the estimated average value of boat capital assets was **J$68,555** per owner. The equivalent **annual capital costs** were thus J$3,472 for $i$ = 0.05, J$6,856 for $i$ = 0.10 and J$10,283 for $i$ = 0.15 for each boat owner. These figures were then deducted from the **total annual net operating** values for net, trap and line fishing owner, yielding 1999 **annual net values**. The resulting **net annual values (NV)** were then converted to NPVs as shown in Table 5.4.

**Table 5.4 Net Annual and Net Present Values for the fisheries of Ocho Rios Marine Park, 2000**

| | ***I = 5%*** | ***i = 10%*** | ***i = 15%*** |
|---|---|---|---|
| Annual Net Value (millions of $J) | $J 10.693 | $J 10.690 | $J 10.687 |
| Net Present Value (millions of $J) | $J 213.9 | $J 106.9 | $J 71.247 |

Source: Environmental Management Unit, 2000

**The** NPV of the Ocho Rios fishery is 213 million J$ at the 5% discount rate.

### 5.3 Indirect Use - Tourism

The Net Present Value (NPV) of the tourism industry in Ocho Rios was estimated through analysis of tourism statistics for the ten-year period 1989 - 99.

The **annual net value** derived from tourist expenditure was measured for stop-over and cruise-ship visitors to Ocho Rios using the following data:

- Total stop over and cruise-ship visitor arrivals to Ocho Rios
- Average length of stay – visitors
- The number of visitors remaining in Ocho Rios hotels
- Average individual daily expenditure by visitors
- Capital costs and expenditure associated with the industry

The methodology adopted was similar to that employed in the calculation of the NPV of coral reef in the Montego Bay Marine Park (Gustavson, 2000). The conversion of average daily visitor expenditure for stop-over and cruise-ship passengers (1989 – 1999) into net earnings is shown in Tables 5.5 and 5.6. The number of bed-nights sold was used as a proxy in the estimation of stop-

[15] The marginal product of labour ($MP_L$) is the change in total product per unit change in labour used, while holding capital constant

over visitors remaining in the greater Ocho Rios area. For the purpose of the calculation, cruise-ship passengers arriving at the Ocho Rios cruise ship terminal were assumed to spend their shore time in the greater Ocho Rios area and spend an average of one day in port.

**Table 5.5: Estimated Total Annual Expenditures by Stop-over Visitors Remaining in Ocho Rios**

| Year | Total Stopover Arrivals | Average length of stay | Number of bed nights sold in Ocho Rios hotels | Proportion of stopover arrivals remaining in Ocho Rios | Average Individual daily expenditures (US$) | Estimated total expenditure (current US$) | Net Earnings Ocho Rios (millions of current US$) |
|---|---|---|---|---|---|---|---|
| 1989 | 220,000 | 10.6 | 1,157,058 | 0.7235 | 78.0 | 9.03E+07 | 10.4 |
| 1990 | 220,000 | 10.9 | 1,351,323 | 0.7232 | 70.0 | 9.46E+07 | 14.7 |
| 1991 | 220,434 | 10.9 | 1,396,710 | 0.7218 | 79.0 | 1.10E+08 | 30.4 |
| 1992 | 255,362 | 11.2 | 1,396,710 | 0.6230 | 84.0 | 1.17E+08 | 37.4 |
| 1993 | 286,801 | 11.0 | 1,634,060 | 0.5547 | 85.0 | 1.39E+08 | 59.0 |
| 1994 | 294,177 | 10.7 | 1,804,680 | 0.5408 | 84.0 | 1.52E+08 | 71.7 |
| 1995 | 313,303 | 10.9 | 1,971,524 | 0.5078 | 86.8 | 1.71E+08 | 91.2 |
| 1996 | 316,897 | 11.1 | 1,937,475 | 0.5021 | 84.7 | 1.64E+08 | 84.3 |
| 1997 | 311,644 | 10.8 | 1,872,667 | 0.5105 | 87.5 | 1.64E+08 | 84.0 |
| 1998 | 315,401 | 10.9 | 1,876,874 | 0.5044 | 90.8 | 1.70E+08 | 90.6 |
| 1999 | 299,867 | 10.5 | 1,700,766 | 0.5306 | 99.0 | 1.68E+08 | 88.5 |
| **Avg.** | **290431.8** | **10.9** | **1,732,385.1** | **N/A** | **86.8** | **1.40E+08** | **66.2** |

Source: Environmental Management Unit, 2000

**Table 5.6: Estimated Total Annual Expenditures by Cruise-ship passengers Arriving in Ocho Rios**

| Year | Total Ocho Rios Cruiseship passenger arrivals | Average length of stay | Average Individual daily expenditures (US$) | Estimated total annual expenditure (current US$) | Net Earnings (millions of current US$) |
|---|---|---|---|---|---|
| 1989 | 344,053 | 1.0 | 48.0 | 1.7E+07 | 15.3 |
| 1990 | 313,265 | 1.0 | 70.0 | 2.2E+07 | 20.7 |
| 1991 | 352,461 | 1.0 | 73.0 | 2.6E+07 | 24.5 |
| 1992 | 425,968 | 1.0 | 51.0 | 2.2E+07 | 20.5 |
| 1993 | 442,737 | 1.0 | 69.0 | 3.1E+07 | 29.4 |
| 1994 | 436,106 | 1.0 | 83.0 | 3.6E+07 | 35.0 |
| 1995 | 411,261 | 1.0 | 82.7 | 3.4E+07 | 32.8 |
| 1996 | 456,312 | 1.0 | 85.3 | 3.9E+07 | 37.7 |
| 1997 | 532,408 | 1.0 | 84.7 | 4.5E+07 | 43.9 |
| 1998 | 568,909 | 1.0 | 84.7 | 4.8E+07 | 47.0 |
| 1999 | 583,623 | 1.0 | 80.0 | 4.7E+07 | 45.5 |
| **Average** | **428,348** | **1.0** | **73.1** | **3.2E+07** | **30.7** |

Source: Environmental Management Unit, 2000

Estimates of the **capital and operating cost** of the industry were obtained from the Jamaica Tourist Board, 1997 Economic Analysis of Tourism in Jamaica. In the absence of detailed capital and expense records for Ocho Rios's tourism sector, the tourism market share of Ocho Rios over the period 1989 – 1999 was applied to the total expenses of each tourism sector, obtaining the capital and operating expenses for the Ocho Rios tourism industry. The breakdown of gross earnings in some of Jamaica's tourism-related sectors is shown in Table 5.7.

**Table 5.7 Results of the OAS (1997) Analysis of the Main Private Sector Tourism Firms in Jamaica for 1997**

| Sector/Type of Business | Earnings as a percentage of total revenue |
|---|---|
| All-inclusive Hotels | 6.6 |
| Mixed Hotels | 7.3 |
| Large Non-inclusive hotels | 12.8 |
| Medium Non-inclusive hotels | -2.0 |
| Small Non-inclusive hotels | -3.3 |
| Guesthouses, Villas and Apartments | 4.7 |
| Other Accommodations | -1.2 |
| Mezzanine Companies | -6.5 |
| Restaurants | 8.6 |
| Night clubs | 0.8 |
| Tour Operators | 3.8 |
| Sports & Recreation | -0.1 |
| Attractions | 13.9 |
| Car Rentals | -6.1 |
| Taxis | 1.9 |
| Other Transportation | 2.4 |
| In-bond Shopping | 4.3 |

Source: Jamaica Tourist Board, 1998

Ocho Rios's **annual net values** for the period 1989 to 1999 attributed to stop-over and cruise-ship visitor expenditure is detailed in Table 5.8. Using the results from Table 5.8, Table 5.9 shows the NPVs for the same period. Due to the difficulty in obtaining accurate estimates of capital cost information (land, buildings and equipment), the NPVs reported represent a partial cycle analysis. The **discount rates** (*i*) used were 5%, 10% and 15%.
It should be noted that the estimates of labour cost were based on the accounting costs of labour and not necessarily the opportunity cost. However, as noted in the Montego Bay valuation exercise, given the large size of the tourism sector and the predominant use of relatively low-skilled labour, any discrepancy was not expected to be large.

The estimated total ***annual net value*** of the Ocho Rios tourism sector was **US $134 million in 1999** and the **NPV US $2,679 million** assuming the 5% discount rate.

**Table 5.8: Annual net value (current US) for tourism in Ocho Rios 1989-99**

| Year | Annual Net Value derived from stop-over expenditures | Annual net value derived from cruise ship passenger expenditures | Total Tourism sector annual net value |
|---|---|---|---|
| 1989 | $ 10,354,421.0 | $ 15,322,652.1 | $ 25,677,073.1 |
| 1990 | $ 14,696,507.0 | $ 20,736,658.1 | $ 35,433,165.1 |
| 1991 | $ 30,443,987.0 | $ 24,537,761.1 | $ 54,981,748.1 |
| 1992 | $ 37,427,537.0 | $ 20,532,476.1 | $ 57,960,013.1 |
| 1993 | $ 58,998,997.0 | $ 29,356,961.1 | $ 88,355,958.1 |
| 1994 | $ 71,697,017.0 | $ 35,004,906.1 | $ 106,701,923.1 |
| 1995 | $ 91,232,180.2 | $ 32,827,618.0 | $ 124,059,798.2 |
| 1996 | $ 84,208,029.5 | $ 37,731,521.7 | $ 121,939,551.2 |
| 1997 | $ 83,962,259.5 | $ 43,913,713.9 | $ 127,875,973.3 |
| 1998 | $ 90,561,593.6 | $ 46,989,011.3 | $ 137,550,605.0 |
| 1999 | $ 88,479,731.0 | $ 45,492,111.9 | $ 133,971,842.8 |

Source: Environment Management Unit, 2000

**Table 5.9: Net Present Values (current million US$) by year for tourism in Montego Bay, 1989–99**

| Year | Total Tourism sector annual net value (million $US) | *I = 5%* | *i = 10%* | *i = 15%* |
|---|---|---|---|---|
| 1989 | 25.7 | 513.5 | 256.8 | 171.2 |
| 1990 | 35.4 | 708.7 | 354.3 | 236.2 |
| 1991 | 55.0 | 1,099.7 | 549.8 | 366.5 |
| 1992 | 58.0 | 1,159.2 | 579.6 | 386.4 |
| 1993 | 88.4 | 1,767.1 | 883.6 | 589.0 |
| 1994 | 106.7 | 2,134.0 | 1,067.0 | 711.3 |
| 1995 | 124.1 | 2,481.2 | 1,240.6 | 827.1 |
| 1996 | 121.9 | 2,438.8 | 1,219.4 | 812.9 |
| 1997 | 127.9 | 2,557.5 | 1,278.8 | 852.5 |
| 1998 | 137.6 | 2,751.0 | 1,375.5 | 917.0 |
| 1999 | 134.0 | 2,679.4 | 1,339.7 | 893.1 |

Source: Environmental Management Unit, 2000

## 5.4 Indirect Local Use – Recreation

### *5.4.1 Travel Cost Method*

Travel Cost models are a class of valuation techniques that were developed in the 1950s and 1960s for estimating site recreational benefits. They are based on the observation that visits to

recreational sites involve an implicit transaction – the cost of travelling to a site are incurred in return for access to the site's recreational services flows. The travel cost method relies on the observation that visitors to a site incur different costs to get there, depending primarily on the distance travelled. This cost incurred by the individual in travelling to the site can then be used as a surrogate or cost of access to the site. The relationship between quantity demanded (e.g. number of visits per season) and price, measured by travel cost to the site, is estimated to construct a market demand curve for the site. The area under the demand curve approximates the total recreational benefit provided by the site. The model can be extended to incorporate site quality in order to estimate how changes in site attributes affect site benefits.

In order to calculate the consumer surplus values for different regions, researchers collect data on the visits per thousand of population from the various regions and the cost of travel to the recreational facility or 'good'. Visits per thousand of the population are used, instead of absolute values, to normalize the population differences between regions, and obtain comparable participation rates (Brown and Henry, 1989). Once these data are collected one may relate visitation rates to travel costs to yield a 'linear demand function' for the good as explained in Section 5.4.3. The net economic benefits or consumer surplus that visitors receive from the recreational good may then be calculated.

### *5.4.2 Application of Travel Cost to Ocho Rios*

The travel cost procedure has been utilized to estimate the slope of the demand function for the Ocho Rios vacation experience. From this slope, the total consumer surplus that visitors receive annually from the vacation was calculated.

In addition, a survey[16] was conducted among the visitors to Ocho Rios from which a usage index for recreational services related to the coastal and marine resources (i.e. beaches, sea water & coral reef) in their present condition was calculated. The ratio of usage for these activities compared to activities not related to the coastal and marine resources during the vacation experience was then generated and this information was utilized to estimate the shift in the demand for Ocho Rios as a vacation resort due to changes in the status (quality) of these resources.

### *5.4.3 The Effect of Coastal and Marine Resources Degradation on the Demand for Ocho Rios as a Vacation Resort: The Travel Cost Method*

The Travel Cost method described above was used to derive the demand function for the Ocho Rios vacation experience. To achieve this, information on the cost of travel to Ocho Rios from the top ten tourist producing states in America, and the number of visitors to Ocho Rios annually from each state was gathered[17]. A regression analysis was conducted using theses data, and this gave the slope of the demand curve for the Ocho Rios Vacation. Table 5.10 summarizes the ten states used, and the number of visitors to Ocho Rios annually from each.

**Table 5.10 Top ten visitor producing states of visitor sources, 1999**

| States | Visitors to Ocho Rios Annually |
|---|---|
| New York | 46,267 |
| Florida | 29,654 |

[16] Socio-economic survey carried out in August 2000 by the Environmental Management Unit.

[17] Because visitors from the United States comprise over 60% of the total visitor population to Jamaica, travel cost figures and visitation rates from the top ten producing states in America were used as proxy variables for deriving the demand curve for Ocho Rios.

| States | Visitors to Ocho Rios Annually |
|---|---|
| Illinois | 13,474 |
| New Jersey | 12,841 |
| Pennsylvania | 10,978 |
| California | 10,113 |
| Texas | 9,266 |
| Georgia | 9,115 |
| Michigan | 7,466 |
| Maryland | 7,341 |

Source: Calculated from national data sourced from the Jamaica Tourist Board

In order to determine the cost of travel for visitors from each state, three components of the vacation cost were taken into account. These were:

- The cost of airfare
- The opportunity cost of the time spent travelling to and from Jamaica
- The land cost of the vacation, including expenditures on lodging, food, entertainment, ground transportation and other miscellaneous expenses.

The opportunity cost of time was assumed to be equal to the average hourly wage rate of worker in the United States, which was estimated to be US $ 13.81(World Almanac 2000). The opportunity cost of the round trip travel from each state was therefore calculated by multiplying the round trip travel time in hours, by the average wage rate. The land cost of the vacation travel was assumed to be the same for all visitors, and was calculated by multiplying the average length of stay for a US citizen by the average expenditure per person per night. The average length of stay for a US citizen in Jamaica is 10.5 nights, and the average expenditure is US $99 per night[18] (Jamaica Tourist Board, 1999). This gives an average land cost of US $1039.50 per visitor.

Data on the number of visitors to Jamaica from each state were normalised for differences in the population size of each, in order to make visitation rates comparable between states. This was achieved by dividing the number of visitors to Jamaica annually from each state by the 1999 resident population estimates for each state. Quantified data were therefore quoted in 'visits per thousand of the population'. Table 5.11 summarises the travel cost, and the visits per thousand data for the top ten states of origin[19].

**Table 5.11 Travel Cost and Visits per Thousand (VPT) for Top Ten Producing States**

| States | Cost of Travel (US $) | Visits per Thousand |
|---|---|---|
| New York | 1,764 | 2.5426 |
| Florida | 1,582 | 1.9624 |
| Illinois | 1,794 | 1.1110 |
| New Jersey | 1,771 | 1.5769 |
| Pennsylvania | 1,825 | 0.9153 |
| California | 2,126 | 0.3051 |
| Texas | 2,075 | 0.4623 |

[18] Visitor expenditure includes accommodation, entertainment, shopping, food and beverage, transportation, miscellaneous.

[19] The largest cities in each State were identified. Airfare costs to Jamaica from these city was solicited from airline companies. Visits per thousand of population figures were calculated using visitor statistics from Jamaica Tourist Board, and 1999 population estimates for each state.

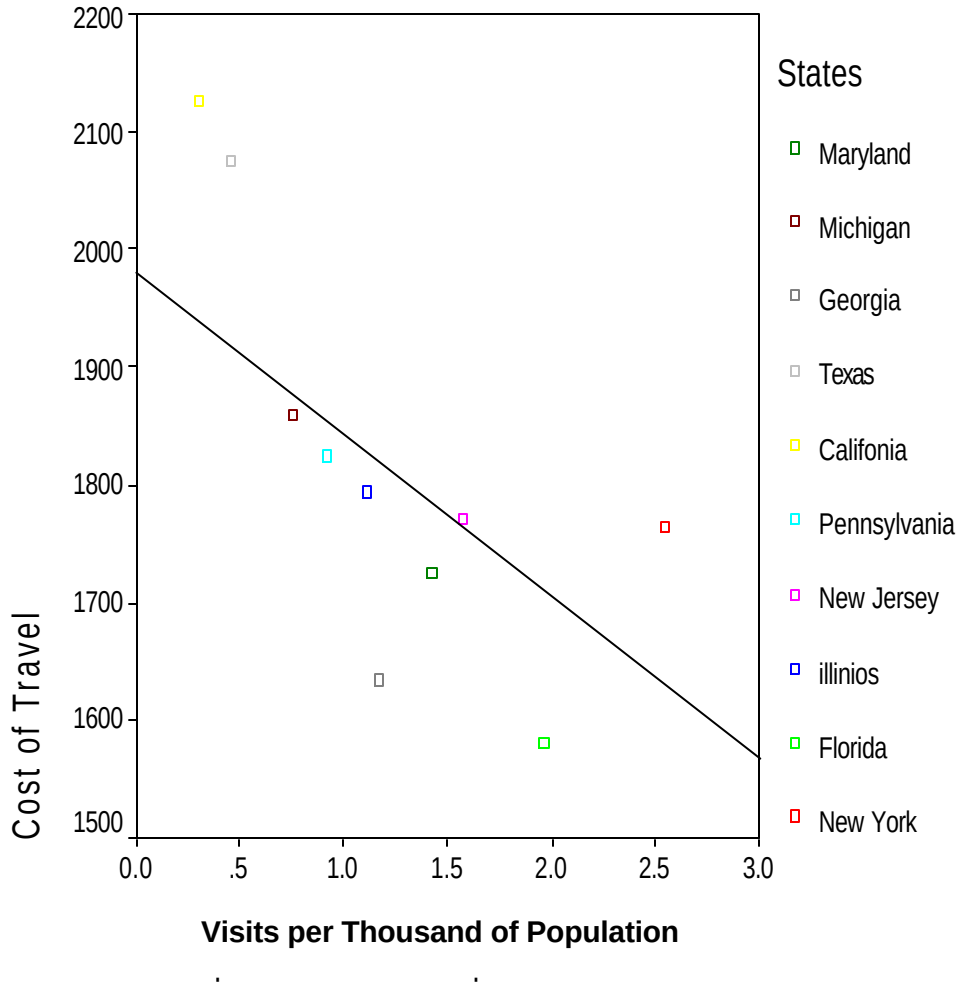
| States | Cost of Travel (US $) | Visits per Thousand |
|---|---|---|
| Georgia | 1,635 | 1.1705 |
| Michigan | 1,859 | 0.7569 |
| Maryland | 1,726 | 1.4195 |

Source: Calculated from 1999 US population estimates visitor statistics from the Jamaica Tourist Board and Travel Agencies Information.

The demand function for the Ocho Rios vacation derived from the cost and quantity variables shown in Table 5.11, is illustrated graphically in Figure 5.2.

**Figure 5.2 Demand Function for Ocho Rios as a Vacation Resort**

From the regression analysis, the slope of the linear demand curve for the Ocho Rios Vacation




was found to be:

Where

**y** = 2039.15 – 182.85x
**y** = Cost of Travel

**m** = Slope[20]
**c** = Intercept on the y axis
**x** = Visits per thousand population

The next step in the calculation of change in demand and tourism revenue is to calculate the average per person net economic benefit, or consumer surplus, that visitors receive from their vacation. The equation of the linear demand curve that was previously calculated is used to achieve this. Consumer surplus is the area under the demand curve and above the supply curve or marginal cost function[21].

Given the equation of the line, we can calculate per person consumer surplus by determining an average price for the Ocho Rios vacation at which supply is fixed (supply line is horizontal). The average price of a vacation in Ocho Rios is estimated by weighting the cost of travel from the US states of origin used in deriving the demand curve for the Ocho Rios vacation see Table 5.10.

Using this method, the average price of a vacation in Ocho Rios is US $1,773.90[22]. In order to derive per person consumer surplus for the Ocho Rios visitor, both the average price of the vacation and the equation of the linear demand function for Ocho Rios were utilized. Per person consumer surplus (CS) is calculated using the following equation:
Consumer surplus (CS) = ½ x (Maximum price paid – Average price paid)

**CS** = 0.5 x (2,039 –1,773.94)
**CS** = US $132.53

Visitors to Ocho Rios therefore receive an average per person consumer surplus of US $132.53 from their total vacation experience in the town. Total annual consumer surplus (TCS) was found by multiplying the average individual CS by the total number of visitors to Ocho Rios annually.

**TCS** = 15,6518 x 132.53
**TCS** = $ 20, 743,330.54 (US)

The socio-economic survey conducted among visitors to Ocho Rios, and subsequent calculations[23] revealed that the ratio of demand for activities directly dependant on the coastal and marine resources as opposed to activities that were not was found to be 1.1 : 1 (Coastal : Not Coastal). This ratio was then used to estimate the distribution of consumer surplus from the overall Ocho Rios vacation experience. This distribution was found to be 11.3 : 9.4 million US dollars, in favour of activities related to the coastal and marine resources.

### *5.4.4 Cost of Resource Degradation*

If these resources were degraded to an unacceptable level **and assuming that this will result in the loss of the associated consumer surplus[24]** then visitors to Ocho Rios stand to lose a total

[20] Needed for completion of the equation of the linear demand curve
[21] This is the line from the average price of the vacation on the y axis that meets the linear demand curve line
[22] An average price is used here because we want to estimate the average consumer surplus for an Ocho Rios visitor. The alternate to using an average price would be to calculate the consumer surplus received by visitors from each state separately using the travel cost unique to each state. In order to find the average consumer surplus for an Ocho Rios visitor we would then find a weighted average of the consumer surplus of visitors from each state. The former method has been chosen because it simplifies the analysis.
[23] See section on Social Valuation
[24] It should be noted that if the price of an Ocho Rios vacation is reduced to compensate for the reduction in vacation quality that will occur from degraded reefs, then there might not be a reduction in the number of visitors to Ocho Rios. This analysis is based on the assumption that the price of the Ocho Rios vacation remains the same after the coastal resources have been degraded.

consumer surplus of 11.3 million US dollars. This translates into a potential loss of $72.29 US each in net benefit.

As a result the demand curve will now shift downwards as consumer surplus is reduced. Because each visitor would lose US $72.29 in benefits the intercept of the demand curve on the price axis will also shift down by US$72.29[25]. Assuming that the average price of an Ocho Rios vacation remains the same, the new intercept on the y-axis will be 1,966.71. This new intercept and the new consumer surplus can then be used to estimate the number of visitors that would come to Ocho Rios if the coastal and marine resources were degraded to an unacceptable level. This can be calculated as follows using the formula:

**New area of triangle (New Consumer surplus) = ½ Base x Height**
(Where Height = 192.22 and New Consumer surplus = 9,428,786.6)
**(9,428,786.6/192.22)*2**
**=49052 * 2**
**= 98014**

The number of visitors that would come to Ocho Rios after coastal and marine degradation had occurred would therefore be reduced from 156,518 to 98,014[26]. This represents a 37% decrease in the number of visitors that would frequent Ocho Rios. If each visitor spends an average of US $1,039.5 and 58,504 fewer visitors should come to Ocho Rios because of coastal degradation then Ocho Rios stands to lose an estimated US $ 60,824,908 in tourism revenue annually[27].

### *5.4.4 Economic and Social Impact*

Information on the distribution of expenditure for stop-over visitors to Ocho Rios revealed the following (Jamaica Tourist Board, 1999):

| | |
|---|---|
| Accommodation | 59.6% |
| Food and Beverage | 6.2% |
| Entertainment | 10.3% |
| Transportation | 6.5% |
| Shopping | 9.7% |
| Miscellaneous | 7.7% |

Using this information and the results of the previous calculations the potential impacts of a reduction in the number of visitors to Ocho Rios as a result of marine and coastal degradation can be estimated. This will yield the following results:

Accommodation = 59.6% x 60,824,908 = $35,886,696
Food and Beverage = 6.2% x 60,824,908 = $3,711,144
Entertainment = $6,264,965.5
Transportation = $3,953,619
Shopping = $5,900,016

[25] It is assumed that the shift in the demand curve is parallel.

[26] This is an assumption for unless maybe garbage is floating on the water in the sea some visitors will continue to come

[27] It is plausible that some of the visitors who stop coming to Ocho Rios may move to another resort town. In this case it should be noted that the loss in revenue attributable to this portion of visitors is a net loss only to Ocho Rios, and not to the island of Jamaica as a whole. However, because of the fact that other resort towns in Jamaica are experiencing similar problems with coastal degradation, it is also likely that visit Ocho Rios because of degraded coastal resources will move to another island entirely. It is therefore possible to assume that the US$ 60,824,908 loss in revenue to Ocho Rios is also representative of the loss in revenue to Jamaica

From this calculation it can be concluded that hotel and guesthouse owners stand to lose approximately US $ 35,886,696 annually. This will no doubt have a tremendous impact on the 9,688 workers employed in the accommodation sector (Jamaica Tourist Board, 1999) in terms of wage reduction and job losses.

Taxi and other transportation providers will also be affected to the tune of US $3,953,619 annually, Restaurant owners and other food and drink providers, US $3,711,144 and in bond storeowners, craft and other vendors, US $5,900,016.

The tremendous social impacts of this economic loss are not difficult to predict especially as Ocho Rios is heavily dependent on the tourism industry. Further it is already known that Ocho Rios generates the highest level of Gross Domestic Product (GDP) (J$5,206.5 millions) of all the tourist regions in Jamaica (Jamaica Tourist Board, 1998), therefore a loss of tourist revenue in Ocho Rios would have far reaching economic and social impacts for the entire island.

### 5.5 Indirect Local Use - Coastal Protection

The three main indirect uses of coral reefs are as follows:

- Coastal protection
- Support of offshore fisheries
- Assimilation of waste.

This resource valuation exercise considered the coastal protection that coral reefs afford as the sole indirect use value that can be quantified, since at present there is a lack of tools available to quantify the role of the coral reefs in the offshore fisheries production.

Assimilation of waste, pollution and discharge from anthropogenic sources is yet another potential indirect benefit of the presence of the coral reef. However, corals are highly sensitive to nutrient and sediment input and as such these latter benefits were not considered to be viable or sustainable indirect uses to be considered in a local use model[28].

The value of coastal protection was estimated from the value of land that is vulnerable to erosion. Obtaining detailed information of the land values proved to be quite difficult. Information was solicited from various sources as follows:

- CD Alexandra (Real Estate Agent)
- Land Valuation Department, Government Jamaica
- S A M$^{c}$Cally and Associates (Real Estate Agent)
- Stamp and Estate Duties Department, Government of Jamaica

It must be here pointed out that relying on real estate markets for land value information is limited by the nature of the property that is available on the market at the time of investigation and so this may not yield results representative of the entire region[29].

Based on the real estate prices obtained the average shoreline value of land vulnerable to erosion within Ocho Rios was estimated to be US $10.78 per sq. ft. in 2000[30].

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[28] Gustavson, K. Huber, R.M. and Ruitenbeek, J. (2000), pg. 93. Integrated Coastal Zone Management of Coral Reefs: Decision Support Modelling

[29] Land price depends on the type of available for sale which will vary from time to time and land available at one particular time may not be representative in type or price of the majority of shoreline properties in Ocho Rios

[30] Real estate prices for land in Ocho Rios were used to calculate an average price per sq ft of land.

Information from the NRCA Coastal Atlas (NRCA, 1997) revealed that there is approximately 12.63 km of shoreline within the Ocho Rios Marine Park. This translates into 4,144,800 sq. ft being vulnerable to erosion assuming that approximately 100 feet of shoreline property are at risk of erosion should the protective function of the coral reefs be compromised. The net value of the total amount of land at risk was thus calculated to be US $44.91 million dollars.

### 5.6 Indirect Local Use - Biodiversity

The estimate of the economic value of the Ocho Rios Marine Park biodiversity adopted a benefit transfer approach. This involved an adaptation of the biodiversity estimate for developing countries suggested by Ruitenbeek, who proposed that the value of biodiversity can be estimated by examining the value of foreign support likely to be available to protect the biodiverse resource through the NGOs, the Global Environment Facility (GEF) as well as through other means (Ruitenbeek, 1992).

A recent study for Indonesia showed that two marine parks were able to capitalise on their global value of biological diversity, by obtaining an average grant of US$ 10,000 per $km^2$ (Cesar et al, 2000). In the Ocho Rios marine park the areas of most interest to biodiversity are the coral reefs, seagrass beds and associated flora and fauna. Based on the estimated seagrass and coral reef cover (NRCA, 1997), approximately 0.884 $km^2$ is eligible for biodiversity funding.

For a more accurate estimate of potential biodiversity grants for conservation of marine park resources, the biodiversity of the entire park would have to be considered. However, this information was not available for inclusion in this valuation exercise.

### 5.7 Summary – Economic Valuation

The economic analysis evaluated the direct economic impact on the communities and various economic agents in and outside Ocho Rios should the coastal and marine resources become degraded. The net benefit of the resources to each set of agents was calculated. These included tourism, fishing and real estate. To be sure, the economic value of the resources in the park area extends far beyond the three categories identified above. This means that whatever estimates were presented above should really be considered a lower bound on the economic value of these resources, rather than a comprehensive, immutable value for them. For example, not included were the secondary impact of expenditures made elsewhere by persons who work in Ocho Rios but spend a significant portion of their income in another town where they reside. The impact of these expenditures on the economic health of other areas is also large, especially as a large percentage of the Ocho Rios workforce are non-Ocho Rios residents. Direct and indirect payments to government departments were also not taken into account in the calculation since these payments are for the most part not for services rendered by the government. However, Ocho Rios produces a significant proportion of Jamaica's Gross Domestic Product, and the generation of that product is largely dependent on the resources in the Park area. The impact on government revenues and the impact of those revenues on the wider Jamaican community are beyond the scope of this study. Nevertheless, one can anticipate that the ability of the government to raise revenue domestically would be severely hampered if the Park-related economic activities of Ocho Rios were to be threatened.

This study selected some beneficiaries of the marine and other resources whose assets were easily quantified and estimated their net returns from exploitation of the resources. This was done by removing from gross receipts the cost of providing the particular good or service. The total net economic benefit of fishing activity within Park waters was estimated to be US $.25 million. This number takes into account the opportunity cost of labour (the value of labour in its next best use) and the cost of capital involved in fishing activities. Given the level of unemployment in Jamaica, and the fact that a large proportion of the persons who are involved in

fishing have no other viable skill, it is unlikely that the opportunity cost of labour is as high as it is estimated to be here. Hence it is likely that these figures understate the importance of fishing activities, to say nothing of the cost of dietary replacement of the fish protein.

It is estimated that tourism contributed a net total of US $134 million to the Ocho Rios economy. This figure is the most difficult to interpret because it was not possible to take full account of the annual cost of capital that is invested in the Ocho Rios economy. In a more accurate calculation, the annual cost of capital would be removed from the figure quoted above. However, since there are several benefits associated with the existence of the tourist sector that were not accounted for, this omission is not as severe as it appears to be. While understating the costs associated with tourism, the benefits are also grossly understated.

Any scaling back of tourist activities because visitors find the quality of the resources no longer acceptable will have not only direct negative impacts on the providers of the tourism product, but also employment repercussions that affect the surrounding communities. The impact will be large. There should therefore be a strong incentive to preserve the resources on which tourism depends for its very existence.

The total value of the discussed coastal and marine resource can be combined to estimate the total value of the ORMP. The total value of the ORMP (summarised in Table 5.13) is estimated at US$ 245.2 million.

**Table 5.12 Summary - Economic Value: Ocho Rios Marine and Coastal Resources**

| Resource Function | Economic Value (million $US) |
|---|---|
| Fishery | 4.7 |
| Tourism | 134 |
| Recreation | 60.8 |
| Coastal Protection | 44.9 |
| Biodiversity | 0.8 |

Source: Environmental Management Unit, 2000

In resource economics, monetary value assigned to a resource is based on human preference (Taylor, 1999). However, increasingly, introducing non-economic estimates of value enhances valuation measurement. Section 6 examines measures of social value to generate a more balanced valuation assessment for the Ocho Rios Marine Park.

# 6.0 RESOURCE VALUATION – SOCIAL

## 6.1 Introduction

An examination of the social worth of the resources in the marine park to each user group must be seen as an important component in any valuation aimed at informing a management plan. For the purpose of this study, a questionnaire survey[31] was administered to the identified resource users and the data collected were used to generate indices for the measurement of social value. The indices generated were:

- Usage
- Preference
- Acceptability
- Satisfaction; and
- Importance

The survey included the following user groups:

- Tourist
- Fishermen
- Business Operators
- Hospitality Industry Workers

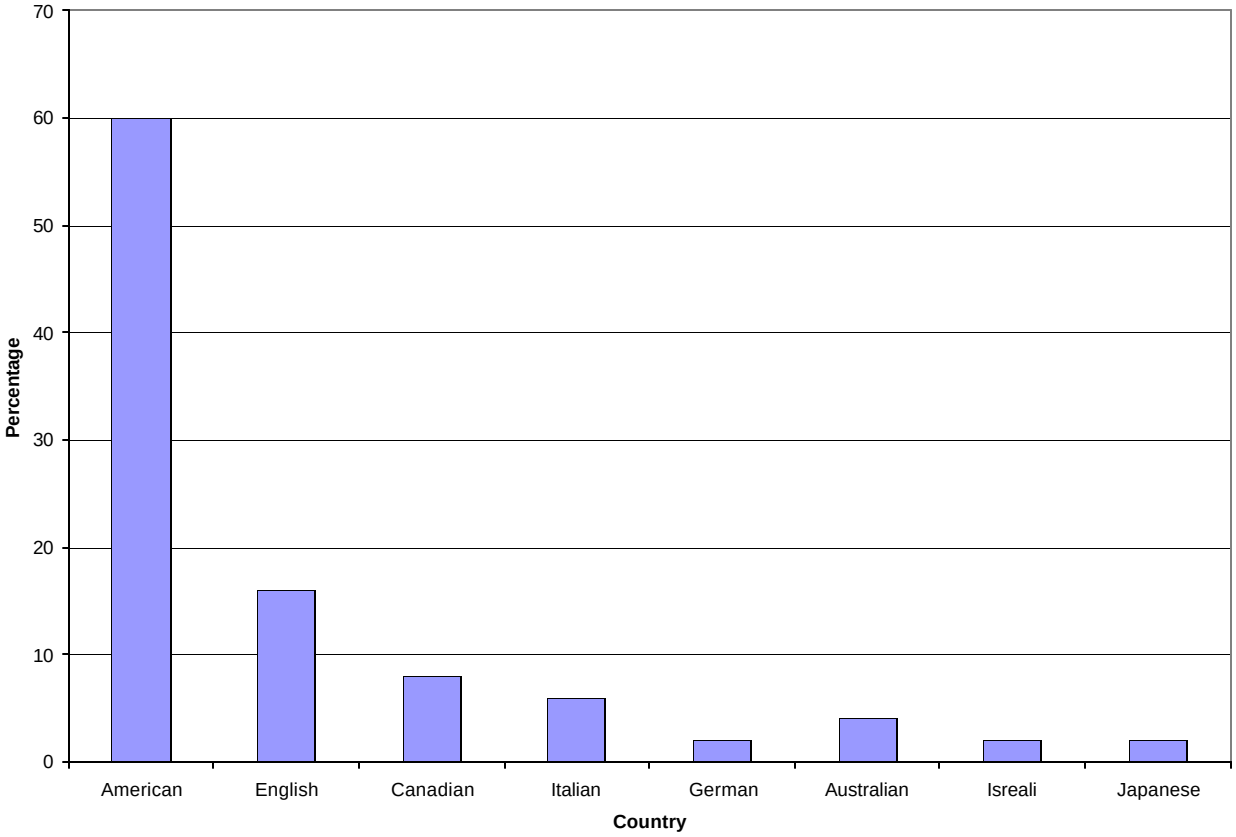
There were two questionnaires, one for visitors and the other for local groups comprised of fishermen, members of the business community, hospitality workers, and general members of the Ocho Rios public (Appendix 2 and 3).

## 6.2 Visitor Profile

Visitors to Ocho Rios who were interviewed can be broadly classified as cruise-ship and stop-over visitors. American tourists dominated the visitor population, with other regions of origin including Europe, Asia, and Australia (Figure 6.1).

[31] Social survey conducted by Environmental Management Unit – August 2000 (See Chapter 1)

**Figure 6.1 Visitors to Ocho Rios by Country of Origin**




The visitor survey showed that there were equal numbers of male and female visitors (50:50) to Ocho Rios. The greater proportion of the population was within the 21-40 age group (Table 6.1). In general, visitors tended to be skilled or professional persons. Occupation types included teachers, computer technicians, nurses, government workers and secretaries. Fourteen percent of the survey population was retired persons and 12% was students.

**Table 6.1 Age Distribution of the Visitor Population**

| Age Category | % age |
|---|---|
| 11-20 | 4 |
| 21-30 | 24 |
| 31-40 | 36 |
| 41-50 | 20 |
| Over 50 | 16 |

## 6.3 Ocho Rios Community Profile

Of the survey population, a significant number of the respondents (44%) had jobs that were directly in the tourism industry. Of the remainder, significant proportions had jobs with indirect linkages to the industry or whose economic activity was generated because of the Ocho Rios tourism industry. These included restaurant workers, taxi drivers, shop owners and attendants

and other employees in the hospitality industry (entertainers, beach sweepers, and watersport operators).

Sixty percent of the persons interviewed resided and worked in Ocho Rios. However, 60% of the hospitality workers did not reside in Ocho Rios. The good economic prospects of Ocho Rios were cited as the main reason for choosing Ocho Rios over another town, when seeking jobs or operating businesses.

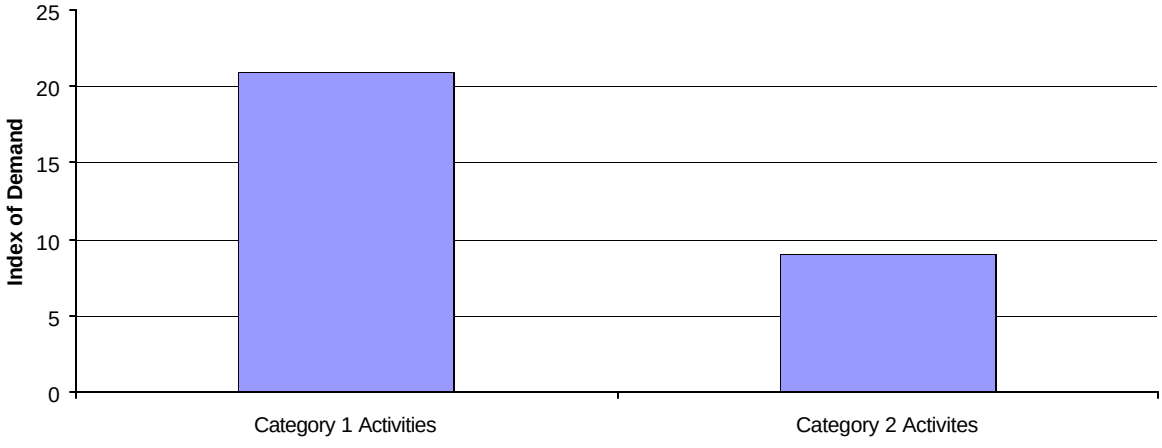
## 6.4 Measured Indices

### *6.4.1 Index of Demand or Usage*

The usage or demand index for recreational activities seeks to estimate the social value of the site by rating associated recreational activities. For the purpose of the social valuation, recreational activities (see Appendix 2 and 3) were divided into two categories; Category 1 activities included those directly utilising the Marine Park resources while Category 2 included activities with indirect linkages to the resources[32]. Each respondent was asked whether the activity was, or would be carried out by him or her and the results tallied. The activities were then ranked and assigned demand values with 1 as Lowest Demand and 7 as Highest Demand. The total demand index for each category of activity was then standardised by dividing the total index by the number of activities in each category.

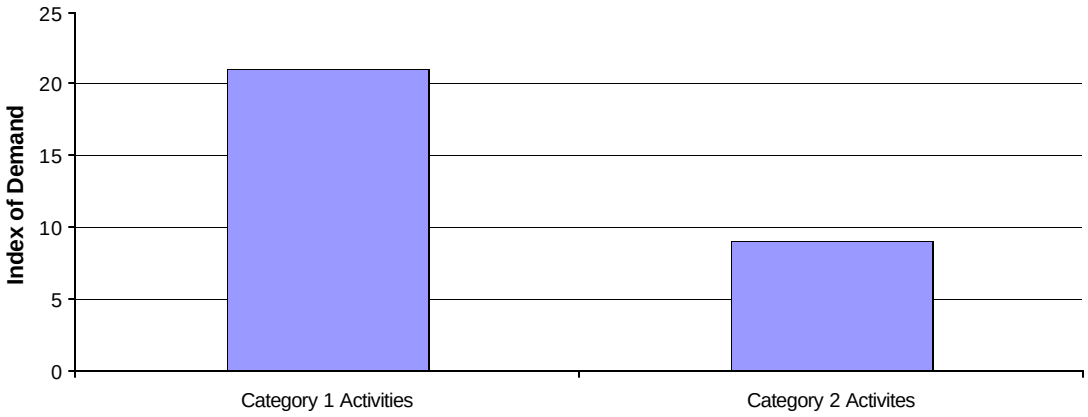
For local community members, the index for Category 1 and 2 activities was 21 and 9 respectively, while that of the visitors was 17 and 12. The greater demand for the Category 1 activities common to both user groups is shown in Figure 6.2 and 6.3. Swimming was the activity with the highest demand rating among local users, while sunbathing followed by swimming, generated the highest ratings among the visitor group. Shopping (a category 2 activity) had the second highest demand rating among the visitor group and the third highest among the locals, highlighting the significance of the spin-offs from category one activities going to shops and stores and other business operations within the town of Ocho Rios. The higher demand rating placed on shopping re-emphasised the importance of the presence of the tourism industry to the town of Ocho Rios, since associated with resource-use activities, there is a demand for shops, stores and other business operators indirectly linked to the tourism industry.

**Figure 6.2 Demand Index for Recreational Activities - Locals**




[32] Category 1 activities – Swimming, Diving, Snorkelling, Sunbathing and Watersport.
Category 2 activities – Shopping, Touring, Hiking

**Figure 6.3 Demand Index for Recreational Activities - Tourist**



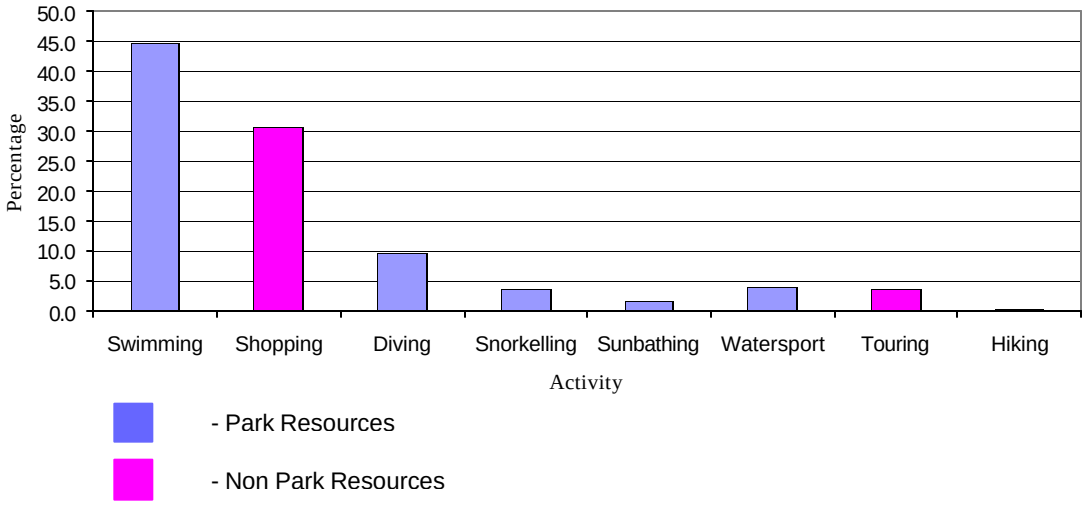

### *6.4.2 Index of Preference*

The User Preference Index, rates the 'user preference' for the Category 1 and 2 recreational activities discussed in the previous section, using a similar method of analysis as that employed in the calculation of the demand index.

User preference was found to be closely associated with the demand index. The user preference index for Category 1 and 2 activities was 21 and 10 (for locals) and 17 and 12 (for tourists) respectively.

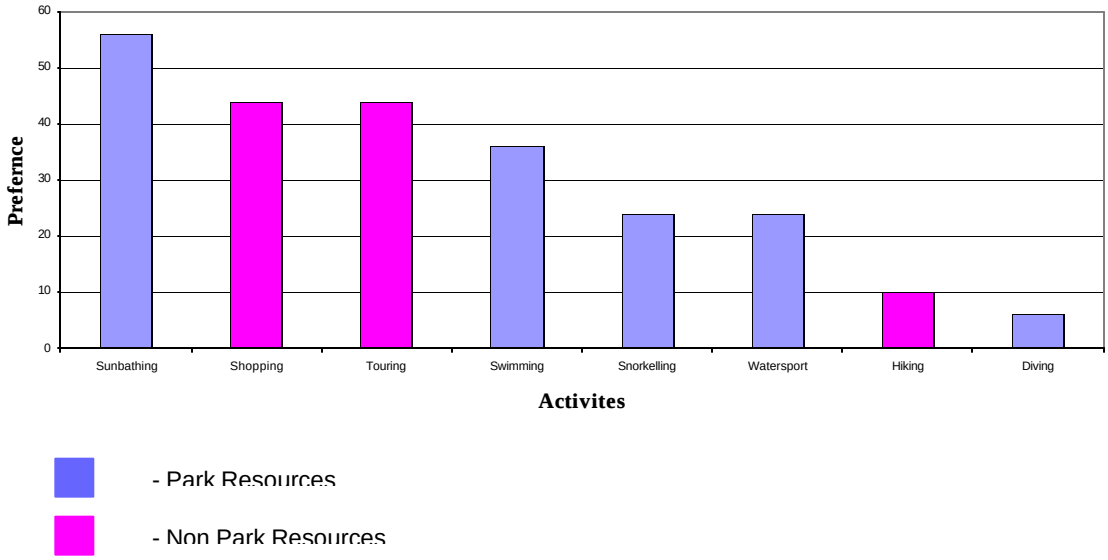
Local users indicated that swimming was their preferred recreational activity, with shopping being the next preferred activity (See Figure 6.4). For this group of users, the preference rating of diving, watersports and snorkelling was influenced by the income generating activity of the user group hence, fishers and watersport operators indicated higher preferences for diving and snorkelling.

**Figure 6.4 Indicated Prefernce for Recreational Activites - Ocho Rios Marine Park**



For visitors to Ocho Rios, sunbathing was the activity given the highest preference rating (See Figure 6.5). Shopping (as with local user groups) was given the second highest rating.

**Figure 6.5 Prefernce Rating of Marine Park and Non-Marine Park Recreational Activites (Tourists)**




### *6.4.3 Index of Acceptability*

The resource acceptability index sought to measure the acceptable environmental quality of key marine park resources (beaches, coral reef, and coastal water). Respondents were asked to rank their responses and these were recorded using a Likert scale where 1=Very Polluted, 3=Moderately Contaminated, and 5=Highest Quality. To generate the 'acceptability index'[33] the acceptable environmental standard for each marine park resource was multiplied by the associated rating value and divided by the number of respondents interviewed.

For all three key Marine Park resources the 'acceptability index' for both user groups indicated a willingness to accept only the highest environmental quality (See Table 6.2). A few persons were willing to accept moderately contaminated waters or degraded reefs, however the indices fell to zero when environmental quality fell to 'very polluted'.

[33] This index and the indices to follow were calculated using different methods because demand and preference were based on yes – no responses while the other measures were done using a Likert scale

**Table 6.2 Acceptability Indices - Key Marine Park Resources**

| Environmental Standard | Resource | | | | | |
|---|---|---|---|---|---|---|
| | Water quality | | Beach condition | | Coral reef | |
| | Local Users | Visitors | Local Users | Visitors | Local Users | Visitors |
| Highest Quality | 3.9 | 3.4 | 3.8 | 3.4 | 2.6 | 2.9 |
| Moderately Contaminated | 0.7 | 1.0 | 0.7 | 1.0 | 1.0 | 1.1 |
| Very Polluted | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Source: Environmental Management Studies, 2000

### *6.4.4. Index of Satisfaction*

To capture a measure of satisfaction resource users experienced, visitors and local residents in the survey were asked to indicate their satisfaction with the following Marine Park resources - water, beaches, reef, and fish. The responses given were applied to a rating scale, where 1 was the lowest and 5 was the highest.

In general, local users showed lower levels of resource satisfaction as compared to the visitor group (Table 6.3).

**Table 6.3 Satisfaction Index for Key Marine Park Resources**

| | Resource Users | |
|---|---|---|
| | Locals | Visitors |
| Water | 2.86 | 4.7 |
| Beach | 3.14 | 4.7 |
| Reef | 1.90 | 3.3 |
| Fish | 1.96 | 2.8 |

Source: Environmental Management Unit, 2000

The ratio of satisfaction to dissatisfaction was also calculated for user groups, demonstrating that the quality of the beaches and reefs were rated most important by local users and reef, followed by marine water quality, the most highly rated by visitors (Tables 6.4).

**Table 6.4 Ratio of Satisfaction to Dissatisfaction: Resource Users**

| Resource Assessed[34] | Local Users | Visitors |
|---|---|---|
| | Ratio Satisfied :Dissatisfied | Ratio Satisfied :Dissatisfied |
| Water Quality | 3:1 | 4 : 1 |
| Beach Conditions | 5:1 | 3 : 1 |
| Reef Quality | 5:1 | 5 : 1 |
| Fish – Quantity & Quality | 3:1 | 3 : 1 |

Source: Environmental Management Unit, 2000

### *6.4.5 Index of Resource Importance*

Local resource users were asked to rate the importance of key Marine Park resources and these were recorded using a Likert scale where 1 = Of Little Importance and 5 = Very Important. The resource functions targeted were Visitor Attraction, Fisheries Maintenance, Coastal Protection[35], and Aesthetic Value.

The 'Importance Indices' for the targeted resource functions indicated that local users of the Ocho Rios Marine Park placed a high value on the importance of the resource functions. The visitor attraction function was given an importance rating of four. Of the rating for the remaining resource functions the support of fisheries, local recreation facilities and scenic views were the second most frequently cited as being 'very important' (Table 6.5).

**Table 6.5 Importance Indices for Select Coastal Resource Functions**

| | Attracting Visitors | Fisheries Maintenance | Coastal Protection | Local Recreation | Scenic View |
|---|---|---|---|---|---|
| Very Important | 4 | 3 | 2 | 3 | 3 |
| Moderately Important | 0 | 1 | 1 | 1 | 1 |
| Not Important | 0 | 0 | 0 | 0 | 0 |

Source: Environmental Management Studies

## 6.5 Social Valuation Summary

The overall social value of the marine park resources was rated very important or moderately important, both to local residents and to visitors. Each resource was attributed a value ranging from 2 – 4 when the Likert scale was applied. Very high importance ratings were assigned by local and tourist resource users to the visitor attraction, scenic views, and fisheries maintenance, with coastal protection being rated the lowest (Table 6.5). It was also the case that members of the visitor user group recorded a higher value index for the key Marine Park resources compared to local users (Table 6.6). People were largely unaware of the role of healthy marine ecosystems in giving protection to the coastal zone. It is important that a public education programme should address this issue.

[34] It is important to note that a significant number of respondents in both user groups were unable to state their level of satisfaction with fish quantity and quality because they did not know much about the resource.

[35] As indicated in Section 5.4

**Table 6.6 Average Social Value for Marine Park Resources[36] (Visitors and Local Community Members)**

| Resource | Average Social Value (Likert Scale[37]) | |
|---|---|---|
| | Locals | Visitors |
| Coastal Water | 3 | 4 |
| Beach | 3 | 4 |
| Coral Reef | 2 | 3 |
| Fisheries | 2 | 3 |

Source: Environmental Management Unit, 2000

In general, it was found that indices of value generated for Marine Park recreational activities were higher than those that were not Marine Park related. This was the case for visitors and local users (Table 6.7). For both user groups (visitors and local users), the majority of respondents indicated a willingness to accept only the highest standards for beach conditions, coral reef and water quality. In comparative terms, more persons were willing to accept a lower environmental quality for coral reefs than for beach and water quality.

**Table 6.7 Park versus Non-Park Resources**

| Social Value Measure | Index Value – Tourists | | Index Value – Locals | |
|---|---|---|---|---|
| | Park Resources | Non-Park Resources | Park Resources | Non-Park Resources |
| Activity Demand / Usage | 21 | 9 | 22 | 12 |
| User Preference | 21 | 10 | 17 | 12 |

Source: Environmental Management Unit, 2000

Moderately degraded environmental conditions were acceptable to less than 20% of the survey population. No one indicated a willingness to accept very polluted environmental conditions. At present user satisfaction with the resources was rated between 2 and 4.7[38] across both user groups, however in the event of resource degradation, this index stands to fall further below it's current lower limit of 2. As user satisfaction falls, there will be repercussions to the tourism and tourism dependent business.

The ratings of the importance of each resource function must also be considered in this discussion, since the highest rating (4) for resource importance was given to the tourist attraction function provided by the coastal and marine resources. This correlates with the primary reasons visitors gave for choosing Ocho Rios as their vacation destination – the beaches and Dunns River falls. If, therefore, the quality of these resources were to decline, then the quality of the vacation experience would be reduced, and one would expect a fall-off in visitor numbers.

[36] The Average Social value was calculated by averaging the of each resource related index gene

[37] Likert Scale – 1 = Lowest Rating and 5 = Highest Rating

.

[38] Ratings on the Likert scale with 1 – lowest and 5 - highest

It was very significant that the values placed upon the resources by visitors were consistently higher than that of local residents. This is an important indicator of the urgent need for heightened local awareness among local residents of the resources upon which Ocho Rios depends. This applies to those resources within the Marine Park area as well as those indirectly linked to the coastal and marine conditions of the Park.

Further it may be concluded that Ocho Rios and the neighbouring towns stand to suffer direct and indirect economic and social impacts if the current status of marine and coastal resources are not maintained and/or improved. The primary loss is projected to originate from the repercussions of resource degradation on the tourism industry. In light of this it is important that management decisions be made which will ensure the future sustainable use of the coastal and marine resources.

## 7.0 CONCLUSION AND DISCUSSION

The economic and social resource valuation demonstrates the fundamental importance of the coastal and marine ecosystems of Ocho Rios to the viability of the town through a combination of economic, social and cultural factors. The total economic value of the coastal and marine park resources was estimated at US $245.2 million. The potential loss that would result from coastal resource degradation (discussed in Chapter 5.4.4) was estimated at US $60.8 million annually. The economic impacts of this loss is particularly great in the tourists accommodation sector which, it is estimated, would lose US $35.8 million annually. The projected economic impacts of the potential resource degradation will inevitably affect the socio-economic well being of the workers in the tourism industry.

It is also projected that the social impacts of marine and coastal resource degradation would be great. This is reflected not only in the social impacts of economic loss (for example, increased unemployment, reduced business activity, increases in crimes, and increases in tourist harassment) but also the social measures of resource worth. These social measures, though inextricably linked to the economic worth, are additionally reflective of the attractiveness, pleasure and aesthetic value of the resources to visitors and local residents.

The, protection and preservation of these resources are critical to the economic and social well being of the community. Their significance is not only at the local level through support of local economic activity but also at the national level. At the national level the report findings are substantiated by the Jamaica Tourist Board (JTB) report (1998), which lists Ocho Rios as the recipient of the largest proportion of Tourism Final Demand[39] , some (J $15,254.1 millions). Ocho Rios also generates the highest level of GDP of all regions (J$5,206.5 millions) contributing 296.5 million.

It is important therefore, that in an examination of the benefits received through the utilisation of the Ocho Rios marine and coastal resources that the cost associated with overuse and/or misuse be highlighted. In evaluating the costs not only must degradation in the quantity and quality of resources be considered but so also must the economic loss in associated industries be taken into account.

This valuation report serves to highlight some of the benefits that are currently accruing to Ocho Rios through the utilisation of the marine and coastal zone resources. Those resources that are critical to ecological integrity and economic sustainability for the town of Ocho Rios are:

- Beaches
- Coral Reef & Seagrass communities
- Fresh and Marine water quality
- Fishery

It is difficult however to conserve any single resource or group of resources in the absence of a comprehensive integrated framework for policy, planning and management. With the development of a management plan the costs of managing the Marine Park's coastal and marine resources could be determined. This could then be used in a Cost Benefit Analysis to determine the **economic efficiencies** associated with different management strategies.

Effective management could be achieved by the setting up of small councils comprising as many stakeholders as possible, (including government), for the resources identified, who would focus

[39] Tourism Final Demand is a measure of spending by tourists, spending by public sector entities supporting tourists and investment by tourist firms in fixed capital

on education, policy implementation, enforcement, research and monitoring. Management strategies are suggested for fisheries, the resource users and those operations included in land-based activities in Ocho Rios.

### 7.1 Fisheries

Some management of the fisheries industry in Ocho Rios is urgently needed. Management tools that are considered suitable for situations of over-fishing and increasing fishing pressure include gear restrictions such as minimum mesh size, the designation of fish sanctuaries and limited entry to users. The integration of the Fisheries Improvement project should be considered as a possible means of achieving fisheries management in the Ocho Rios marine park.

### 7.2 Management of Resource Users

Control over the activities of resource users is of vital importance if fisheries, other resource management strategies, and the protection of critical species are to be effective and will involve a system of zoning in the park area. The implementation of zoning will make necessary some amount of enforcement as it is in this regard that co-management, focusing on community involvement, could be utilised. A well-structured educational programme should be able to raise the awareness of the critical importance of the coastal and marine resources of Ocho Rios to the viability of the town and the significance of any degradation of these resources. Full and widespread awareness of these factors should enable the leading stakeholders to galvanise enough support to ensure that community policing is implemented and effective.

### 7.3 Management Of Land-Based Activities

Through the integration with government agencies, this aspect of the management plan will aim to achieve goals such as pollution control and watershed management with a view to decreasing negative land-based impacts upon the coastal resources. In addition, the long-range strategies which will guide development decisions relating to the coastal zone area should be implemented with a view to ensuring habitat preservation and the protection of sensitive areas. Data presented in the report also indicate that any management of the Ocho Rios Marine Park needs to make provision for the identification of restorative and rehabilitative actions to combat the degradation that has already occurred.