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Establishing a Socio-economic Monitoring Program for Glover's Reef Atoll, Belize

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ABSTRACT

In an effort to strengthen the management of the Glover's Reef Marine Reserve in Belize, a socioeconomic monitoring program is being developed. Although the Marine Reserve was declared in 1993, comprehensive socioeconomic data have not been systematically collected for the site. The SocMon protocol for the Caribbean was applied and the results provide a baseline of the status of the Atoll against which future surveys can be compared. Results presented for the survey of fishermen from Sarteneja, Dangriga and Hopkins include summaries on demographics, marine activities, attitudes and perceptions, perceived threats, and material style of life. By continuing this program, information will be generated which should ensure adaptive management occurs, introducing measures that are acceptable and effective.

KEY WORDS: Fishing, marine reserve, socioeconomics

Estableciendo un Programa de Monitoreo Socioeconomico en Glover's Reef Atoll, Belize

Con el esfuerzo de resforzar el manejo de la la Selva Marina de Glover's Reef en Belize, se esta desarrollando un programa de monitoreo. Informacion socioeconomica debera de ser incorporada en la planificacion de gerencia para asegurarse que las medidas implementadas responden a las prioridades y necesidades comunitarias y mas. Implementando este tipo de medidas entonces motivara a la comunicadad a apoyar la conservacion. Aun cuando la Reserva Marina de Glover Reef fue declarada en 1993, informacion comprensible no ha sido colectada en una manera sistemamatica, con la exepcion de algunas encuestas que se han llevado acabo en las comunidades del area de pesca. La pesca es la actividad mas importante de Atoll, una area tradicionalmente especializada en la crianza de langosta, caracol y pescado finfish. El turismo es la segunda fuerza social y economica, el cual se esta desarrollando rapidamente con actividades como buseo, buseo en las profundidades, kayak, y la pesca deportiva. En este estudio se desarrollaron unas encuestas durante un taller de entrenamneto y consideraban a los pescadores, guias turisticos y

las familias. Las encuestas se llevaron a cabo en mayo, junio y julio del 2004 en las tres comunidades más importantes de pescadores, guías turísticos los cuales están activos en Glover's Reef, específicamente en Sartaneja, Dangriga y Hopkins. El Protocolo de SocMon desarrollado en el Caribe se aplicó y los resultados indicaron así una base de la situación socioeconómica de Atoll con los cuales se podrán comparar futuras encuestas. La información incluye síntesis de actividades marinas y demográficas, actitudes y percepciones, amenazas y problemas percibidos y material sobre el estilo de vida. Con la continuidad de este programa se generará información la cual puede asegurar que se lleve a cabo un manejo adaptable, introduciendo medidas de manejo que son aceptables y efectivas.

PALABRAS CLAVES: Programa de monitoreo, Reserva Marina de Glover Reef, Belize

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). This elongate atoll, measuring 32 km long and 12 km wide, has also been identified as a global and regional priority for conservation attention (Kramer and Kramer 2002).

Fishing is the most important economic activity on the Atoll. The Nassau grouper spawning bank on the northeastern point has been traditionally exploited by fishermen from the village of Hopkins. 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 the bank was closed to fishing in 2002. Fishermen from Dangriga and Sartaneja also fish the Atoll, diving for lobster and conch, and catching finfish using a variety of methods.

Tourism is a second major social and economic force at Glover's Reef. Six tourism facilities are based on the Atoll; boats from other resorts and private yachts also visit the area. The main activities include snorkeling and scuba diving; kayaking has recently developed, and some sport fly-fishing occurs (Gibson 2003).

These reefs also have cultural and archeological significance. Glover's Reef lies on the pre-Columbian trade route between Honduras and 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 has been inhabited by shipwrecked Spanish and British sailors.

The Atoll was declared the Glover's Reef Marine Reserve in 1993, and a World Heritage Site in 1996. Encompassing 35,076 hectares, the reserve has been zoned into four management areas, including a Conservation Zone that covers about one-fifth of the area, the largest 'no take' zone of the reserves in Belize.

Despite its protected status, Glover's Reef is threatened by various factors, including a lack of support for the reserve, primarily from the fishing community. 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. Establishing a socioeconomic monitoring program is one 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 measures that are responsive to community priorities, needs and mores. A second objective is to ensure that the potential benefits and costs of management of the reserve to stakeholders are fully documented and accounted for.

Glover's Reef fishermen come mainly from three coastal communities: Sarteneja, Dangriga and Hopkins (Figure 1).



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

Sarteneja

Sarteneja village, with a population of approximately 1,591 (CSO 2003), is located on Corozal Bay in northern Belize. 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. 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. Garaway and Esteban (2002) indicated that Glover's Reef was the major fishing area for Sarteneja fishermen.

The heavy dependence of villagers on fishing is due to several environmental and socioeconomic constraints such as geographic remoteness, few choices for employment, limited education, lack of access to financial capital and land, and language (Pantin et al. 2004). The tourism industry is very underdeveloped 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) noted that eight sail boats from Sarteneja fish at Glover's Reef, ranging in size from 21 to 38 ft, and carrying 7 to 14 dories each. The fishermen free dive using hook sticks for catching

lobster, Hawaiian slings and spear guns to spear fish, and collecting conch by hand.

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 (CSO 2003), and 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 include agriculture, particularly the citrus and banana industries, aquaculture, fishing, tourism and commerce, including 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 and Creole.

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

Hopkins

Hopkins is a village of 994 persons (CSO 2003), located a few miles south of Dangriga on one of the few mainland beaches in Belize. It is a Garifuna community, and fishing is part of the subsistence tradition of the people (Perez 2003, Pantin 2004). Other economic activities include working in agricultural plantations, subsistence farming, and government employment (Garaway and Esteban 2002). Tourism is also now well established and growing.

Glover's Reef is the third most important fishing area for fishers from Hopkins, who have traditionally fished the Nassau grouper aggregation site on the atoll during the spawning season (Garaway and Esteban 2002). Twelve skiffs, powered by outboard engines and ranging in size from 20 to 26 ft, fish at Glover's Reef (Grant 2004). 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.

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 and 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.

As a practical exercise during a two-day training workshop on the SocMon guidelines, participants developed a draft questionnaire targeting Glover's Reef fishermen. The survey team refined the draft to apply to fishermen in

Sarteneja, Dangriga and Hopkins and also used it as the basis for developing the questionnaires for tour guides and households.

The interviews were conducted during May, June and July 2004. An effort was made to interview at least 10% of fishermen who fish at Glover's Reef. Twenty fishermen in Sarteneja, eight in Dangriga, and 15 in Hopkins were interviewed, including both captains and crew. The questions in the questionnaires were coded and the data entered in Excel spreadsheets. The data were then analyzed and the results of the fishermen interviews are presented below.

Documents providing secondary data were also 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.

RESULTS

Demographics

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 a secondary education. The average household size was five people. Half of the respondents reported that fishing was their primary occupation. Five of the eight respondents reported that other family members were involved in income-generating activities.

In Hopkins, the average age was 28, with 11 of the 15 respondents having primary, three having secondary, and one having tertiary level education. The average household size was six people. Fourteen of the 15 respondents reported that fishing was their primary occupation. Five respondents reported that other family members were involved in income-generating activities.

In Sarteneja, the average age was 34, with 19 of the 20 respondents having primary level education and one having secondary level education. The average household size was five people. All respondents reported that fishing was their primary occupation. Eight fishermen reported that other family members were involved in income-generating activities.

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 fishermen used primarily fishing lines and fishing rods to target finfish including snappers, kingfish, barracudas, marlin, tuna and wahoo. Boats had an average of three crew members. Only one respondent sold 100% of his catch to a cooperative, while two sold 100% to hotels, three sold their fish primarily in local markets, and two kept 100% for their own use.

The respondents in Dangriga felt that the condition of fisheries resources at Glover's Reef had worsened in the last five years. This was reportedly due to overfishing, more fishermen in the area, the marine reserve being established, and hurricanes. The majority (75%) felt that fishermen could work together to solve a problem in the fishery, and all felt that there should be co-

management with the government. The majority of respondents (75%) would support Glover's Reef being managed by a partnership between government and another group, such as an NGO or fishing cooperative.

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 fishermen primarily dived using hook sticks and spear guns to target lobster, conch and reef fish. Several fishermen also used fishing lines and rods 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 sold their catch primarily to a fishing cooperative. Two sold their catch primarily to hotels, three to local markets, and two kept their catch for their own use.

The Hopkins respondents felt the condition of fisheries resources at Glover's Reef had got worse in the last five years due to climate change, the marine reserve, and research being conducted. The majority (93%) felt that fishermen could work together to solve a problem in the fishery. Most fishermen felt there should be co-management with government. The majority of respondents (54%) would support Glover's Reef being managed by a partnership between government and another group.

The majority of Sarteneja respondents had also fished at Glover's Reef for more than ten years and 85% of them received 76 to 100% of their annual catch from the area. The fishermen dived, using spear guns and hook sticks to primarily target lobster and conch, and secondarily finfish such as hogfish, grouper, snapper and rockfish. Boats had an average of nine crew members. All respondents sold their catch primarily to a fishing cooperative, although two 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. This was overwhelmingly reportedly due to the marine reserve, although other causes included hurricanes, more fishermen in the area and illegal fishing. All respondents felt that they could work together to solve a problem in the fishery and almost all felt that there should be co-management with government. The majority (60%) would not support Glover's Reef being managed in partnership between government and another group; only five of the 20 respondents would support such a partnership.

Attitudes and Perceptions

All respondents in Dangriga were aware that Glover's Reef is a marine reserve and seven of the eight respondents were familiar with the management zones. All 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 respondents in Sarteneja were also aware of the marine reserve and its management zones. Table 1 shows the fishermen's familiarity with the various other rules and regulations of Glover's Reef.

Table 1. Familiarity with rules and regulations at Glover's Reef (percent familiar)

	Dangriga	Hopkins	Sarteneja
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 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 Committee. In Sarteneja, of 18 respondents to the question, seven reported being very well or well represented, while seven reported being poorly represented by their cooperative on the Committee.

Half of the respondents in Dangriga stated that they were willing to change to another occupation if it provided equal or more income than fishing. One preferred to be a tour guide, and three others preferred an unspecified occupation. Five of the respondents in Dangriga stated that they would choose 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 fishing. Six preferred to be a tour guide, one a sport fishing guide, one in aquaculture, and two respondents preferred an unspecified occupation. Four of the respondents in Hopkins stated that they would choose 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 preferred to be a tour guide and seven other respondents preferred an unspecified occupation. Eighteen of the respondents in Sarteneja stated that they would choose 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 the marine resources, marine resource management and tourism:

- i) The marine reserve is important for protecting the atoll's coral reef system,
- ii) The conservation zone is helping to sustain fisheries,
- iii) More area should be opened to fishing in the marine reserve,
- iv) Penalties for illegal fishing should be increased,
- v) Mangroves should be protected at Glover's Reef,
- vi) Enforcement of the reserve regulations is adequate,
- vii) Participation in management decisions about Glover's Reef marine reserve is important to you,
- viii) The closure of the NE point spawning aggregation site is a good management measure, and
- ix) Most fishermen respect the marine reserve regulations.

Respondents from Dangriga agreed with the statements on the marine reserve, conservation zones, increasing penalties, protecting mangroves, and participation in management. In Hopkins they agreed with the statements on 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. In Sarteneja there was agreement for the marine reserve, opening more area of the marine reserve for fishing, protecting mangroves, and participation in management, but weaker agreement for the conservation zones.

Threats and Problems

Respondents were asked to state the three major threats to the marine resources at Glover's Reef. The primary problems reported by respondents in Dangriga were illegal fishing, over fishing, and area too large to patrol. The main problems reported by those in Hopkins were illegal fishing, area too large to patrol, oil well, and human resources. The primary problems reported by Sarteneja respondents were caye owners fish in reserve, fisheries staff is biased, over fishing, illegal fishing, and area too large to patrol.

The respondents were asked to state the possible solutions to these problems. In Dangriga, the solutions included enforce laws, more patrols, and more rangers. Solutions proposed by Hopkins respondents included increasing fishing area, more patrols, new marker buoys, and enforce laws. In Sarteneja, the solutions included increasing fishing areas, enforce laws, no special licenses, more patrols, more rangers needed, and change rangers.

Material Style of Life

As a proxy of the measure of wealth, respondents were also asked questions concerning their household assets and construction materials of their house. The results indicated that more respondents in Hopkins own their house (87%) and lot (93%) than those in Dangriga and Sarteneja. Respondents in Dangriga own more household assets, such as stereos, telephones, and refrigerators, than respondents in Hopkins and Sarteneja. The quality of

housing of Sarteneja respondents was slightly higher than those in Dangriga and Hopkins, with more respondents having concrete walls and floors. Poorer quality houses of palmetto with thatch roofs, however, were recorded only in Sarteneja.

DISCUSSION

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.

Dangriga and 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 a significant portion kept for subsistence use. Fishers in Hopkins sold their catch mainly to the cooperative, some was sold in local markets 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.

Fishers from the communities differed in the type of gear used and the species targeted. Fishers from Dangriga used mainly fishing lines and rods, targeting benthic and pelagic finfish. 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, several fishers used fishing lines and rods capturing a variety of pelagic species. On the other hand, fishers from Sarteneja were all divers using hook sticks and spear guns, taking conch, lobster, and reef fish.

Respondents from all communities agreed that the fishing resources are in worse condition compared to five years ago. All communities indicated that one reason was the establishment of the marine reserve in 1993. This was ranked as the most important reason by the respondents from Sarteneja.

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 Sarteneja fishers being only concerned with fishing, while the Dangriga fishers have more varied activities related to the reef, such as tourism.

Significantly, the majority of respondents in Dangriga and Hopkins, and 50% from Sarteneja, felt they were poorly represented by their respective co-operatives on the Glover's Reef Advisory Committee.

Fifty percent of respondents from Dangriga and 60% from Sarteneja were willing to change to another occupation. Willingness to change was particu-

larly 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.

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 for fishing and have fewer alternatives. Nevertheless, the majority in all communities, particularly Sarteneja, felt more of the reserve area should be opened to fishing.

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

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 few years.

RECOMMENDATIONS FOR PRIORITY ACTIONS

Based on the results of the survey, we recommend several priority actions related to education, alternative livelihoods, legal issues, reserve management and improved participation.

Education and Awareness

Gaps in the fishermen's knowledge of the regulations of the reserve management zones, particularly amongst Hopkins fishers, need to be urgently addressed by the reserve staff. Although good support for the reserve was evident, respondents generally felt that fishers do not respect the reserve regulations. The benefits of the reserve need to be clearly demonstrated to fishers, especially to those in Sarteneja who were the least supportive.

Fishers also need to be educated in the regulations governing mangrove use, tourism, and coastal development. An awareness 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. The primary level of education of most fishers must be considered, and material should be translated into Spanish for

those from Sarteneja.

Alternative Livelihoods

Sarteneja fishers are almost totally dependent on fishing. If fishing effort is to be reduced in order to achieve sustainable fishing levels, alternatives for these fishermen need to be provided. Fishermen were mainly interested in becoming involved in the tourism industry; however, 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 tourism training and marketing, these are longer term aims and short-term alternatives need to be identified, such as training in computer skills, small business development, handicrafts, and aquaculture.

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 this industry are recommended, as they should have a very good chance of success.

Legal Concerns

Many respondents emphasized the need to adequately charge those who fish illegally. As penalties are charged at the discretion of the magistrates, they may need to be better informed of the importance of the industry and the harmful effect illegal fishing is having on the resources. Penalties may need to be increased or new measures introduced, such as cancellation of fishing licenses.

The reserve regulation allowing subsistence fishing by caye owners within the Conservation Zone should be repealed. This law has caused resentment amongst fishermen who consider it unfair, as the Zone is closed to commercial fishing. The Conservation Zone should be designated a fully protected area, with no exceptions allowed.

As many respondents felt strongly that the use of the Atoll by too many fishermen is causing a decline in the resources, we recommend that special fishing licenses be issued only to traditional fishers. This is provided for in the reserve regulations but has not yet been implemented. Traditional fishers feel that, as they have forfeited some of their fishing area by respecting the Conservation Zone on the Atoll, they should be the beneficiaries of the enhanced catches that may result from the protected area.

Reserve Management

Strong concerns were expressed regarding the need to strengthen patrols and improve the caliber of rangers. Although patrols have improved recently, 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 strategic and effective.

In an effort to hire the most suitable rangers, it may be beneficial to involve the Committee in the review of applications. Additional training could also be provided for rangers to help 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 safety when on patrol.

Representation and Participation

Many fishermen felt that they were not well informed by their representatives on the Glover's Reef Advisory Committee. As the Committee provides the main mechanism for their participation in the management of the reserve, this is a matter of critical importance. Their representation could be enhanced by the reporting of Committee proceedings at monthly and annual general meetings of the two fishing co-operatives. Communications between Committee representatives and their membership could also be improved by the preparation and distribution of bulletins that update the membership on issues under discussion by the Committee. Training of Committee members in their responsibilities should also continue to help 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 problems should be addressed jointly by fishermen and government, and were interested in increasing their participation in reserve management. 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.

In conclusion, the study provided useful baseline data against which future surveys can be compared to detect socioeconomic trends. Applying the recommendations can also help management be more responsive to the concerns expressed by one of the reserve's major stakeholder groups, the fishermen.

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