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# **ESTABLISHING A SOCIOECONOMIC MONITORING PROGRAM FOR GLOVER'S REEF ATOLL, BELIZE**

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## Executive Summary

In an effort to strengthen the management of the Glover's Reef Marine Reserve in Belize, a socioeconomic monitoring program is being developed. Socioeconomic data should be incorporated into management planning to ensure that measures implemented are responsive to community priorities, needs and mores. Implementing such appropriate measures can thereby encourage community support for conservation. Although the Glover's Reef Marine Reserve was declared in 1993, comprehensive socioeconomic data have not been systematically collected for the site, apart from a couple of surveys in two of the communities that fish the area. Fishing is the most important activity on the Atoll, a traditional area for harvesting lobster, conch and finfish. Tourism is the second major social and economic force, which is developing rapidly with the main activities including snorkeling, scuba diving, kayaking, and sport fishing. In this study questionnaires were developed during a training workshop, and were tailored for fishermen, tour guides and households. The surveys were conducted during May, June and July 2004 in the three main communities of fishermen and tour guides that are active on Glover's Reef, namely Sarteneja, Dangriga and Hopkins. The SocMon protocol developed for the Caribbean was applied and the results provide a baseline of the socio-economic status of the Atoll against which future surveys can be compared. The information includes summaries on demographics, marine activities conducted, attitudes and perceptions, threats and problems perceived, and material style of life. Based on the results of the data analysis conducted, some preliminary recommendations for improving management can be made. By continuing this program information will be generated which should ensure that adaptive management occurs, introducing management measures that are acceptable and effective.

## 1. Introduction

Located 30 miles off the coast of Belize, Glover's Reef Atoll supports extraordinarily high biological diversity and possesses the greatest range of reef types in the Caribbean Sea (Dahl *et al.* 1974). The shallow protected waters of the Atoll's lagoon are dotted with approximately 800 patch reefs and provide nursery and feeding habitat for at least three species of sea turtles, eight species of sharks and rays, more than twenty species of aggregating reef fish, and numerous species of coral. The northeastern corner of the Atoll is the site of one of the Caribbean's largest and last remaining Nassau grouper spawning aggregations, a spectacular biological phenomenon with cultural and economic importance that is severely threatened across the Caribbean. The benthic community of coral and sponges on the western wall of Glover's Reef is among the most diverse and densely covered sites reported anywhere in the Caribbean, exhibiting 95% living cover and as many as 11 species per square meter. This elongate atoll, measuring 20 miles long and eight wide, was identified by the Comparative Investigations of Tropical Reef Ecosystems (CITRE) program as the most preferred site in the Caribbean for "long term, multi-disciplinary, multi-institutional investigation of coral reef ecosystems" (Dahl *et al.* 1974). The site has also been identified as a global and regional priority for conservation attention (Kramer & Kramer 2002).

The biological importance of Glover's Reef Atoll is matched by its social, cultural, and economic importance for Belize. While the permanent residential population of the Atoll numbers fewer than 60 people, Glovers Reef Atoll contributes significantly to a much larger non-resident economy through fisheries and tourism activities. Fishing is the most important economic activity on the Atoll, which is a traditional area for harvesting lobster, conch and finfish. The majority of fishermen are organized into co-operatives; the largest of the five active fishing co-operatives are National and Northern. Being a co-operative member has significant advantages as the co-operatives purchase, store, process and market the catch on behalf of their members, and they also provide loan facilities.

The most intensive fishing occurs during the grouper spawning season (December – January) and the opening of the lobster (15<sup>th</sup> June) and conch (1<sup>st</sup> October) seasons. The Nassau grouper spawning bank at the northeast corner of the Atoll is exploited mainly by fishermen from the village of Hopkins, using hand lines. The number of fishermen on the bank has been decreasing with the dramatic decline in numbers of spawning groupers over the last 25 years (Sala et al. 2001), and evidence suggests the abundance and diversity of large fish at Glover's Reef Atoll continue to decrease. In an effort to protect the populations of Nassau grouper, one of the most commercially valuable reef fish, eleven spawning sites including the one at Glover's Reef were closed to fishing. Furthermore a four-month closed season for the species was introduced. These protective regulations were put in place in 2003. In addition to Hopkins, fishermen from Dangriga and Sarteneja also fish the Atoll, diving for lobster and conch, and catching finfish using a variety of gear.

Tourism is a second major social and economic force on the Atoll. All the islands are privately owned, and tourism is rapidly developing. Six commercial tourism facilities are currently based on the Atoll: five small resorts and a tented camp. During 2001 the Atoll had the capacity for housing at least 80 guests. Boats from other resorts and private yachts also visit the Atoll. The main activities include snorkeling and scuba diving. Kayaking has recently developed, and there is some sport fly-fishing for bonefish (Gibson 2003).

These reefs also have important cultural and archeological significance. Glover's Reef lies on the pre-Columbian (20,000 B.C. to 1521 A.D.) trade route between Honduras and the Yucatan. Pottery shards are evidence of pre-Classic Maya (500-900 A.D.) settlements on some of the islands of the Atoll. Since then the Atoll appears to have been inhabited by Mayan peoples, shipwrecked Spanish and British sailors, and Africans shipwrecked or fleeing the colonial slave trade. More recently, Charles Darwin discussed Glover's Reef Atoll in his seminal geologic work, *Structure and Distribution of Coral Reefs* (1842) in which he correctly theorized about the processes underlying the creation of coral reefs.

The Belize Government declared the Atoll the Glover's Reef Marine Reserve under the Belize Fisheries Act in 1993. The marine reserve encompasses the entire Atoll, extending to the 100 fathom depth line, and totals an area of 35,876 hectares. The reserve has been zoned into four management areas, including a 'no take' or Conservation Zone that includes about one-fifth of the total area, the largest 'no take' area of the reserves in Belize. The Atoll was declared a World Heritage Site in 1996. Presently the Glover's Reef Marine Reserve is managed by three to four staff members of the Fisheries Department, the agency responsible for marine reserves in Belize. The Wildlife Conservation Society (WCS) has been involved in providing support for the reserve for many years, developing its first draft management plan in 1988. Over the past 10 years the Society has run a marine field station located on Middle Caye, Glover's where long-term research on the Atoll has provided information to improve the management of the protected area. WCS also hosts the marine reserve headquarters on Middle Caye, providing critical logistical support and training to the reserve staff. A 17-member group of stakeholders, the Glover's Reef Marine Reserve Advisory Committee, which is appointed by the Fisheries Administrator, is charged with assisting the management team in various aspects such as to review and revise the management plan, make recommendations on legislation, provide advice on permits, and help with enforcement, administrative matters and the development of sustainable financing mechanisms. This group is comprised of members of the fishing and tourism industries, local authorities from Dangriga and Hopkins, the NGO community, atoll landowners, WCS, and relevant government departments. Despite its protected status, Glover's Reef Atoll and the Belize Barrier Reef are threatened by human activities, including unsustainable fishing, impacts of global climate change, nutrification and high turbidity of the Atoll's lagoon due to poorly regulated development, lack of support for the marine reserve by some stakeholders, lack of alternative activities for fishermen and lack of sufficient information for conservation managers.

The failure to adequately incorporate socioeconomic information into management planning can be a great threat to long-term conservation of priority marine sites because it can allow implementation of measures that are not responsive to community priorities, needs, and mores, and can undermine community support for conservation. In recent years a general lack of support for the Glover's Reef Marine Reserve has been observed, primarily from the fishing community. Resentment by fishermen, particularly in relation to the seasonal closure of the Nassau grouper spawning grounds, but also to the Conservation Zone, has been noted. This lack of support has probably arisen due to limited community participation in the management of the reserve, lack of a strong public awareness program, poor enforcement of reserve regulations, and lack of recognition of the role that no-take zones play in increasing fish biomass in fishing grounds outside the no-take areas.

Although the Glover's Reef Marine Reserve was declared in 1993, comprehensive socio-economic data have not been systematically collected for the site, apart from a couple of surveys in two of the communities that fish the area. Establishing a socioeconomic monitoring program is one important step in addressing this weakness, by providing a mechanism for community input to the management process, and by also generating information that will improve the development of appropriate, acceptable, and effective conservation interventions. Some preliminary recommendations for improving management are made related to education and awareness, alternative livelihoods, legal concerns, reserve management, and representation and participation. A second major objective of establishing a socioeconomic monitoring program is to ensure that the potential effects, benefits, and costs of management of the marine reserve to stakeholders are fully documented and accounted for.

## 2. Three Fishing Communities

Fishermen active on Glover's Reef Atoll come mainly from three coastal communities: Sarteneja, Dangriga and Hopkins (Fig.1).



*Fig. 1: Map showing the location of Sarteneja, Dangriga, Hopkins and Glover's Reef*

### 2.1 Sarteneja

Sarteneja village has a population of approximately 1,591, comprised of 336 households with an average of 4.7 persons (CSO 2003). It is located in the Corozal District in northern Belize, on the coast of the Corozal Bay. The community was established in 1854 by the Mexican and Mayan peoples fleeing persecution by the Spaniards in Mexico, and the primary language remains Spanish. Initially Sartenejans sold fuel wood and were involved in agriculture, but these

activities declined and they turned to fishing in the mid 1950s (Pantin *et al.* 2004). At first they used traps and lines, but then engaged primarily in diving for conch and lobster. Today, fishing is the major economic activity and the village has one third of the total population of commercial fishermen in Belize ( Programme for Belize 2003). Sarteneja fishers travel long distances to their fishing grounds, which include areas along the entire coast of Belize. They work in groups at various sites, including Glover's Reef, with older fishers diving in shallower waters while younger ones dive the deeper areas (Palacio 2002). Garaway & Esteban (2002) indicated that Glovers Reef was the major fishing area for Sarteneja fishermen and the main species targeted were lobster, conch and finfish.

The heavy dependence of villagers on fishing is due to several environmental and socioeconomic constraints such as geographic remoteness, availability of few choices for employment, limited education, lack of access to financial capital, language, and access to land (Pantin *et al.* 2004). The tourism industry is very underdeveloped at this site, with few tourist facilities located in the village. Due to this dependence and lack of alternatives, Sarteneja villagers are most at risk of losing their fishing livelihood (Palacio 2002).

A recent boat census (Grant 2004) indicates that eight boats from Sarteneja presently fish at Glover's Reef. They are all sail boats, with supplemental power from outboard or inboard engines. The boats range in size from 21 to 38 ft, and carry 7 to 14 dories each. The fishermen free dive using hook sticks for catching lobster, collecting conch by hand, and using Hawaiian slings and spear guns to spear fish.

Grant (2004) also describes the fishing operations of the Sarteneja fishermen. The sailboats return to Sarteneja for major repairs usually twice during the year: just before the opening of the lobster season (15<sup>th</sup> June) and when catches are low. During the rest of the year, their boats are stationed in Belize City when they return from sea, and the fishers commute to Sarteneja by bus. Trips to the atoll usually last eight days, followed by four to five days of rest.

## **2.2 Dangriga**

Dangriga is the largest town in the Stann Creek District and is located in the centre of the mainland coast, at the mouth of the North Stann Creek River. The town has a population of 8,814, with 2,100 households with an average size of four persons (CSO 2003). This coastal community has experienced a faster rate of population growth since 1990 than Sarteneja, possibly due to the greater growth of tourism in the area (Palacio 2002).

The main economic activities of the area include agriculture, particularly the citrus and banana industries, aquaculture, fishing, tourism and commerce, including the activities related to the port at Commerce Bight, located just south of the town (Dangriga Town Council 2004). The main ethnic groups are the Garifuna (it is the largest Garifuna community in Belize) and Creole.

Glover's Reef is the third most important area for Dangriga fishers, with the Southwater Caye and Tobacco Caye areas the other most important fishing grounds (Garaway & Esteban 2002). According to Grant (2004), only two boats from Dangriga are currently active at Glover's Reef. These are skiffs of 23 ft, one with two crew members and the other with three crew members. The Dangriga fishers use mainly hand lines (drop and set lines) and hook sticks, used for catching finfish and lobster, respectively.



(photo: Sandra Grant)

*Fig. 2: Belize City – Sarteneja sail boat in background with dories stacked on deck*

### 2.3 Hopkins

Hopkins is a village of 994 persons, with 197 households of an average size of five (CSO 2003), located a few miles south of Dangriga and on one of the few mainland beaches in Belize. It is a Garifuna community and fishing has been a part of the subsistence tradition of the people (Perez 2003; Pantin 2004). Fishing is carried out on a small-scale basis to meet daily needs rather than as a major business (Pantin 2004). Other economic activities include working in agricultural plantations, subsistence farming and government employment (Garaway & Esteban 2002). Tourism is also now well established and growing, and coupled with the remittances from the many community members now residing in the USA, Hopkins is probably less reliant on fishing than Sarteneja.

Following Southwater Caye and Gladden Spit, Glover's Reef is also the third most important fishing area for fishers from Hopkins, who have traditionally fished the Nassau grouper aggregation site on the northeastern point of the atoll during the spawning season (Garaway & Esteban 2002). Twelve boats from the village fish at Glover's Reef (Grant 2004). These are skiffs, powered by outboard engines and ranging in size from 20 to 26 ft. Several of the skiffs also carry one or two dories, and have two to four crew members. The Hopkins fishers use a range of gear: hand line, spear gun, hook stick and rod and reel. They usually remain two to three nights at sea.



(photo: Sandra Grant)

*Fig 3: Skiff on beach in Hopkins*

## 3. Methods

The methods used in the study generally followed the protocol described in the manual *Socioeconomic Monitoring Guidelines for Coastal Managers in the Caribbean: SOCMON Caribbean* (Bunce & Pomeroy 2003) and the *GCRMN Socioeconomic Manual for Coral Reef Management* (Bunce *et al.* 2000). These included carrying out document analysis, holding discussions with key persons in each community, and conducting surveys of fishermen, tour guides and households in the three chosen communities.

To start the process, Dr. Robert Pomeroy held a two-day training workshop in the SOCMON methodology. The training was based on the SocMon guidelines for the Caribbean and covered data



collection and analysis. A draft questionnaire targeting Glover's Reef fishermen was developed by the participants as a practical exercise during the workshop. As several institutions in Belize were interested in conducting socioeconomic surveys, the training was offered to several NGOs and government agencies, in addition to members of the survey team for the Glover's Reef study. Participants included representatives from the Coastal Zone Management Authority & Institute, Hol Chan Marine Reserve, Green Reef, Belize Audubon Society and University of Belize.

Two members of the Wildlife Conservation Society's (WCS) marine program staff, Dr. Robert Pomeroy, and a student intern from the University of Belize (UB) formed the survey team. The team refined the draft questionnaire for fishermen in Sarteneja, Dangriga and Hopkins and also used it as the basis for developing the questionnaires for tour guides and households in Dangriga and Hopkins (Note that tour guides and households were not surveyed in Sarteneja as tourism is not yet developed in this community and fishermen spend most of their time away from the community, docking their boats in Belize City.) Samples of the questionnaires are included in Appendix 1.

The team then visited the three communities and met with key informants to explain the purpose of the socioeconomic survey and to gather information which would help ensure that the interviews were conducted successfully. In Hopkins the team members met with the Village Council Chairman and an experienced fisherman. In Dangriga they met with several Town Councilors, a major hotelier, and an experienced fisherman. In Sarteneja the group held discussions with the Village Council Chairman, a former fisherman who is now the manager of a guest house, the manager of a locally-based NGO, and several fishermen.

Documents providing secondary data were collected and reviewed. Many of these provided background information on the three coastal communities, and included papers on population statistics, previous surveys conducted and community assessments. These documents are listed in the references section.

The UB student intern conducted the interviews during May, June and July 2004. As many of the persons interviewed in Sarteneja were more comfortable speaking Spanish, she was accompanied by a local fisherman who acted as translator. During the surveys in Dangriga and Hopkins, she was also accompanied by a fellow UB student who has lived in both these communities.

An effort was made to interview at least 10% of the total target population. Twenty fishermen who fish at Glover's were interviewed in Sarteneja. In Dangriga eight fishermen, seven tour guides who operate at Glover's Reef, and 10 households were interviewed. Fifteen Glover's Reef fishermen, 10 tour guides and 11 households were interviewed in Hopkins.



*Fig. 4: Discussing survey with the Village Council Chairman in Sarteneja*

The questions in the questionnaires were coded and the data entered in an Excel spreadsheet. Using the various spreadsheets, the data were then analyzed and the results are presented below.

## **4. Results**

### **4.1 Fishermen Interviews in Dangriga, Hopkins and Sarteneja**

#### **4.1.1 Demographics**

Random interviews were held with captains and crew of fishing boats in Dangriga, Hopkins and Sarteneja. In Dangriga, eight interviews were conducted including seven captains and one crew. In Hopkins, fifteen interviews were conducted including ten captains and five crew. In Sarteneja, twenty interviews were conducted including eight captains and 12 crew. All those interviewed were males.

In Dangriga, the average age of respondents was 40, with half of the eight respondents having a primary education and half having a secondary education. The average household size was five people. Half of the respondents reported that fishing was their primary occupation, two reported water taxi as their primary occupation, and one each reported tour guide and owner of a hardware store. Four respondents reported that fishing was their secondary occupation, and one each reported tour guide and mason. Five of the eight respondents reported that other family members were involved in income-generating activities. In all cases, this was the spouse. Two spouses were reported to be entrepreneurs, two were teachers, and one was in tourism. No fisherman reported that any females in the household were involved in fishing.

In Hopkins, the average age of respondents was 28, with 11 of the fifteen respondents having a primary education, three having a secondary education, and one having a tertiary education. The average household size was six people. Fourteen of the fifteen respondents reported that fishing was their primary occupation. One respondent reported park ranger being their primary occupation. Six respondents reported having secondary occupations that included fishing, tour guide, farming, mason, bartender, and mechanic. Five of the respondents reported that other family members were involved in income-generating activities. Three were spouses, one was a child, and one was another relative. Three worked in tourism, one as a teacher, and one as a fisheries ranger. No fisherman reported that any females in the household were involved in fishing.

In Sarteneja, the average age of respondents was 34, with 19 of the 20 respondents having a primary level education and one having a secondary level education. The average household size was five people. All respondents reported that fishing was their primary occupation. Seven respondents reported having a secondary occupation with two being tour guides and one each doing farming, carpentry, fixing appliances, bar owner, and singer. Eight of the fishermen reported that other family members were involved in income-generating activities. Three were parents, two were children, two were a sibling, and one was another relative. Five of these family members were entrepreneurs, two were fishermen, and one was in tourism. No fisherman reported that any females in the household were involved in fishing.

#### **4.1.2 Coastal and Marine Activities**

The majority of Dangriga respondents had fished at Glover's Reef for more than eight years and received more than 50 % of their annual catch from the area. The majority of respondents (75%) reported taking an average of 20 trips per year to Glover's Reef, with an average fishing trip of four days. The fishermen used primarily fishing lines and fishing rods, with one fisherman using a speargun, to target primarily finfish including snappers, kingfish, barracudas, marlin, tuna and wahoo. Boats had an average of three crew members. Only one respondent sold 100% of the fish to a cooperative, while two sold 100% of the

catch to hotels, three sold their fish primarily in local markets, and two kept 100% of the fish for their own use.

The respondents in Dangriga felt that the condition of fisheries resources at Glover's Reef had got worse in the last five years (Table 1). This was reportedly due to overfishing, more fishermen in the area, the marine reserve being established, and hurricanes. The majority of the fishermen (75%) felt that fishermen could work together to solve a problem in the fishery. All the fishermen felt that there should be co-management with government. The majority of the respondents (75%) would support Glover's Reef being managed in partnership between government and another group such as an NGO or fishing cooperative.

*Table 1. Condition of fisheries resources at Glover's Reef five years ago and today, Dangriga.*

<b>Condition</b>	<b>No. of respondents – five years ago</b>	<b>No. of respondents – today</b>
Very good	4	-
Good	2	2
Not good	-	2
Not bad	-	2
Bad	-	1
Very bad	-	1

The majority of Hopkins respondents had fished at Glover's Reef for more than ten years and received an average of 50 % of their annual catch from the area. The majority of respondents (60%) reported taking an average of 26 to 50 trips per year to Glover's Reef, with an average fishing trip of four days. The fishermen primarily dived using hook stick and spear gun, to target lobster, conch and reef fish. Several fishermen also used fishing lines and fishing rods, with some using multiple fishing gears, to target a more varied number of fish species including snappers, kingfish, and barracuda. Boats had an average of three crew members. The majority of respondents (8 of 15) sold their catch primarily to a fishing cooperative. Two sold their catch primarily to hotels, three primarily to local markets, and two primarily for their own use.

The respondents in Hopkins felt that the condition of fisheries resources at Glover's Reef had worsened in the last five years (Table 2). This was reportedly due to climate change, the marine reserve being established, and research. The majority of the fishermen (93%) felt that fishermen could work together to solve a problem in the fishery. Fourteen of the 15 fishermen felt that there should be co-management with government, while one stated that fishermen alone should solve problems. The majority of the respondents (54%) would support Glover's Reef being managed in partnership between government and another group such as an NGO or fishing cooperative, with 13% reporting don't know.

*Table 2. Condition of fisheries resources at Glover's Reef five years ago and today, Hopkins*

<b>Condition</b>	<b>No. of respondents – five years ago</b>	<b>No. of respondents – today</b>
Very good	3	1
Good	8	7
Not good	1	4
Not bad	2	1
Bad	0	2
Very bad	0	0
Don't know	1	-

The majority of Sarteneja respondents had fished at Glover's Reef for more than ten years and 85% of the respondents received 76 to 100% of their annual catch from the area. The majority of respondents (60%)

reported taking an average of 10 to 25 trips per year to Glover's Reef, with an average fishing trip of eight days. The fishermen primarily dived using spear gun and hook stick, to target lobster and conch, and secondarily finfish such as hogfish, grouper, snapper and rockfish. Boats had an average of nine crew members. All the respondents (20) sold their catch primarily to a fishing cooperative, although two respondents sold part of their catch to local markets.

The respondents in Sarteneja felt that the condition of fisheries resources at Glover's Reef had declined in the last five years (Table 3). This was overwhelmingly reportedly due to the marine reserve being established, although other causes include hurricanes, more fishermen and illegal fishing. All the fishermen felt that fishermen could work together to solve a problem in the fishery. Nineteen of the 20 fishermen felt that there should be co-management with government, while one fisherman reported that fishermen alone could solve problems. The majority of the respondents (60%) would not support Glover's Reef being managed in partnership between government and another group such as an NGO or fishing cooperative. Only five of the 20 respondents would support such a partnership.

*Table 3. Condition of fisheries resources at Glover's Reef five years ago and today, Sarteneja*

<b>Condition</b>	<b>No. of respondents –five years ago</b>	<b>No. of respondents – today</b>
Very good	8	0
Good	11	1
Not good	0	2
Not bad	1	4
Bad	0	7
Very bad	0	6

#### **4.1.3 Attitudes and Perceptions**

All the respondents in Dangriga were aware that Glover's Reef is a marine reserve and seven of the eight respondents that there are management zones. All of the respondents in Hopkins were aware that Glover's Reef is a marine reserve and 14 of the 15 respondents that there are management zones. All of the respondents in Sarteneja were aware that Glover's Reef is a marine reserve and that there are management zones.

The majority of respondents from Dangriga and Hopkins reported that they were familiar with rules and regulations for commercial fishing, sport fishing, mangrove use, resort development, and tourism snorkeling/diving (Table 4). The majority of Sarteneja respondents reported being familiar with rules and regulations for commercial and sport fishing and mangrove use, but not with resort development and tourism snorkeling/diving, as they are not involved with these activities (Table 4).

*Table 4. Familiarity with rules and regulations at Glover's Reef (percent familiar)*

<b>Regulations on:</b>	<b>Dangriga</b>	<b>Hopkins</b>	<b>Sarteneja</b>
Commercial fishing	100	93	95
Sport fishing	75	67	60
Mangrove use	88	60	65
Resort development	75	60	25
Tourism snorkeling/diving	88	53	45

Three of the respondents in Dangriga and seven in Hopkins belonged to the Northern fishing cooperative. In Sarteneja, 17 respondents belonged to a fishing cooperative; eight were members of National fishing cooperative and nine of Northern fishing cooperative.

In Dangriga, of three respondents to the question, only one felt that the fishing cooperative represented them well on the Glover's Reef advisory committee. In Hopkins, of seven respondents to the question, one reported being well represented and four poorly represented on the Glover's Reef advisory committee. In Sarteneja, of 18 respondents to the question, seven reported being very well or well represented, while seven reported being poorly represented on the Glover's Reef advisory committee by their cooperative.

In Dangriga, no respondent was a member of another organization in the village. In Hopkins, two respondents were members of the tour guide association and one the village council. In Sarteneja, no respondent was a member of another organization in the village.

Half of the respondents in Dangriga stated that they were willing to change to another occupation if it provided equal or more income than the fishing occupation. One respondent preferred to be a tour guide and three other respondents preferred an unspecified other occupation. Five of the respondents in Dangriga stated that they would chose an occupation for their children. Two preferred education for their children, two preferred cooperative jobs, and one preferred tourism.

Eighty percent (12) of the respondents in Hopkins stated that they were willing to change to another occupation if it provided equal or more income than the fishing occupation. Six respondents preferred to be a tour guide, one a sport fishing guide, one in aquaculture, and two other respondents preferred an unspecified other occupation. Four of the respondents in Hopkins stated that they would chose an occupation for their children. One respondent each chose education for their children, doctor, trade school, and tourism.

Sixty percent (12) of the respondents in Sarteneja stated that they were willing to change to another occupation if it provided equal or more income than the fishing occupation. Five respondents preferred to be a tour guide and seven other respondents preferred an unspecified other occupation. Eighteen of the respondents in Sarteneja stated that they would chose an occupation for their children. Fourteen preferred education for their children, four preferred tourism, and one preferred cooperative job.

The respondents were asked to indicate their degree of agreement with a series of statements concerning marine resources, marine resource management and tourism:

- a) the marine reserve is important for protecting the atoll's coral reef system (reserve)
- b) the conservation zone is helping to sustain fisheries (zone)
- c) more area should be opened to fishing in the marine reserve (area)
- d) penalties for illegal fishing should be increased (increasepenalties)
- e) mangroves should be protected at Glover's Reef (mangroves)
- f) enforcement of the reserve regulations is adequate (enforcement)
- g) participation in management decisions about Glover's Reef marine reserve is important to you (participation)
- h) the closure of the NE point spawning aggregation site is a good management measure (aggregation)
- i) most fishermen respect the marine reserve regulations (respectreserve)

The responses for Dangriga are presented in Table 5. There was agreement by the majority for the marine reserve, conservation zones, increasing penalties, protecting mangroves, and participation in management.

*Table 5. Degree of Agreement with Statements, Dangriga*

Topics	Strongly disagree		Disagree		Neutral		Agree		Strongly Agree		Don't know	
	#	%	#	%	#	%	#	%	#	%	#	%
Reserve	-	-	1	12.5	2	25	-	-	5	62.5	-	-
Zones	-	-	1	12.5	1	12.5	1	12.5	4	50	-	-
Increase Marine Reserve	1	12.5	1	12.5	2	25	1	12.5	2	25	1	12.5
Increase penalties	1	12.5	1	12.5	3	37.5	2	25	1	12.5	-	-
Mangrove	-	-	-	-	-	-	4	50	4	50	-	-
Enforcement	1	12.5	1	12.5	4	50	1	12.5	1	12.5	-	-
Mgmt. Participation	-	-	-	-	4	50	3	37.5	1	12.5	-	-
Close NE point	3	37.5	-	-	-	-	3	37.5	2	-	-	-
Respect of Reserve	3	37.5	1	12.5	1	12.5	2	25	1	12.5	-	-

The responses for Hopkins are presented in Table 6. There was agreement for the marine reserve, conservation zones, opening more area of the marine reserve for fishing, increasing penalties, protecting mangroves, participation in management, and respect for regulations.

*Table 6. Degree of agreement with statements, Hopkins*

Topics	Strongly disagree		Disagree		Neutral		Agree		Strongly Agree		Don't know	
	#	%	#	%	#	%	#	%	#	%	#	%
Reserve	-	-	-	-	-	-	8	53.3	7	46.7	-	-
Zones	-	-	1	6.7	-	-	7	46.7	7	46.7	-	-
Increase Marine Reserve	2	13.3	2	13.3	2	13.3	6	40	3	20	-	-
Increase penalties	3	20	1	6.7	2	13.3	6	40	2	13.3	1	6.7
Mangrove	-	-	-	-	1	6.7	5	33.3	9	60	-	-
Enforcement	3	20	1	6.7	8	53.3	2	13.3	1	6.7	-	-
Mgmt. Participation	-	-	1	6.7	6	40	7	46.7	1	6.7	-	-
Close NE point	3	20	5	33.3	3	20	3	20	1	6.7	-	-
Respect of Reserve	1	6.7	1	6.7	2	13.3	10	66.7	1	6.7	-	-

The responses for Sarteneja are presented in Table 7. There was agreement for the marine reserve, opening more area of the marine reserve for fishing, protecting mangroves, and participation in management. There was weaker agreement for the conservation zones.

*Table 7. Degree of agreement with statements, Sarteneja*

Topics	Strongly disagree		Disagree		Neutral		Agree		Strongly Agree		Don't know	
	#	%	#	%	#	%	#	%	#	%	#	%
Reserve	-	-	4	20	2	10	8	40	5	25	1	5
Zones	3	15	6	30	1	5	8	40	2	10	-	-
Increase Marine Reserve	-	-	-	-	1	5	19	95	-	-	-	-
Increase penalties	7	35	5	25	2	10	3	15	3	15	-	-
Mangrove	1	5	3	15	5	25	11	55	-	-	-	-
Enforcement	9	45	5	25	3	15	3	15	-	-	-	-
Mgmt. Participation	-	-	-	-	-	-	20	100	-	-	-	-
Close NE point	16	80	1	5	-	-	2	10	1	5	-	-
Respect of Reserve	11	55	1	5	4	20	4	20	-	-	-	-

#### 4.1.4 Threats and Problems

Respondents were asked to state the top three major problems for the marine resources at Glover's Reef. The primary problems reported by respondents in Dangriga were illegal fishing, overfishing, and area too large to patrol (Table 8). The primary problems reported by respondents in Hopkins were illegal fishing, area too large to patrol, oil well, and human resources (lack of people and training) (Table 9). The primary problems reported by respondents in Sarteneja were caye owners fish in reserve, fisheries staff is biased, overfishing, illegal fishing, and area too large to patrol (Table 10).

*Table 8. Major problems for Glover's Reef marine resources, Dangriga*

Problems	Primary Problems		Secondary Problems *4 responded to this question		Tertiary Problems * only 1 responded to this question	
	#	%	#	%	#	%
Illegal fishing	3	37.5	1	12.5	-	-
Fisheries staff biased	-	-	-	-	1	100
Area too large to patrol	-	-	2	25	-	-
Overfishing	2	25	-	-	-	-
Improper disposal of conch shells	1	12.5	-	-	-	-
Lack of trained human resources	1	12.5	1	12.5	-	-
Don't know	1	12.5	-	-	-	-

*Table 9. Major problems for Glover's Reef marine resources, Hopkins*

Problems	Primary Problems		Secondary Problems *13 responded to this question		Tertiary Problems * only 3 responded to this question	
	#	%	#	%	#	%
Illegal fishing	4	57	-	-	1	14
Fisheries staff biased	-	-	1	12.5	-	-
Caye owners fish in reserve	-	-	-	-	-	-
Area too large to patrol	2	28	1	12.5	1	14
Overfishing	1	14	-	-	-	-
Oil well	-	-	2	25	1	14
Human resources (lack of people and training)	-	-	2	25	1	14
Too much research	-	-	-	-	1	14
Park fees not registered	-	-	1	12.5	1	14
Sarteneja fishermen	-	-	1	12.5	-	-
Rangers dive and sell products from reserve	-	-	-	-	1	14

Table 10. Major problems for Glover's Reef marine resources, Sarteneja

Problems	Primary Problems		Secondary Problems *13 responded to this question		Tertiary Problems * only 3 responded to this question	
	#	%	#	%	#	%
Illegal fishing	3	15	1	7.7	-	-
Fisheries staff biased	4	20	6	46.2	1	33.3
Caye owners fish in reserve	6	30	3	23.1	1	33.3
Area too large to patrol	2	10	2	15.4	-	-
Overfishing	5	25	1	7.7	1	33.3

The respondents were asked to state the possible solutions to these problems. In Dangriga, the solutions included enforce laws, have more patrols, and more rangers (Table 11). In Hopkins, the solutions included increasing fishing area, having more patrols, new marker buoys, and enforcing laws (Table 12). In Sarteneja, the solutions included increasing fishing areas, enforcing laws, no special licenses, more patrols, more rangers, and change rangers (Table 13).

Table 11. Solutions to the problems at Glover's Reef, Dangriga

Solutions	Primary Solution		Secondary Solution *4 responded to this question		Tertiary Solution * only 1 responded to this question	
	#	%	#	%	#	%
More patrols	2	25	1	12.5	-	-
Enforce laws	3	37.5	1	12.5	-	-
More rangers needed	1	12.5	1	12.5	1	100
Don't know	2	25	1	12.5	-	-

Table 12. Solutions to the problems at Glover's Reef, Hopkins

Solutions	Primary Solution		Secondary Solution *11 responded to this question		Tertiary Solution * only 4 responded to this question	
	#	%	#	%	#	%
More patrols	1	12.5	3	33	-	-
Investigate laws	-	-	-	-	-	-
No special licenses	-	-	1	11	-	-
Owners fish in General Use Zone	-	-	-	-	-	-
Enforce laws	1	12.5	1	11	-	-
Increase fishing area	3	37.5	-	-	-	-
Change rangers	-	-	-	-	-	-
More rangers needed	-	-	1	11	-	-
New marker buoys	-	-	1	11	-	-
Stop drilling	1	12.5	-	-	-	-
Stop doing so much research	1	12.5	-	-	-	-
Give caye owners power to be rangers	-	-	1	11	1	100
Don't know	1	12.5	1	11	-	-



Table 13. Solutions to the problems at Glover's Reef, Sarteneja

Solutions	Primary Solution		Secondary Solution *11 responded to this question		Tertiary Solution * only 4 responded to this question	
	#	%	#	%	#	%
More patrols	3	15	1	9.1	-	-
Investigate laws	1	5	1	9.1	1	25
No special licenses	3	15	2	18.2	-	-
Owners fish in General Use Zone	-	-	-	-	1	25
Enforce laws	4	20	-	-	1	25
Increase fishing area	5	25	1	9.1	1	25
Change rangers	1	5	5	45.5	-	-
More rangers needed	2	10	1	9.1	-	-
Don't know	1	5	-	-	-	-

#### 4.1.5 Material Style of Life

As a proxy of the measure of wealth of respondents, the respondents were asked to answer a number of questions concerning their household assets and construction materials of the house. The results indicate that more respondents in Hopkins own their house (87%) and lot (93%) than those in Dangriga and Sarteneja (Tables 14, 15 and 16). Respondents in Dangriga own more other household assets, such as stereos, telephones and refrigerators, than respondents in Hopkins and Sarteneja.

Table 14. Household assets of respondents, Dangriga

Assets	YES		NO	
	#	%	#	%
Farmland	1	12.5	7	87.5
House lot	6	75	2	25
Own house	5	62.5	3	37.5
Skiff	5	62.5	3	37.5
Outboard engine	7	87.5	1	12.5
Vehicle	4	50	4	50
Bicycle	5	62.5	3	37.5
Washer	6	75	2	25
VCR	6	75	2	25
Phone	7	87.5	1	12.5
TV	8	100	0	-
Stereo	8	100	0	-
Refrigerator	8	100	0	-
Stove	8	100	0	-

Table 15. Household assets of respondents, Hopkins

Assets	YES		NO	
	#	%	#	%
Farmland	4	26.7	11	73.3
House lot	14	93.3	1	6.7
Own house	13	86.7	2	13.3

Skiff	11	73.3	4	26.7
Outboard engine	13	86.7	2	13.3
Vehicle	6	40	9	60
Bicycle	13	86.7	2	13.3
Washer	11	73.3	4	26.7
VCR	9	60	6	40
Phone	11	73.3	4	26.7
TV	15	100	-	-
Stereo	13	86.7	2	13.3
Refrigerator	11	73.3	4	26.7
Stove	14	93.3	1	6.7

*Table 16. Household assets of respondents, Sarteneja*

Assets	YES		NO	
	#	%	#	%
Farmland	6	30	14	70
House lot	14	70	6	30
Own house	12	60	8	40
Sailboat	6	30	14	70
Skiff	3	15	17	85
Outboard engine	7	35	13	65
Canoe	20	100	-	-
Vehicle	2	10	18	90
Bicycle	20	100	-	-
Washer	20	100	-	-
VCR	13	65	7	35
Phone	12	60	8	40
TV *only 19 responded	18	94.7	1	5.3
Stereo	20	100	-	-
Refrigerator	16	80	4	40
Stove	20	100	-	-

The quality of housing of Sarteneja respondents (Tables 25, 26, 27 and 28) was slightly higher than the respondents in Dangriga (Tables 17, 18, 19 and 20) and Hopkins (21, 22, 23 and 24) with more respondents having concrete walls and floors. Poorer quality houses of palmetto with thatch roofs, however, were recorded only in Sarteneja.

*Table 17. Type of roof material, Dangriga*

Roof type	#of respondents	% of respondents
Zinc	5	62.5
Cement	3	37.5

*Table 18. Type of wall material, Dangriga*

Wall type	#of respondents	% of respondents
Wood	2	25
Cement	6	75

Table 19. Type of window material, Dangriga

Window type	#of respondents	% of respondents
Wooden	1	12.5
Metal	4	50
Glass	3	37.5

Table 20. Type of floor material, Dangriga

Floor type	#of respondents	% of respondents
Cement	7	87.5
Wood	1	12.5

Table 21. Type of roof material, Hopkins

Roof type	#of respondents	% of respondents
Thatch	-	-
Zinc	1	6.7
Cement	14	93.3

Table 22. Type of wall material, Hopkins

Wall type	#of respondents	% of respondents
Palmetto	-	-
Plywood	-	-
Wood	8	53.3
Cement	7	46.7

Table 23. Type of window material, Hopkins

Window type	#of respondents	% of respondents
Wooden	7	46.7
Metal	5	33.3
Glass	3	20

Table 24. Type of floor material, Hopkins

Floor type	#of respondents	% of respondents
Dirt	-	-
Cement	5	33.3
Wood	6	40
Tile	4	26.7

Table 25. Type of roof material, Sarteneja

Roof type	#of respondents	% of respondents
Thatch	3	15
Zinc	17	85
Cement	-	-

Table 26. Type of wall material, Sarteneja

Wall type	#of respondents	% of respondents
Palmetto	3	15
Plywood	-	-
Wood	-	-
Cement	17	85

Table 27. Type of window material, Sarteneja

Window type	#of respondents	% of respondents
Wooden	12	60
Metal	4	20
Glass	4	20

Table 28. Type of floor material, Sarteneja

Floor type	#of respondents	% of respondents
Dirt	-	-
Cement	18	90
Wood	-	-
Tile	2	10

## 4.2 Household Interviews in Dangriga and Hopkins

### 4.2.1 Demographics

Ten random household interviews were conducted in Dangriga and 11 in Hopkins. In Dangriga nine respondents were male and one was female; in Hopkins 10 were male and one was female. The average age of the 21 respondents was 34, with over half having only a primary school education. Only two of the 21 respondents had tertiary level education. The average household size of the respondents was 4.5 members.

Fishing and tourguiding were the primary occupations of the respondents in both Dangriga and Hopkins (Table 1). Additional primary occupations of respondents included teaching, park ranger, construction worker, water taxi operator, and hotel worker. Four of the respondents in Dangriga reported having a secondary occupation including two as farmers, one as fishing, and one as selling barbeque. No respondent in Hopkins reported having a secondary occupation.

Table 1. Primary occupation of respondents

Primary occupation	No. of respondents - Hopkins	No. of respondents - Dangriga
Tourguide	4	4
Fishing	4	3
Teaching	1	1
Ranger	1	-
Construction worker	1	-
Water taxi operator	-	1
Hotel worker	-	1

In Dangriga, one respondent reported having a woman in the household involved in fishing. This woman was a fish seller. The respondents in Hopkins reported no women in the household involved in fishing.

#### 4.2.2 Coastal and Marine Activities

All 21 respondents reported that fish caught by household members at Glover's Reef was used for home consumption. In Dangriga, all ten respondents had themselves or a family member who had visited Glovers Reef, while in Hopkins, eight of 11 respondents have visited Glover's Reef.

In Dangriga, seven of ten respondents reported that they think that people in their community can work together to solve a problem in the fishing or tourism industries (co-management); while nine of 11 respondents reported that people can work together in Hopkins. In Dangriga, all the respondents reported that both the government and the people should work together to solve a problem in the fishing or tourism industry; while ten of 11 respondents in Hopkins reported that both should work together and only one respondent reported that government alone should solve problems.

In Dangriga, seven of the ten respondents reported that Glover's Reef should be managed in partnership between government and another group, such as an NGO or fishing cooperative. In Hopkins, eight of 11 respondents reported that there should be a partnership for management, with one respondent reporting 'no' and one respondent reporting 'don't know'.

#### 4.2.3 Attitudes and Perceptions

All the respondents in both Dangriga and Hopkins reported that they were aware that Glover's Reef is a marine reserve. Seven of the 10 respondents in Dangriga and four of 11 in Hopkins reported that they were aware of the Glover's Reef marine reserve management zones.

In Dangriga, four respondents reported being members of an organization. Three were members of the Dangriga Tour Guide Association, one a member of BTIA, and one a member of PADI. In Hopkins, only one respondent reported being a member of a organization and this was the Teacher's Association.

The respondents were asked to state an occupation that they would choose for their children. In both Dangriga and Hopkins, the respondents reported a range of occupations (Table 2 and 3). Only one respondent in Hopkins chose fishing as an occupation for their children. The other respondents all chose professional occupations.

*Table 2. Occupations that respondents would choose for their children, Dangriga*

Occupation	#of respondents	%of respondents
Scientist	1	10
Lawyer	2	20
Fishing	1	10
Corporate jobs	1	10
Don't know	6	60

(\* one person chose 2 options)

*Table 3. Occupations that respondents would choose for their children, Hopkins*

Occupation	#of respondents	%of respondents
Corporate jobs	3	27.2
Gov't jobs	1	9.1

Teachers	1	9.1
Highest education	1	9.1
Don't know	5	45.5

(\* one person chose 2 options)

In both Dangriga and Hopkins, the respondents reported that the condition of the marine resources at Glover's Reef had got worse in the last five years (Tables 4 and 5).

*Table 4. Condition of marine resources at Glover's Reef, Dangriga*

Condition	No. of respondents – five years ago	No. of respondents – today
Very good	4	1
Good	4	6
Not good	-	3
Not bad	-	-
Bad	1	-
Very bad	-	-
Don't know	1	-

*Table 5. Condition of marine resources at Glover's Reef, Hopkins*

Condition	No. of respondents – five years ago	No. of respondents – today
Very good	4	-
Good	4	4
Not good	-	4
Not bad	-	-
Bad	-	-
Very bad	-	-
Don't know	3	3

The respondents were asked to indicate their degree of agreement with a series of statements concerning marine resources, marine resource management and tourism:

- j) the marine reserve is important for protecting the atoll's coral reef system (reserve)
- k) fisheries are adequately managed and enforced (fishmgt)
- l) penalties for illegal fishing should be increased (increasepenalties)
- m) mangroves should be protected at Glover's Reef (mangroves)
- n) participation in management decisions about Glover's Reef marine reserve is important to you (participation)
- o) most fishermen respect the marine reserve regulations (respectreserve)
- p) marine protected areas are beneficial to Belizean marine resources (MPAbenefits)
- q) children need to learn more about marine conservation at school (educatekids)
- r) tourism has been good to your community (tourismcomm)
- s) tourism has been good for your household (tourismhousehold)

The responses for Dangriga are presented in Table 6. There was agreement for the marine reserve, increasing penalties for illegal fishing, protecting mangroves, participation in management, MPAs are beneficial, more marine conservation education for children, and that tourism has been good for the household.

Table 6. Degree of Agreement with Statements, Dangriga

Topics	Strongly disagree		Disagree		Neutral		Agree		Strongly Agree		Don't know	
	#	%	#	%	#	%	#	%	#	%	#	%
a) Reserve	-	-	-	-	2	20	3	30	5	50	-	-
b) Fishmgt	2	20	2	20	-	-	4	40	1	10	1	10
c) Increasepenalties	2	20	-	-	1	10	3	30	3	30	1	10
d) mangroves	2	20	-	-	1	10	3	30	3	30	1	10
e) participation	1	10	-	-	3	30	2	20	4	40	-	-
f) respectreserve	6	60	-	-	1	10	1	10	1	10	1	10
g) MPAbenefits	1	10	1	10	-	-	2	20	5	50	1	10
h) Educatekids	-	-	-	-	-	-	-	-	10	100	-	-
i) Tourismcomm	1	10	2	20	1	10	2	20	3	30	1	10
j) Tourismhousehold	1	10	3	30	-	-	1	10	5	50	-	-

The responses for Hopkins are presented in Table 7. There was agreement for the marine reserve, increased penalties for illegal fishing, mangrove protection, participation in management, benefits of MPAs, and the need for more marine conservation education for children.

Table 7. Degree of Agreement with Statements, Hopkins

Topics	Strongly disagree		Disagree		Neutral		Agree		Strongly Agree		Don't know	
	#	%	#	%	#	%	#	%	#	%	#	%
a) Reserve	-	-	1	9.1	1	9.1	4	36.4	5	45.4	-	-
b) Fishmgt	1	9.1	3	27.2	1	9.1	5	45.5	1	9.1	-	-
c) Increasepenalties	-	-	2	18.2	-	-	4	36.4	4	36.4	1	9.1
d) mangroves	-	-	-	-	1	9.1	5	45.5	5	45.4	-	-
e) Participation	-	-	2	18.2	2	18.2	6	54.5	1	9.1	-	-
f) respectreserve	1	9.1	1	9.1	3	27.2	2	18.2	1	9.1	-	-
g) MPAbenefits	1	9.1	-	-	3	27.2	6	54.5	2	18.2	-	-
h) Educatekids	-	-	-	-	-	-	6	54.5	5	45.4	-	-
i) Tourismcomm	2	18.2	2	18.2	4	36.4	4	36.4	-	-	-	-
j) Tourismhousehold	-	-	-	-	-	-	-	-	-	-	-	-

#### 4.2.4 Threats and Problems

Respondents were asked to state the top three major problems for the marine resources at Glover's Reef. The primary problems reported by respondents in Dangriga were illegal fishing and improper patrols (Table 8). The primary problems reported by respondents in Hopkins were illegal fishing, patrolling and hurricanes (Table 9).

Table 8. Major problems for Glover's Reef marine resources, Dangriga

Problems	Primary Problems		Secondary Problems *5 responded to this question		Tertiary Problems * only 1 responded to this question	
	#	%	#	%	#	%
Illegal Fishing	7	70	-	-	-	-
Fishermen involvement	-	-	1	20	-	-
Lack of education about GRMR	-	-	1	20	1	100
High entrance fee	1	10	-	-	-	-

Improper mgmt	1	10	-	-	-	-
Improper patrols	-	-	2	40	-	-
Human resources	-	-	1	20	-	-
Overfishing	-	-	-	-	-	-
No rescue training	-	-	-	-	-	-
Don't know	1	10	-	-	-	-

*Table 9. Major problems for Glover's Reef marine resources, Hopkins*

Problems	Primary Problems		Secondary Problems		Tertiary Problems * only 1 responded to this question	
	#	%	#	%	#	%
Illegal Fishing	3	27.3	-	-	-	-
Fishermen involvement	-	-	-	-	-	-
Lack of education about GRMR	-	-	-	-	-	-
High entrance fee	-	-	-	-	-	-
Patrolling	3	27.3	3	33	-	-
Improper mgmt	-	-	1	11	-	-
Improper patrols	-	-	-	-	-	-
Human resources	-	-	-	-	-	-
Overfishing	1	9.1	1	11	-	-
No rescue training	1	9.1	-	-	-	-
Don't know	1	9.1	2	22	-	-
Hurricanes	2	18.1	-	-	-	-
Oil well	-	-	1	11	-	-
Too much research	-	-	1	11	-	-

The respondents were asked to state the possible solutions to these problems. In Dangriga, the solutions included charge illegal fishers and more education about the marine reserve (Table 10). In Hopkins, the solutions included more patrols (Table 11).

*Table 10. Solutions to the problems at Glover's Reef, Dangriga*

Solutions	Primary Solution *9 responded to this question		Secondary Solution *4 responded to this question		Tertiary Solution * only 1 responded to this question	
	#	%	#	%	#	%
Get fishermen involved	-	-	1	25	-	-
Educate about GRMR	1	11.1	2	50	1	100
Lower entrance fee	1	11.1	-	-	-	-
Unbiased rangers	-	-	1	25	-	-
More patrols	1	11.1	-	-	-	-
Charge illegal fishers	3	33.3	-	-	-	-
Get more money	1	11.1	-	-	-	-
More severe penalties	1	11.1	-	-	-	-
Don't know	1	11.1	-	-	-	-



Table 11. Solutions to the problems at Glover's Reef, Hopkins

Solutions	Primary Solution		Secondary Solution		Tertiary Solution	
	#	%	#	%	#	%
Get fishermen involved	-	-	-	-	-	-
Educate about GRMR	-	-	-	-	-	-
Lower entrance fee	-	-	-	-	-	-
Unbiased rangers	1	9.1	-	-	-	-
More patrols	3	27.2	-	-	-	-
Charge illegal fishers	1	9.1	-	-	-	-
Get more money	-	-	-	-	-	-
More severe penalties	-	-	-	-	-	-
Don't know	2	18.2	-	-	-	-
Have shifts for rangers	1	9.1	-	-	-	-
Have rescue training	1	9.1	-	-	-	-
Open more fishing area	1	9.1	-	-	-	-

#### 4.2.5 Material Style of Life

As a proxy of the measure of wealth of respondents, the respondents were asked to answer a number of questions concerning their household assets and construction materials of their house. The results indicate that more respondents in Dangriga own farmland than those in Hopkins, although respondents in Hopkins own more household assets such as washers and VCRs (Tables 12 and 13).

Table 12. Household assets of respondents, Dangriga

Assets	YES		NO	
	#	%	#	%
Farmland	3	30	7	70
House lot	8	80	2	20
Own house	6	60	4	40
Vehicle	3	30	7	70
Bicycle	5	50	5	50
Washer	8	80	2	20
VCR	7	70	3	30
Phone	8	80	2	20
TV	10	100	-	-
Stereo	10	100	-	-
Refrigerator	9	90	1	10
Stove	10	100	-	-

Table 13. Household assets of respondents, Hopkins

Assets	YES		NO	
	#	%	#	%
Farmland	1	9.1	10	90.9
House lot	9	81.8	2	18.2
Own house	7	63.6	4	36.4
Vehicle	3	27.2	8	72.7
Bicycle	9	81.8	2	18.2
Washer	10	90.9	1	9.1
VCR	9	81.8	2	18.2
Phone	7	63.6	4	36.4

TV	11	100	-	-
Stereo	11	100	-	-
Refrigerator	11	100	-	-
Stove	11	100	-	-

The quality of housing was approximately equal in both Dangriga (Tables 14, 15, 16 and 17) and Hopkins (18, 19, 20 and 21) with most respondents having zinc roofs, cement walls, wooden or glass windows, and tile or wood floors.

*Table 14. Type of roof material, Dangriga*

Roof type	#of respondents	% of respondents
Thatch	-	-
Zinc	7	70
Cement	3	30

*Table 15. Type of wall material, Dangriga*

Wall type	#of respondents	% of respondents
Palmetto	-	-
Plywood	-	-
Wood	4	40
Cement	6	60

*Table 16. Type of window material, Dangriga*

Window type	#of respondents	% of respondents
Wooden	3	30
Metal	4	40
Glass	3	30

*Table 17. Type of floor material, Dangriga*

Floor type	#of respondents	% of respondents
Dirt	-	-
Cement	-	-
Wood	3	30
Tile	7	70

*Table 18. Type of roof material, Hopkins*

Roof type	#of respondents	% of respondents
Thatch	-	-
Zinc	11	100
Cement	-	-

*Table 19. Type of wall material, Hopkins*

Wall type	#of respondents	% of respondents
Palmetto	-	-
Plywood	-	-
Wood	5	45.5
Cement	6	54.5

*Table 20. Type of window material, Hopkins*

<b>Window type</b>	<b>#of respondents</b>	<b>% of respondents</b>
Wooden	5	45.5
Metal	1	9
Glass	5	45.5

*Table 21. Type of floor material, Hopkins*

<b>Floor type</b>	<b>#of respondents</b>	<b>% of respondents</b>
Dirt	-	-
Cement	4	36.3
Wood	4	36.3
Tile	3	27.3

### **4.3. Tour Guide Interviews in Dangriga and Hopkins**

#### **4.3.1 Demographics**

Seven tour guides were interviewed in Dangriga and ten in Hopkins. All those interviewed were male. The average age of the tour guides was 28 years, with tour guides in Hopkins being younger than those in Dangriga. The majority of the tour guides had secondary level education (58%). The average household size was 4.2 persons.

The primary occupation of five of the seven respondents in Dangriga was tour guide, the other two respondents having a primary occupation of fishing. The two fishermen had tour guide as their secondary occupation. Other secondary occupations included fishing, farming and car dealer.

In Hopkins, all respondents had tour guide as their primary occupation. Only two respondents reported having a secondary occupation and this was fishing and construction.

In Dangriga, two respondents had other family members providing income to the family. In one case this was a spouse and in another a relative. One worked in tourism and the other in a corporate job. In Hopkins, four respondents had other family members providing income to the family. In three cases this was a spouse and in the other a parent. One worked in tourism, one in a corporate job, and two as teachers.

#### **4.3.2 Coastal and Marine Activities**

As would be expected from their ages, the tour guides in Dangriga, being older on average than those in Hopkins, had more years using Glover's Reef as a tour guide (Table 1).

*Table 1. Years tour guides have used Glover's Reef*

<b>Years</b>	<b>No. of respondents - Dangriga</b>	<b>No. of respondents – Hopkins</b>
Less 5	2	6
5-10	2	3
More 10	3	1

The tour guides from both Dangriga and Hopkins primarily used the south end of the Atoll for visitor use. Dangriga tour guides also used the west reef, while Hopkins tour guides also used the north end and east reef..

The primary type of guiding undertaken by tour guides from Dangriga is diving (3 respondents) and snorkeling (3 respondents), with one respondent reporting sport fishing. Seven respondents in Hopkins reported diving being the primary type of guiding on Glover's Reef, with one respondent each reporting sport fishing, snorkeling and other.

The majority of Dangriga tour guides did up to 50% of their annual business at Glover's Reef, while the majority of Hopkins tour guides did up to 25% of their annual business there (Table 2).

*Table 2. Percentage of annual business done at Glover's Reef*

<b>Percentage</b>	<b>No. of respondents - Dangriga</b>	<b>No. of respondents – Hopkins</b>
0-25	3	6
25-50	3	2
50-75	1	1
75-100	-	1

The months of the year when tour guides from Dangriga primarily use Glover's Reef for their business are December through May, with peak use in March and April. In Hopkins, primary use was December through April, with peak use in December through March.

The number of guide trips to Glover's Reef taken per year by tour guides from Dangriga ranged from 5 to 16 trips (Table 3). Hopkins tour guides made a much greater number of trips each year to Glover's Reef, ranging up to 100 trips (Table 4).

*Table 3. Number of guide trips to Glover's Reef per year, Dangriga*

<b>Trips/yr.</b>	<b>No. of respondents</b>	<b>% of respondents</b>
5	1	16.7
6	2	33.3
10	1	16.7
12	1	16.7
16	1	16.7

(\* only 6 respondents)

*Table 4. Number of guide trips to Glover's Reef per year, Hopkins*

<b>Trips/yr.</b>	<b>No. of respondents</b>	<b>% of respondents</b>
1-25	2	20
26-50	4	40
51-75	1	10
76-100	2	20
Don't know	1	10

The average number of people taken diving and snorkeling by Dangriga tour guides, the primary guiding which they undertake, is 7 persons and 16 persons, respectively. The number of people taken diving by Hopkins tour guides, the primary guiding which they undertake, is 10 persons.

The primary fish species targeted at Glover's Reef for sport fishing by Dangriga tour guides are kingfish, bonefish, snook, grouper, barracuda and king mackerel. The primary fish species targeted at Glover's Reef for sport fishing by Hopkins tour guides are bonefish, kingfish, tarpon, wahoo, tuna and permit.

The average fee charged per person/per trip by Dangriga tour guides for sport fishing was \$100, \$100 for diving, \$85 for snorkeling (with a range between \$52.50 and \$126.00), and \$100 for kayaking (with a range between \$58.00 and \$126.00). The average fee charged per person/per trip by Hopkins tour guides for diving was \$247 (with a range between \$142.00 and \$350.00) and \$100 for snorkeling.

The average number of crew members per boat for Dangriga tour guides was two and for Hopkins tour guides was three.

Dangriga tour guides gave tourists an oral briefing (four respondents), lectures (two respondents) and pamphlets (one respondent) about marine conservation and protection. The tour guides felt that useful educational materials would include brochures and a tour guide manual. Hopkins tour guides gave tourists primarily oral briefings (eight respondents) and lectures (two respondents). The Hopkins tour guides felt that useful educational materials would include brochures, charts, a WCS educational center at Glover's Reef, and research results.

The majority of tour guides in both Dangriga and Hopkins reported that visitors to Glover's Reef had very good and excellent satisfaction with their visit (Table 5).

*Table 5. Visitor satisfaction with visit to Glover's Reef*

<b>Rating</b>	<b>No. of respondents - Dangriga</b>	<b>No. of respondents – Hopkins</b>
Fair	-	
Good	1	1
Very Good	3	5
Excellent	3	4

Respondents from Dangriga felt that the condition of fisheries resources at Glover's Reef had got worse in the last five years (Table 6), while tour guides from Hopkins felt that it had improved over the last five years (Table 7).

*Table 6. Condition of fisheries resources at Glover's Reef five years ago and today, Dangriga*

<b>Condition</b>	<b>No. of respondents – five years ago</b>	<b>No. of respondents – today</b>
Very good	1	1
Good	5	4
Not good	-	-
Not bad	-	-
Bad	-	2
Very bad	1	-

*Table 7. Condition of fisheries resources at Glover's Reef five years ago and today, Hopkins*

<b>Condition</b>	<b>No. of respondents – five years ago*</b>	<b>No. of respondents – today</b>
Very good	-	4
Good	3	4
Not good	3	2
Not bad	-	-
Bad	-	-

Very bad	-	-
Don't know	3	-

(\*only 9 respondents)

When asked why they felt that the conditions had changed, two respondents in Dangriga stated that worsening conditions were due to the marine reserve being established and one stated it was due to overfishing. Three respondents in Hopkins stated that improvement was due to better rangers, one stated it was due to conservation, and one that fisheries officers were doing a better job.

When asked whether they would support Glover's Reef being managed in a partnership between government and another group, such as an NGO or fishing cooperative, five of the seven respondents in Dangriga stated that they would support such an arrangement and six of the ten tour guides in Hopkins would support such an arrangement.

#### 4.3.3 Attitudes and Perceptions

All the tour guides in Dangriga and nine of the ten tour guides in Hopkins stated that they were aware that Glover's Reef was a marine reserve. All the tour guides in Dangriga and seven of the ten tour guides in Hopkins reported that they were aware of the Glover's Reef marine reserve management zones.

The tour guides were asked if they were familiar with any rules and regulations in the Glover's Reef marine reserve related to commercial fishing, sport fishing, mangrove use, resort development, and tourism snorkel/diving (Table 8). In general, the tour guides in Hopkins were less familiar with the rules and regulations at Glover's Reef than the tour guides from Dangriga.

*Table 8. Familiarity with rules and regulations at Glover's Reef (percent familiar)*

<b>Regulations on:</b>	<b>Dangriga</b>	<b>Hopkins</b>
Commercial fishing	100	60
Sport fishing	71	50
Mangrove use	71	60
Resort development	86	50
Tourism snorkeling/diving	100	90

Five of the seven respondents from Dangriga reported that they were members of a tourism association. All were members of the Dangriga Tour Guide Association and one was also a member of the BTIA. Nine of the ten respondents in Hopkins were members of a tourism association. Four were members of the Dangriga Tour Guide Association, one was a member of the Belize Tour Guide Association, and four were members of the Hopkins Tour Guide Association.

Neither the Dangriga nor the Hopkins tour guides felt that their association represents them very well on the Glover's Reef advisory committee (Table 9).

*Table 9. Representation of the tourism association on the Glover's Reef Advisory Committee*

<b>Option</b>	<b>No. of respondents - Dangriga</b>	<b>No. of respondents – Hopkins</b>
Very well	-	-
Well	1	1
Fair	1	2
Poor	2	4
Don't know	3	3

Three tour guides in Dangriga reported being members of another organization in their village. Two were members of the Professional Association of Dive Instructors and one a member of the Stann Creek boat owner's association. Only one tour guide in Hopkins reported being a member of another organization in their village and this was an un-named business association.

The respondents were asked to indicate their degree of agreement with a series of statements concerning marine resources, marine resource management and tourism:

- a) the marine reserve is important for protecting the Atoll's coral reef system (reserve important)
- b) the conservation zone is helping to sustain fish stocks (conservationzone)
- c) all sportfishing should be catch and release (sportfishing)
- d) penalties for illegal fishing should be increased (penalties)
- e) mangroves should be protected at Glover's Reef (mangroves)
- f) enforcement of the reserve regulations is adequate (enforcement)
- g) participation in management decisions about Glover's Reef marine reserve is important to you (participation)
- h) facilities for tourists at the reserve headquarters at Middle Caye are adequate (facilities)
- i) most fishermen respect the marine reserve regulations (fishermenrespect)
- j) most tour guides respect the marine reserve regulations (tourguidesrespect)

The responses for Dangriga are presented in Table 10. There was agreement for the importance of the marine reserve, conservation zones, increasing penalties, protecting mangroves, adequate enforcement, adequate facilities at Middle Caye, and that tour guides respect reserve regulations.

*Table 10. Degree of Agreement with Statements, Dangriga*

Topics	Strongly disagree		Disagree		Neutral		Agree		Strongly Agree		Don't know	
	#	%	#	%	#	%	#	%	#	%	#	%
Reserveimportant	-	-	-	-	-	-	3	42.9	4	57.1	-	-
Conservationzone	-	-	-	-	-	-	4	57.1	3	42.9	-	-
Sportfishing	-	-	2	28.6	2	28.6	2	28.6	1	14.3	-	-
Penalties	1	14.3	-	-	1	14.3	3	42.9	2	28.6	-	-
Mangrove	-	-	-	-	-	-	2	28.6	4	57.1	1	14.3
Enforcement *6 respondents	1	16.7	-	-	-	-	4	66.7	1	16.7	-	-
Participation	-	-	-	-	-	-	3	42.9	4	57.2	-	-
Facilities	-	-	-	-	1	14.3	3	42.9	2	28.6	1	14.3
Fishermenrespect	4	57.1	1	1.3	-	-	1	14.3			1	14.3
tourguiderespect	1	14.3	-	-	-	-	3	42.9	3	42.9	-	-

The responses for Hopkins are presented in Table 11. There was agreement for the marine reserve, conservation zones, sport fishing catch and release, increasing penalties, mangrove protection, participation, and that tour guides respect regulations.

*Table 11. Degree of Agreement with Statements, Hopkins*

Topics	Strongly disagree		Disagree		Neutral		Agree		Strongly Agree		Don't know	
	#	%	#	%	#	%	#	%	#	%	#	%
Reserveimportant *8 ppl	-	-	-	-	-	-	3	37.5	5	62.5	-	-
conservationzone	-	-	-	-	-	-	2	20	8	80	-	-

Sportfishing	-	-	2	20	-	-	1	10	7	70	-	-
penalties	-	-	2	20	-	-	2	20	5	50	1	10
Mangrove	-	-	-	-	1	10	1	10	8	80	-	-
Enforcement	2	20	3	30	1	10	4	40	-	-	-	-
Participation	1	10	-	-	1	10	2	20	6	60	-	-
Facilities	1	10	4	40	1	10	3	30	-	-	1	10
fishermenrespect	3	30	4	40	1	10	3	30	-	-	1	10
tourguiderespect	1	10	-	-	2	20	3	30	3	30	1	10

#### 4.3.4 Threats and Problems

Respondents were asked to state the top three major problems for the marine resources at Glover's Reef. The primary problems reported by respondents in Dangriga were illegal fishing and improper patrols (Table 12). The primary problems reported by respondents in Hopkins were illegal fishing, understaffing, public relations, and destroyed corals (Table 13).

*Table 12. Major problems at Glover's Reef as perceived by the tour guides, Dangriga*

Problems	Primary Problems *7 respondents		Secondary Problems *4 responded to this question		Tertiary Problems * only 2 responded to this question	
	#	%	#	%	#	%
Illegal Fishing	3	42.9	-	-	-	-
Fishermen involvement	-	-	1	25	-	-
Lack of education about GRMR	-	-	1	25	1	50
High entrance fee	1	14.3	-	-	-	-
Understaffed	1	14.3	-	-	-	-
Improper patrols	1	14.3	1	25	-	-
Staff underpaid	-	-	1	25	-	-
PR	-	-	-	-	1	50
Don't know	-	-	-	-	-	-
Caye owner's fish in reserve	1	14.3	-	-	-	-

*Table 13. Major problems at Glover's Reef as perceived by tour guides, Hopkins*

Problems	Primary Problems *7 respondents		Secondary Problems *9 responded to this question		Tertiary Problems * only 6 responded to this question	
	#	%	#	%	#	%
Illegal Fishing	4	57.1	-	-	1	16.6
Fishermen involvement	-	-	-	-	-	-
Lack of education about GRMR	-	-	-	-	-	-
High entrance fee	-	-	-	-	-	-
Understaffed	2	28.5	1	11.1	1	16.6
Improper patrols	1	14.2	-	-	-	-
Staff underpaid	-	-	-	-	1	16.6
PR	-	-	2	22.2	1	16.6
Don't know	-	-	-	-	-	-
Caye owner's fish in reserve	-	-	-	-	-	-
Coral destroyed	-	-	2	22.2	1	16.6
Tagging	-	-	-	-	1	16.6



No medical training	-	-	1	11.1	-	-
Improper buoys	-	-	1	11.1	-	-
No bathroom	-	-	1	11.1	-	-
No feedback from researches	-	-	1	11.1	-	-

The respondents were asked to state the possible solutions to these problems. In Dangriga, the solutions include more patrols, clarify laws, have unbiased rangers, and coral reef rehabilitation (Table 14). In Hopkins, the solutions included more patrols, charge illegal fishers, have unbiased rangers, and train staff (Table 15).

*Table 14. Solutions to the problems at Glover's Reef as perceived by tour guides, Dangriga*

Solutions	Primary Solution *6 responded to this question		Secondary Solution *4 responded to this question		Tertiary Solution * only 2 responded to this question	
	#	%	#	%	#	%
Get fishermen involved	-	-	1	25	-	-
Educate about GRMR	-	-	1	25	-	-
Lower entrance fee	-	-	-	-	1	50
Unbiased rangers	1	16.7	-	-	-	-
More patrols	2	33.3	-	-	-	-
Clarify laws	1	16.7	1	25	-	-
Coral reef rehab.	1	16.7	-	-	-	-
Don't know	1	16.7	1	25	1	50

*Table 15. Solutions to the problems at Glover's Reef as perceived by tour guides, Hopkins*

Solutions	Primary Solution *9 responded to this question		Secondary Solution *9 responded to this question		Tertiary Solution * only 1 responded to this question	
	#	%	#	%	#	%
Charge illegal fishers	1	11.1	3	33.3	-	-
Educate about GRMR	-	-	1	11.1	-	-
Lower entrance fee	-	-	-	-	-	-
Unbiased rangers	1	11.1	1	11.1	-	-
More patrols	3	33.3	-	-	-	-
Clarify laws	-	-	-	-	-	-
Coral reef rehab.	-	-	1	11.1	-	-
Don't know	1	11.1	1	11.1	-	-
Train staff	1	11.1	1	11.1	-	-
Have workshops for staff	-	-	1	11.1	1	100
More buoys	1	11.1	-	-	-	-
Results from researches	-	-	-	-	-	-

#### 4.3.5 Material Style of Life

As a proxy of the measure of wealth of respondents, the respondents were asked to answer a number of questions concerning their household assets and construction materials of their house. Dangriga tour guides are relatively wealthier than Hopkins tour guides. The results indicate that more respondents in

Dangriga own farmland, house lot and house than those in Hopkins, and that the Dangriga tour guides own more household assets than Hopkins tour guides (Tables 16 and 17).

*Table 16. Household assets of the tour guides, Dangriga*

Assets	YES		NO	
	#	%	#	%
Farmland	2	28.6	5	71.4
House lot	6	85.7	1	14.3
Own house	5	71.4	2	28.6
Sailboat	5	71.4	2	28.6
Skiff	4	57.1	3	42.9
Outboard engine	5	71.4	2	28.6
Vehicle	4	57.1	3	42.9
Bicycle	4	57.1	3	42.9
Washer	7	100	0	
VCR	6	85.7	1	14.3
Phone	7	100	0	
TV	7	100	0	
Stereo	7	100	0	
Refrigerator *only 6 responded	6	100	0	
Stove	7	100	0	

*Table 17. Household assets of the tour guides, Hopkins*

Assets	YES		NO	
	#	%	#	%
Farmland	1	10	9	90
House lot	5	50	5	50
Own house	3	30	7	70
Skiff	2	20	8	80
Outboard engine	1	10	9	90
Vehicle	4	40	6	60
Bicycle	5	50	5	50
Washer	7	70	3	30
VCR	5	50	5	50
Phone	8	80	2	20
TV	8	80	2	20
Stereo	8	80	2	20
Refrigerator	7	70	3	30
Stove	8	80	2	20

The quality of housing was better in Hopkins (Tables 22, 23, 24 and 25) than in Dangriga (Tables 18, 19, 20 and 21) with more respondents in Hopkins having glass windows, and tile or wood floors.

*Table 18. Type of roof material, Dangriga*

Roof type	#of respondents	% of respondents
Thatch	-	-
Zinc	5	71.4
Cement	2	28.6

Table 19. Type of wall material, Dangriga

Wall type	#of respondents	% of respondents
Palmetto	-	-
Plywood	2	28.6
Wood	2	28.6
Cement	3	42.92

Table 20. Type of window materials, Dangriga

Window type	#of respondents	% of respondents
Wooden	2	28.6
Metal	2	28.6
Glass	3	42.9

Table 21. Type of floor material, Dangriga

Floor type	#of respondents	% of respondents
Dirt	-	-
Cement	4	57.1
Wood	3	42.9
Tile	-	-

Table 22. Type of roof material, Hopkins

Roof type	#of respondents	% of respondents
Tatch	-	-
Zinc	9	90
Cement	1	10

Table 23. Type of wall material, Hopkins

Wall type	#of respondents	% of respondents
Palmetto	-	-
Plywood	2	20
Wood	6	60
Cement	2	40

Table 24. Type of window materials, Hopkins

Window type	#of respondents	% of respondents
Wooden	5	50
Metal	1	10
Glass	4	40

Table 25. Type of floor materials, Hopkins

Floor type	#of respondents	% of respondents
Dirt	-	-
Cement	2	20
Wood	7	70
Tile	1	10

## **5. Discussion**

### **5.1 Fishermen**

The fishing industry based in these communities is dominated by males. The females in their families are not involved in fishing-related activities. The respondents from Dangriga had the highest percentage (50%) with a secondary level education. In contrast, almost all from Sarteneja only had a primary level education. The majority of fishers in Hopkins also had only primary level education, but a few had completed education to the secondary level and one to the tertiary level.

Of the three communities, Dangriga appeared to be the least dependent on fishing at Glover's Reef. Apart from having the smallest number of fishers using the Atoll, 50% of the respondents had activities other than fishing as their primary occupation. In contrast, all respondents in Sarteneja, and almost all in Hopkins, indicated that fishing was their primary occupation.

In all the communities, most respondents had fished at Glover's for more than eight to 10 years. Dangriga & Hopkins respondents obtained about 50% of their catch from the Atoll. Sarteneja fishers, however, obtained 76% to 100%, demonstrating their greater dependence on the resources of the Atoll.

Marketing and use of the catch also differed amongst the communities. Fishers in Dangriga sold their catch mainly in local markets and hotels, with some kept for subsistence use. Fishers in Hopkins sold their catch mainly to the cooperative, some was sold locally and to hotels, and some was also kept for subsistence use. In Sarteneja, however, virtually all the catch was sold to the co-operatives, with just a small amount sold locally. The portion of catch used by fishers and their families in Dangriga and Hopkins probably represents an important source of their protein consumption. Knowledge of how the catch is marketed can help to determine the most effective means of collecting catch data. Collecting such data at the point of sale rather than at sea is generally easier and less costly.

Fishers from the communities differed to some degree in the type of gear used and the species targeted. Fishers from Dangriga used mainly fishing lines and rods, targeting finfish such as snappers, kingfish, barracudas, marlin, tuna and wahoo. Most of these species are pelagics. Fishers from Hopkins used a mixture of gear, with most fishers being divers using hook sticks and spear guns to catch lobster, conch and reef fish. In addition, though, several fishers used fishing lines and rods to capture a variety of fish such as snappers, barracuda and kingfish. On the other hand, fishers from Sarteneja were all divers using hook sticks and spear guns, taking conch, lobster, and reef fish.

Respondents from the three communities agreed that the fishing resources are in worse condition compared to five years ago. The reasons quoted for this degradation were varied, including illegal fishing, more fishermen in the area, hurricanes and climate change. All communities indicated that a reason was also the establishment of the marine reserve in 1993, which designated about one-fifth of the area of the Atoll as a 'no take' or 'no fishing' zone. This was ranked as the most important reason by the respondents from Sarteneja. This indication, however, is contradictory to the general feeling that the Conservation Zone of the reserve has helped to sustain fisheries, and therefore requires further follow up for clarification.

Respondents from Dangriga and Hopkins were supportive of co-management efforts with the government and the majority would support management of the reserve through a partnership between the government and a NGO or a fishing co-operative. Those from Sarteneja, however, would not support such a partnership. Fishers from Sarteneja may view such an arrangement with some apprehension as their community is distantly located from the Atoll, which could likely exclude them from involvement in

a management capacity. In addition, at the time of the survey, their community did not have a local NGO or association that could be viewed as a potential management partner.

Respondents from all communities had a high awareness of the reserve and its management zones. All fishers were familiar with the commercial fishing regulations, but were less so with those regarding mangrove use, tourism and resort development. Dangriga fishers appeared to be the most familiar with the various rules and regulations, whereas those from Sarteneja were the least familiar. This could possibly be a reflection of the higher level of education of the Dangriga respondents, fifty percent of which had secondary level education. Almost all the respondents from Sarteneja had only primary level education. It could also be that Sarteneja fishers are only concerned with fishing, while the Dangriga fishers live closer to the reserve and have more varied activities related to the reef, such as tourism.

About half the respondents from the southern communities of Dangriga and Hopkins were members of a fishing co-operative; all of these belonged to Northern Co-operative. In Sarteneja the majority of the respondents (17) were co-operative members, belonging to either Northern or National Co-operative. Educational efforts or training in alternative livelihoods will therefore need to be directed through both these fishing co-operatives. In addition, educational efforts will also need to be developed for individual fishermen who are not co-operative members.

Significantly, the majority of respondents in Dangriga and Hopkins felt that they were poorly represented by their respective co-operatives on the Glover's Reef Advisory Committee. Fifty percent of respondents from Sarteneja also felt this way. The weakness of representatives not adequately reporting back to their membership organizations has also been identified in previous consultations with fishermen. Training of the Glover's Reef Advisory Committee members in their roles and responsibilities is underway, which should help to address this concern. In addition, the mechanism through which the co-operative representatives report back to their membership needs to be investigated and improved.

Fifty percent of respondents from Dangriga and 60% from Sarteneja were willing to change to another occupation. Willingness to change was particularly high amongst the respondents from Hopkins (80%), possibly a factor of the younger average age of the fishers in this village. In Hopkins the fishers were mainly interested in becoming involved in tourism. Although many respondents from Sarteneja were also interested in tourism, the overwhelming majority in this village were interested in further education for their children. Sarteneja offers fewer livelihood options than Hopkins and Dangriga as, for example, there are fewer tourism opportunities. More thought will need to be given to a range of alternative livelihoods in Sarteneja.

Despite concerns about the negative impacts of the reserve, the majority of fishers from all communities agreed with the importance of the reserve in protecting the Atoll's resources and the Conservation Zone's role in helping to sustain fisheries. The degree of agreement was weakest in Sarteneja, however, where fishers are more dependent on the reserve area for fishing and have fewer alternatives. Nevertheless, the majority of respondents in all communities, particularly in Sarteneja, felt more of the marine reserve area should be opened to fishing. This reflects the contradictory feeling towards the reserve, which were mentioned earlier.

Unexpectedly, more of the respondents from Sarteneja disagreed with the closure of the grouper spawning site on the Atoll's NE Pt. than those from Hopkins, although the Hopkins fishers have traditionally fished this site.

Respondents from Hopkins felt that most fishermen respect the reserve rules; in contrast, the majority from Sarteneja did not agree. On the other hand, Sarteneja respondents felt strongly (70%) that enforcement of the reserve was not adequate, while most from Dangriga and Hopkins did not have a

strong opinion on the issue. Virtually all respondents from Dangriga and Hopkins agreed with the importance of protecting mangroves, but only slightly more than half from Sarteneja agreed.

Managers will need to address the threats and problems highlighted by fishers. Illegal fishing and the challenge of adequately patrolling such a large area were primary concerns that are general threats to the fishing industry as a whole and require more patrols and enforcement. Threats that are more specific to the Atoll, however, are the regulation that allows cay owners to fish in the reserve and the claim that fisheries staff are biased. The current reserve regulations allow residents on the atoll to conduct subsistence fishing in the 'no take' zone. Fishermen believe this is an unfair rule as several residents could be fishing for their resort guests, which is a form of commercial fishing. Fishermen believe that the 'no take' or Conservation Zone should be closed to fishing to all, with no exceptions. Some respondents also felt that the reserve rangers do not apply the regulations fairly, strictly enforcing the laws for fishers from certain communities and allowing others to fish illegally.

Finally, contrary to the common belief that fishermen are not prospering economically, the results indicated that the majority of respondents in all communities own their house lot and home, and also their boat and engine (or dory in the case of Sarteneja). The majority also own a wide variety of household assets and appliances such as washers, VCRs, telephones, televisions, stereos, stoves and refrigerators. This economic progress, however, may have been realized at the expense of the marine resources, which the majority of respondents agreed have declined over the past five years.

The majority of homes in Dangriga (75%) and Sarteneja (85%) were concrete, but they varied in the type of windows and roofs. In Hopkins the majority of homes (53%) were wooden. However, poorer quality houses of palmetto with thatch roofs were only recorded in Sarteneja.

## **5.2 Households**

Most of the respondents in the two communities surveyed, Dangriga and Hopkins, were male. Only two were females, one in each community. More than half the respondents had only primary level education. In Dangriga, 50% had primary, 40% had secondary, and 10% had tertiary level education. In Hopkins the percentages were very similar, 54.5% with primary, 36.3% with secondary, and 9.1 % with tertiary education.

Unlike Dangriga where several respondents had a secondary occupation such as farming, fishing and selling barbecue, none in Hopkins had a secondary occupation. Notably in Dangriga, one woman in a household was involved in fishing, as a fish seller.

All households used some of the fish caught for home consumption. This likely provides an important source of food and protein for families.

In general respondents were supportive of co-management, that is, government and the fishing or tourism industry working together. They were also supportive of the reserve being managed through a partnership between government and a NGO or fishing co-operative.

The respondents had very high awareness of the Glover's Reef Marine Reserve, but awareness of the reserve's management zones was weaker, particularly in Hopkins.

The household respondents also agreed that the condition of the marine resources is worse than five years ago. In Dangriga 80% of respondents, and in Hopkins 81.8%, recorded strong agreement with the importance of the reserve and the majority also agreed that MPAs are beneficial to Belizean marine resources.

Most respondents would choose occupations other than fishing for their children, and the highest number of choices were for lawyers and corporate jobs; only one respondent, from Hopkins, chose fishing as an occupation for his children. The strong preference of choosing another occupation probably reflects the feeling that, as the condition of the marine resources is getting worse, fishing is not a wise choice of livelihood for the future.

Both communities supported increased penalties, protection of mangroves, and participation in management decisions. In Dangriga, households felt that most fishermen do not respect the reserve regulations, while in Hopkins most did not have a strong opinion on the matter.

All agreed that children need to learn more about marine conservation at school. Surprisingly, despite the growing tourism trade in Hopkins, only 36.4% felt that tourism has been good for the community; in Dangriga, 50% of the households agreed that tourism has been beneficial. This result, however, might be related to many of the guides in Hopkins working for a couple of the larger hotels rather than having their own businesses. Unlike the situation in Dangriga where the majority of guides owned their boat, most guides in Hopkins did not, which would support this reasoning.

Similar to the responses of the fishermen, the primary problems for marine resources were felt to be illegal fishing, improper patrols and hurricanes. The main solutions suggested were conducting more patrols and charging illegal fishers.

Similar to the results from the survey of fishermen, the majority of respondents owned their house lots and homes, and also a variety of household assets and appliances such as washers, VCRs, telephones, stereos, refrigerators and stoves. In both communities, approximately half the houses were concrete and the other half were built of wood.

### **5.3 Tour Guides**

All respondents in Dangriga and Hopkins were young males, with an average age of 28 years. Unlike the fishermen and household respondents, the majority of tour guides had a secondary level education. Being a tour guide was the primary occupation for the majority of respondents in Dangriga and for 100% of those in Hopkins. For the majority in both communities, it was also their only occupation. Therefore tourism was a critical source of income for most of the guides interviewed.

From the responses recorded, the guides from Dangriga and Hopkins utilized different parts of the Glover's Reef Atoll for their tours. The guides in Dangriga were mainly involved in diving and snorkeling tours, while those in Hopkins mainly offered diving tours. Only two of all respondents were also involved in sport fishing tours.

In terms of the percentage of their annual tour business, the Dangriga guides relied more on the Atoll than those from Hopkins. Guides from Hopkins, however, made many more trips to the Atoll each year than the Dangriga guides and they charged substantially more for their services.

The peak time for tours to the Atoll, December through April or May, coincides with the country-wide peak for tourist visitors in general. The peak times for each community, however, differed slightly with Dangriga guides having more business in March and April, and those from Hopkins being busiest from December through March. All respondents felt their guests experienced good to excellent satisfaction with their visits to the Atoll.

Both communities requested more educational material for tourists, such as brochures on the Atoll, an education centre at the reserve headquarters, and dissemination of the results of the research being carried out at Glover's.

In Dangriga the guides felt that the condition of the marine resources was worse than five years ago. On the other hand, Hopkins guides felt that they were better due to better rangers and conservation efforts.

The majority of guides supported co-management of the reserve through a partnership between government and a NGO or fishing co-operative.

As with the fisher and household respondents, there was high awareness of the reserve and its management zones, but less awareness in the respondents from Hopkins regarding the zones. In addition, the Hopkins guides were less familiar with the regulations pertaining to commercial and sport fishing, mangrove use, tourism and resort development. Most respondents were members of a tourism association, and these groups would likely be effective in channeling information to the guides.

Similar to many fishers, the majority of tour guide respondents felt that they were not well represented on the Glover's Reef Advisory Committee.

Generally, the guides supported the reserve and its Conservation Zone, and recognized its importance in protecting the marine resources of the Atoll. Although the majority of guides from Hopkins were supportive of catch-and-release sport fishing, those from Dangriga did not strongly support this measure. The training that Hopkins fishers have received recently in sport fishing, in particular fly fishing, may have been a factor contributing to their support for this effort to make sport fishing more sustainable.

The majority supported increased penalties and the protection of mangroves. Dangriga respondents believed that enforcement on the Atoll was adequate, but 50% in Hopkins disagreed. The reason for this difference in opinion requires further investigation.

The great majority of respondents were supportive of participating in the management of the reserve. Dangriga guides felt the facilities in the reserve were adequate, but 50% of those from Hopkins disagreed. Both communities felt, however, that most fishers do not respect the reserve regulations.

Like the fisher and household respondents, the tour guides also felt the main problems were illegal fishing, understaffing of the reserve and improper patrols. Other weaknesses included poor public relations, lack of education about the reserve, and lack of fishermen involvement. Solutions identified to address these problems were conducting more patrols, charging of illegal fishers, hiring of unbiased rangers, clarifying the laws, and training staff.

In Dangriga the majority of guides owned their house lot and home. In contrast, in Hopkins only 50% of the guides owned their lot and only 30% their home. Also in Dangriga, the majority owned their boat and engine but in Hopkins only a small percent owned their boats. The guides from Hopkins, however, mainly work for resorts that provide their own boats.

In relation to household assets and appliances, approximately 100% of the guides in Dangriga owned washers, VCRs, telephones, stereos, refrigerators, and stoves. In Hopkins the majority of the guides also owned these items. On the other hand, the quality of housing in Hopkins could be considered of slightly better quality than in Dangriga, with the Hopkins guides having more houses with glass windows and wood or tile floors.



## **6. Recommendations for Priority Actions**

Based on the results of the surveys, several priority actions and considerations for implementing them are recommended. The survey results were presented and discussed at meetings held in December 2004 in each of the communities. In addition, summaries were distributed to those who participated in the surveys and samples of these summaries can be seen in Appendix 2. The recommendations for management received from the participants during these meetings are recorded in Appendix 3, and some are incorporated in the suggestions below. Most of these recommendations pertain to education, but they also include some relating to alternative livelihoods, legal concerns, reserve management, and representation and participation.

### **6.1 Education and Awareness**

Gaps in knowledge were revealed in relation to the management zones of the reserve, particularly in fishers from Hopkins, and need to be addressed as a matter of urgency by the reserve staff. The recently completed reserve brochure, which includes a map illustrating the zones and descriptions of the regulations for each zone, should be distributed to fishermen as soon as possible.

Although good support for the reserve was evident, respondents generally felt that fishers do not respect the reserve regulations. A special effort needs to be made to demonstrate the benefits of the reserve to fishers, especially to those in Sarteneja who were the least supportive. A project on fisheries catch data collection is underway to determine whether the Conservation Zone is helping to enhance or at least sustain catches in the General Use Zone where fishing is permitted. Every opportunity must be made to share the results of this project with fishermen. The catch data should also supply information on the level of catch of juvenile Nassau groupers. In addition, fishermen must be kept informed of the results from the monitoring of the Nassau grouper spawning aggregation site which has recently been closed to fishing.

Education is also required for fishers on the regulations governing mangrove use, tourism and coastal development. A campaign on marine-related environmental laws should be conducted to provide a comprehensive legal knowledge base for fishers. Although education efforts can be channeled through the fishing co-operatives, programs also need to be developed that will reach the independent fishermen. Furthermore, any training or educational workshops and meetings for fishermen should be scheduled so that they take place at the most appropriate time of the year, and not during the height of the lobster and conch fishing seasons.

In developing educational material for fishers, the primary level of education of most fishers must be considered, and material should also be translated into Spanish for those from Sarteneja.

Tour guides also need to be educated on the regulations governing mangrove use, tourism and coastal development. This material could be developed in partnership with the tourism associations and channeled to the guides through these groups. As most tour guides have secondary level education, the material can be more advanced. Material developed should also include the topic of catch-and-release sport fishing, especially when targeting the guides in Dangriga. Workshops should be planned at times that avoid the peak season for the guides in Dangriga and Hopkins.

The results indicate that Glover's is becoming increasingly important as a tourist destination and guides are requesting more educational material to distribute to their tourists. The reserve staff should provide copies of the recently-produced reserve brochure, and supplement these with pamphlets covering special topics such as diving, snorkeling and sport fishing. The Wildlife Conservation Society's research station

should provide regular summaries on the results of their many ongoing research projects on the Atoll. Fishermen are also keen to participate in research projects and are very interested in having the Fisheries Department provide them with reports on the various fisheries-related studies that are carried out.

As the number of tour guides operating on the Atoll increases, the reserve staff should consider hosting a special workshop for guides, similar to the one held by the Belize Audubon Society for guides active at Lighthouse Reef. This would provide a forum for sharing scientific and natural history information on the Atoll and information on rules and regulations. It would also provide an opportunity for discussing problems and concerns that possibly can be solved by joint action between managers and the industry.

As more marine environmental education in the schools is required, the marine reserve staff, the Fisheries Department and NGOs involved in working in these communities should endeavour to supply more school programs and supporting material. As many of the children in these coastal communities will enter the fishing and tourism industries, it is essential that they learn to appreciate the importance of their marine resources and the need to conserve and use them wisely. This appreciation can be developed through appropriate environmental education programs.

## **6.2 Alternative Livelihoods**

Sarteneja fishers are almost totally dependent on fishing. If fishing effort is to be reduced in order to achieve sustainable fishing levels, urgent attention is required in providing alternatives to fishermen. Moreover, as catches decline and more fishers enter the fishery at Glover's Reef, these fishers will increasingly need to supplement their income from fishing. Although fishermen were mainly interested in becoming involved in the tourism industry, the infrastructure and services in the village and surrounding area first need to be developed and improved before Sarteneja can become a tourist destination. Furthermore, technical training and marketing of the site are required. Consequently, tourism in Sarteneja cannot be considered an immediate alternative, unless fishers enter the industry at other sites, such as becoming guides for the cruise tourism trade. Although efforts should continue in training and marketing for tourism, these are longer-term aims and therefore alternatives in the short term also need to be identified urgently, such as training in computer skills, small business development, handicrafts, and aquaculture. Interestingly, Sarteneja fishermen did not wish their children to enter the fishing industry, and indicated that education for their children was their top priority.

Hopkins fishers also rely very heavily on fishing as their source of income. Options for tourism alternatives, however, are more well developed in this village. As the fishers' willingness to change to tourism-related activities was also very high, projects that facilitate their move to alternatives in tourism are recommended, as they should have a very good chance of success.

Regarding training programs for fishermen to become tour guides, however, the program should also ensure as far as possible that jobs for the newly trained guides will be available. Furthermore, in the case of flying fishing tour guides, the possibility of trainees being granted internships with skilled guides should be explored.

## **6.3 Legal Concerns**

Many respondents emphasized the need to charge those who fish illegally. Several noted that illegal fishers are rarely charged at the maximum level permitted that would likely act as a deterrent, which results in several repeat offenders. As penalties are charged at the discretion of the magistrate, we recommend that the Fisheries Department hold formal discussions with the magistrates to inform them of the importance of the fishing industry and the harmful effect that illegal fishing is having on the resources

of the country. The Fisheries legislation should also be reviewed to see whether penalties need to be increased or new measures introduced, such as the cancellation of fishing licenses.

Another reason affecting the effective charging of illegal fishers is that some cases do not result in convictions. Weak preparation of cases by the prosecution is a possible cause. Support must be given to strengthen the Fisheries Department's ability to successfully prosecute cases.

We also recommend that the reserve regulation allowing subsistence fishing within the Conservation Zone be repealed. This law has caused resentment amongst fishermen who consider it unfair, as the Zone is closed to commercial fishing. To resolve the perceived unfairness, it would be best to designate the Conservation Zone a fully protected or 'no take' or 'no fishing' area, with no exceptions allowed.

As many respondents felt strongly that one of the problems causing the decline in the condition of the marine resources is the use of the Atoll by too many fishermen, we recommend that special fishing licenses only be issued to traditional fishers. This is provided for in the reserve regulations but has not yet been implemented. The issue is particularly a problem at the beginning of the lobster and conch seasons, which open on the 15<sup>th</sup> June and 1<sup>st</sup> October respectively, during which time many fishermen from other areas travel to the Atoll to fish. Traditional fishers feel that, as they have forfeited some of their traditional fishing area by respecting the 'no take' area of the Conservation Zone on the Atoll, they should be the beneficiaries of the enhanced catches that may result from this closed area.

#### **6.4 Reserve Management**

The strong concerns regarding the need to strengthen patrols and improve the caliber of rangers need to be addressed. Although the patrols have improved recently, as recognized by three tour guide respondents from Hopkins, recommendations on ways to further improve surveillance on the Atoll could be made by the Glover's Reef Advisory Committee. Records of warnings, arrests, and convictions should continue to be reported to the Committee through the reserve's quarterly reporting system, thus aiding in the formulation of recommendations for patrols to be more effective and strategic.

In an effort to hire the most suitable rangers, it may be beneficial to involve the Committee in the review of applications and to submit their recommendations to the Fisheries Department. Additional training could also be provided for rangers to help improve the protocols used, enhance the use of education as a tool fostering compliance, strengthen the process of collecting evidence and making arrests, emphasize the importance of record-keeping, and ensure their safety when on patrol. In an effort to sustain high morale amongst reserve staff, more attractive incentives could be offered for good work performance.

#### **6.5 Representation and Participation**

The majority of fishermen and tour guides interviewed felt that they were not well informed by their representatives on the Glover's Reef Marine Reserve Advisory Committee. As the Committee provides the main mechanism for their participation in the management of the marine reserve, this is a matter of critical importance and needs to be rectified as soon as possible. Their representation could be enhanced by the reporting of Committee proceedings at monthly and annual general meetings of the two fishing co-operatives and the relevant tourism associations. Communications between Committee representatives and their membership could also be improved by the preparation and distribution of bulletins that can update the membership on the issues under discussion by the Committee. In addition, the Committee could include representatives chosen by the fishermen of Glover's Reef, one from each of the three communities. Training of Committee members in their responsibilities should also continue and thus help to strengthen their ability to fulfill their role.

The majority of respondents identified illegal fishing and inadequate patrols as a major problem on the Atoll. Most respondents also felt that problems should be addressed jointly by fishermen/tour guides and the government, and they were interested in increasing their participation in the management of the reserve. This provides the perfect opportunity to seek their involvement in assisting the Fisheries Department and reserve personnel in surveillance of the Atoll, thus improving patrols and reducing illegal fishing.

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## Appendix 1 - Survey Questionnaire Forms

### Fishermen Interview questionnaire for Glovers Reef

Date and time \_\_\_\_\_ Captain \_\_\_\_\_ Crew \_\_\_\_\_  
Interviewer \_\_\_\_\_ Respondent # \_\_\_\_\_  
Location \_\_\_\_\_

#### **Demographics**

1. How old are you? \_\_\_\_\_
2. What is your level of education?  
Primary \_\_\_\_\_ Secondary \_\_\_\_\_ Associates \_\_\_\_\_
3. How many people live in your household?  
\_\_\_\_\_
4. Which job provides you with the most income?  
1<sup>st</sup> \_\_\_\_\_,  
2<sup>nd</sup> \_\_\_\_\_,  
3<sup>rd</sup> \_\_\_\_\_
5. Are any other members in your household involved in an income-generating activity?  
Yes \_\_\_\_\_ Who \_\_\_\_\_ What activity? \_\_\_\_\_  
No \_\_\_\_\_
6. Are there any females in your household who are involved in the fishing business?  
Yes \_\_\_\_\_ Who \_\_\_\_\_ What activity? \_\_\_\_\_  
No \_\_\_\_\_

#### **Coastal and Marine/Fishing Activities**

7. How many years have you fished at Glover's Reef?  
Less than 5 years \_\_\_\_\_ 5 – 10 years \_\_\_\_\_ More than 10 years \_\_\_\_\_
8. What percentage of your total catch per year is caught at Glovers Reef?  
0-25% \_\_\_\_\_ 25-50% \_\_\_\_\_ 50-75% \_\_\_\_\_ 75-100% \_\_\_\_\_
9. What is the average number of days of each fishing trip spent at Glover's Reef?  
\_\_\_\_\_ days
10. How many fishing trips to Glover's Reef do you make each year?  
\_\_\_\_\_ trips
11. What are the top 4 species that you target at Glover's Reef?  
1) \_\_\_\_\_ 2) \_\_\_\_\_  
3) \_\_\_\_\_ 4) \_\_\_\_\_
12. What are the gear types that you use at Glover's Reef?  
1) \_\_\_\_\_  
2) \_\_\_\_\_  
3) \_\_\_\_\_
13. How many crew members are usually on your boat?  
\_\_\_\_\_ crew
14. What percentage of your boat's total catch from Glover's Reef is usually or generally sold to:  
Cooperative \_\_\_\_\_ Hotels/Restaurants \_\_\_\_\_ Local markets \_\_\_\_\_  
Own use \_\_\_\_\_ Other \_\_\_\_\_
15. How would you describe the condition of fisheries resources five years ago at Glovers Reef?  
very good \_\_\_ good \_\_\_ not good \_\_\_ not bad \_\_\_ bad \_\_\_ very bad \_\_\_
16. How would you describe the conditions of fisheries resources today at Glovers Reef?

very good \_\_\_\_ good \_\_\_\_ not good \_\_\_\_ not bad \_\_\_\_ bad \_\_\_\_ very bad \_\_\_\_

Why do you think the conditions have changed? \_\_\_\_\_

17. Do you think that fishermen can work together to solve a problem in the fishery?  
Yes \_\_\_\_ No \_\_\_\_ Don't know \_\_\_\_
18. Should the government alone, the fishermen alone or both together, work to solve a problem in the fishery?  
government only \_\_\_\_ fishermen only \_\_\_\_ both \_\_\_\_
19. Would you support Glover's Reef being managed in partnership between government and another group? Such as an NGO, Fishing Cooperative etc.  
Yes \_\_\_\_ No \_\_\_\_ Don't know \_\_\_\_

### ***Attitudes and Perceptions***

20. Are you aware that Glovers Reef is a Marine Reserve?  
Yes \_\_\_\_ No \_\_\_\_
21. Are you aware of the Glovers Reef Marine Reserve management zones?  
Yes \_\_\_\_ No \_\_\_\_
22. Are you familiar with any rules and regulations in the Glover's Reef Marine Reserve related to:  
Commercial fishing \_\_\_\_; Sport fishing \_\_\_\_; Mangrove use \_\_\_\_;  
Resort Development \_\_\_\_; Tourism snorkel/diving \_\_\_\_
23. Are you a member of a fishing co-operative?  
Yes \_\_\_\_ Which? \_\_\_\_  
No \_\_\_\_
24. How do you feel your co-operative represents you on the Glover's Reef Advisory Committee?  
Very well \_\_\_\_ Well \_\_\_\_ Fair \_\_\_\_ Poor \_\_\_\_ Don't know \_\_\_\_
25. Are you a member of any other organization in Sarteneja?  
Yes \_\_\_\_ What organization? \_\_\_\_  
No \_\_\_\_
26. If you were able to change to another occupation that provided equal or more income than your fishing occupation would you be willing to change occupations?  
Yes \_\_\_\_ No \_\_\_\_
27. If so, what would you be interested in?  
Tour guide \_\_\_\_, Sportfishing guide \_\_\_\_, Aquaculture \_\_\_\_, Information Technician \_\_\_\_,  
SCUBA guide \_\_\_\_, Kayaking guide \_\_\_\_, other \_\_\_\_
28. If you could choose an occupation for your children, what would it be?  
\_\_\_\_\_
29. Indicate degree of agreement with the following statements using the scale: don't know (6) strongly agree (5), agree (4), neutral (3), disagree (2), or strongly disagree (1)
- \_\_\_\_\_ a) The Marine Reserve is important for protecting the Atoll's coral reef system
  - \_\_\_\_\_ b) The conservation zone is helping to sustain fish stocks
  - \_\_\_\_\_ c) More area should be opened to fishing in the marine reserve
  - \_\_\_\_\_ d) Penalties for illegal fishing should be increased
  - \_\_\_\_\_ e) Mangroves should be protected at Glover's Reef
  - \_\_\_\_\_ f) Enforcement of the reserve regulations is adequate
  - \_\_\_\_\_ g) Participation in management decisions about Glover's Reef Marine Reserve is important to you.
  - \_\_\_\_\_ h) The closure of the North East Point spawning aggregation site is a good management measure.
  - \_\_\_\_\_ i) Most fishermen respect the marine reserve regulations.

***Threats and problems***

30. What do you think are the top three major **problems** for the Glovers Reef marine resources?

Problems: 1 \_\_\_\_\_,  
2 \_\_\_\_\_,  
3 \_\_\_\_\_

31. What do you think are the possible **solutions** to these problems?

Solutions: 1 \_\_\_\_\_,  
2 \_\_\_\_\_,  
3 \_\_\_\_\_

***Material style of life.***

32. Do you have:

Own farm land \_\_\_\_\_ Own house lot \_\_\_\_\_ own house \_\_\_\_\_  
sailboat \_\_\_\_\_ skiff \_\_\_\_\_ outboard engine \_\_\_\_\_ canoe \_\_\_\_\_  
vehicle \_\_\_\_\_ bicycle \_\_\_\_\_  
washer \_\_\_\_\_ VCR \_\_\_\_\_ phone \_\_\_\_\_ TV \_\_\_\_\_ stereo \_\_\_\_\_ refrigerator \_\_\_\_\_ stove \_\_\_\_\_

33. The roof of your house is made up of what type of material: thatch \_\_\_\_\_ zinc \_\_\_\_\_  
cement \_\_\_\_\_

The wall of your house is made out of what type of material: palmetto \_\_\_\_\_ plywood \_\_\_\_\_  
wood \_\_\_\_\_ cement \_\_\_\_\_

Windows: wooden \_\_\_\_\_ metal \_\_\_\_\_ glass \_\_\_\_\_

Floors: dirt \_\_\_\_\_ cement \_\_\_\_\_ wood \_\_\_\_\_ tile \_\_\_\_\_

## Household Interview questionnaire for Glovers Reef

Date and time \_\_\_\_\_

Interviewer \_\_\_\_\_

Respondent # \_\_\_\_\_

Location \_\_\_\_\_

### ***Demographics***

1. How old are you? \_\_\_\_\_
2. What is your level of education?  
Primary \_\_\_\_\_ Secondary \_\_\_\_\_ Associates \_\_\_\_\_
3. How many people live in your household? \_\_\_\_\_
4. Which job provides your household with the most income?  
1<sup>st</sup> \_\_\_\_\_, 2<sup>nd</sup> \_\_\_\_\_, 3<sup>rd</sup> \_\_\_\_\_
5. Are there any females in your household who are involved in the fishing business?  
Yes \_\_\_\_\_ Who \_\_\_\_\_ What activity? \_\_\_\_\_  
No \_\_\_\_\_

### ***Coastal and Marine/Fishing Activities***

6. Is any of the fish caught by your family at Glover's Reef used for food by the household?  
Yes \_\_\_\_\_  
No \_\_\_\_\_
7. Have you or any of your children visited Glover's Reef?  
Yes \_\_\_\_\_  
No \_\_\_\_\_
8. Do you think that people in your community can work together to solve a problem in the fishing or tourism industries?  
Yes \_\_\_\_\_ No \_\_\_\_\_ Don't know \_\_\_\_\_
9. Should the government alone, the people alone or both together, work to solve a problem in the fishing or tourism industries?  
government only \_\_\_\_\_ people only \_\_\_\_\_ both \_\_\_\_\_
10. Would you support Glover's Reef being managed in partnership between government and another group? Such as an NGO, Fishing Cooperative etc.  
Yes \_\_\_\_\_ No \_\_\_\_\_ Don't know \_\_\_\_\_

### ***Attitudes and Perceptions***

11. Are you aware that Glovers Reef is a Marine Reserve?  
Yes \_\_\_\_\_ No \_\_\_\_\_
12. Are you aware of the Glovers Reef Marine Reserve management zones?  
Yes \_\_\_\_\_ No \_\_\_\_\_
13. Are you a member of any organization in Dangriga/Hopkins?  
Yes \_\_\_\_\_ What organization? \_\_\_\_\_  
No \_\_\_\_\_
14. If you could choose an occupation for your children, what would it be?  
\_\_\_\_\_
15. How would you describe the condition of the marine resources five years ago at Glover's Reef?  
Very good \_\_\_\_\_ good \_\_\_\_\_ not good \_\_\_\_\_ bad \_\_\_\_\_ very bad \_\_\_\_\_



16. How would you describe the condition of the marine resources today at Glover's Reef?  
 Very good \_\_\_\_\_ good \_\_\_\_\_ not good \_\_\_\_\_ bad \_\_\_\_\_ very bad \_\_\_\_\_
17. Indicate degree of agreement with the following statements using the scale: don't know (6) strongly agree (5), agree (4), neutral (3), disagree (2), or strongly disagree (1)
- \_\_\_\_\_ a) The Marine Reserve is important for protecting the Atoll's coral reef system
  - \_\_\_\_\_ b) Fisheries are adequately managed and enforced.
  - \_\_\_\_\_ c) Penalties for illegal fishing should be increased
  - \_\_\_\_\_ d) Mangroves should be protected at Glover's Reef
  - \_\_\_\_\_ e) Participation in management decisions about Glover's Reef Marine Reserve is important to you.
  - \_\_\_\_\_ f) Most fishermen respect the marine reserve regulations.
  - \_\_\_\_\_ g) Marine protected areas are beneficial to Belizean marine resources.
  - \_\_\_\_\_ h) Children need to learn more about marine conservation at school.
  - \_\_\_\_\_ i) Tourism has been good for your community.
  - \_\_\_\_\_ j) Tourism has been good for your household.

### ***Threats and problems***

18. What do you think are the top three major **problems** for the Glovers Reef marine resources?

Problems: 1. \_\_\_\_\_, 2. \_\_\_\_\_, 3. \_\_\_\_\_.

19. What do you think are the possible **solutions** to these problems?

Solutions: 1. \_\_\_\_\_, 2. \_\_\_\_\_, 3. \_\_\_\_\_.

### ***Material style of life.***

20. Do you have:

Own farm land \_\_\_\_\_ Own house lot \_\_\_\_\_ own house \_\_\_\_\_  
 vehicle \_\_\_\_\_ bicycle \_\_\_\_\_ washer \_\_\_\_\_ VCR \_\_\_\_\_ phone \_\_\_\_\_ TV \_\_\_\_\_  
 stereo \_\_\_\_\_ refrigerator \_\_\_\_\_ stove \_\_\_\_\_

21. The roof of your house is made up of what type of material: thatch \_\_\_\_\_

zinc \_\_\_\_\_ cement \_\_\_\_\_

Type wall of your house is made out of what type of material: palmetto \_\_\_\_\_ plywood \_\_\_\_\_

wood \_\_\_\_\_ cement \_\_\_\_\_

Windows: wooden \_\_\_\_\_ metal \_\_\_\_\_ glass \_\_\_\_\_

Floors: dirt \_\_\_\_\_ cement \_\_\_\_\_ wood \_\_\_\_\_ tile \_\_\_\_\_

## Tour Guide Interview Questionnaire for Glovers Reef

Date and time \_\_\_\_\_

Interviewer \_\_\_\_\_

Location \_\_\_\_\_

Respondent # \_\_\_\_\_

### *Demographics*

1. How old are you? \_\_\_\_\_
2. What is your level of education?  
Primary \_\_\_\_\_ Secondary \_\_\_\_\_ Associates \_\_\_\_\_
3. How many people live in your household? \_\_\_\_\_
4. Which job provides you with the most income?  
1<sup>st</sup>. \_\_\_\_\_, 2<sup>nd</sup>. \_\_\_\_\_, 3<sup>rd</sup>. \_\_\_\_\_
5. Are any other members in your household involved in an income-generating activity?  
Yes \_\_\_\_\_ Who \_\_\_\_\_ What activity? \_\_\_\_\_  
No \_\_\_\_\_

### *Coastal and Marine/Fishing Activities*

6. How many years have you used the Reserve as a tour guide?  
Less than 5 years \_\_\_\_\_ 5 – 10 years \_\_\_\_\_ More than 10 years \_\_\_\_\_
7. What part of the Reserve do you visit/use?  
South end \_\_\_\_\_ North end \_\_\_\_\_ East reef \_\_\_\_\_ West reef \_\_\_\_\_  
Cayes \_\_\_\_\_ Other \_\_\_\_\_
8. What type of guiding to Glover's Reef do you do?  
Sportfishing \_\_\_\_\_ Dive \_\_\_\_\_ Snorkel \_\_\_\_\_ Kayak \_\_\_\_\_ General \_\_\_\_\_ Other \_\_\_\_\_
9. What percentage of your annual business is done at Glovers Reef?  
0-25% \_\_\_\_\_ 25-50% \_\_\_\_\_ 50-75% \_\_\_\_\_ 75-100% \_\_\_\_\_
10. What are the major months in the year for your guide business to Glover's Reef?  
J \_\_\_\_\_ F \_\_\_\_\_ M \_\_\_\_\_ A \_\_\_\_\_ M \_\_\_\_\_ J \_\_\_\_\_ J \_\_\_\_\_ A \_\_\_\_\_ S \_\_\_\_\_ O \_\_\_\_\_ N \_\_\_\_\_ D \_\_\_\_\_
11. How many guide trips to Glover's Reef do you make each year?  
\_\_\_\_\_ trips
12. What is the average number of people that you take on a trip to Glover's Reef for:  
Sportfishing \_\_\_\_\_ Dive \_\_\_\_\_ Snorkel \_\_\_\_\_ Kayak \_\_\_\_\_ General \_\_\_\_\_ Other \_\_\_\_\_
13. What are the top 4 sportfishing species that you target at Glover's Reef?  
1) \_\_\_\_\_ 2) \_\_\_\_\_  
3) \_\_\_\_\_ 4) \_\_\_\_\_
14. What is the charge/fee per person per trip for:  
Sportfishing \_\_\_\_\_ Dive \_\_\_\_\_ Snorkel \_\_\_\_\_ Kayak \_\_\_\_\_ General \_\_\_\_\_ Other \_\_\_\_\_
15. How many crew members are usually on your boat?  
\_\_\_\_\_ crew
16. What type of information do you provide your tourists on marine resource conservation and protection? \_\_\_\_\_
17. What type of education materials on marine resource conservation and protection would be useful to you and your tourists? \_\_\_\_\_
18. How would you rank visitor satisfaction after visiting the reserve?  
Fair \_\_\_\_\_ Good \_\_\_\_\_ Very good \_\_\_\_\_ Excellent \_\_\_\_\_
19. How would you describe the condition of fisheries resources five years ago at Glovers Reef?  
very good \_\_\_\_\_ good \_\_\_\_\_ not good \_\_\_\_\_ not bad \_\_\_\_\_ bad \_\_\_\_\_ very bad \_\_\_\_\_
20. How would you describe the conditions of fisheries resources today at Glovers Reef?  
very good \_\_\_\_\_ good \_\_\_\_\_ not good \_\_\_\_\_ not bad \_\_\_\_\_ bad \_\_\_\_\_ very bad \_\_\_\_\_

21. Why do you think the conditions have changed?  
\_\_\_\_\_
22. Would you support Glover's Reef being managed in partnership between government and another group? Such as an NGO, Fishing Cooperative etc.  
Yes \_\_\_\_\_ No \_\_\_\_\_ Don't know \_\_\_\_\_

### *Attitudes and Perceptions*

23. Are you aware that Glovers Reef is a Marine Reserve?  
Yes \_\_\_\_\_ No \_\_\_\_\_
24. Are you aware of the Glovers Reef Marine Reserve management zones?  
Yes \_\_\_\_\_ No \_\_\_\_\_
25. Are you familiar with any rules and regulations in the Glover's Reef Marine Reserve related to:  
Commercial fishing \_\_\_\_\_; sport fishing \_\_\_\_\_; Mangrove use \_\_\_\_\_; resort development \_\_\_\_\_; tourism snorkel/diving \_\_\_\_\_
26. Are you a member of a tourism association?  
Yes \_\_\_\_\_ Which? \_\_\_\_\_  
No \_\_\_\_\_
27. How do you feel your tourism association represents you on the Glover's Reef Advisory Committee?  
Very well \_\_\_\_\_ Well \_\_\_\_\_ Fair \_\_\_\_\_ Poor \_\_\_\_\_ Don't know \_\_\_\_\_
28. Are you a member of any other organization in Dangriga/Hopkins?  
Yes \_\_\_\_\_ What organization? \_\_\_\_\_  
No \_\_\_\_\_
29. Indicate degree of agreement with the following statements using the scale: don't know (6) strongly agree (5), agree (4), neutral (3), disagree (2), or strongly disagree (1)
- \_\_\_\_\_ a) The Marine Reserve is important for protecting the Atoll's coral reef system
  - \_\_\_\_\_ b) The conservation zone is helping to sustain fish stocks
  - \_\_\_\_\_ c) All sportfishing should be catch and release
  - \_\_\_\_\_ d) Penalties for illegal fishing should be increased
  - \_\_\_\_\_ e) Mangroves should be protected at Glover's Reef
  - \_\_\_\_\_ f) Enforcement of the reserve regulations is adequate
  - \_\_\_\_\_ g) Participation in management decisions about Glover's Reef Marine Reserve is important to you.
  - \_\_\_\_\_ h) Facilities for tourists at the reserve headquarters at Middle Caye are adequate.
  - \_\_\_\_\_ i) Most fishermen respect the marine reserve regulations.
  - \_\_\_\_\_ j) Most tour guides respect the marine reserve regulations.

### *Threats and problems*

30. What do you think are the top three major **problems** for the Glovers Reef marine resources?  
Problems: 1. \_\_\_\_\_, 2. \_\_\_\_\_, 3. \_\_\_\_\_.
31. What do you think are the possible **solutions** to these problems?  
Solutions: 1. \_\_\_\_\_, 2. \_\_\_\_\_, 3. \_\_\_\_\_.

### *Material style of life.*

32. Do you have:  
Own farm land \_\_\_\_\_ Own house lot \_\_\_\_\_ own house \_\_\_\_\_ skiff \_\_\_\_\_ outboard engine \_\_\_\_\_ vehicle \_\_\_\_\_ bicycle \_\_\_\_\_ washer \_\_\_\_\_ VCR \_\_\_\_\_ phone \_\_\_\_\_  
TV \_\_\_\_\_ stereo \_\_\_\_\_ refrigerator \_\_\_\_\_ stove \_\_\_\_\_

33. The roof of your house is made up of what type of material: thatch \_\_\_\_\_ zinc \_\_\_\_\_  
cement \_\_\_\_\_  
Type wall of your house is made out of what type of material: palmetto \_\_\_\_\_  
plywood \_\_\_\_\_ wood \_\_\_\_\_ cement \_\_\_\_\_  
Windows: wooden \_\_\_\_\_ metal \_\_\_\_\_ glass \_\_\_\_\_  
Floors: dirt \_\_\_\_\_ cement \_\_\_\_\_ wood \_\_\_\_\_ tile \_\_\_\_\_

## **Appendix 2 - Notes on Recommendations made at Community Meetings**

### **Sarteneja**

Twenty-six participants attended the meeting held in Sarteneja at the Community Center on the 28<sup>th</sup> December, 2004. Twenty were fishermen, and six of them recorded that they fished at Glover's Reef.

The main comments were:

- In relation to the problem of fishermen not being well represented on the Glover's Reef Advisory Committee, the group felt that a Glover's Reef fisherman should be chosen to represent them.
- Feedback on the work of the Committee should be given through regular reports.
- Fishing at night is a major problem at Glover's. Illegal fishing continues in several areas by Guatemalans and Hondurans.
- The Fisheries Dept. should distribute reports of studies on conch and lobster to fishermen e.g. studies on the spawning of conch.
- The impacts of caye developments on fisheries need to be taken into consideration.
- Many fishermen felt that there are too many reserves.
- Although some have received training to become tour guides, no jobs are available for them when they have completed the training.
- The group recommended that researchers work in partnership with fishermen to identify the most suitable areas for protection.
- They felt that Sarteneja fishermen are being targeted by the reserve and fisheries enforcement patrols.
- Studies are also required to help develop fisheries, not only conservation.

### **Dangriga**

The meeting in Dangriga, which was held on the afternoon of the 29<sup>th</sup> December 2004 at the Town Hall, was very poorly attended with only five persons present. These included one tour guide and a teacher; no fishermen were present.

The points of discussion included:

- The importance of teaching children about the marine resources, which benefit the communities
- Schools need access to the type of information presented at the meeting, which they can then pass on to their students
- Marine education needs to include more than only marine reserves
- Marine education could be included in the new Center for Employment Training which is being built in Dangriga
- Some fishermen, who are members of fishing co-operatives, violate the reserve regulations
- The Fisheries Dept. needs to share more information with fishermen

### **Hopkins**

The meeting in Hopkins was held on the evening of 29<sup>th</sup> December 2004 at the Community Center. Ten persons participated; three were fishermen and two were tour guides. Two of the fishermen and one guide worked at Glover's Reef.

The main comments were:

- Tarpon and permit need to be protected from netting, as they are important sport fish species.
- Not just the spawning adults, but young groupers also need to be protected.
- Buying out traps or nets, such as was done in Bermuda, may help fishermen to change their livelihood.
- Tour guides in fly fishing are not receiving sufficient specialist training; they require much more training in technique to become successful. This could possibly be acquired through arranging internships with skilled guides.
- Hopkins fishermen feel that they have been unfairly affected, as the authorities closed the spawning sites near their village that they fished (Glover's and Emily), yet they left open two sites to fishing that are located far away in the north. They requested some feedback from the Fisheries Department on the issue.
- They also felt the numbers of Nassau groupers had declined at Emily due to tagging of fish at that site with the use of spears.
- In relation to the safety of their divers, tour guides were concerned about the need to be informed of the times that researchers would be tagging sharks at Glover's Reef.

### Appendix 3 - Samples of Result Summaries

## GLOVER'S REEF MARINE RESERVE SOCIOECONOMIC SURVEY RESULTS: SARTENEJA 2004

In June 2004, Wildlife Conservation Society (WCS) conducted a socioeconomic survey in Sarteneja, focusing on the fishermen who use the resources of the Glover's Reef Marine Reserve. The objective of the survey was to help strengthen the management of the Reserve by conducting planning that is responsive to the needs and priorities of the community, while encouraging community support for the conservation of the Glover's Reef Atoll. Similar surveys were conducted in Dangriga and Hopkins, communities that also depend on the Atoll's resources. The surveys followed the method described in the SocMon guidelines developed for the Caribbean.



Glover's Reef is one of the most important fishing areas for Sarteneja fishermen. Based on a recent census of boats, eight sailboats with 7 to 14 dories are currently active at Glover's. Twenty fishermen (8 captains and 12 crew) were interviewed. The survey covered information on demographics, coastal and marine activities, attitudes and perceptions, threats and problems, solutions, and material style of life.

### Results – Demographics

All fishers were males. Fishing was the primary occupation for all respondents, with only seven fishermen also having a secondary occupation. This demonstrates their strong dependence on fishing the resources of Glover's Reef.

Average age	34
Average household size	5
No. with primary education	19
No. with secondary education	1
No. with family members involved In income-generating activities	8
No. member of a fishing co-operative	17



### Coastal and Marine Activities

Almost half the fishermen interviewed have fished Glover's for more than 10 years, and the majority received 76% to 100% of their catch from the atoll. Most made 10 to 25 fishing trips per year, and the average length of a trip was 8 days. All were divers, fishing for lobster and conch and also taking finfish such as hog fish, grouper, snapper and rockfish. Almost all respondents sold 100% of their catch to a cooperative, either Northern or National. Only two fishers sold 25% and 50%, respectively, of their catch locally.

## Attitudes & Perceptions

Virtually all respondents felt the condition of the resources was worse than five years ago. The reasons stated for this decline were the establishment of the marine reserve, hurricanes, more fishermen using the area, and illegal fishing.

The results also demonstrated the following:

- 65% agreed the Conservation Zone was helping to sustain fisheries
- 95% felt more of the Conservation Zone should be opened to fishing
- 55% felt penalties should not be increased
- 70% agreed that enforcement was not adequate
- 60% felt most fishermen do not respect the reserve regulations
- 55% supported protection of the mangroves at Glover's
- 100% wished to participate in decision-making.



About half the respondents felt they were not well represented on the Glover's Reef Advisory Committee, and the majority did not support joint management of the reserve by government and a NGO or co-operative. On the other hand, the majority supported co-management of the resources between fishermen and the government. **Significantly, the majority agreed that the marine reserve is important for protecting the atoll's coral reef system.**

All fishermen were aware of the Glover's Reef Marine Reserve and its management zones. They were also familiar with the regulations for commercial and sport fishing, and for the protection of mangroves. The majority, however, were not familiar with regulations for resort development and tourism (e.g. snorkeling and diving). Most respondents were willing to change to another occupation, e.g. tour guiding, and they would choose an occupation other than fishing for their children. Fishermen were mainly interested in education for their children.

## Threats, Problems and Solutions

Respondents identified the following as the main threats and problems facing the reserve:

- Overfishing and illegal fishing
- Caye owners are allowed to fish in the Conservation Zone
- Reserve staff are biased
- Area is too large to patrol adequately

They recommended the following solutions to address these concerns:

- Increase area open to fishing
- Enforce the laws
- Conduct more patrols and appoint more rangers
- Install new marker buoys
- Issue no special licenses to fish in the Conservation Zone

## Material Style of Life

Most fishermen (60%) owned their house and 70% owned their lot; in addition, 30% owned farmland. All owned a dorey, bicycle, stove, washer and stereo equipment, and almost all had a TV. The majority also owned a VCR, refrigerator, and telephone.

Most of the homes were built of cement (85%), with wooden windows (60%), cement floors (90%) and zinc roofs (85%).

*WCS is grateful to all the fishermen who took part in the survey and to the villagers who assisted with the study. We are also grateful to NOAA who funded the study.*





## **GLOVER'S REEF MARINE RESERVE TOUR GUIDE SOCIOECONOMIC SURVEY RESULTS: HOPKINS 2004**

In June 2004, Wildlife Conservation Society (WCS) conducted a socioeconomic survey in Hopkins, focusing on the tour guides who use the resources of the Glover's Reef Marine Reserve. The objective of the survey was to help strengthen the management of the Reserve by conducting planning that is responsive to the needs and priorities of the community, while encouraging community support for the conservation of the Glover's Reef Atoll. Similar surveys were conducted in Sarteneja and Dangriga, communities that also depend on the Atoll's resources. The surveys followed the method described in the SocMon guidelines developed for the Caribbean.



Glover's Reef is one of the areas used by tour guides based in Hopkins. Ten guides were interviewed. The survey covered information on demographics, coastal and marine activities, attitudes and perceptions, threats and problems, solutions, and material style of life.

### **Results – Demographics**

All tour guides were males. Guiding was the primary occupation for all respondents, and only two also had a secondary occupation, which was fishing and construction. Nine were members of an association, the Dangriga, Belize City or Hopkins Tour Guide Association.

Average age	28
Average household size	3
No. with primary education	2
No. with secondary education	7
No. with tertiary education	1
No. with family members involved in income-generating activities	4
No. member of an association	9



### **Coastal and Marine Activities**

The majority of the guides have used Glover's Reef for less than five years and carried out 25% of their business at this site. They used mainly the north end and east reef of the atoll, and the main type of guiding is for diving. Their trips to the atoll were mainly in December to April, with peak use in December to March. The guides made an average of 26 to 50 trips annually to the atoll, with an average group size of 10. The average fee per person for diving was \$247.

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Guides gave tourists oral briefings and lectures. The respondents requested that they be supplied with material such as brochures, charts, and results of research. They also requested an educational center at the reserve headquarters at Middle Caye. Guides reported that visitors registered very good to excellent satisfaction with their trips to Glover's.

### Attitudes & Perceptions

Respondents felt the condition of the resources had improved over the past five years. The reasons stated for this improvement were the appointment of rangers and fisheries officers who are doing a better job and the results of conservation efforts on the atoll.

The results also demonstrated the following:

- 100% agreed the Conservation Zone was helping to sustain fisheries
- 70% felt penalties should be increased
- 40% agreed that enforcement was adequate
- 30% felt most fishermen respect the reserve regulations
- 60% felt most tour guides respect the reserve regulations
- 90% supported protection of the mangroves at Glover's
- 80% felt all sport fishing should be catch-and-release
- 30% agreed the facilities at the reserve HQ on Middle Cayes were adequate
- 80% wished to participate in decision-making.

The majority of respondents felt they were not well represented on the Glover's Reef Advisory Committee. The majority supported joint management of the reserve by government and a NGO or co-operative. **Significantly, all guides agreed that the marine reserve is important for protecting the atoll's coral reef system.**

All guides were aware of the Glover's Reef Marine Reserve and the majority knew of the management zones. The majority also reported that they were familiar with the regulations for commercial and sport fishing, the protection of mangroves, resort development, and tourism (e.g. snorkeling and diving).



### Threats, Problems and Solutions

Respondents identified the following as the main threats and problems facing the reserve:

- Illegal fishing
- Reserve understaffed
- Improper patrols
- Poor public relations
- Destroyed coral

They recommended the following solutions to address these concerns:

- Conduct more patrols
- Charge illegal fishers
- Train staff

### Material Style of Life

Only 35% of the guides owned their house and 50% owned their lot; in addition 10% owned farmland. A few owned their own boat (20%) and engine (10%). The majority owned a washer, TV, phone, stereo, refrigerator and stove.

Most their homes were built of wood (60%), with zinc roofs (90%), wooden (50%) or glass (40%) windows, and wooden floors (70%).

*WCS is grateful to all the fishermen who took part in the survey and to those who assisted with the study. We are also grateful to NOAA who funded the study.*

