



**SocMon Assessment:**  
**Fishery Livelihoods in Copper Bank,  
Chunox and Belize City**

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## 1 Introduction

The Caribbean spiny lobster, *Panulirus argus*, and queen conch, *Strombus gigas* (referred to as lobster and conch, respectively) fisheries are important sources of livelihood for many households in Belize. Commercial fishing of lobster and conch started in the mid to late 1950s, mainly for export to the US (Gongora, 2010). The number of fishers involved has been increasing over time. Between 2004 and 2008, the number of licensed fishers rose from 1,731 to 2,246, representing an overall increase of 30% in four years (Ministry of Agriculture and Fisheries, 2008). In the last nine years the exploitation rate<sup>1</sup> for lobster and conch has increased; in the case of lobster this index has increased from 0.72 in 1999 to reach 0.79 in 2008 (Gongora, 2010). As fishing has increased over time to meet the high demand for lobster and conch from export markets, signals of over-exploitation are also increasing (Huitric, 2005). It is important to note that fish production from offshore areas is determined by, among other factors, the amount and quality of effort that is applied in fishery activity and the availability of stocks. Over the years, the number of people joining the lobster and conch fishery industry has increased, thereby putting considerable pressure on the limited stocks.

In partnership with the Belizean government, the Belize Audubon Society (BAS), a non-governmental membership organization dedicated to the sustainable management of natural resources –through protected areas management. BAS manages seven protected areas, including the Half Moon Caye and Blue Hole Natural Monuments two of which are found in the Lighthouse Reef Atoll two components of the Belize Barrier Reef Reserve – World Heritage Site marine protected areas, which are popular for lobster and conch fishing. Fishermen from different Belizean communities on the mainland use those areas as their main fishing spots. In their conservation strategy for the protected areas, BAS developed a strong focus on community-based natural resource management, where fishery communities take their own responsibility for managing the marine resources: “We (BAS) provide opportunities for stakeholders to participate in the management of their environment, adopt sustainable practices that are compatible with existing values and create alternative livelihoods (BAS, 2012).” The BAS program has a strong environmental education component to encourage fishermen to work cooperatively to protect the area and its resources.

An important group of households from Chunox, Copper Bank and Belize City are significantly dependent on coastal and marine resources for sustenance. As true with many human activities, the fishing industry can have negative impacts on the marine environment which supports these communities. It is therefore critical to have an understanding of not only the biological, but also socioeconomic factors, in order to manage fishery activities in a sustainable and efficient manner. The aim of this assessment is to provide BAS and the communities with basic information that can contribute to improving the effectiveness of decision making, interventions and organization with respect to the management of fisheries and other marine resources. To that end, we conducted a

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<sup>1</sup> “Exploitation rate, applied on a fish stock, is the proportion of the numbers or biomass removed by fishing. If the biomass is 1000 tons and the harvest during a year is 200 tons, the annual exploitation rate is 20%.” ( United Nations Food and Agriculture Organization, 1997)

livelihood analysis of the fishermen. Belize City was for baseline for the newly established marine protected area Turneffe Reef Atoll.

The document is structured as follows: Section 2 describes the research approach and the instruments used for the data collection and analysis. This is followed by a brief presentation of some critical features of the historical development of the lobster and conch fishery industry in Belize that helps to determine the current challenges for sustainable fishery management and briefly describes the sites where the assessment was conducted. This is followed by Section 3, which presents a summary of village and household-level livelihood characteristics that were encountered during our field work, which focused on the asset status of fishery households, the income-generating activities they engage in and the institutional environment in which livelihood strategies are adopted and adapted. Finally, the household-level findings are linked back to the general level management strategies with a view to identifying weaknesses and gaps in these strategies that need to be addressed if real progress in sustainable fishery management in Lighthouse and Turneffe Atoll is to be achieved.

## **2 Research approach**

### **2.1 Livelihoods**

Based on the sustainable livelihoods framework discussed by Scoones (1998) and Allison and Ellis (2001), we define livelihood strategies as the choices that people make in search of income, security, well-being, and other productive and reproductive goals. These choices are reflected in the way that people use their assets or capital and, as such, are an important part of household behavior, while determining well-being. The concept of livelihood strategies has developed through many years of thought and study on how rural households, including fishery households, construct their lives and income earning activities, the importance of the institutional structures that surround these households and their resulting poverty levels (Dearden *et al.*, 2002). According to Chambers and Conway (1992), a livelihood is sustainable if “[it] can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term.”

The sustainable livelihoods conceptual framework represented in Figure 2.1 is a dynamic tool that aims to combine and capture interactions between households, assets and their surrounding institutional environment. Central to the sustainable livelihoods approach is the question of how the poor combine different assets and capabilities to reduce vulnerabilities when facing stresses and shocks (Allison and Ellis, 2001). These assets can be grouped into five categories, namely natural, human, social, physical and financial capital; each plays a significant role in every livelihood strategy adopted to help achieve a particular livelihood outcome (Carney, 1998). The approach acknowledges the different assets, including entitlements, such as fishing rights, that people have in relation to the broader institutions, policies and culture. The sustainable livelihood approach also recognizes the risk and vulnerability of livelihoods to external shocks, trends and

seasonality (Allison and Ellis, 2001). Following this definition, there is substantial evidence to demonstrate that the livelihoods of the coastal fishers in Belize (and other Central American countries) are becoming increasingly *unsustainable*.

Our initial focus was on the conceptualization and quantification of the household's asset portfolio as an input into the explanation of a household's livelihood strategy. Sustainability is one of the essential characteristics of the livelihood focus, and it is key to the theory's success. Sustainability requires risk management in the face of unexpected situations to ensure the availability of resources for future generations. A sustainable system includes a conjugation of the economic, social, environmental and institutional aspects and the management and adaptation to a vulnerability context, such as climate change. In coastal zones, the sustainability of natural capital is the basis for the development of other capitals. In this case, the productivity of the zone is based on the marine resources. The sustainability of the livelihoods may be affected by positive or negative externalities that are presented within the context of vulnerability.

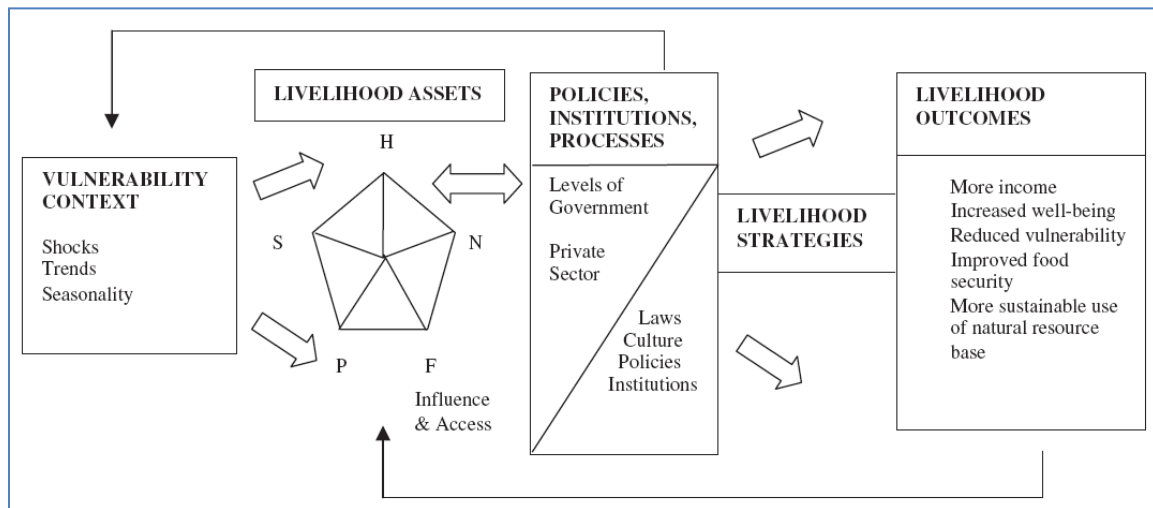


Figure 2.1: Sustainable Livelihoods Framework  
Source: Ellis (2000).

The assets determine the strengths and weakness of the households for dealing with external shocks. Better prepared households with more assets are more successful at coping with externalities and are less likely to fall into extreme poverty. Human capital reflects the stock of human skills and knowledge in the household and includes education, fishing skills, knowledge and health. Natural capital reflects the household's endowment of natural resources and includes land, marine resources, mangroves and biodiversity. Financial capital includes savings in cash and kind, credit, and transfers and remittances. Physical capital includes vehicles, boats, engines, fishing gears and methods and technology. Finally, social capital is embodied in human relationships and includes any networks that increase trust, ability to cooperate, access to opportunities and membership in organizations like fishery cooperatives or local credit associations.

## 2.2 SocMon approach

The SocMon methodology stresses the need to understand the human dimension in the management of coastal and marine resources. It provides simple guidelines and structures for monitoring, which may be adapted to the needs of each study site (Bunce *et al.* 2000; Bunce and Pomeroy, 2003). SocMon includes three phases for understanding the weaknesses and strengths of the coastal marine resources to permit the creation of action mechanisms that give incentives to improve their conservation and management.

After undertaking preparatory activities that included the elaboration of a proposal and its respective socialization with the included actors, primary and secondary data were collected.

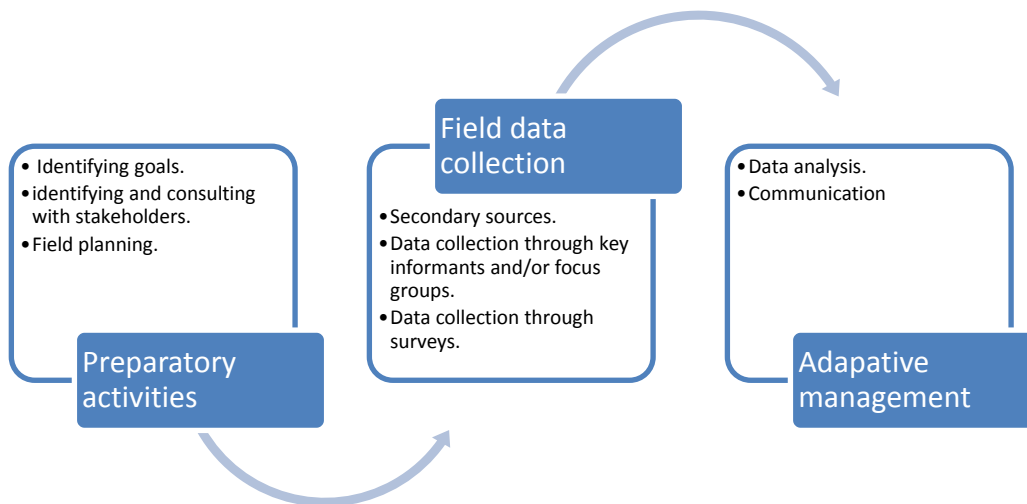


Figure 2.2: SocMon Methodology  
Source: Bunce and Pomeroy (2003).

## 2.3 Data collection

For the analysis, we collected original survey data from fishery households in the district of Corozal (Chunox and Copper Bank) and Belize City. Households were selected from a list that was compiled in collaboration with the Belizean Audubon Society. Face-to-face interviews were conducted at or near the homestead of the household and lasted for approximately 30 minutes. If a selected household was unavailable for the interview, the household was replaced with another household from the list. All interviews were carried out by locally recruited enumerators who were knowledgeable about the area and the activities carried out by fishery households. A standardized questionnaire was used to obtain information on household characteristics based on the asset pentagon. In addition, we asked detailed questions about the fishery, processing and marketing activities.

Given the focus of our assessment, we necessarily adapted and narrowed the broad asset definitions and used the following working definitions of each type of asset:

- *Human capital* is represented by the size and composition of the household with the latter determining the dependency ratio, formal education level of its members and age and gender of the household head.
- *Physical capital* for the fishery activities includes gear, boats and boat engines. We also included questions about the housing conditions (roof, walls and floor) and about small domestic assets (fans, stoves and refrigerators). Such assets determine the wellbeing status of the household.
- *Financial capital* includes transfers (remittances and other cash transfers), credit and savings.
- *Natural capital* is represented by the amount of land (plot and farm size) and the use of marine resources. Because the fishing grounds are not owned by the fishermen, we included questions related to the use of the fishing grounds (fishing calendar, frequency of visiting the fishing grounds).
- *Social capital* includes membership in various types of organizations and programs, including fishing cooperatives and associations and NGO projects.

Data was entered into a statistical program and cleansed. 35 households had to be removed from the data set because of missing data, resulting in a total sample of 102 households for the analysis.

#### **2.4 Data analysis**

We employed a wealth index to describe the household welfare situation. A wealth index is based on such durable goods as televisions, radios and transportation means and is considered more reliable than an estimation of household income. In addition, the index requires less intensive data, potentially resulting in a smaller measurement error.

Principal Component Analysis (PCA) was used to assign the indicator weights (Hair, *et al.* 2010) . In addition, the factor analysis process has been used as follows: First, the indicator variables were standardized (normalized); subsequently, the factor loadings were calculated; and finally, for each household, the indicator values were multiplied by the loadings and added up to produce the household's index value. In this process, only the first factor produced was used to represent the wealth index. The households were ranked by score and distributed into three sections (33% for each). Then the household score was recorded into the tercile variable so that each household received a category.

Frequencies and means were used to describe the five types of capital, fishing activities and general perception about fishery of each of the households. Pearson's correlation coefficients were used to examine the association between livelihood patterns and geographic location. The Statistical Package for the Social Sciences was used for all computations.



### **3 The Context**

#### **3.1 Lobster and conch fishery in Belize**

The Belizean fishery sector is an important productive component of the country's economy. During 2006, the fishery sector exported 25.6 million pounds of seafood, which represented a total of US\$ 53.4 million in revenue. This data includes aquaculture and wild catch fisheries where 95% of the productions and 80% of the revenue was from farmed seafood (Environmental Defense Fund, 2008). Lobster and conch are still the most productive wild catch fisheries; 90% of the lobster, conch and shrimp produced in Belize are exported to the United States.

The Spiny lobster and Queen conch continued to be Belize's principal fishery resources in 2008, and these two commodities are thus responsible for the largest portion of foreign exchange earnings from the wild catch fishery sector. This sector employed 2246 fishermen and 643 fishing vessels and, an estimated 15,000 Belizeans have a direct benefit from the fishing activity (Ministry of Agriculture and Fisheries, 2008).

The number of licensed fishermen has steadily increased from 1,731 in 2004 to 2,246 in 2008, representing an interesting pattern in the levels of fishing effort. In addition, Belizean fishermen depend on national stocks, and they cannot easily relocate if stocks decline.

##### *3.1.1 Lobster*

The total value of exported Belizean lobster in 2008 was US\$ 7.4 million, resulting from the export of approximately 470,485 pounds of lobster (Ministry of Agriculture and Fisheries, 2008). 90% of spiny lobster caught in Belize is exported. Lobster landings peaked at 750,000 pounds in 1981. Legal methods for catching lobster include traps, free diving and lobster shades. Fishermen have been deploying lobster shades to create aggregation sites. The season is closed from February 15th to June 14th, limiting lobster fishing to eight months (Environmental Defense Fund, 2008).

North of Belize is a major nursery area for lobster; 40% of lobster production comes from the north of Belize City in the surrounding area of Turneffe Atoll. The minimum size for lobsters is a three-inch length between horns and the beginning of the tail and a 4-ounce minimum tail weight.

##### *3.1.2 Conch*

In 2008, 614,050 pounds of conch exports amounted to US\$ 3.3 million (Ministry of Agriculture and Fisheries, 2008), and conch landings have declined from a peak of 1.2 million pounds in 1972. The only legal form of conch collection is free diving; assisted diving is prohibited. The closed season is from July 1st to September 30th, limiting the conch fishing season to nine months (Environmental Defense Fund, 2008).

By carrying out field studies, the Belize Fisheries Department determines the total allowable catch (TAC) for conch every two years; in 2006 the TAC on conch was set at 620,000 pounds. The Cooperatives are assigned a share of the TAC based on their historical catch, and when they meet their quota, they are required to stop harvesting conch.

### **3.2 Study sites**

The study was conducted in two communities on the Belizean north coast, namely Copper Bank, Chunox and in Belize City. These are important lobster and conch fishing communities where fishermen work mainly in the fishing grounds of Lighthouse and Turneffe Atoll. Each of the communities has its own unique characteristics. Copper Bank is a typical fishing community with a high percentage of households dedicated to commercial lobster and conch fishing. It is situated on the west bank of Laguna Seca, a shallow lagoon that empties into Chetumal Bay just north-east of the community. The local economy is based primarily on fishing for lobster and conch, although tourism is becoming increasingly significant as a source of income. Chunox is a rural community that depends on both fishing and peasant farming. .

The fishermen of Belize City are mainly located in the south-side of the city. Fishermen live in different neighborhoods where people engage in multiple different economic activities. However, for the fishery households, lobster, conch and finfish is the main income source.

### **3.3 Belize Audubon Society**

The Belize Audubon Society (BAS) is a non-profit NGO dedicated to the promotion of the sustainable use and preservation of the country's natural resources in order to maintain a balance between the population and the environment. Since its formation in 1969, the BAS has been Belize's foremost environmental organization, protecting Belize's precious natural resources while educating the public about their value and sustainable use. BAS has grown from an all-volunteer organization with 55 charter members to a Society of over 300 members and a staff of more than 40 dedicated professionals. The Belize Audubon Society cares for public lands in national parks, wildlife sanctuaries and natural monuments, which encompass more than 180 thousand acres.

At the request of the Government of Belize (GOB), the Belize Audubon Society has been instrumental in the financing, development and management of protected areas that have been designated under the National Parks System Act of 1981. Currently BAS manages seven of Belize's protected areas with a well-trained, knowledgeable staff, most of who are from the surrounding buffer communities. BAS works in partnership with government agencies such as the Belize Forest Department and Fisheries Department.

## **4 Livelihoods**

### **4.1 Profile of the interviewed fishermen**

A total of 105 fishermen were interviewed from the three study sites. Almost all respondents were male (97%) with permanent residency in communities in the district of Corozal and Belize City. The average age of the respondents was 37.1 years, and the majority of them were in the 26-45 age group. Most fishermen had completed primary school (63%), and only 4% didn't receive sufficient formal education to achieve an acceptable level of literacy. Over 92% of the respondents identified themselves as full-time fishermen dedicated to harvesting lobster and conch. All the fishermen used Lighthouse or Turneffe Atoll as their main fishing ground. Fishing lobster and conch is mainly

a male activity; no female fishers were sampled or interviewed. The general characteristics of the respondents are shown in Table 4.1.

## **4.2 Household Capital**

In this section we analyze the five different kind livelihood capitals: human, social, natural, physical and financial. Critical features of capital in relation to the ability of households to cope with and adapt to change are the diversity of capital held and whether the nature and diversity of the capital creates a capacity to cope and adapt, thereby reducing vulnerability (Scoone, 1999).

### *4.2.1 Human Capital*

Human capital represents the skills, knowledge, capacity to work and good health that together enable people to pursue different livelihood strategies and achieve their livelihood outcomes (DFID, 1999). In our analysis of human capital, we include the aspect of food security. Household eating patterns are strong indicators of relative poverty and vulnerability.

The results in Table 4.2 confirm findings in other SocMon assessments concerning the role of various demographic variables with respect to low-income households in coastal areas. The average family size of about 4.7 is much higher than the national average of 4.0. However, over the last ten years, average family size has declined in Belize by more than 20%. According to the poverty assessment report (GoB-CDB, 2010), as a result of declining fertility there has been a drastic decrease in the proportion of children aged under 15, from over 40% in 2000 to 34% today.

The dependency ratio is a measure of how much the non-working age population (0-14 years and 65 and over) is dependent on the working age population (15 to 64 years). A higher dependency rate means that more members of a household are not economically active and that the income generated depends from a small number of household members. The average dependency ratio (ratio of non-working members to total household size) in the three sites is about 25%, which is surprisingly low for a rural or coastal area. This means that most of the household members are old enough to be economically active and can have a positive impact on the household's per capita income.

A large number of studies have established that human capital, especially education and skills, is very important for improving livelihood outlooks. Low income and poverty are closely associated with low levels of education and lack of skills. In general, Belizean fishing communities have historically suffered from very low levels of education. However, it appears that the situation is changing for the better. Out of all the household heads, 64% had finished their primary education. Although educational rates in the three communities continue to be below the national average, many people have begun taking an active interest in education and in sending their children to primary school. The enrollment rate for primary education, which is the percentage of the number of children of official school age, was almost 100%. It's obvious that the enrollment for secondary schools is lower than for primary schools. An analysis of all the persons between the age of 18 and 25 showed that only 20% had completed their secondary education. This is far below the national average of 65%. One possible reason for the low rate of young people in the Corozal communities

culminating their secondary school could be the distance to the secondary school; however, we found a same low rate for the households interviewed in Belize City.

Variables	Community			Total
	Chunox	Copper Bank	Belize City	
<b>Demographic and education</b>				
Gender household head (male =1)	100.0	100.0	100.0	100.0
Age group household head	43.6	32.9	39.1	37.1
< 25 years	4.2%	29.4%	11.1%	18.6%
26- 45 years	50.0%	60.8%	66.7%	59.8%
46 – 65 years	33.3%	7.8%	14.8%	15.7%
> 65 years	12.5%	2.0%	7.4%	5.9%
Education level household head				
< primary	12.5%	13.7%	11.1%	12.7%
Primary complete	54.2%	70.6%	59.3%	63.7%
> primary	33.3%	15.7%	29.6%	23.5%
Family size	5.0	4.4	4.5	4.6
Dependency ratio	0.25	0.25	0.28	0.26
<b>Food security</b>				
Days served during the last week				
Maize	4.3	4.1	2.5	3.8
Rice	5.0	4.3	5.4	4.7
Wheat	6.9	6.5	4.9	6.2
Beef	2.6	1.8	2.1	2.0
Poultry	5.0	5.6	4.9	5.3
Fish	4.0	3.6	5.3	4.2

Source: Questionnaire SocMon-BAS, 2014

By including some aspects of household eating patterns, it is possible to analyze aspects related to food security and household wellbeing. Poorer households tend to consume foods on a less regular basis than wealthier households and may eat lesser quantities per person. Also, poorer households tend to consume more of less costly foods and less of more costly foods. The wealthier households often are more able to purchase staple foods in larger quantities at more favorable per-unit prices.

#### 4.2.2 Social Capital

Social relations between individuals, families and groups play an important role in sustaining household livelihoods. These social relations create trust, collective action and facilitate the access to wider institutions, memberships and the establishment of informal safety nets among the community members. A frequently used benchmark to estimate household social capital is their

membership in social and economic organizations. The majority of the fisher households have affiliation with production-oriented organizations, such as cooperative and local credit groups (92% of all household heads). As explained in the former section, the high incidence of membership in fishery cooperatives has to do with marketing the lobster and conch. Almost all the catch is sold to the national cooperatives. Membership in the local credit branch facilitates access to credit for fishery and non-fishery activities. On average, the household head has been a member of one of the two national fishing cooperatives for almost 13 years.

We found active participation of fishers in the production-related organizations; more than 42% has or has had an appointed leadership position in one of these organizations. Being active as leader involves connectivity that increases peoples' trust and collective movement and expands accessibility to other institutions like NGOs such as BAS.

Variables	Community			Total
	Chunox	Copper Bank	Belize City	
<b>Fishing cooperative (household head)</b>				
Membership in a cooperative (1=Yes)	100.0	96.1	77.8	92.2
Appointed leadership position in the cooperative (1=Yes)	16.7	52.0	47.6	42.1
Number of years being a registered member (years)	15.1	10.1	17.2	12.9
<b>Local organization (all members)</b>				
Membership in local organization (1=Yes)	16.7	29.4	22.2	24.5
Appointed leadership position in local organization (1=Yes)	0	25.0	33.3	23.1
Number of years being a registered member (years)	6.8	1.5	2.0	2.4

Source: Questionnaire SocMon-BAS, 2014

Except for religious organizations (churches), we did not find involvement in other social and cultural associations. This is possibly because the fishermen are more concerned about work and income-generating activities to fulfill their basic needs.

If we analyze the participation of women in the economically related networks, it seems that at the household level, women have become secondary participants in the economic activities related to fishing. This marginal role of women in the lobster and conch fishery activities undermines not only their status, but also their roles in the households and social networks. The concentration of fishery activities in Belize City and the few available economic activities in the area of Corozal have left women economically marginalized. Because fishermen are out at sea for

long periods of time, care functions are disproportionately allocated to women and create a major barrier to women's full participation in economic market activity.

#### 4.2.3 *Physical Capital*

Physical capital comprises the basic infrastructure and producer goods needed to support livelihoods. The lack of particular types of basic infrastructure is considered to be a core dimension of poverty. Without adequate access to services, such as water and energy, the quality of human life deteriorates. Also the opportunity costs associated with poor infrastructure (collecting firewood or drinking water) can preclude education, access to health services and income generation. Insufficient or inappropriate producer goods can also constrain people's productive capacity and therefore the human capital at their disposal. More time and effort are spent on meeting basic needs, production and gaining access to the market (Allison and Ellis, 2001).

To estimate the household welfare situation, we used data on household access to assets, dwelling and basic infrastructure use. According to Filmer and Pritchett (1998), dwelling and basic infrastructure may be a better benchmark for long-run household wealth than per-capita consumption. We assume that households with more access to infrastructure are better off than households with less access to it.

Almost 70% of the households interviewed are house owners; this is in line with national statistics (67%). "The typical Belizean dwelling is an undivided house, owned by its occupants, with walls of concrete or wood and roofed with sheet metal" (GoB-CBD, 2010). This is a very good description of what we found in the households interviewed during our assessment. Most of the houses were in good condition with permanent concrete walls and flushing toilets, piped water, electricity and indoor kitchens. The number of inferior constructions was very low and more prevalent in Belize City.

The distribution of dwellings according to the number of rooms shows that the majority (43%) of them has 2 rooms, 37% has 3 rooms and 17% has 3 or more rooms. The dwelling density measures the number of persons per room. It is considered that an adequately occupied dwelling has less than an average of 1.9 persons per room, and therefore dwellings with more than 2 persons are defined as overcrowded. The distribution of overcrowded dwellings reveals a slightly better situation in the Corozal area (37%) relative to Belize City (41%).

In the second part of Table 4.3, we present the ownership rates for amenities. Ownership of all means of transport is higher in Corozal because of the lack of public transport and its geographic isolation and may be as a result of the need for transportation to the city for selling or buying products. The bicycle seems to be the most popular form of transport, with 78% having at least one; 42% have a car and 6% have a motor bike. Almost as many households own a boat as own a bicycle. Most households are thus likely to have access to some means of transport.

The ownership of indispensable durables like TVs, refrigerators and washing machines is high. The percentage of households possessing refrigerators is on average 90%; this number is lower in Belize City. Given the almost universal ownership of TVs in Belize, we asked about ownership of

flat screen televisions, and an impressive 73% already own one. The use of cable TV was much higher in Belize City.

Variables	Community			Total
	Chunox	Copper Bank	Belize City	
<b>Housing</b>				
Ownership (1=owner)	78.3	66.7	66.7	69.3
Number of rooms	2.8	2.6	2.9	2.7
Rooms per capita	1.9	1.8	1.6	1.7
Roof (1=improved)	100.0	96.1	88.5	95.0
Floor (1=improved)	100.0	98.0	57.7	88.0
Wall (1=improved)	95.7	90.2	42.3	79.0
Condition of the house (1=good)	87.0	92.2	76.9	87.0
Electricity (1=own connection)	91.3	64.7	92.3	78.0
Cooking fuel (1=gas or electricity)	100.0	96.0	93.0	96.0
Toilet facility (1=flush)	50.0	35.0	81.0	51.0
<b>Amenities</b>				
Cars (1=yes)	52.2	41.2	33.3	41.6
Motorcycles (1=yes)	0.0	7.8	7.4	5.9
Bicycles (1=yes)	73.9	90.2	59.3	78.2
Washing machine (1=yes)	95.7	98.0	70.4	90.1
Refrigerator (1=yes)	95.7	62.7	85.2	76.2
Flat screen (1=yes)	60.9	76.5	77.8	73.3
Mobile phone (1=yes)	100.0	100.0	100.0	100.0
DVD player (1=yes)	43.5	68.6	74.1	64.4
Cable TV (1=yes)	26.1	31.4	85.2	44.6
<b>Fishery equipment</b>				
Sail boat (1=yes)	9.8	20.8	3.7	10.8
Canoe (1=yes)	90.9	98.0	100.0	96.5
Skiff (1=yes)	12.5	2.0	77.8	24.5
Spears (1=yes)	95.0	97.7	91.3	95.4

Source: Questionnaire SocMon-BAS, 2014

With regard to communication services to which households have access, results show that at least one member of every interviewed household owns a mobile phone. This percentage is very high for both areas. At the district level, only 65% of the households in Corozal and 84% in Belize City possess a mobile phone. This implies that the great majority of households have telephone access.

For fishery activities the ownership of a sail boat, canoe, skiff, motor engine and other fishing equipment is considered as the most important element for the sustainability of the fishery

production system. Social differentiation is based on the ownership of these productive assets because they dictate fishing strategies and influence economic behavior and attitudes. However, in the case of our communities, fishermen do not necessarily need to own these assets, but at least need to have access to them.

Lobster and conch are caught mainly throughout the inner lagoon of the atolls. The fishing vessels used in this activity are constructed of fiberglass or wood and are powered by outboard engines (25-75HP). Wooden boats equipped with cloth sails and outboard engines are also used. These vessels and boats carry nine to twelve divers. The large sailboat is used as the “mother ship” where divers eat, sleep and store all their catch. We found that 97% of the fishermen have at least one canoe, which represents an approximate average investment of US\$400 per canoe. About 25% of the fishermen own a skiff with an average value of approximately US\$ 12,000 (there are big price differences between the different skiffs, the standard deviation was USD 8,000). We found higher values for the fishermen from the northern communities (USD 15,000 against USD 10,000 in Belize City).

#### 4.2.4 *Financial Capital*

Financial capital is defined as the financial resources that people use to achieve their livelihood outcomes. These are resources in the form of available stocks (i.e. livestock) and regular inflows of money (salary, remittances and transfers), but also the access to financial services (savings and credit facilities). The role of financial capital is important in explaining fishers’ livelihoods. In our case, we will pay attention to the kind of income sources and the access to financial services.

It is important for conservation policies to have a sound understanding of the role that non-fishery activities and income sources can play in rising incomes in coastal areas. This could help to determine, for example, an appropriate way to balance resource use between promoting sustainable fishing on one hand, and providing support and services to non-fishery activities on the other.

Overall, across the sample communities, all the households mentioned that lobster and conch fishing was the main income source. About 81% of the fishers in Chunox and Copperbank are also engaged in subsistence farming while some are engaged in part-time jobs to supplement their incomes. Among these, especially in Belize City, part-time work includes carpentry and construction predominates, although to varying degrees across the study areas. Financial transfers mainly involve remittances from family members living elsewhere and featured very little in the income portfolios of households in these communities.

Belize has a relatively extended network of formal credit suppliers, where credit unions play an important role in providing access to rural and coastal communities. During the last eight years, the Belize Rural Development Project (BRDP) has been supporting the financial sector: “*Empower the rural poor and invest with them to create wealth and eliminate poverty*” (BRDP, 2014). Simultaneously through grant support from Friend of World Heritage, two Community Credit Enterprises were established in Copper Bank and Chunox Villages, providing soft loans and



competitive interest rates to fishermen. In general, low income households have limited access to financial services and are unable to invest in the productive sector to generate income.

Variables	Community			Total
	Chunox	Copper Bank	Belize City	
<b>Income Sources</b>				
Fishery as main economic activity (%)	100.0	100.0	100.0	100.0
Other income sources	66.7	64.7	14.8	52.0
Production and sale of commodities (%)	18.8	37.5	0	29.4
Casual labor (%)	43.8	46.9	66.7	47.1
Other (%)	37.5	15.6	33.3	23.5
<b>Financial Services</b>				
Borrowed money during the last 2 years (%)	54.2	41.2	33.3	42.2
Purpose of the loan				
Fishery activities (%)	53.8	47.6	100.0	60.5
Other economic activities (non-fishery) (%)	15.4	4.8	0	7.0
Consumption (%)	30.8	47.6	0	32.5
Credit granted by Credit Union (%)	53.8	71.4	55.6	62.8
Average amount of the loan (B\$)	4,568	4,026	2,533	3,779
Source: Questionnaire SocMon-BAS, 2014				

However, in the case of the interviewed households, access to credit during the last two years was relatively high. In average, 42% of the households had a cash loan during this period; this figure was higher than expected. One possible explication could be the positive impact of the BRDP project in the area of Corozal. In 2009, under a project title “Community Empowerment for sustainable livelihoods through the promotion of alternative livelihoods such as sustainable tourism for the conservation of Blue Hole and Half Moon Caye” funded by Friends of World Heritage, the Belize Audubon Society guided the establishment of two community credit enterprises (CCEs) within Copper Bank and Chunox Villages. The CCEs are an alternative credit enterprises managed and operated by members of the fishing communities. The CCEs allow fishermen to access soft loans that support development of fisher’s capacities and involve them in identifying sustainable development activities towards addressing the requirement of emergent tourism and agriculture sectors. The local village bank, which is linked to the credit union, highlights the important role of the credit union as a loan provider. Loan size averages about USD 2,000 and the funds are mainly used for fishery activity.

#### 4.2.5 *Natural Capital*

The concept of natural capital refers to the source or supply of resources and services that are derived from nature. In general, user rights and the status of resource ownership are often unclear

in the coastal areas, and much of the coast is common property. In the case of our communities, fishermen are mainly active in the fishing grounds of Lighthouse and Turneffe Atoll. Lighthouse Reef Atoll has two natural monuments that serve as replenishment zones. Turneffe Atoll is newly established marine protected area. Both areas is regulated by the Belize Audubon Society, Turneffe Atoll Sustainable Association (TASA), Fisheries Department and Forest Department; situated relatively far from the communities.

Turneffe Atoll is located 50 km from Belize City and is approximately 48 km long and 16 km wide, making it the largest coral atoll in the MBRS. Turneffe atoll was officially declared a marine reserve in November 2012. Lighthouse Reef Atoll is farther offshore, about 75 km from Belize City and has had some sort of protection since 1982. Access to both areas is only by sea, with vessels originating from the mainland, including Chunox, Copper Bank and Belize City. All vessels and fishermen must be licensed and pay a yearly fixed fee of US\$15. In the next table, we present the importance of both areas for each of the communities and the importance of each of the fishing groups.

Table 4.5 describes the use of the fishing grounds and kind of species by community. Conch and lobster fishing is part of a multi species fishery whereby fishers also catch other marine products such as finfish and sea cucumber (Monnereau and Helmsing, 2011). But this by catch is considered by the fishers as less significant and is underreported. The main differences we found was that the fishers of Belize City are travelling less to Lighthouse and the reported absence of conch fishing in Turneffe Atoll because of the lack of conch in this area.<sup>2</sup> According to the Belize Fisheries Department's *Fisheries Statistical Report of 2009*, commercial fishing at Turneffe Atoll experienced an alarming decline between 2004 and 2009 with a 70% decline in lobster tail sales to Cooperatives and a 60% decline in conch sales.

Because the vessels are anchored in the city, Chunox and Copper Bank fishers must travel via public transportation to their communities, this result in additional travel costs to fishers. As consequence Chunox and Copper bank fishers are more exclusive in their fishing practices to cover the additional cost. It's important to notice that almost all fishers reported the (by)catch of finfish,. The catch of cucumber was nihil.

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<sup>2</sup> Despite the fact that fishermen no reported conch fishing in Turneffe Atoll, there is sufficient evidence that fishers from Belize City are fishing conch in the area.

Variables	Community			Total
	Chunox	Copper Bank	Belize City	
<b>Specie</b>				
Lobster	100.0	96.1	100.0	98.0
Conch	95.8	96.1	81.5	92.2
<b>Fishing ground and specie</b>				
Lighthouse - lobster	83.3	67.3	40.7	64.0
Lighthouse - conch	87.5	64.7	29.6	60.8
Turneffe Atoll – lobster	87.5	88.2	88.9	88.2
Turneffe Atoll - conch	0	0	0	0

Source: Questionnaire SocMon-BAS, 2014

### 4.3 Fishing lobster and conch

#### 4.3.1 Fishing activities

Lobster and conch fishing takes place during a period of 9 to 10 months of the year. During the closed season, fishers carry out other activities that can earn them income. Most fishers go to the sea for eight to ten days and on average take 2 trips per month. Fishing effort has been measured by the pounds of lobster and conch landed per fisherman per trip. The number of pounds harvested by each fisherman is influenced by a number of factors, including the time spent fishing, diving and/or snorkeling, equipment quality and skills (experience in lobster and conch fishing), the tidal regime and condition of the fishing ground (season). Lobster and conch fishing does not require complicated fishing gear. As mentioned above, for lobster fishing they use a hook stick or spear, while conches are picked by hand from their habitats. On average, 40 pounds of lobster and 158 pounds of conch are landed per fisherman per trip.

#### 4.3.2 Equipment used by fishers

The sea conch and lobster fishers use simple traditional equipment. In order to reach their fishing grounds, the fishers organize trips with other fishers of their community using sailboats. The older fishers and entrepreneurs own the sailboats. The trips are organized with fishermen members of the family or friends. Between April and May (end of conch season and start of lobster season), the sailboats are returned to the community to be repaired with the help of the other fishermen. One sailboat can carry up to twelve fishermen, including their canoes and fishing gear. Once in the fishing ground, each fisherman starts working with his own canoe and fishing gear. Each fisherman has to pay a boat commission of around ten pounds of lobster or 14 pounds of conch per trip, which is around US\$110. In Table 4.6 the most used fishing equipment and its cost are shown.

**Table 4.6 Commonly used fishing gear for lobster and conch and its costs.**

Item	Amount	Unitary Cost US\$	Total US\$
Hook sticks (lobster)	2	13	26
Long/hand-line fishing	2	3	6
Free diving (conch) snorkel, masks and fins	2	45	90
Spear fishing (finfish)	2	250	500
Canoe (repair)	1	120	120
<b>Total</b>			<b>742</b>

Source: Questionnaire SocMon-BAS, 2014

Every fisherman owns at least two items of each kind of fishing gear, depending on the season (conch and/or lobster); they always carry both in case one gets broken. Equipment like hooks and long/hand line fishing is bought every season; snorkels, masks, fins and spears last longer and are replaced every two years. The canoes are also repaired at the end of every season.

#### 4.3.3 Fishing costs

We present here the estimated costs per trip for each of the communities studied. The following figures are presented in unitary values and present total cost per season. In the following part, the estimated income is calculated.

**Table 4.7: Estimated costs by trip and season for the Communities of Copper Bank and Chunox (amounts in US\$).**

Item	Total cost/trip	Unitary cost/trip	Average trips/season	Total costs/season
Fuel	250	25	20	500
Packaging (plastic bags)	9	0.90	20	18
Ice	75	7.50	20	150
Food, beverages	350	35	20	700
Boat commission		110	20	2,200
Fishing License		0.75	20	15
Gear		31	20	622
Other costs: Emergency Kit		1	20	20
<b>Total costs</b>		<b>211.25</b>		<b>\$4,225.00</b>

Note: The calculations were made taking into account an average of ten fishers per sailboat and an average of 20 trips in a season for conch or lobster. All costs are presented in US\$.

Source: Estimations based on SocMon –BAS questionnaire, 2014

For every trip, the captain of the sailboat is in charge of buying the provisions, fuel, ice and packaging, and then the costs are divided between the fishers on the boat. Fishers can pay either in cash after receiving their payment from the cooperative or in kind with the catch of the day. The cost of fuel includes the transportation on the sailboat from the community to the fishing grounds.

**Table 4.8: Estimated costs by trip and season for Belize City.**

Item	Total cost/trip (US\$)	Unitary cost/trip (US\$)	Average trips/season	Total costs/season (US\$)
Fuel	190	19	20	380
Packaging (plastic bags)	9	0.90	20	18
Ice	75	7.50	20	150
Food, beverages	350	35	20	700
Boat commission		110	20	2,200
Fishing License		0.75	20	15
Gear		31.10	20	622
Other costs: Emergency Kit		1	20	20
<b>Total costs</b>		<b>205.25</b>		<b>4,105</b>

Note: The calculations were made taking into account an average of ten fishers per sailboat and an average of 20 trips in a season for conch or lobster. All costs are presented in US\$.

Source: Estimations based on SocMon –BAS questionnaire, 2014

For fishers in Belize City the estimated cost of fuel is less since the travelling distance is shorter. Fuel represents the highest cost during a trip. The average cost of a trip for a fisherman is US\$205.25. This cost can be covered in cash or in kind. During a season, the average total cost is US\$ 4,015; this represents 27% of the total income. We estimate that the operational costs are probably underestimated.

**Table 4.9: Estimated income for lobster and conch for a season (amounts in US\$).**

Item	Average* landing/trip/fisherman	Average trips/year	Market Price	Operational Costs	Income
Lobster	40	20	7	2,112	3,487
Conch	158	20	3	2,112	7,368
				<b>Total income</b>	<b>10,855</b>

Note: \*Average presented in pounds.

Source: Estimations based on SocMon –BAS questionnaire, 2014

The total cost per trip was divided between conch and lobster, since fishers do not make specific trips for these species unless one of them is in closed season. The estimated total income for an average fisherman is approximately US\$ 10,855 per year. A fisherman harvests an average of 40 pounds of lobster on a ten-day trip. This represents an average of 4 pounds a day. This data is coherent with the results presented by Gongora (2010). The calculation for conch average harvest per fisherman per day is around 15.8 pounds; this data was multiplied by the average number of days/trip to have a catch estimation that was finally multiplied by the average number of trips

during a season. Calculations on economic value are extremely difficult to make, since prices of the two species vary substantially. The price per pound is established by the cooperative. After export and at the end of the season, each fisherman receives a standard extra payment of US\$2.5/lb for the total amount of product he delivered.

#### *4.3.4 Fishing market*

Belize is strategically located to access North American seafood markets, as well as those in Mexico and Europe. Lobster and conch fishing in Belize is still done in an artisanal manner. Most of the lobster and conch is processed by cooperatives/plants located on Belize City. There are five cooperatives which are the most important link for accessing international markets. The two biggest cooperatives, Northern and National Cooperative, are the only ones authorized to export fish products (Gongora, 2006). The other three fishermen cooperatives (Caribena, Placencia and Rio Grande) sell their collected product to the Northern and the National Cooperatives. In the cooperatives, conch, lobster and finfish are processed, packed and prepared for export. In the case of lobster, 5% of total production has to be sold on the local market pursuant to Belizean law. The fishermen can sell their catch either to the cooperative they are associated with or to another cooperative through another member or directly to restaurants.

In recent years, the cooperatives have created incentives to continue fishing despite declining catches (CZMAI, 2014; Gongora 2010). These incentives include direct subsidies for fishing supplies, such as ice, low-interest loans and indirect subsidies, which create perverse incentives for fishermen including loan abuse and providing landing sites to nonmembers of cooperatives.

Since Belizean offshore waters/fishing areas are shallow, there is no possibility to access the sites with industrial fishing fleets. This has made it difficult for medium-sized and large vessels to navigate there and has thus helped to maintain Belizean conch and lobster fishing activities at an artisanal level. The government has used the geographic condition to its favor by prohibiting fishing methods that could damage or destroy the coral reefs.

In the sea, each fisherman works by himself, going with his canoe and free diving to catch the conch or lobster. In the case of lobster, the product is then brought back to the sailboat, where it is cleaned, put on ice and prepared for delivery. Fishermen deliver only lobster tails to the fishing cooperatives. The conch is cleaned and also put on ice. In addition, small-scale lobster extraction using traps known as “casitas” (little houses) or shades is also a significant activity, and it is mostly carried out by fishermen living close to Belize City.

#### **4.4 Institutions and livelihood strategies**

The institutional context is an important set of man-made external factors that influence the range of livelihood options open to different categories of people. They also influence access to assets and vulnerability to shocks (FAO, 2001). A more enabling institutional environment makes it easier for fishermen to gain access to assets they need for their livelihoods. Efforts have been made by the Government of Belize to create opportunities for poor and marginalized coastal communities

to build sustainable livelihoods. One of those projects is “The Sustainable Natural Resource-based Livelihoods Project,” which promotes viable and sustainable natural resource-based livelihoods for poor communities in Belize (BEST, 2013). Apart from the government, there are many other organizations and institutions involved in socioeconomic development activities in the coastal areas. At the same time, there is a large group of organizations, governmental and non-governmental, which mediate access to coastal assets and affect coastal livelihood opportunities. Their roles and responsibilities are not always clear and make it difficult to determine who has authority over coastal assets and who can facilitate socioeconomic development. Based on different documentation and articles, we present a short list of general institutional problems that could affect the coastal livelihoods in Belize in general.

1. The Belize Fisheries Department, which is responsible for marine resources, including fishery, does not have the human and material resources to carry out its job effectively, in spite of numerous legislative acts and formal institutions. According to Gillet (2003), “The Government has neither been successful in the sustainable management of fisheries and their resources, nor guarantees the health of the ecosystems upon which the fisheries and the resource depend.”
2. Enforcement of existing policies and laws is weak for a variety of reasons. One of the main problems is the unlimited entry into the fishery because there is no limit on the number of licenses issued, and there are no restrictions on how much can be fished (Huitric, 2005). Also there are no limits on gear or the amount of lobster or conch that can be fished.
3. The fishermen cooperatives play an important role in the sector, and their economic impact has been an important driver of the industry. Fishermen can sell their catch to their own cooperative, other cooperatives directly or via another member, or directly to local buyers. However, according to a study of EDF (2008), the cooperatives are reporting a decline in active membership and reduced influence in the fisheries sector. Also they have problems related to their credit schemes; there are difficulties in recovering the loans made to their members.
4. In relation to the former two paragraphs. Fishers who are members of a cooperative are not supposed to sell their catch to intermediaries, but fieldwork shows that a large of fishers does so. Form the intermediaries they get a higher initial price but lose their second payment (cooperatives pay a second payment at the end of the season, depending of their profit). Monnereau and Helmsing (2012) estimate that as many 35-50% of fisher sells occasionally to intermediaries.
5. There is discontinuity of formal institutions. Many coastal activities are project-based and linked to external funding. Setting up and sustaining successful partnerships between the government, NGOs and/or communities has proven to be difficult to realize in practice (CHEC, 2008).

The policy and institutional context largely define the opportunities for fishermen to access and benefit from coastal capital and consequently the livelihood strategies they adopt. Fishermen engage in multiple livelihood activities in each of the communities. However, fishing is still the

predominant activity used for livelihoods. The increase in number of fishermen and boats observed during the last years translates into even higher fishing effort applied to lobster and conch fishing. This increase is unsustainable, especially in the case of the lobster fishery where the production trend shows that the Maximum Sustainable Yield (MSY) has already been reached (Gongoroe, 2014). Livelihood challenges and opportunities will vary between and within the communities.

#### 4.5 Perception about fishery and fishery management

Fishermen were asked about the marine reserve and the potential impact from the activities conducted there. Our questionnaire contained a total of 13 questions using a Likert scale to obtain an individual's opinion about the importance of marine resources and his perception of the current management system of the fishing grounds. First we aggregated the individual preference scores for each of the three communities and then assigned rankings to these scores and used Kendall's Tau rank-order correlation analysis to test if there was correlation among the rankings provided by these groups of respondents. As seen in Table 4.8, the rankings obtained were significantly correlated. This means that the attitudes and perceptions we found are very similar in the three communities, so the results will be presented in their totality in Figure 4.1.

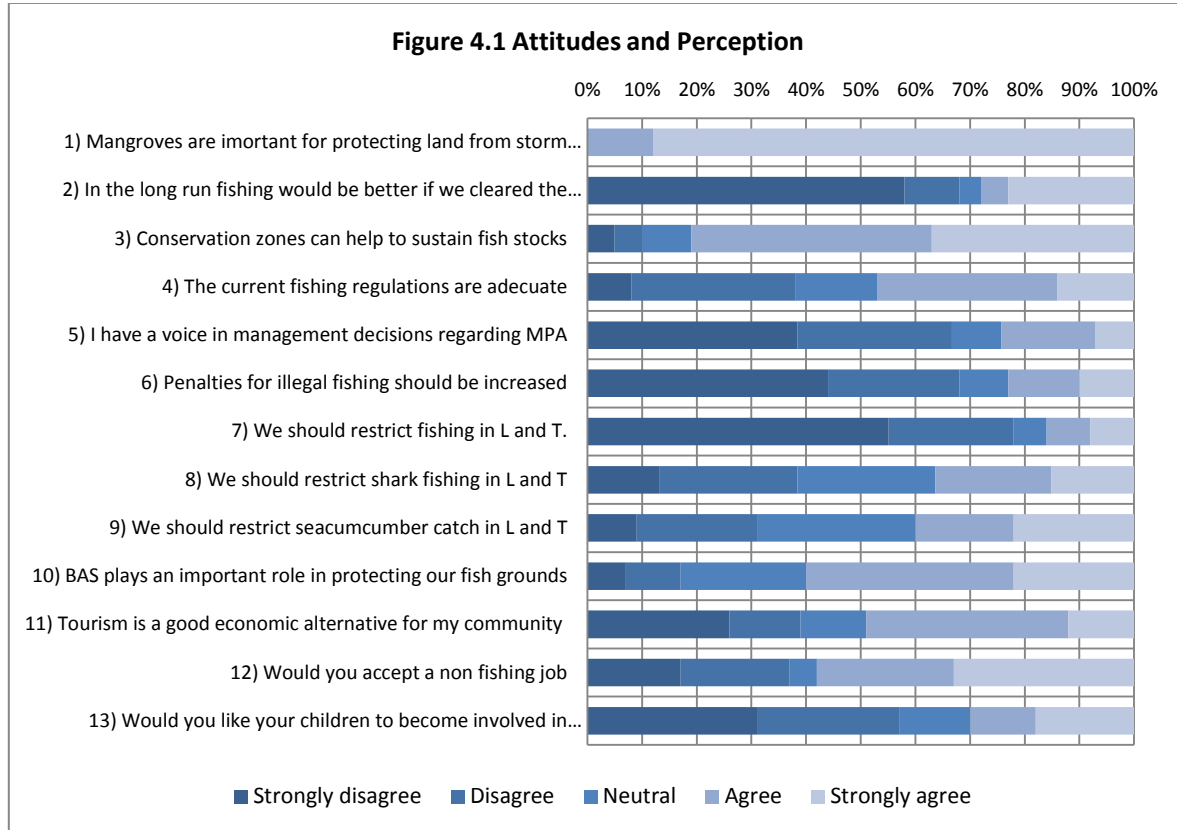
Table 4.10: Kendall's tau rank correlation coefficients between the communities.			
	Copper bank	Chunox	Belize City
Copper Bank	1.000	0.667***	0.571***
Chunox	0.667***	1.000	0.416**
Belize City	0.571***	0.416**	1.000

Significant correlation at: \*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$   
 Source: Estimations based on SocMon –BAS questionnaire, 2014

Three groups of questions were used to obtain the communities' opinions about the importance and management of marine resources in Lighthouse and Turneffe Atoll. In the first group of questions (Q1-Q3) about the perception of marine resources, fishermen are aware that those resources are important for their own economic activities. More than 80% agreed on the importance of conservation zones for sustaining fish stocks (Q3). However, if we apply this question with regard to specific activities in the Lighthouse and Turneffe Atoll areas (Q7 - Q9), fisherman are becoming less enthusiastic about conservation zones. The application of fishing restrictions is considered as undesirable and short term economic objectives prevail. Shark fishing and sea-cucumber harvesting is a less important source of fisherman income. However, fewer than 40% of the fisherman interviewed agreed to apply restrictions to this activity. While the most important species, lobster and conch, are faraway, the bycatch of finfish and to a lesser extent, sea cucumber, is also important for the fishery households. The bycatch is partly used for subsistence



purposes, but can also help cover the cost of a fishing trip, especially when the catch of lobster and conch is low.



Less than 50% of the fishers approved of the current fishing regulations (Q4). Besides their own economic interest, the level of communication by MPA authorities on the benefits of a protected area could be an important factor in the low approval rating. A relatively low 25% of the fisherman felt that they have influence on the MPA decision-making processes (Q5). Most Belizean fishers did not know of any MPA plans; however, during the interviews some of them expressed their interest in becoming involved in MPA planning procedures. The success of MPAs as a means of management depends largely on the participation of the people involved, including fishers. The BAS approval rate is high; more than 80% considered that their role in protecting the fishing grounds is important.

In the near future the decline of the lobster and conch catch at both fishing grounds will strain coastal communities. Fishers dependent on fisheries for income may find few options for other employment, particularly in northern Belize where the economic development is relatively low compared with the national economy. When prospects for alternative employment are limited, fishing-dependent communities can suffer economic hardships, including unemployment and

outward migration. Alternative livelihoods for fishers may become necessary. As we see in other coastal communities of Belize, dive and snorkel tourism is an option as a livelihood. However, not all the fishers see themselves working as tourist guides (Q11). Although tourist guides earn more than fishers, the work is highly seasonal and requires investment in adequate equipment. Nonetheless, fishers feel optimistic about the possibility of finding work in non-fishing activity (Q12) and also would prefer that their children look for an alternative outside the sector (Q13). At the same time, the success of alternative livelihood programs in coastal areas, designed to encourage fishers to reduce or eliminate fishing activities in pursuit of other income generating opportunities, is often limited. This is particularly the case if fishing remains a more profitable source of income than alternative employment opportunities.

Fishers were also asked to identify the main fishing problems. Almost 45% signaled the increasing number of fishers and illegal fishing. This perception is sustained by the number of licenses supplied by the fishery authorities during the last decade (see section 3). The negative perception of the fishers about the reserves is noteworthy. Only 10% mentioned that there are too many marine protected areas, and that the rules and restrictions are affecting them in their fishing activities and finally in their incomes. This is a positive outcome and demonstrates that the fisher community supports the system of MPAs, but, as mentioned above, is concerned about tools used for fisheries management such as managed access and zonation of MPAs. About a quarter of the fishers mentioned that there are serious problems with enforcement, resulting in illegal and overfishing. Illegal fishing at night, particularly by fishers from Honduras and Guatemala, is a concern, and it seems that there is lack of resources to patrol the areas sufficiently.

## **4.6 Wealth, capital and perceptions**

### *4.6.1 Wealth index*

In this section we evaluate the households' material lifestyle by measuring wealth based on the presence or absence of household possessions. This can be an indicator of relative wealth in a community. To determine this indicator, we used the variables defined in the physical capital section, including items such as a flatscreen television, cable TV, washing machine, type of toilet, home ownership and the type of walls, roof and floor. To get a better portrait of the distribution of material wealth within the communities, scales can be constructed based on the interrelationship between these items. The items were factor analyzed using the principal component method and *varimax* rotation, resulting in two material styles of wealth factors that explained 45% of the variance (Table 4.11). Some items did not have significant loading on either factor and were eliminated from the analysis.

Item	Wealth index 1	Wealth index 2
Flush toilet	0.588	
Cement walls	-0.342	0.790
Cement floor	-0.445	0.671
Condition house is good	-0.367	0.496
Own electric connection	0.713	
Refrigerator	0.751	0.420
Washing machine		0.320
Eigen value	23.6%	21.8%

Source: Estimations based on SocMon –BAS questionnaire, 2014

As indicated in Table 4.11, the items that have the highest positive loading on the first component are associated with electricity, flush toilets and refrigerators. Items with high negative loading on the first factor include sanded floors, wooden walls and poor general condition of the house. Thus, index one (subsequently called “wealth index one”) is comprised of accessories and having electricity. Items with high positive loading on the second factor include cement walls and floors, good housing condition, refrigerators and washing machines. There was no negative loading on the second index. Items with high positive loading have a stronger contribution than those with low or negative values. Wealth index one scores in the communities range from -2.38 to 1.01. Wealth index two scores range from -2.77 to 0.86. Scores are standardized, having a mean of zero and a standard deviation of one.

Based on the estimated wealth index, a cutoff of 33 percent is used to define the poorest group in the population. This decision is based on the usefulness of categorizing populations into terciles that can be broadly interpreted to represent the lowest, middle and higher ranked groups of households with respect to relative wealth.

#### *4.6.2 Wealth index and the livelihood capitals*

The wealth index can be seen as the materialized outcome of the households’ livelihoods. By combining the wealth index with the livelihood variables it is possible to analyze the importance of each of the selected capitals. In the next Table (4.12), we present the three wealth groups based on wealth index one.

The average education level is above the national average, and in families with higher income levels, there is an increasing emphasis on education. Within the sample, 5% of the heads of household in the lowest wealth tercile has no education. Family size decreases consistently from 5.0 members per household in the lowest tercile to 4.2 members in the highest tercile. Also, less wealthy households have a higher dependency ratio than better-off households.

Of the 105 fishers surveyed, almost all were participating in the fishing cooperatives, suggesting that cooperatives are very important to the fishermen. Having a higher wealth index increases the possibility of becoming an appointed member of the cooperative. Less wealthy fishers are more linked to local organizations, which could be an important network for maintaining their

livelihoods. As mentioned before, credit access is relatively high, thanks to the fisher cooperatives, especially for the highest tercile, in which more than 47% of the fishers have access to credit.

A closer look at income sources for fishery households reveals that non- fishery activities can be very important during the closed season when fishers work as part-time laborers, but the participation in these activities is more urgent for less wealthy households. The more successful fishers are more engaged in fishery activities than the fishers with a lower wealth index. Our data confirms that non-fishery activities are inversely related to the implicit fishery income. Similarly, fishers more involved in lobster fishing have a higher wealth index.

Capitals	Wealth groups			
	1	2	3	Total
<b>Human capital</b>				
Age HH (years)	33.8	38.6	38.5	36.9
Household head education level primary education <u>not</u> completed (%)	17.6	13.3	2.8	24.0
Household members	5.0	4.6	4.2	4.6
Dependency rate	0.31	0.26	0.22	0.26
<b>Social capital</b>				
Appointed leadership position in the cooperative (1=Yes)	23.5	43.3	52.8	40.0
Number of years being a registered member (years)	7.9	13.1	14.4	11.8
Membership in local organization (%)	41.2	20.0	13.9	25.0
<b>Financial capital</b>				
Access to credit (%)	38.2	43.3	47.2	43.0
Other income source than fishery	70.6	53.3	36.1	53.0
<b>Natural capital</b>				
Lobster fishing	96.7	97.1	100.0	98.0
Conch fishing	94.1	96.7	88.9	93.0
<b>Physical capital</b>				
Access to electricity (%)	41.2	93.3	100.0	78.0
<b>Location</b>				
Copper Bank (%)	21.7	47.8	30.4	100.0
Chunox (%)	47.1	25.5	27.5	100.0
Belize City (%)	19.2	23.1	57.7	100.0

Source: Estimations based on SocMon –BAS questionnaire, 2014

Our estimates suggest that internal characteristics of the fisher households are very important for wealth accumulation. Nevertheless, nearness to the cooperatives, alternative markets for lobster and conch and lower transport costs could also be an important factor for wealth accumulation. We found wealthier fishers in Belize City than in the two villages of Corazal.

## 5 Conclusions and policy implications

By using the livelihood approach we tried to address the complexity of the fishers' livelihoods in three coastal communities in Belize. The livelihood approach is used to gain a broader picture of the capital and activity patterns that characterize fisher households in the three communities and the institutional context that either help or obstruct fishers in their search for more secure livelihoods. By better understanding the capacity and strength of the coastal households, it is possible to define the development goals based on what the households already have and can do.

We found that the fishers in the three communities still depend principally on lobster and conch fishing and a growing engagement of other household members in non-fishery self-employment activities. Livelihood diversification is a feature of many fishing households. There is a tendency for projects in coastal areas to lay emphasis on expanding fishing activities as the primary development strategy. What we saw suggests that coastal community development requires a broader starting point than this, especially in the case of Corozal, and has as much to do with awareness raising and mobility as with promoting the fishing sector.

Regarding the topic of costs and income, we found that fishermen in Chunox and Copper Bank have an average operational cost per season of US\$4,225 and of US\$4,105 in Belize City; this difference is explained by the traveling cost from the communities to the fishing grounds. The average annual income per fisherman in a season was estimated at US\$10,855. The average lobster catch was estimated at 800 pounds per fisherman per season and at 3,160 pounds per fisherman per season for conch. It is important to emphasize that interviewees tend to underestimate their operational costs and to overestimate their incomes, creating an illusion that the fisher business is doing a lot better than it really is.

Lobster and conch fishing plays an important role in the current incomes of the households in the study area. If we compare the living standard of the fishers with national data, the fishers are better off than the average Belizean living in the coastal and rural areas. This result is the opposite of what we found in other socioeconomic assessments in the Central American region, where fishery is a typical activity for low income households. Lobster and conch fishing is still an attractive economic activity for the people interviewed. Nevertheless, economic problems in other productive sectors of the Belizean economy are compelling more people to turn to fishing for their livelihoods. Belizean national data also demonstrates that levels of coastal poverty are closely related to the absence of employment opportunities in other economic sectors, which is the case in Corozal and the Toledo District. Development in coastal areas where fishing is important may not be best served by intervention to increase fishing incomes, but rather to support complementary household activities. We do not want people to leave the fishery sector; until now, lobster and conch fishing has been very attractive and generates a stable income for most of the interviewed households. However, encouraging alternative livelihood sources will raise the opportunity for income from fishing and will help to protect the fishing grounds against overfishing.

The main question is whether the current living standard can be maintained by focusing only on lobster and conch fishing. This depends directly on if the current management of the fishing grounds is effective enough to maintain the current stock. If not, fishers have the option to change to other activities or carry out deep sea fishing in other areas. Both alternatives are insecure and would threaten their livelihoods.

The SocMon assessment is BAS's first intent to get a more detailed evaluation of fishers' livelihoods in the communities where they work. Because of the complexity of their livelihoods, this assessment is far from complete, and there are a lot of aspects that have not been included in our study. Topics like gender, climate change and community development are very important and useful for the BAS's current work in the field. In order to understand livelihoods and the factors that are likely to make them sustainable in the face of change, it is necessary to take into account a broad range of factors and influences that may play a role at the different levels of the fishery sector as a whole.

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