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THE IMPACT OF MARINE PROTECTED AREAS ON POORER COMMUNITIES LIVING IN AND AROUND THEM: INSTITUTIONAL OPPORTUNITIES AND CONSTRAINTS

Appendix 4 –
Case Study of Glover's Reef Marine Reserve, Belize

December 2002

MRAG

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Table of Contents

List of Figures

List of Tables

Acronyms

AGM	Annual General Meeting
AGRRA	Atlantic and Gulf Rapid Reef Assessment
BAS	Belize Audubon Society
BBRWHS	Belize Barrier Reef World Heritage Site
BEST	Belize Enterprise for Sustainable Technology
BFD	Belize Fisheries Department
BTIA	Belize Tourism Industry Association
CANARI	Caribbean Natural Resources Institute
CBO	Community Based Organisation
COMPACT	Community Management of Protected Areas Conservation Project
CRMP	Coastal Resources Management Project, TCI
CZMAI	Coastal Zone Management Authority and Institute, Belize
DECR	Department of Environmental and Coastal Resources
DFID	UK Department for International Development
EFJ	Environment for Jamaica
EPA	Environment Protection Area
EU	European Union
GEF	Global Environment Fund
GRMR	Glover's Reef Marine Reserve, Belize
HCMR	Hol Chan Marine Reserve, Belize
ICZM	Integrated Coastal Zone Management
LAC	Local Advisory Committee
MOU	Memorandum of Understanding
MPA	Marine Protected Area
MRAG	Marine Resources Assessment Group Ltd
NCRPS	Negril Coral Reef Preservation Society, Jamaica
NEPT	Negril Environmental Protection Trust
NGO	Non-Governmental Organisation
NMP	Negril Marine Park
NPEAC	National Parks Environmental Advisory Committee, TCI
NR	Natural Resources
PA	Participatory Appraisal
PACT	Protected Areas Conservation Trust, Belize
PALSNP	Princess Alexandra Land and Sea National Park, TCI
PAP	Public Awareness Programme
PRA	Participatory Rural Appraisal
PS	Permanent Secretary
RRA	Rapid Rural Appraisal
SEA	Socio Economic Assessment
SI	Statutory Instrument
TCI	Turks and Caicos Islands
TCNT	Turks and Caicos National Trust
UDC	Urban Development Corporation, Negril, Jamaica
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
UWI	University of the West Indies
WCS	Wildlife Conservation Society
WWF	World Wildlife Fund

4 Glover's Reef Marine Reserve, Belize

The following information represents the results of field research undertaken in Southern Belize, in February 2002 relating to Glover's Reef Marine Reserve. Only the results for this research are presented here. Methodology can be found in Appendix 1 of this report. Glover's Reef Marine Reserve was one of four case studies investigated, results from others are presented in other appendices of this report. Details of the main contributors of information are mentioned in text where relevant and a list of respondents presented in section 4.11. As will be seen in section 4.11, the number of respondents was low, with emphasis being placed on fewer, but in depth, interviews. Whilst this meant that it was possible that opinions collected were not representative of the particular group in question, the principles of triangulation were applied to crosscheck information[1] and representative results were not an over-riding requirement of the research in any case. Being exploratory in nature, views of any individual were useful and, to the extent that they helped to build up an explanation of a case and develop hypotheses, were considered valid.

Glover's Reef is the southernmost of the three atolls off the coast of Belize (the others being Turneffe Reef and Lighthouse Reef). It is located about 75km southeast off the mainland and 25km east of the Barrier Reef. Unlike the other marine parks in this case study research, due to its distance from the mainland Glover's Reef is remote – home to only a few residents who run tourist operations and fishers who might camp there whilst fishing its waters. As a result of its remoteness in 1988 Gibson described it as "relatively untouched" and "in almost pristine condition" (Gibson, 1988, p2).

The site was chosen as a case study because although it did not have a local community, geographically speaking, it was used by fishers from both Southern and Northern Belize and it was the effect of the Park on this user 'community' which was of primary interest. Glover's Reef was chosen then as an example of an MPA that differed from other case studies in this research in terms of its location (remote rather than at the centre of a large tourist industry) and its principal users (fishers rather than tourist industry).

4.1 History of park and management

Interest in Glovers Reef started during the 1970's when it was chosen by a team of leading marine scientists as a valuable site for coral reef study (Gibson, 1988). In 1978 a UN consultant recommended that it be declared an underwater reserve and, 10 years later, in 1988, a draft management plan was proposed (Gibson, 1988). In 1990, the Wildlife Conservation Society purchased one of the six cayes in Glover's Reef atoll for the purposes of providing a MPA headquarters for the Government of Belize and to establish a Marine Research Field Station (Geoghegan *et al.*, 2001; Richards, 2002).

In 1993, the reserve was officially declared under the Fisheries (Glovers Reef Marine Reserve) Order S.I. 38. This was after the declaration of Hol Chan Marine Reserve in 1987 (the first in Belize), which had required a change in legislation that

[1] This involves obtaining information from a range of sources, using a range of methods and a range of investigators and/or disciplinary approaches. Such a method also involves actively seeking out diversity and different perspectives, and investigating, in situ, contradictions and anomalies.

empowered the Minister of Agriculture (under which the Department of Fisheries resides) to make regulations for the control of Marine Reserves.

The main events in the creation and subsequent development of the reserve are shown in Table 4-1.This information came from interviews with available Park Staff, the manager of the WCS Research Station, the Belize Fisheries Department and available literature (in particular Gibson, 1988; Richards, 2002).

Table 4-1 Major events in the creation and development of Glovers Reef Marine Reserve

Date	Event
1970's	• Glovers subject of interest to international marine scientists
1988	• Consultations with local users and draft management plan proposed
1993	• Glover's Reef Marine Reserve legally declared under management of Belize Fisheries Department (BFD)
1993 – late 90's	• Several intervals of no active management up until 99[2]
1995	• WCS set up research station
1996	• Glovers Reef declared a World Heritage Site • Glover's Reef regulations passed and 4 zones established (not demarcated properly due to lack of buoys)
1997	• First meeting of the Glover's Reef Local Advisory Committee. • Wilderness zone enforced
2000	• Advisory Committee re-established[3] • March. Agreement on revised boundaries of conservation (no fishing) zone. • December. Fishing in grouper spawning bank banned, (exception made for fishers from Hopkins)
2001	• Hurricane Iris • Fishing in grouper spawning bank banned, even for Hopkins fishers • New park manager • New boundaries for conservation zone implemented causing much disagreement, particularly with fishers
2002	• Marine reserve biologist left

4.2 Current management practices and park activities

Figure 4-1 shows a map of Glovers Reef and the different zones as stipulated by the Glovers Reef regulations in 2001. Glover's Reef had a total area of 30,735ha, being approximately 1 mile long and 7 miles wide with a deep inner lagoon containing more than 800 reef patches. It also had six small islands. The four zones within the reserve were as follows:

[2] McField (2000)
[3] Richards (2002). Richards says that whilst it is existed on paper the GRMR local advisory committee had "met infrequently" and "been described as non-existent" (p100).

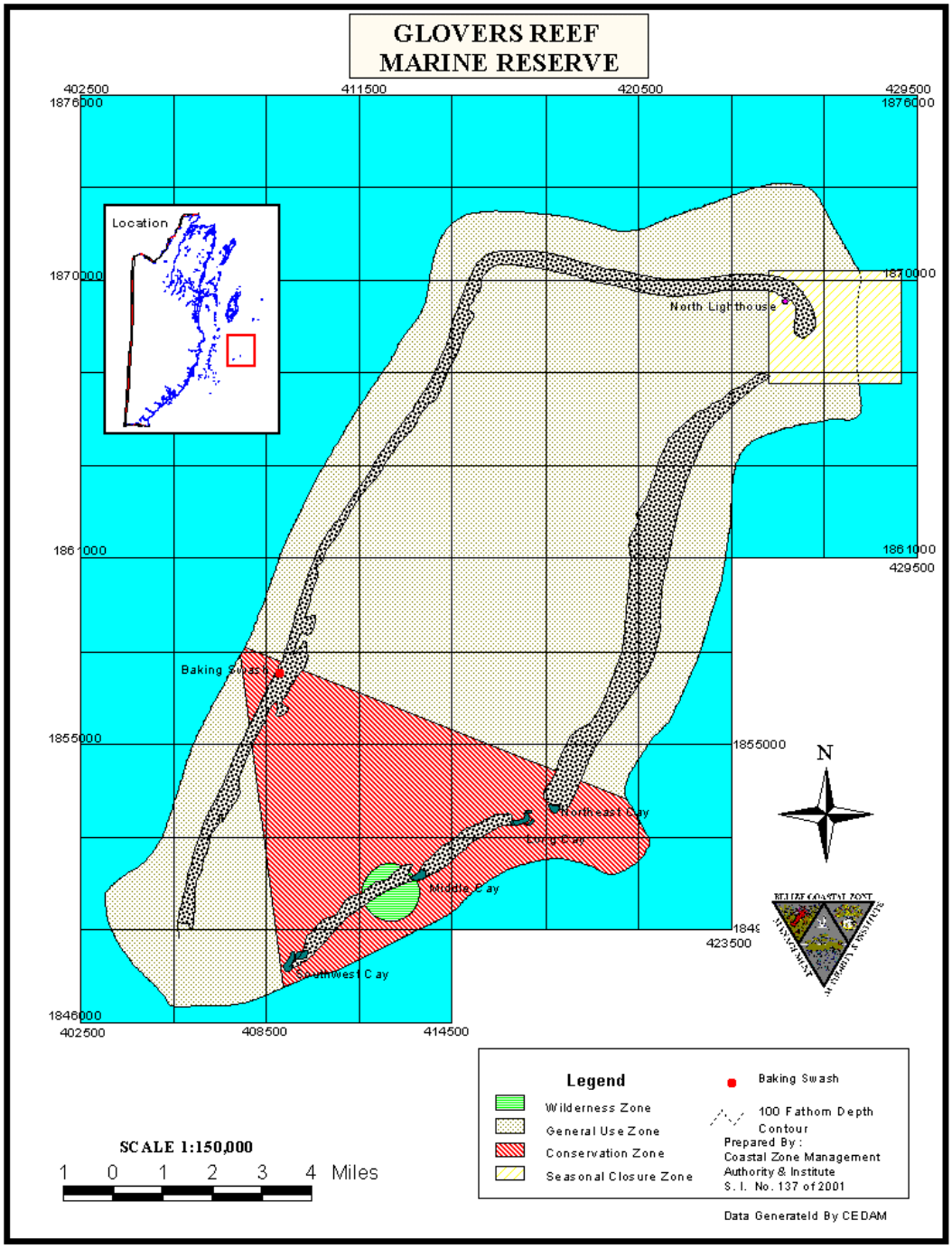

Figure 4-1 Map of GCMR (Gibson, pers. comm.)[4]

- General use zone (70% of area) – Fishing and recreational activities allowed but no traps, nets or long lines
- Conservation use zone – Commercial fishing prohibited. Fishing allowed by residents of cayes for subsistence purposes only. Catch-and-release sport fishing also allowed.
- Wilderness Zone – No fishing or recreational activities allowed

[4] This is the new zoning scheme map; representing the adjusted zone boundaries legislated in September 2001 and replacing zones legislated in 1996.

- Seasonal closure zone – this zone, a Nassau grouper spawning bank, was closed to fishers between December 1st – March 1st

As indicated in section (4.1), whilst these zones were designated in 1996 (and boundaries adjusted in 2001), they had been enforced to varying degrees and at various times. The least enforced was the seasonal closure with last year being the first year that a total ban on fishing had been imposed.

4.2.1 Activities within the marine park

Give its remoteness; human activity within the park was relatively limited. Besides the WCS research station, there were two small tourist outfits within the reserve catering to SCUBA divers and sports fishers. Tourist operations also came out to Glovers from Southern Belize (e.g. Placencia and Hopkins), Belize City and the Northern Cayes, Glover's Reef being recognised as one of the prime dive sites in Belize. Aside from tourism (which was minimal when compared to a place such as Ambergris Caye) the principle activity was commercial fishing. Fishers came from both Northern and Southern Belize and the nature and extent of fishing activities is described in section 4.7.

4.2.2 Current activities of GRMR staff

At the time of the research 4 staff were employed as GRMR staff. These were one manager, one biologist and two wardens. They were employed by the Belize Fisheries Department (BFD), who had responsibility for management of the Reserve, however funding came from the Institute of Coastal Zone Management (see section 4.2.3). A new manager had only just been recruited after a significant gap and the biologist had just handed in his notice and was due to leave soon. High staff turnover and difficulty in filling posts was perceived to be a significant problem of the reserve as will be seen in section 4.3. Unfortunately, at the time of the research only 1 staff member (a warden) was available to discuss with us and no Park staff were actually at Glover's Reef. Whilst the plan was that staff followed a rota system for being at the Reserve (2 weeks on the reef and one week off), it did not always work out like this and having no staff at the Reserve was not an unusual situation. Table 4-2 shows the current activities of marine park staff as explained by the warden, and some staff from WCS. Given that not all staff were spoken to, the table of activities is incomplete (though it was not clear from those people spoken to, what, if any, other significant activities were actually taking place). The draft management plan (Gibson, 1988) recommended activities in several areas and current activities are, here, set against those.

Table 4-2 Current or recent activities of Marine Park staff

Recommended Activities	Specific activities
Zoning Programme	• Patrolling • Demarcating new agreed conservation zone • Enforcement of conservation zone and seasonal Grouper bank (including making arrests, 7 in 2001) • Educating users whilst out and about, about the zones and the purpose of them • Handing out leaflets whilst patrolling
Environmental Management Programme	• Involvement in grouper tagging programme with WCS (research by Ihde and Hoenig)

Recommended Activities	Specific activities
	• Conch and lobster surveys (carried out by GRMR staff who have been trained by WCS)
Recreation & Tourism Management Programme	• Enforcing sports fishing regulations
Administration & Maintenance Programme	• Attending Local Advisory Committee meetings

The overall impression given was that patrolling and enforcement were the primary activities of Park Staff. Staffing problems meant that other duties were relegated, with the biologist and manager[5] taking on roles originally perceived to be those of the wardens. There were rarely more than two staff at Glover's at the same time and if possible, two would patrol together for safety reasons. The warden spoken to, however, said that he was often out at the reef on his own, and when he came back to mainland he was often not replaced. Scientific research was conducted by the WCS (with whom the Belize Fisheries Department had an MOU - see below) and scientists visiting the research station, and any GRMR staff would help if they were on the atoll and help was needed. Clear distinctions between roles were therefore not obvious.

Regarding enforcement, since he had started working at the Reserve (20 months ago), 18 people had been arrested and charged according to the warden spoken to. Of these, seven or eight had been banned from fishing for one year, whilst others were given fines. These were by no means the only infractions but the warden also explained that he used his discretion in most cases (e.g. giving warnings for a first time offence) as he recognised that he was in a delicate position and had to live with many of these people.

4.2.3 Management responsibility and linkages with other organisations

4.2.3.1 The Belize Fisheries Department

The Belize Fisheries Department had the legal responsibility for administration and management of Glover's Reef. Eight of the 12[6] MPA's established in Belize were under the jurisdiction of the Belize Fisheries Department (Geoghegan *et al.,* 2001). However the Fisheries Department had acknowledged that it could not financially support the MPA system of Belize (McField, 2000). McField gives an estimate of $BZ1.3 million per year to adequately support the eight MPA's, reflecting operational costs only. The Government of Belize only gave the Fisheries Department BZ$450,000 per year for everything (staffing and all departmental activities) showing that the required amount was far beyond the financial capacity of the BFD (McField, 2000). To overcome these financial constraints, the BFD had theoretically agreed to enter into co-management arrangements with local NGO's and community groups but to date (02/02) this had not occurred with GRMR. The direct supervisors of the GRMR staff were therefore the BFD, though staff also reported to the Coastal Zone

[5] Interviews suggested there had not been a manager for some time

[6] In their characterisation review Geoghegan *et al.* (2001) state that all 12 reserves have active management (2 low, 8 moderate, 1 high, 1 not classified). However McField (2000) states that only four of Belize's MPA's are under active management, only two of which involve the BFD. Only one of these is fully administered by the BFD (Glovers Reef) whilst the other (Hol Chan) is semi-autonomous. Differences between the two authors are a result of timing and the fact that McField limited herself to discussion of reserves which had had active management for more than one year.

Management Authority and Institute (CZMAI) who were the principal funders of reserve activities at GRMR.

4.2.3.2 Coastal Zone Management Authority and Institute

The Coastal Zone Management Authority and Institute (CZMAI) was the largest financial supporter of protected areas (Gibson, pers. comm.), including GRMR, and assistance also extended to general development of MPA's in Belize. It was involved in financing staff, infrastructure, management plans, mechanisms for community involvement and staff training. The Institute had started as an offshoot of the development of the first MPA's in Belize (Hol Chan then Glover's Reef) when it was recognised that these reserves were good but a more integrated approach was required. The Institute had started in 1989 and MPAs had always been at the core of the programme. Funding for the Institute came from the Global Environment Programme (GEF) and, now in its 2nd phase of funding, there had been a shift in emphasis towards only those MPA's that made up the World Heritage Site. Luckily for GRMR, this included them and CZMAI had been the principal supporters of the Reserve, providing not only funds but also administrative support. CZMAI was also on the GRMR Local Advisory Committee.

4.2.3.3 GRMR Local Advisory Committee

All MPA's in Belize were expected to have a Local Advisory Committee (LAC) and the same was true of Glovers Reef. The Advisory Committee was supposed to consist of the following 11 members[7]:

- 4 representatives from fisher co-operatives
- 2 representatives from the Glover's reef atoll
- 1 representative from CZMAI
- 1 representative from WCS
- 1 representative from the Co-operative department
- 1 representative from The Belize Tourism Industry Association (BTIA)
- 1 representative from the Belize Audubon Society (BAS)

As of December 2001, the BTIA and Co-operative Department were not represented but councillors from both the towns of Dangriga and Hopkins were. Meetings were expected to occur quarterly though twice yearly was more common. The ToR for the Committee included the following;

- Ensure regular revision and review of the management plan
- Comment on legislation & regulations
- Provide advice on applications for permits
- Report on matters mulcting on the reserve and maintain dialogue with government enforcement agencies
- Assist with enforcement activities
- Assist in the development of sustainable funding mechanisms
- Advise and assist on administrative matters, publicity, educational and interpretative programmes and decisions relating to research.

The history and the effectiveness of the LAC had been questioned with some reported to have said that, prior to the agreement in 2000, it was virtually non-

[7] MPA Stakeholders agreement March 30th, 2000.

existent (Richards, 2002). Certainly the first of these activities in the ToR had not yet been addressed with still only a draft (and most probably outdated) management plan being in place. The meetings were also not always well attended with the distance between members (from Belize City, Glovers Reef, Southern Belizean towns) being a major constraint. One more recent member of the committee (Chairman of Hopkins council) said that whilst the committee was a good idea in principle, it was currently "not a forum for making decisions, just a forum for being told regulations", this opinion very much reflecting the mood of fishers in his town, as will be discussed in later sections.

4.2.3.4 Wildlife Conservation Society (WCS)

A draft Memorandum of Understanding had been drawn up between WCS and BFD regarding the use and development of Middle Caye where the WCS had its research station. In the MoU the parties agreed that actions with respect to the Caye would be in line with the draft management plan (Gibson, 1988). The draft MoU also called for inter-agency co-ordination and co-operation and provision of a visitor's centre and interpretative site on the Caye (Richards, 2002). Whilst this MoU had never been signed there was a great deal of co-operation between the GRMR staff and WCS staff at the atoll, sharing both physical and human resources. WCS also provided BFD with an annual report on research activities at the site and these research activities were expected to provide recommendations for improved management of the reserve's resources.

4.2.3.5 Programme for Belize - Community Management of Protected Areas Conservation Project (COMPACT)

Whilst not specific to GRMR, this project is mentioned here as it was a potential means for local communities to benefit from the Belize Barrier Reef World Heritage Site (BBRWHS).

The Project, hosted by the NGO Programme for Belize, was funded by UNDP-GEF/SGP. It recognised that communities had a significant impact on marine resources in general and aimed to lessen that impact by promoting and financing sustainable livelihood approaches. The types of activities supported included:

- Expand sustainable livelihood opportunities of communities that use the protected area.
- Increase awareness of value and protection of the BBRWHS.
- Develop capacities of community-based organisations (CBO's), NGO's and other associations whose existence and future prospects are linked to the BBRWHS.
- Enhance the institutional capabilities of CBO's to participate in the co-management of marine protected areas.

This project had been set up very recently. At the time of this research, proposals were being submitted and judged with the expectation that successful proposals would be implemented in April of the same year (2002). The Belize Enterprise for Sustainable Technology was aware of 17 or 18 concept notes for community based projects that had been submitted, including four submitted by communities in Dangriga and Hopkins[8] (Hargreave[9], pers. comm.). Of these 17 or 18, some had been accepted and several turned down because they didn't fulfil the criteria for

[8] The towns on the Southern coast closest to Glovers Reef
[9] Employed by World Bank as Project Advisor

COMPACT projects. The concept notes from Dangriga and Hopkins had been rejected although every effort was made to include projects from these two communities, especially Hopkins (Gibson, pers. comm.). There was concern from Hargreave that this rejection was another instance of, what he saw as, expenditure being blocked for real community based projects and "too little money getting to the right hands" (Hargreave, pers. comm.). The COMPACT programme was still active.

4.3 Opportunities and constraints of management as perceived by implementing organisations

In this section positive and negative attributes of management are those cited by the organisations described in section 4.2.3. Those perceived by members of the local community are presented in section 4.9.

4.3.1 Strengths and/or opportunities recognised by GRMR staff and other decision-making bodies

During the discussions with individuals regarding Glover's Reef, far more problems and constraints were mentioned than strengths and opportunities. Strengths of Glover's were more related to its biophysical characteristics, being a prime example of an atoll in relative untouched condition, than they were to the way it was being managed.

Despite this, a significant opportunity was seen to be its World Heritage status that many believed would increase its profile and the chances of it being adequately protected.

On a different note, staff of WCS and GRMR were also pleased with recent attempts to involve fishers in scientific research. In the Grouper tagging project (research by Ihde and Hoenig), two fishers from Hopkins (who used to fish the grouper until the season was closed) were paid to come and join the research team tagging the fish. In doing so, it was hoped that they would see for themselves how few grouper were left and that they would understand what the research team were doing and see that researchers were, amongst other things, protecting the interests of fishers. The staff at the Reserve felt that this was a small but positive step towards;

- improving relations (which were at quite a low) between fishers and, as the fishers perceived the GRMR staff, 'the government',
- increasing the participation of local stakeholders in the management of the reserve.

4.3.2 Weaknesses and/or constraints recognised by GRMR staff and other decision-making bodies

A constraint mentioned by some staff was a general lack of funds and also continuous uncertainty about funding. However, others believed that adequate funding had been provided by GEF/UNDP. In particular, whilst some stated that this had been a reason for the delay in updating the management plan, others controlling the fund indicated that the funding for this process had been available for some time and it was for other reasons that it was not acted upon. Funding was not the only problem and/or constraint recognised and the others (and problems they caused/were causing) are also shown in Table 4-3.

Table 4-3 Constraints perceived by GRMR staff and other decision-making bodies

Constraint	Some of problems caused
Lack of funding	• Lack of staff • Management plan not revised (reason for this debated)
Insufficient human resource development at FD Remoteness of Glover's atoll	• Low staff morale • High staff turnover
Lack of staff Low morale of staff	• Staff not always at reserve and fishers know this resulting in illegal fishing
No entry rules for General use Zone	• Legal over-fishing in General Use zone
Use rules in Conservation Zone unclear	• Disputes between residents and fishers • Illegal fishing
Lack of consultation (from 1993 onwards)	• Poor relations between government and fishers • Fisher disagreement with regulations • Illegal fishing
Fisher disagreement Fishers don't see benefits	• Illegal fishing • Cutting buoys
Slow response of government to legislate changes (blamed by some on lack of political will)	• Delay between management plan and establishment of Park. • Delay between agreement on boundary changes and them being gazetted Both these delays caused loss of momentum and people forgetting original agreements – complaints, loss of trust
Local advisory committee not effective	• Lack of meaningful participation of local stakeholders
User fees go to centralised fund and not earmarked for Glover's Reef	• Resident tour operators' refusal to pay fees • Sense of injustice

Illegal fishing and the limited capacity of staff to enforce regulations were seen, by staff, as the principal problems at Glover's Reef. Illegal fishing was thought to be at a level where it was having a negative impact on the resource. Whilst lack of enforcement capacity was recognised as one of the causes of illegal fishing, it was also believed that fishers' disagreement with the regulations was making enforcement that much harder and this disagreement could have been lessened by a more inclusive approach to management.

Not only was illegal fishing a problem, but several of the staff working out at the reef thought that the lack of implementation of regulations requiring acquisition of permits to enter GRMR meant that the general use zone was being "legally" over-fished.

4.4 Identification of stakeholder groups

In the other case studies, specific procedures were carried out to identify the poorest stakeholders affected by, or affecting the MPA. Individuals from these groups were then interviewed with respect to the effect the Marine Park had on their livelihoods. At GRMR the situation was different. Fishers had already been identified as the relevant stakeholder group as firstly, it was anticipated that this group would be affected by the regulations more than any other group (who were few in number) and secondly, others involved in the tourist industry that utilised Glovers reef (a relatively small number) were not considered to be in the 'poorer' sectors of Belizean society.

Efforts focused on interviewing as many fishers as possible though this proved difficult as the lobster season had just closed and fishers were hard to find. However, fishers from the southern villages of Dangriga, Placencia and Hopkins were interviewed, as were some representatives from the Northern Fishers' co-operative in Belize City. Results of these interviews are presented in subsequent sections.

4.5 Identified potential benefits and costs

The potential beneficial and non-beneficial impacts of GRMR on specifically *fishers* are outlined in Figure 4-2 and Figure 4-3 respectively. All possibilities, large or small, likely or highly unlikely are listed here. Some of the more important or relevant potential impacts became the objects of further investigation and these are discussed in the remaining sections of this appendix.

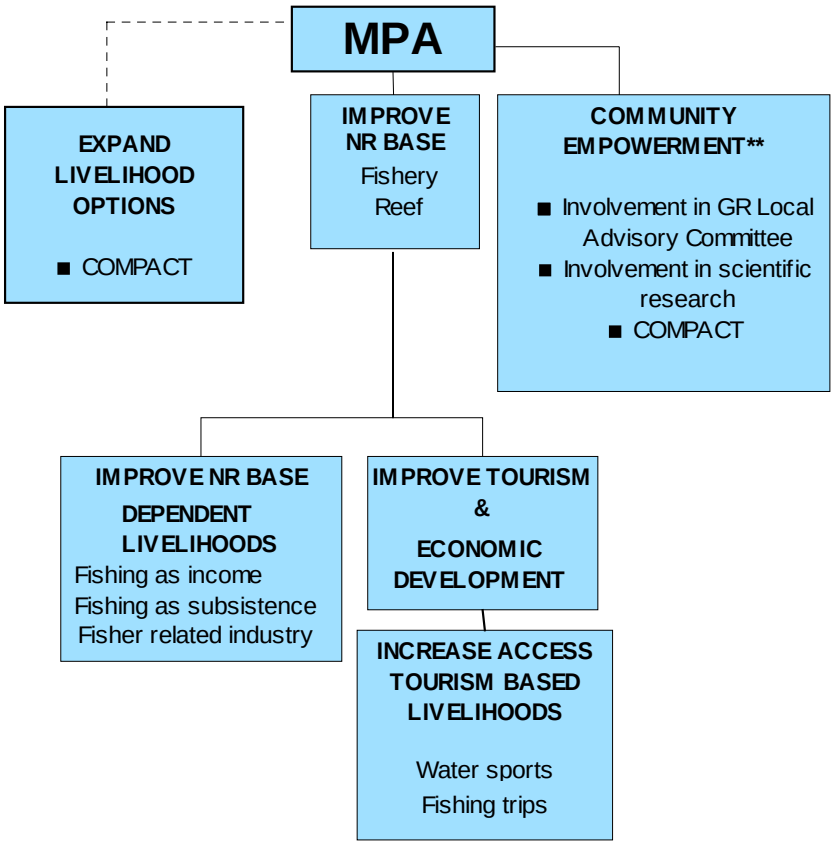

Figure 4-2 Potential beneficial impacts of GRMR management and services ([10])**

[10] Empowerment, as meant here, is concerned with capacity building of individuals and the community in order for them to have greater social awareness, to gain greater autonomy over

The line between the 'MPA' box and 'Expand livelihood Options' is dotted to denote the fact that this is not an initiative of GRMR specifically but is an opportunity that has come about as a result of Glovers Reef being part of the Belize Barrier Reef World Heritage Site.

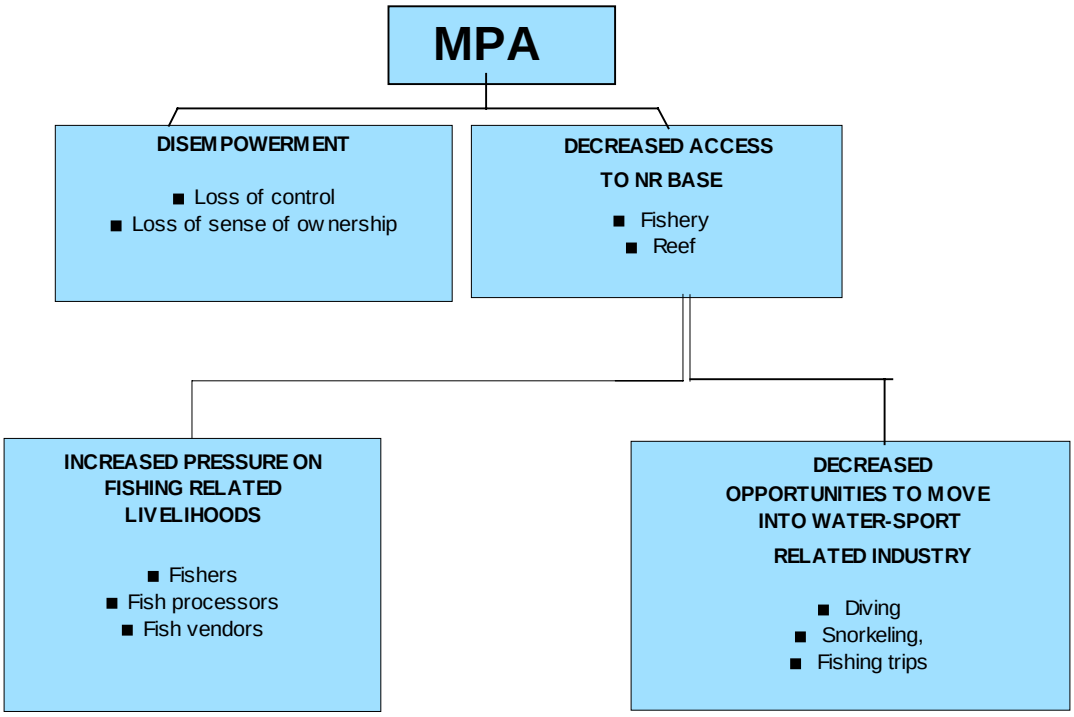

Figure 4-3 Potential non-beneficial impacts of GRMR management and services

4.6 Ecological impact of GRMR on reef and fishery

Located 45km east of the mainland coast, Glover's Reef is the most southern of Belize's three atolls. In comparison to the other atolls, Glover's Reef has been described as the best developed biologically, with the greatest diversity of reef types and in an almost pristine state due to its distance from mainland (Gibson, 1988). The atoll has an elongate rectangular shape covering an area of about 308km² (32km length and 12km width) with three major channels in the reef and there are six cayes along its southeastern rim (Bood, 2001). The atoll has a unique lagoon due to its depth (maximum of 43m) and abundant patch reefs (about 700). The GRMR encompasses the entire atoll and was established in 1993, gaining legal recognition in 1996.

Due to the fact that Middle Caye has been home to the WCS research station since 1995, GRMR has been the subject of fairly intensive research since early days of its

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decision-making, or to establish a balance in community power relations. Used here, it covers a range of issues including the following: community access to information and services, community participation, consciousness raising, business and enterprise management skills, reducing conflicts, and gaining control over the utilisation and management of coastal resources.

management and before active enforcement of the Conservation Zone/Wilderness Zone commenced in 2000. It is not surprising therefore, that this was the case study where most research had been undertaken over a long-term period. This section draws on grey- (BFD, WCS) and published literature, as well as MSc research carried out as part of the current project (see Cummings, 2002).

4.6.1 Fishery

One of the primary reasons for the establishment of GRMR was in response to increasing concern that the finfish populations (especially grouper and snapper species) had been overfished in the last decade. There was also concern for the lobster and conch populations and most of the available results from long term studies have focussed on two heavily exploited species (spiny lobster *Panulirus argus* and queen conch *Strombus gigas*).

Although GRMR was legally established in 1996, there appears to be a distinct change in the fishery after active enforcement commenced in late 1998. Prior to this date, there was no evidence that GRMR management affected the fishery. Surveys took place during 1997 and 1998 to track the changes in distribution and abundance of spiny lobster and queen conch in different zones of GRMR (Ihde and Hoenig, 2001). The results of these surveys revealed that the abundance of adult and juvenile spiny lobsters and queen conch fluctuated with the fishing season in the Conservation (no-fishing area) and General Use (fished area) zones, conch abundance increasing in all zones only during the closed season. Fluctuation of abundance with fishing season in the Conservation Zone indicated that there was no impact of the GRMR management on the lobster and conch fishery during this period. A similar study was carried out between 1996 and 1998 with quarterly population surveys of spiny lobster and queen conch in the Conservation Zone and General Use Zone (Acosta and Robertson, 2001). Results from this study also showed that the densities of lobsters and conch in the Conservation Zone were not different from the densities in the General Use Zone. Enforcement was minimal during this period (Acosta, 1998), and results suggested that poaching was widespread with up to 40% of sub-adults of spiny lobster being taken illegally during fishing seasons (Acosta, 2000).

It appears from the available literature that the fishery benefited from active enforcement by park rangers (starting in late 1998). Results from quarterly population surveys of spiny lobsters and queen conch showed that the densities of lobster and conch increased in the Conservation Zone (Acosta and Robertson, 2001). In fact, the density of adult lobsters in the Conservation Zone increased by 350% from 15/ha to over 70/ha in 2001. Biomass increased by over 700% due mainly to survival and growth of large adults in the Conservation Zone. There was a corresponding increase in density and biomass of adult conch by over 200%. This study showed a movement of adults from the Conservation to the General Use Zone, although the benefit to fishers was masked by increased fishing pressure. The growing number of fishing vessels at GRMR resulted in a major decline of exploitable lobster and conch in the General Use Zone (Acosta and Robertson, 2001).

Data from finfish surveys have generally shown an increase in abundance in the Conservation Zone. Surveys of the five most commercially valuable fish species in Belize took place in 2000 and 2001 (Acosta and Robertson, 2001). Survey data indicated that active enforcement by GRMR had benefited the fishery as three of the species (black grouper *Mycteroperca bonaci*, mutton snapper *Lutjanus analis* and hogfish *Lachnolaimus maximus*) were twice as abundant in the Conservation Zone

as in the General Use Zone (the other species Nassau grouper *Epinephelus striatus* and ol' wife *Balistes vetula* were absent from the shallow habitat in the General Use Zone during the survey period). The average sizes of fish species were also greater in the Conservation Zone. Preliminary results from a three year finfish tagging programme (which started in 2000 after active enforcement began) supported qualitative information from our interviews that there has been long term decline of groupers in Glover's lagoon as no individuals were caught in traps set in the protected and unprotected areas. On the other hand, a large number of snapper (over 1800) were caught and tagged in October 2000 and April 2001. Trap rates from April 2001 indicated that there was a positive ecological impact of GRMR on the fishery as results suggested that finfish are concentrated in and adjacent to the Conservation Zone (Ihde and Hoenig, 2001).

Although McClanahan (2001) found that the total number of fish in each zone (Conservation and General Use Zones) did not change greatly between 1998 and 2001, his results showed that some of the larger-bodied groups (snappers, grunts, angelfish, barracuda and jacks) were more abundant and increasing in the Conservation Zone. The greatest effect of closed area management was on snappers, which appeared to increase exponentially, while other increases were small. At the same time, there was no evidence that any group of fish were decreasing in the Conservation Zone (except for butterflyfish), whilst wrasses, surgeonfish, the spotlight parrotfish and angelfish were all declining in the General Use Zone, suggesting that fishers were targeting species of lower value. Another study by McClanahan (2001) supported results from the fish surveys as it was noted that the predation index on the dominant sea urchin *Echinometra viridis* showed an increase in the Conservation and decrease in the General Use Zones between 1996 and 1998. In support of the above, Cummings (2002) compared a protected site in the Conservation Zone and an unprotected site in the General Use Zone in 2001 and found that the key fish families (most abundant) had higher densities at the protected site, whilst there was also a higher abundance of commercially important fish species recorded. These observations were supported by analysis of an interview-based survey of observed changes at GRMR and results were in line with the perception of MPA users (Cummings, 2002)

4.6.2 Coral reef

In comparison to research information available on the fishery, there were fewer studies available on coral reef monitoring at GRMR. A study by McClanahan and Muthiga (1998) recorded that, similar to many Caribbean coral reefs, the patch reefs at Glover's Reef had experienced ecological disturbances during the 1980s and 1990s. Ecological disturbances (such as coral diseases, higher water temperature and hurricanes) often lead to death of corals or competition with erect algae that have increased through reduced herbivory or increased nutrient loads. At GRMR, McClanahan and Muthiga (1998) found that the patch reefs had experienced this change with algae increasing from 20% to 80% of the cover over a 25 year period. Patterns of herbivory on the seagrass *Thalassia testudinum* were also similar across the Conservation and General Use Zones prior to 1998 (McClanahan, 2001).

Benthic surveys carried out after commencement of active enforcement of GRMR in 1998 recorded a decline in sea urchin numbers in the Conservation Zone and a modest increase in all sea urchin predators (jolthead porgy, ocean and queen triggerfish and the hogfish) and also predation rates on sea urchins (McClanahan, 2001). A general decline in sea urchin predators and associated increase in sea urchin numbers occurred in the General Use Zone suggesting overfishing in this zone. At the same time, the patterns of herbivory on seagrass *T. testudinum* also

altered with significant difference between the Conservation Zone and General Use Zones since 1998. Studies of assays showed that the amount eaten in the General Use Zone declined from 20% to 7% in 1998 whereas it remained constant in the Conservation Zone at about 15-20%. In summary, patterns suggested loss of herbivory, particularly by fish, in the General Use Zone. Herbivory is more constant, and fish dominated, in the Conservation Zone (McClanahan, 2001). Interestingly, McField (1999) demonstrated that MPA status was an influential variable in her multivariate analysis to determine key environmental and management linked influences on coral reef community structure (two of the 12 sites were at GRMR).

There were a number of studies that gave conflicting evidence about whether GRMR has had a positive effect on coral reef. Studies by McClanahan *et al.* (McClanahan, 2001) suggested that the management zones had an effect on benthic component patterns. Erect fleshy algae formed the largest component of the substratum - about 45% of cover in the Conservation Zone between 1996 and 2001. However, fleshy algae was lowest in the General Use Zone in 1996 but highest in 2001, increasing from 30-50% of cover during the period. Hard coral was the second most abundant component, and was constant in the General Use Zone (17% of cover) but in steady decline in the Conservation Zone (from 27% to 10% from 1996 to 2001). These results were unexpected, as it was expected that management of the Conservation Zone would have increased herbivory, decreasing abundance fleshy algae and increasing abundance of the groups more resistant to predators (hard corals, coralline and calcareous algae). McClanahan *et al.* (2000) also carried out a year-long experimental manipulation study designed to test for effects of reef functions and processes in relation to MPAs. Results showed that there was no measurable impact of GRMR on the benthic community, however this study was confounded by two major disturbances: Hurricane Mitch and the bleaching event in 1998. Research by Cummings (2002) found that there were few notable significant differences for the main ecological indicators of live hard coral cover, algal (macro and turf) cover and urchin abundance between a protected site and unprotected site, and that protection was not having a marked effect on the substratum.

As already suggested, the above results may be affected by abiotic factors, such as cooler water and greater water flow (due to reef breaks and emerged islands) in the General Use Zone which may reduce coral mortality during periods of warm water. The average depth of the General Use Zone is also greater than that of the Conservation Zone. The impact of hurricanes has naturally played a major factor in the status of coral reef, particularly in shallow locations, and recent examples are Hurricane Mitch (October 1998) and Hurricane Iris (October 2001). Bood (2001) assessed impacts of Hurricane Iris and recorded 12.2% recent mortality and 52% mechanical damage at a forereef site (1.5-2.5m) at South West Caye, with the deeper patch reef site (12-15m) near South West Caye predictably less impacted with 4% recent mortality and 28% mechanical damage. The influence of abiotic factors and coral reef disturbance was documented by McField (2001). A temporal survey of the 12 sites along the Belize Barrier Reef Complex (BBRC) included two sites at GRMR in 1997 and 1999 (McField, 2001). Coral cover at each site declined over the two year period by 56% at Middle Caye and 53% at Spur and Groove (south east side of GRMR). However, coral cover declined at all 12 sites in this study and the decline was partially attributed to wave exposure and fluvial influence from run-off after Hurricane Mitch in 1998 (McField, 2001). There was also a massive coral bleaching event in 1998.

4.6.3 Sea grass

There was no literature available on sea grass at Glover's Reef. During research as part of the current project, Cummings (2002) studied the impact of GRMR on sea grass conditions via a semi-quantitative assessment of ecological changes at GRMR. He found that a fairly high proportion of interviewees reported an increase in seagrass cover in the General Use Zone (23%), as opposed to decrease (3%). Of those who noticed a change in abundance of fish in the seagrass areas, the majority observed an increase inside and outside the Conservation Zone.

4.6.4 Summary

There were a large number of publications about the fishery and benthic communities at GRMR and this section has presented a brief summary of the information available. The majority of long-term studies of the fishery (finfish, conch and lobster) have recorded a distinct (positive) change in abundance and size in the Conservation Zone. This change appeared only after active enforcement by GRMR rangers commenced in 1998. Studies of benthic communities gave a conflicting message, as some studies reported that the management of GRMR had had a positive impact in the Conservation Zone, with a resultant decline in sea urchins and increase in herbivores and sea urchin predators. On the other hand, other studies reported deterioration in ecological health in the Conservation Zone, although (as discussed above) these results may have been affected by recent disturbances. In a recent study to assess ecological impacts of GRMR, Cummings (2002), concluded that at least some of the observed differences between the Conservation and General Use Zones could probably be attributed to protection as the fish abundance was higher in the Conservation Zone and ecological conditions also appeared better than those of the General Use Zone. These findings were supported by the many MPA users interviewed by Cummings (2002). Studies by McClanahan (2001) and Acosta and Robertson (2001) have also supported the general conclusion that GRMR management measures are impacting positively on the ecosystem of the protected area.

4.7 Impact of GRMR on fishers

The potential beneficial or non-beneficial impacts of Glovers Reef Marine Reserve on fishers, as developed by the project team, were presented in section 4.5. These frameworks guided the project team in their discussions with fishers. This section looks at the opinions of fishers with regards the impact the reserve has had on them, and the opportunities and/or constraints it has presented. Firstly, it describes the nature and extent of fishing practices in and around the reserve.

4.7.1 Fishing practices in and around GRMR

In the 1988 draft management plan, written five years before the park became legally established, it was stated that only about ten boats used the atoll regularly. (Gibson, 1988 p.14). It was also reported that as many as 25 Honduran fishermen had been illegally exploiting the atoll, but that their numbers were reducing with the, then recent, increase in BDF patrols.

It is not clear whether the numbers of fishers has increased since this time or whether this was an underestimate as staff from WCS now reported seeing up to 20 boats (each holding up to ten people) in the general use zone at any one time (certainly during the lobster season). One fisher did say that more fishers from

Sarteneja started to come in the mid to late 90's, so this could be one explanation. Also mentioned in the draft management plan, but its significance not highlighted, was the seasonal grouper fishery at Glovers Reef, which was found to be very important to fishers from Hopkins village. Fishing practices at Glover's varied depending on where the fishers came from and the time of year. Table 4-4 shows the fishing practices of those towns nearest to Glovers Reef (Dangriga, Placencia, Hopkins) and fishers from other places who were known to fish at Glover's.

Table 4-4 Fishers and fishing practices in and around Glovers Reef

From	Major fishing areas (in order)	When at Glovers	Estimated numbers[11]	Principal Gears used	Main species
Placencia	Majority now in tourism but for remaining fishers: 1. Gladden spit 2. Point 3. Glovers (priority Jan – March)	Grouper spawning season (January – March).	• 2-4 fishers	handline	Grouper
Dangriga	1. Southwater Cay 2.Tobacco Cay 3. Glovers	Mainly only start of lobster and conch seasons	• 4 boats	Diving	Lobster and conch
Sarteneja	1. Glovers 2. Other places unknown	Lobster season (stay away from home) & some all year	• 15 sail boats • 9-10 sail boats • 7-18 boats	Diving & spear-fishing	Lobster, conch, fish such as barracuda. Some spear any fish including non food fish
Hopkins	1. Southwater Cay 2.Gladden Spit 3. Glovers	Grouper spawning season (January – March) Some at start of lobster season	• 12 fishers • 10-15 skiffs (up to 4 people a boat) • 6 skiffs	Hand-lines Diving	Finfish – snappers/groupers Lobster
Belize City Corozan	Various	Various	Small numbers	Various	Various

With the closure of the grouper spawning grounds, fishers hand-lining for grouper either no longer went to GRMR (as of 2002) or fished for snapper, barracuda and deep water fish, east of Glovers Reef. The starts of the lobster and conch seasons,

[11] In some cases different estimates were provided and both are presented here

and the grouper spawning seasons were the busiest times at Glovers. Whilst not the place most often visited by fishers in Southern Belize, Glovers Reef had long been considered one of the best fishing areas, particularly for lobster and grouper, and at certain times of year the long journey to get there (with all associated costs and risk) was deemed worthwhile. Fishers interviewed stated that the area now a conservation (no fishing) zone was considered by most fishers to be the best area *before* the park existed. However, this information conflicted with that collected during the time of preparation of the management plan. At this time, consultation showed that the most heavily fished area was in the north of the atoll. Hence the location chosen for the Conservation Zone was considered the area that would be the least disruptive to existing fishing practices.

The other fishers commonly talked about by the fishers interviewed were the Hondurans. Whilst some believed Honduran boats weren't going to Glover's as much as previously, others thought they still went there at night and were doing significant damage. Apart from the fact that they were not allowed to fish in Belizean waters, these fishers were thought to catch small fish and not adhere to the closed conch and lobster seasons, hence badly affecting the fishery. One fisher from Hopkins also believed that the Sartenejan fishers were destroying the fishery with indiscriminate spearing of finfish.

4.7.2 Impact of park management on the fishery (opinion of fishers)

Table 4-5 shows the perceptions of the fishers interviewed of the status of the fishery in Glovers, reasons for it and the impact of Reserve management. The areas of Glovers have been split into the different zones.

Table 4-5 General fisher perceptions of status of fishery

Fishing area	Status[12]	Reasons
Seasonal Closure Zone	• Used to be good • Now only small fish <2lb/fish • Big decline in numbers	• Not given • Not given • Fish not biting (two types of shoal – moving and biting)
Conservation Zone	• Best place • Improved a lot (lots of lobster, large conch) • More fin fish and lobster	• Area protected & best area in first place • Not fished • Not because of reserve – naturally sometimes high, sometimes low
Large General Use Zone	• All product gradually getting less and less • Product smaller. No improvement since MPA • Decrease in conch & lobster • Hadn't seen spill over[13]	• More fishers know about Glovers – fishing effort increased • More effort because conservation zone closed • Over-fishing

[12] Each bullet point represents a different opinion.
[13] Opinion in three separate interviews.

Fishing area	Status[12]	Reasons
Smaller General Use Zone	• Improved since park established • No spill over	• More sharks, fewer people
Overall	• Improvement at Glover's • No difference • Cant find much lobster at Glovers anymore (only conch, small fish) • Previously whole boat of fish in1 day – now 3 days to get the same	• Because Hondurans not there and *not* because of rangers • Not given • Over fishing • Over fishing

As can be seen, in general fishers perceive an increase of fish in the Conservation Zone, a decrease or no change in the larger General Use Zone, and a decrease in size and number of grouper in the Seasonal Zone. No fishers had perceived a spill over effect from the Conservation Zone into the General Use Zone.

Looking at the reasons given for these changes, positive changes were not always attributed, or exclusively attributed to Park management (instead reasons given were natural variation in numbers, loss of Honduran fishers), whilst some of the negative changes were (over fishing in General Use Zone due to closing of conservation zone area). These perceptions at the very least suggested that the fishers had yet to be convinced that park management was, or would be, of benefit to them, as discussed in the next section.

4.7.3 Impact of the marine park on fishing activities and fishers livelihoods

4.7.3.1 The Seasonal Zone

Without a doubt, those considering themselves most seriously affected by the reserve management, and the most angry about it, were the hand liners who used to fish for grouper in the seasonal zone. The reserve had tried to impose the ban in the last to previous year, but under pressure from the co-operatives the government had given in and allowed Hopkins fishers to fish there. It was therefore only in the most recent year, and at the time that we were conducting our research, that the ban had been imposed. The timing of the research may have had something to do with the vociferousness of the fishers' complaints, it being a current event. However, the fact that they had put pressure on the government to the extent that they had won their case the previous year is evidence of how important this fishery was to this group. For some, it was the only two months of the year that they fished and so the ban had stopped them fishing entirely.

The chairman of Hopkins council suggested that the fact that fishermen were poaching, using the area and not obeying regulations was evidence of how much the fishermen needed the area, as these people were generally law-abiding folk. He also mentioned that the park was not providing alternative means of raising income, nor were they finding the fishers new fishing spots to compensate for their loss. In the opinion of the Chairman, and backed up by other interviews, the majority of fishermen didn't believe that the groupers were disappearing, instead they were not 'biting'. This lack of belief in the researchers' opinion that it was the only way to save the fishery further exacerbated the situation. Even those who agreed that it had been

over-fished thought the ban should not be permanent but changed to a ban in alternate years.

4.7.3.2 Conservation zone

Because of the closure of the conservation zone, fishers were now confined to the areas either side of it (general use zone) or outside the atoll. Because of an increase in fishing boats in the general use zone (because of conservation zone or because boats had increased generally) marine product was getting less and smaller with the result that fishers were fishing longer for less. For some, this would stop them fishing at Glovers because, in their opinion, the reserve was bad for their livelihoods. Despite this, the non hand-lining fishers were less vociferous about the negative impacts than the hand-liners and there was more support for this part of the park than for the seasonal zone.

4.7.3.3 Poaching within the Park

The extent to which opinions differed on the two restricted areas may have been in part due to the fact that fishers in the seasonal zone had been more reliant on that zone than fishers had been reliant on the conservation zone and hence the impact on the seasonal zone fishers had been much greater in the different zones. Another possible explanation was that it was due, in part, to the extent to which the restrictions were enforced.

Not only did the warden and WCS staff acknowledge that poaching was a problem in the conservation zone, all the fishers also said there was considerable poaching (particularly when the wardens weren't there). At the same time, unlike other examples of malpractice, the fishers did not blame 'outsiders' but said that people from their own towns, and in some cases they themselves, poached. This openness about illegal activities suggested that the fishermen felt that poaching was, to a certain extent, legitimate in this instance, unlike, for example, fishing lobster in the closed season, which was considered very bad practice.

Illegal activities were aided by the fact that fishers at Glovers could easily tell whether the wardens were at the reserve or not because their boat would be moored at Middle Caye. At the same time fishers on the mainland could tell whether the wardens were at the reserve or not, because there boat was moored in a very visible place in Dangriga and the message would get around very quickly. A resident of the park stated that fishers started going into the reserve as soon as they saw that the rangers had gone, whilst another fisher stated that there were more fishers in the conservation zone than out of it when the wardens weren't there.

4.7.3.4 Support for the park

Park staff and WCS staff believed that the majority of fishers agreed with the Marine Reserve. When asked whether they thought the Park was a good idea, with the exception of the seasonal zone (for hand-line fishers), the majority of fishers said 'yes', supporting this view. However, their reports of poaching and apparent lack of condemnation for it was perhaps evidence that the full commitment of fishers was not there. This may have been because they were unconvinced of the benefits that regulations could bring or that, despite these benefits, the impact of full compliance would be too great. Either way it was an issue that the Reserve management would need to address.

Finally here, a common issue that the fishers raised, and not only directed at GRMR, was that they didn't have a problem with one reserve, but that their disagreement was with the fact that all their fishing places were being turned into reserves. There were several established reserves in this part of Belize but, apart from Glovers, none of them had previously been operational. However, this was changing and there was much talk and confusion between the fishers as to which areas were going to be closed and when, leading to much anger and despondency.

4.7.4 Other impacts of reserve management on fishers

In addition to the effect that the reserve had had on legal fishing activities, the way in which regulations had been put in place had left the majority of fishers spoken to feeling resentful and disempowered. Fishers felt that they had not been consulted enough, or in some cases not at all, and that regulations had been imposed on them. They in no way felt that they had any control over management or utilisation of the reserve. There is no doubt that feelings were intensified by activities that were occurring at other reserves, and these charges were not only levelled against GRMR.

Efforts had been made to provide alternatives for fishermen, especially those who fished the grouper banks; for example, several of these fishermen had been hired by GRMR to assist with data collection, and under the COMPACT project (see 4.2.3.5) training had been conducted in Hopkins in fly fishing and qualifying as dive masters. No other benefits of the park were mentioned by the fishers, either in terms of education or knowledge, or initiatives to provide alternatives or improve their livelihoods.

4.8 Importance of tourism locally and importance of GRMR to the local tourist industry

As already mentioned in the opening sections, there were very few residents at Glovers Reef itself, with the closest towns being more than 40-50 km away on the mainland in Southern Belize. Tourism was far less developed in the South than somewhere like Ambergris Caye in the North, and likewise Glover's Reef was not as important to the local industry as, say, Hol Chan Marine Reserve was to the residents of Ambergris Caye. Glovers Reef was not an attraction exclusive to Southern Belize either, with packages to Glovers being offered from all tourist centres in Belize (e.g. Belize City, Ambergris Caye) and overseas (e.g. Canada).

Placencia and, to a lesser extent, Hopkins, both had a local tourist industry but Glovers Reef was not given as one of the principle reasons for tourists coming to either place. At the time of the research, both had been badly affected by Hurricane Iris and life had not got back to normal[14].

In Hopkins, a village of between 1500-2000 people, the main activities were:

- Working on agricultural plantations
- Tourism (estimated about 15% of households)
- Fishing (estimated about 10% of households)
- Subsistence farming
- Government employment

[14] According to the chairman of the council, 50% of Hopkins residents were currently unemployed due to the destruction of the banana plantations. Placencia was still undergoing major reconstruction (pers. obs.).

Tourism was certainly on the increase (jobs as tour guides, waitresses, hostel owners were cited), whilst farming was on the decline, but Glovers Reef was, according to some, not currently that relevant to Hopkins (Chairman of Hopkins village council, pers. comm.). Tourists, mainly backpackers, came to Hopkins mainly for the local Garifuna culture, the Jaguar reserve and trips to the closer cayes inside the barrier reef. The chairman thought that those who went to Glovers didn't go through Hopkins, but instead went there as pre-paid package tourists directly from places like the USA. However a significant number of visitors to the atoll over the previous year had come from a resort in Hopkins (Janet Gibson, pers comm.) suggesting that this was not totally the case. Tour guides in Placencia did go to Glovers, mainly for sport fishing, but their numbers were not that many. There were also diving and fishing trips organised from Dangriga.

In summary, whilst tourism was still not as important as in the North, the industry was thought to be increasing, and whilst Glovers Reef was not crucial to the local tourist industry at present[15], those spoken to in Hopkins thought that places like Glovers rose the profile of Belize and made people come to Belize and also that with its new World Heritage status it might become more important in the future.

4.9 Opinions of park management as perceived by fishers and fishers' co-operatives

In section 4.7.3.4, the extent to which the fishers supported the Reserve (in the sense that they thought that it was a good idea) was discussed. Here, not the existence of the reserve itself, but the way that it was managed is described.

Fishers did not have much to say about Park management, not seeming to know what it consisted of besides patrolling and enforcing regulations. The main problem for the fishers was the lack of consultation, which has been mentioned previously. Table 4-6 shows this and some of the other fisher concerns.

Table 4-6 Constraints/weaknesses of park management

Constraint/weakness	Impact
Lack of consultation about zones (and changes to zones) and not listening to concerns of fishers	Anger and resentment, sense of disenfranchisement, means of making a living adversely affected
Tagging experiment	Frightening off the grouper
Do not provide alternative options (fishing/other)	Means of making a living adversely affected

4.10 Summary

Firstly this section summarises the ecological outcomes of management at Glover's Reef before going on to discuss the benefits, or lack of benefits it has brought fishers and the extent to which this, and the way the reserve has been managed, has affected management effectiveness.

[15] The exception being residents on the atoll itself who owned the atoll resorts and were crucially dependant on Glovers.

Primarily as a result of there being a scientific research station at the site, run by the Wildlife Conservation Society, there was more, and more longer term, scientific research on this MPA than at any of the other case studies.

The majority of long-term studies of the fishery (finfish, conch and lobster) indicated an increase in both the abundance and size of fish in the Conservation Zone. This change appeared only after active enforcement by GRMR rangers commenced in 1998. These findings were corroborated by interviews with MPA users in this and other studies. One study showed a movement of adults from the Conservation to the General Use Zone, although it was suggested that the benefit this brought fishers was masked by increased fishing pressure in this zone. In 2001, it was reported that the growing number of fishing vessels at GRMR had resulted in a major decline of exploitable lobster and conch in the General Use Zone, a fact that was corroborated by fishers during this research.

Studies of benthic communities gave a more conflicting message with some indicating that the management of GRMR had had a positive impact on reefs in the Conservation Zone whilst others indicated a deterioration in ecological health in the Conservation Zone. It was recognised that these latter results may have been influenced by recent disturbances (e.g. hurricanes).

With regards to the benefits that the reserve had brought fishers, whilst many thought the Park was a good idea (with the exception of the seasonal zone (for hand-line fishers)), none were prepared to say that they had benefited from it. Whilst they recognised an increase in fish numbers in the conservation zone, this was offset by the fact that no fishers had perceived a spillover effect from the Conservation Zone into the General Use Zone (though there was scientific evidence that it had occurred) and fishing in the General Use Zone had deteriorated as a result of increased fishing pressure. What fishers did generally seem more pleased about was that enforcement efforts had largely reduced the problem of illegal fishers from Honduras.

With the possible exception of Negril Marine Park, the necessity of the Reserve having the support of the fishers was perhaps more important here than at any of the other case studies involved in this research. Enforcement of regulations was made even more difficult by the remoteness of the atoll and the fact that the presence or absence of the wardens was so obvious that fishers could easily assess the risks to themselves of illegal fishing. For monitoring and enforcement to be truly effective, yet still cost-effective, it required that firstly fishers were committed to not breaking regulations themselves and secondly were wiling to monitor, and in some way sanction, the activities of others. This did not appear to be the case. Reports of poaching and apparent lack of condemnation for it was perhaps evidence that the full commitment of fishers was not there. This may have been for several reasons or combinations of them: that they were unconvinced of the benefits that regulations could bring; that the impact of full compliance would be too great in terms of the effect that it would have on their livelihoods; that they felt alienated or resentful of management and did not see themselves as having a role in it.

There was no doubt that this last issue was a significant one. Results suggested that the perceived non-participatory way in which regulations had been put in place had left the majority of fishers spoken to feeling resentful and disempowered. Fishers felt that they had not been consulted enough, or in some cases not at all; that regulations had been imposed on them and that no efforts had been made to compensate them for loss of earnings. All this led to a feeling that in no way had they any control over management or utilisation of the reserve. This was despite the fact that some efforts

had been made to provide alternatives for fishermen and funding for new community initiatives. These had not, as yet, altered fishers' perceptions.

Enforcement problems were also recognised as a significant constraint by Park management, though scientific evidence suggests that levels of compliance were high enough to allow significant positive changes within the Conservation Zone, a promising finding. Whilst self-enforcement amongst fishers was low, enforcement efforts were helped by the vigilance of the small community, mainly tour operators and WCS station, who lived on the atoll and who recognised that monitoring fisher activities was in their interest. With signs of improvements in the Conservation Zone came evidence of deterioration in the General Use zone. The lack of entry rules for the General Use zone was another constraint recognised by management and one that will have to be addressed. If fishers are to be won over, then they must start to perceive a benefit from collective restraint, and whilst there is over-fishing in the General Use zone this is unlikely to be realised and will perpetuate the perception that others are gaining at the fishers' expense. Again it is suggested that only when user benefits are perceived can ecological and socio-economic outcomes be mutually re-enforcing and improved.

4.11 List of respondents

The tables below detail all the people that were spoken to and whose opinion was sought during the field study research.

Table 4-7 Individual interviews with Park management and other linked organisations

Respondents	
GRMR staff[16]	1 Park Warden 1 ex-warden
WCS	Manager of WCS Station Staff member of WCS
Belize Enterprise For Sustainable Technology, Belmopan	Consultant
Friends of Laughing Bird Caye (now Friends of Nature), Placencia	Manager
Glover's Reef Local Advisory Committee members	Meetings with; • Manager of WCS Station • Belize Audobon Society, Belize City • Fisheries Department, Belize City • CZMAI, Belize City • Chairman, Hopkins Village Council • National Fishermen's Co-operative Society

Table 4-8 Interviews with fishers working in and around the Park

User group	Interview
Fishers [17]	8 interviews (individual and group) in Placencia, Hopkins and Dangriga with 12 fishers

[16] At the time of our visit, the MPA manager and one warden were absent and the biologist had just left, leaving us unable to talk to more than one staff member.

User group	Interview
Dive Guides	2 individual interviews in Dangriga

4.12 References used during case study research

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