MINISTRY OF ECONOMIC AFFAIRS, ECONOMIC PLANNING, INVESTMENT & NATIONAL DEVELOPMENT

OFFICE OF THE NATIONAL AUTHORISING OFFICER

CONCH RESOURCE ASSESSMENT STUDY

Budget Line 21.03.18 (Ex B7-8710)

Reference SFA 2003/SLU/0709/PE/LC

Contract Number SFA 2003/SLU/0709/07

By: Alison King-Joseph, Geraldine Lendor-Gabriel, Nyo Serieux and Andre St. Omer

October 23, 2008

ACKNOWLEDGEMENTS

The support of the Department of Fisheries (DOF) is acknowledged. Mr. Oliviere Cadet of the Saint Lucia Air and Seaports Authority provided British Admiralty Charts for all areas of interest.

Cover Photo: © CITES Management Authority of Spain/Vicente Roncero

ABBREVIATIONS

CFRAMP	Fisheries Resource Assessment and Management Programme of the Caribbean Community
CFMC	Caribbean Fishery Management Council
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COP	Conference of Parties
CRFM	Caribbean Regional Fisheries Mechanism
DIREN	Directions régionales de l'environnement
DOF	Department of Fisheries
EU	European Union
HACCP	Hazard Analysis and Critical Control Point
ind./ha	individuals per hectare
MPA	Marine Protected Areas
NOAA	National Oceanic and Atmospheric Administration
SFA	Special Framework of Assistance
SFSS	Superior Fish and Seafood Suppliers
SLASPA	Saint Lucia Air and Seaports Authority
SLFMC	Saint Lucia Fish Marketing Complex
SPAW	Protocol concerning Specially Protected Areas and Wildlife
Protocol	Protocol concerning Specially Protected Areas and Wildlife
RAU	Lobster and Conch Resource Assessment Unit (of CFRAMP)
US	United States
USD	US dollar

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PHOTOGRAPHS

1. EXECUTIVE SUMMARY

Saint Lucia is party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Queen Conch *(Strombus Gigas)* is listed in Appendix II of the CITES Convention. CITES enabling legislation has been published although it has not yet been enacted. Queen Conch is also listed in Annex III of the SPAW Protocol (Protocol concerning Specially Protected Areas and Wildlife) of the Cartagena Convention, which requires Parties to "adopt adequate measures to ensure the protection and recovery of the species", "to regulate the use of the species" and to "formulate, adopt and implement plans for their management and use". Saint Lucia is party to the SPAW Protocol.

The Department of Fisheries (DOF) routinely gathers catch and effort data for all fisheries including conch. Under the Fisheries Resource Assessment and Management Programme of the Caribbean Community (CFRAMP), the collection of biological and other fisheries related data was undertaken over 199-2001. Joseph (2003) analysed the data generated and her recommendations regarding further research have formed the basis of the Fisheries Management Plan (2006-2011), which recommends *inter alia* that, the status of the conch stocks be determined through available data, visual abundance surveys and other relevant information, and that costs and earnings of the various operators in the fishery be determined.

The DOF designed this study with assistance from the European Union- financed SFA[1] 2003 Programme. Three discreet project activities were implemented:

- Historical Survey (administered to "past" fishers who were diving conch pre-1989, and have since stopped harvesting conch);
- Conch Resource Assessment; and
- Socio-economic Survey (administered to "present-day" fishers who were diving conch since 1989, most of whom are still diving conch today, as well as to conch purchasers).

These activities were designed to ascertain how the conch fishery in Saint Lucia has changed over time, the status of current stocks, and the socio-economic impact of the conch fishery. Questionaires were administered to past and present-day conch fishers, conch vendors, restaurateurs and hoteliers that serve conch, and conch retailers. Information gathered through fisher interviews was used to identify known conch locations, and a physical assessment was undertaken. Dive sites were identified off Gros Loup, Esperance, Marisule, La Brelotte, Vieux Fort Lighthouse, Maria Island and Laborie. Density estimates were made.

The results of the various surveys were analysed and some of the pertinent findings are:

- None of the past fishers (those who were harvesting conch pre-1989) were engaged solely in conch fishing. In 2008 several conch fishers were able to maintain a reasonable standard of living solely from conch harvesting, as there was a high local demand for conch;
- Most fishers (past and present) originated from Gros Islet, with about ¼ of them from Laborie, and most conch were landed in Gros Islet;

[1] Special Framework of Assistance

- Conch fishers in 2008 were remaining longer in the conch fishery than fishers were in the pre-1989 period;
- The bends was the primary reason that fishers (past and present) left the fishery. Some remained despite having had the bends;
- All fishers in 2008 intended to remain in the fishery, and were satisfied with their harvest yields and the revenue earned from conch sales. However, 82% of those who would not encourage a close relative to enter the fishery were divers;
- Divers in 2008 were frequently the owners of the conch fishing boats, and were both the biggest investors and the biggest earners in the fishery;
- Conch dive sites in 2008 had not changed significantly from the pre-1989 period, but more fishers were diving deeper, and none were skin diving. Additional sites on the south-east coast were also being dived in 2008. Conch were always found in areas with seagrass, by both past and present-day fishers. Conch were typically harvested at depths between 80 ft (24.4 m) and 100 ft (30.5 m);
- One quarter of divers in 2008 were uncertified and untrained;
- Not all fishers in 2008 were registered with the DOF;
- Conch were usually landed already de-shelled in 2008, and as such, maturity data for conch landed was not available to the DOF;
- Unlike past fishers who stored conch in offshore baskets, awaiting sale, present-day fishers in 2008 no longer needed to store conch, as they had ready markets for their harvests. Demand exceeded supply in 2008, and was increasing. Fishers in 2008 no longer exported conch to Martinique although it was reported that French customers purchased conch in Saint Lucia;
- Fishers in 2008 sold conch at an average of EC$14 per lb, although their price varied from EC$10 to EC$16 per lb, depending on fisher, buyer and season;
- The conch shell was not highly valued in the past or the present;
- Neither past not present-day fishers had observed significant changes in the size of conch populations (either juvenile or adult), locations or depths over time, and did not expend a greater effort in harvesting conch, although some were diving deeper;
- Two distinct populations of conch were located in Saint Lucia waters. Most present-day fishers did observe significant differences between conch from the south and from the north.
- Conch from the south was found to contain less meat per unit total conch weight than conch from the north.
- Conch densities measured across 9 dive sites averaged 242.9 ind/ha;
- Considering sites where conch were found, population densities were lower at the south sites investigated than at those in the north;
- Average conch landings recorded in the DOF Fish Landing Database (2008) over the period 1998 to 2007 was 43 tonnes per annum. Information from the fisher surveys

undertaken for this study resulted in an estimate of annual conch landings (2007/2008) of 133 tonnes, generating an estimated gross revenue of EC$4.1 million per annum, if sold at EC$14/lb. At this rate, it is estimated that divers earned between EC$27,440 and EC$257,936 over the last year. Owners, captains, crew and the boat each earned between EC$13,720 and EC$128,968 for the same period;

- Conch made a significant contribution to the income of conch vendors in 2008;
- In 2008, restaurants made the largest profit from conch sales, although conch was not a significant contributor to restaurant total sales;
- Value added by the consumers of conch (restaurateurs and vendors) in 2007/2008 was estimated to be EC$2.95 million per annum; and
- Small quantities of conch were being imported from Bequia and Saint Vincent by a retailer and a restaurateur in 2008.

This study recommends that:

- Fisher and vendor selling prices should be reviewed in light of the high demand and increased cost of fuel;
- Efforts to develop markets for conch shell products should be made;
- The DOF should improve efforts at monitoring, regulating and enhancing the conch fishery through:
    - Improving catch and effort data collection;
    - Improving registration and licensing regimes for fishers including divers and boats;
    - Monitoring conch stocks;
    - Continuing to collect fisher socio-economic data;
    - Providing fisher public awareness and training;
    - Engaging conch fishers in decision making relating to the fishery; and
    - Research to identify conch spawning sites.

2. INTRODUCTION

This Conch Resource Assessment Study is financed by the European Union under the SFA 2003 Programme of funding in Saint Lucia. The DOF of the Ministry of Agriculture, Lands, Forestry and Fisheries requested European Union assistance for the implementation of this project. On February 4, 2008, Alison King-Joseph et al were contracted to implement the project.

A significant body of research already exists on the conch fishery in the Western Caribbean, but information required to inform resource management decisions in Saint Lucia is limited. This study was therefore designed to provide more rigorous, scientifically based information and analysis for effective management of conch resources in Saint Lucia. The study sought to obtain a historical perspective of the conch fishery, locate specific areas where conch populations inhabit, determine the distribution of conch resources around the island, both within fished and non-fished areas, determine the abundance and density of conch within the various populations around the island, obtain data on the population structure of the various populations of conch, and obtain information on the costs and earnings pertaining to the conch fishery.

Section 3 provides an overview of information available on the conch fishery in the region and Saint Lucia, and the status of regional and national efforts to protect the resource.

Section 4 provides the study purpose and Section 5 describes the methodology used for the various components of this project.

Section 6 presents the results of the various surveys undertaken and a discussion of these. Conclusions are found in Section 7. Recommendations are contained in Section 8.

3. LITERATURE REVIEW

3.1. Biology and Habitat Requirements of the Queen Conch

According to National Oceanic and Atmospheric Administration (NOAA) Queen Conch *(Strombus gigas)* is one of the seven species of the family Strombidae that can be found in the Western Atlantic Ocean, and is distributed throughout the Caribbean. The Queen Conch is easily distinguished from other strombid species by its large size (up to 30 cm shell length and 3 kg in weight) and its deep pink coloured aperture.

Although conch may be encountered in rocky habitats and on coral reefs, they are generally found in clean waters and primarily inhabit sandy or rubble sea floors that support the growth of seagrass and algae. Adults are typically found in depths between 10 and 30 m, but may occur at depths exceeding 100 m. Population densities decrease significantly at depths exceeding 30 m as light limitations reduce algae and plant growth (Stoner and Waite, 1990).

Sandt and Stoner (993) have shown that Queen Conch actively select among their habitats, with juveniles being more selective than adults, and dependent on certain habitat requirements. Juveniles exhibit a strong preference for intermediate densities of seagrass (Stoner and Waite, 1990), and Stoner (1997) found that most productive nurseries occur in shallow (5-6 m deep) seagrass meadows.

Queen Conch may live for up to 30 years (Anonymous, 1999). Sexual maturity in both sexes is reached at approximately five years (Appeldoorn, 1994). Reproduction generally occurs in the warmer months, although Brownell (1977) found that it can continue throughout the year in some areas. Fertilisation is internal and initial copulation may occur several weeks prior to spawning. Females may spawn several times during the reproductive season (Stoner *et al*., 1996), often producing in excess of 400,000 eggs each time. There is evidence of a relationship between fecundity and age (measured by lip thickness), indicating that fecundity increases with age. However, this relationship cannot be extended to older ages when lip growths ceases (Anon. 1999).

Researchers found that mating in *S. gigas* populations in the Exuma Cays did not occur when adult densities fell below 56 ind./ha and that spawning did not occur if densities were below 48 ind./ha (Stoner and Ray-Culp, 2000). The lack of reproduction in low-density populations was related primarily to the lack of encounters between female and males. Reproduction increased proportionally with density levels (due to increased likelihood of encounters) and remained stable near densities of 200 ind./ha (Stoner and Ray-Culp, 2000).

The species' range is a mixed meta-population with constant genetic flow between populations (Mitton et al, 1989). The majority of Queen Conch populations are considered to be inter-dependent for recruitment at some spatial and temporal scale due to the dispersal of the planktonic larvae, and the species has been considered a shared resource for the Caribbean region (Stoner, 1997). However, the magnitude and frequency of recruitment varies, depending on oceanographic currents and other factors. Local recruitment and larvae retention within a certain stock are also considered important factors (Stoner, 1997). The Windward Islands, at the eastern fringe of the species range with an east-to-west circulation of surface waters through the Caribbean Sea, may be an important Queen Conch producing area (CITES Secretariat, 2003).

The pelagic larvae hatch five to six days after spawning and drift in the upper water layers for the first weeks of their lives, before they descend to start their benthic lifestyle. Larval development is greatly influenced by temperature and the supply of phytoplankton (Stoner, 1997). Larval exchange may occur up to distances of 900 km during the first three weeks, but is generally in the range of tens to hundreds of kilometres within sub-regions (Anon., 1999). Depending on conditions, larvae can settle to benthic habitats 17 to 22 days after hatching, but may remain in the plankton for up to two months (Stoner, 1997). Metamorphosis of the larvae usually starts within five days of settlement, after which the animals are about 0.2 cm in length and start to develop their shell. Laboratory experiments have shown that larvae will not metamorphose, if after around six days, the appropriate habitat conditions are not found (Davis and Stoner, 1994). Metamorphosis depends, among others, on the presence of appropriate stimuli which appear to be certain algae foods and particular characteristics of the sediment (Davis and Stoner, 1994).

Young Queen Conch (less than one year) remain buried for most of the time, but begin to emerge at a shell length of 5 to 10 cm. Juveniles can suffer high mortality from predation (up to 63%) (Alcolado, 1976). Queen Conch is known to be eaten by around 130 marine species (Randall, 1964). Natural mortality rates decrease exponentially with age until the onset of sexual maturity, but can vary widely with season, habitat and other factors (Stoner and Glazer, 1998). Juveniles tend to aggregate regularly over large areas (>100 ha) in dense groups of 0.2-2 ind./m^2, possibly to reduce predation and disperse natural mortality. The most productive nursery habitats appear to be determined by complex interactions of physical oceanographic features, seagrass and algae communities and larval recruitment, and play a crucial role in ensuring population stability (Stoner, 1997).

There are two migrations that occur in Queen Conch; there is a movement of larger juveniles into deeper waters, as well as an annual movement of adults into shallower water during spawning (Anon., 1999). This migration into shallow water coupled with the necessary aggregation for reproduction results in greater vulnerability to fishing (CITES Secretariat, 2003).

Brownell (1977) estimated mean shell lengths of juveniles as shown in Table 1.

Table 1. Estimated Mean Shell Lengths of Juveniles (Brownell, 1977)

Age of animal (years)	Shell length range (cm)
1	7.6 - 10.8
2	12.6 - 17.0
3	18.0 - 20.5

However, bio-erosion of the adult Queen Conch shell can progressively decrease shell length with age (CITES Secretariat, 2003).

Once the Queen Conch starts producing its large flared shell lip, the shell often does not continue to lengthen, and growth occurs by thickening of the shell. However, linear shell growth and flaring of the lip may occur simultaneously for some time before the adult shell length is reached. The flaring of the lip starts at an age of approximately two to four years and lasts for approximately seven to ten months, or more. Young individuals that have begun flaring a shell lip but have not yet reached sexual maturity are considered sub-adults. Sexual maturity usually occurs when the animal is about four to five years old, but only when the flared lip has thickened to approximately 0.5 cm (Appeldoorn, 1988). There are often differences in shell size and shape at the onset of sexual

maturity of various Queen Conch populations, depending on habitat quality, food and water depth (Randall, 1964), and faster growth is often coupled with earlier maturation (CITES Secretariat, 2003). Lip thickness may also decrease progressively with age due to erosion.

Queen Conch is important to the ecology of marine benthic communities, as they feed principally on dead or detritus remains of seagrasses, seagrass epiphytes, and macroalgae (as well as significant amounts of sand), thereby significantly affecting the benthic community structure of seagrass meadows (Randall, 1964). Experimental studies in the Exuma Cays in the Bahamas found that Queen Conch grazing has an important effect on regulating the abundance of seagrass detritus and on the overall structure of the macrofauna communities (Stoner *et al.*, 1995). The loss or substantial decrease of *S. gigas* is, therefore, likely to result in significant community changes and trophic cascades that will negatively affect the productivity and future recruitment of the species as well as other ecologically and economically important fisheries resources (e.g. Spiny Lobster *Panulirus argus*).

3.2. Queen Conch Fishery, Trade and Other Threats

S. gigas has been harvested for food for centuries, but a large commercial fishery has developed in the last few decades in response to an increased international demand for conch meat, making the species one of the most important fishery resources in the Caribbean today. The wholesale value of annual landings has been estimated to be USD $60 million (CITES Secretariat, 2003). Although shells are also used and traded as curio and tourist souvenirs, they typically by-product of the meat trade, except in Barbados where, although conch meat is not discarded, a conch fisher can make more money selling shells than conch meat (Oxenford et al, 2007). The largest exporters of Queen Conch meat are Jamaica and Honduras, followed by the Turks and Caicos Islands, the Bahamas, the Dominican Republic, Colombia and Belize (CITES Secretariat, 2003).

Seventy-eight per cent of all Queen Conch meat in international trade is imported by the US (including Puerto Rico and the US Virgin Islands), followed by France (including Guadeloupe and Martinique) which imported 19% of all meat reported in international trade between 1992 and 2001 (CITES Secretariat, 2003). The French Department of Martinique is one of the largest consumers of Queen Conch meat in the region, and local demand is several times local harvest volumes (Mullikan, 1996). Due to the depletion of Queen Conch stocks in Martinique, most of the Queen Conch consumed there is imported from other countries in the region. Jamaica is one of the most important exporters of Queen Conch meat to the French Departments (French Customs Service, *in litt.* 2001). Cuba is allegedly another important supplier, although no imports from Cuba have been reported. Queen Conch meat was also imported into Martinique from Saint Lucia, Saint Vincent and the Grenadines and Colombia (CITES Secretariat, 2003).

Exports of Queen Conch meat to Martinique were not allowed between July 1997 and December 2001 due to EU Food Sanitary Regulations and no imports were reported by the Directions régionales de l'environnement (DIREN). However, in 1999 the Dominican Republic reported the export of 60,000 kg to Martinique in it's CITES annual report, although that was not confirmed in the annual report of France (UNEP-WCMC, 2002). There were also reports of an increased illegal trade in Queen Conch meat from Saint Lucia to Martinique when the import ban was imposed (CITES Secretariat, 2003).

Queen Conch continues to be available from many Caribbean countries, but intensive fishing pressure over the past few decades has led to population declines and stock collapses, resulting in total or temporary closures of the fishery in some locations. The Queen Conch fisheries are not believed to threaten the survival of the species, but it is likely that many populations will continue to decline and that the fishery ultimately becomes economically unviable (CITES Secretariat, 2003). Available information suggests that most *S. gigas* populations have continued to decline since the species was listed in the CITES Appendices (see Section 3.3 below), and in some areas, population densities are so low that recruitment failure is a risk to local fisheries (CITES Secretariat, 2003). Queen Conch are particularly vulnerable to overfishing because of their slow growth, their occurrence in shallow waters, their late maturation and their tendency to aggregate in shallow waters for spawning. Overexploitation is reported to have changed local distribution and abundance. Due to the depletion of shallow water stocks, fishing efforts have shifted from near-shore to offshore areas. The use of scuba and hookah gear (compressor diving) has become more widespread as near-shore areas are increasingly overfished, and former deep-water refugia (>20 m) have also become subject to intense exploitation (CITES Secretariat, 2003).

There are only a few unexploited populations within the species' range (deep water stocks, stocks in protected areas, etc.). Several stocks show clear signs of overexploitation, for example large landings of juveniles or fishing efforts shifting to the deeper areas of the stock (>20m) (Appeldoorn, 1994). Although overfishing is the major cause of Queen Conch population decline, declines may also be attributed to habitat degradation due to siltation, other forms of pollution, and the use of dynamite and other destructive gears such as bottom nets. This particularly applies to the juvenile Queen Conch which requires undisturbed nursery sites to develop. Many such sites are close to the coast and as a result are more vulnerable to human development activities and pollution. This is likely to increase the mortality and reduce the recruitment of juveniles, thereby reducing overall population growth. Human population growth has led to greater deforestation and erosion of soils, which has led to an increase in sedimentation and water turbidity. There are also concerns about the effects of water pollution on Queen Conch, especially heavy metals and pesticides which leach through the soil into water courses and ultimately end in the sea (CITES Secretariat, 2003).

3.3. Queen Conch Protection Efforts in the Caribbean

Strombus gigas is listed in Annex III of the SPAW Protocol (Protocol concerning Specially Protected Areas and Wildlife) of the Cartagena Convention. The SPAW Protocol was adopted in 1990, and entered into force in April 2002. The listing requires Parties to "adopt adequate measures to ensure the protection and recovery of the species", "to regulate the use of the species" and to "formulate, adopt and implement plans for their management and use" (Article 11(1)(c) of the Protocol). Twenty-four (24) Queen Conch range States have ratified the Cartagena Convention, but to date only ten (including Saint Lucia) have ratified the SPAW Protocol (CITES Secretariat, 2003).

Queen Conch was also listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1992, and Queen Conch became the first large-scale fisheries product to be regulated by CITES. With the exception of Haiti and the Turks and Caicos Islands, all Queen Conch range States (including Saint Lucia) are Parties to CITES.

Most Queen Conch range States have imposed some regulations relating to the management and/or conservation of the Queen Conch fisheries, but, according to the CITES Secretariat (2003), enforcement is poor in some countries and regulations are often ignored.

Since 1995, CITES has been reviewing the biological and trade status of Queen Conch under its Significant Trade Review process. Significant Trade Reviews are undertaken when there is concern about levels of trade in an Appendix II species. Based on this review, CITES recommended that all countries prohibit the importation of Queen Conch from Honduras, Haiti, and the Dominican Republic. The CITES embargo restrictions on Honduras, Haiti, and the Dominican Republic will be lifted when these countries have identified areas to be designated for commercial fisheries; undertaken density studies in these designated areas; identified and analyzed trends in available landing data; established a standardized minimum meat weight that corresponds to adult specimens of unprocessed and processed meat; and analyzed, based on the results of the density studies, landing trends and standardized meat weight to establish cautious catch and export quotas in consultation with the CITES Secretariat (CITES Secretariat, 2003).

Over the past 15 years, several organisations and institutions have sought to develop effective management strategies for *Strombus gigas* and have been active in the promotion of a regional management approach. The Caribbean Fishery Management Council (CFMC) organised several bilateral, sub-regional and regional meetings concerning the conservation of Queen Conch and the sustainable management of its fishery. The First International Queen Conch Conference in 1996 led to the formal establishment of the "International Queen Conch Initiative" and to the "Declaration of San Juan" which set out a framework for more effective collaboration between range States regarding the promotion and development of a regional management regime. The Declaration of San Andrés" was adopted in 1997, cognizant of the need to strengthen regional co-operation in managing the Queen Conch fisheries. The Second International Queen Conch Conference in 2001 brought together 22 Queen Conch range States as well as observers from inter-governmental and non-governmental organisations (CITES Secretariat, 2003).

The "Lobster and Conch Resource Assessment Unit" (RAU) of the Fisheries Resource Assessment and Management Programme of the Caribbean Community (CFRAMP) undertook various conservation and management activities including assessment studies in Antigua and Barbuda and Belize; capacity building, training and technical assistance; the organisation of Lobster and Conch workshops; and collection of biological and other fisheries related data in all seven Member States (CITES Secretariat, 2003).

The Organisation of the Eastern Caribbean States (OECS) in the early 1990s, seeking to harmonise fisheries regulations among its members, recommended that members implement certain management measures for the Queen Conch fishery. These included a minimum shell length and meat weight restriction, allowing only the harvest of specimens with a flared lip and establishing closed seasons or areas. Seven (7) of the nine (9) OECS members have implemented all or some of these measures; exceptions are Anguilla and Montserrat (CITES Secretariat, 2003).

The most common management measures across the region include different minimum size restrictions (shell length or meat weight), temporal or geographical closures of the fishery, gear and vessel restrictions (e.g. prohibition of scuba gear), bulk harvest restrictions (quotas or daily bag limits) and limited entry measures. However, the effectiveness of these measures is largely dependent on adequate knowledge of stock status (size, distribution, abundance, etc.), other

biological and morphometric criteria (location of nurseries and spawning sites, time of the spawning period, shell growth and maturity, etc.) and country-specific characteristics of the fishery (CITES Secretariat, 2003).

Imposition of a minimum shell length restriction for *S. gigas* does not prevent the harvest of immature individuals, unless implemented in combination with a lip thickness requirement, because sexual maturity only occurs when the shell lip has flared and reached a thickness of approximately 5 mm; as previously noted, this may occur as much as one year after the start of lip formation. The imposition of shell length limits can also result in selective pressure on local stocks as the size of individuals can vary from one area to another, and females are generally slightly larger than males. Shell size requirements can also be difficult to enforce in countries where only the meat is landed (CITES Secretariat, 2003).

Gear restrictions such as banning the use of SCUBA (thus limiting the legal harvest of Queen Conch to free diving) or hookah, are an effective management tool for reproductive stocks as they help to preserve deep-water populations and important spawning stock refugia (Stoner, 1997). A total prohibition of these two types of gear not only effectively limits the depths that can be fished and effectively reduces the overall fishing pressure, but also helps to prevent the serious health risks associated with unsafe diving practices using these gear types (Espeut, 1997). However, the ban of SCUBA has negative effects because it may increase the fishing pressure on shallow water stocks and potentially lead to increased exploitation of juvenile Queen Conch in shallower waters (Appeldoorn, 1997). In some areas, only deepwater Queen Conch populations remain, and a total prohibition of scuba and/or hookah would likely end the fishery (Espeut, 1997).

Closed areas ("no take zones" or Marine Protected Areas (MPA)) are one of the most important management tools to protect Queen Conch populations (Stoner, 1997). MPAs allow maintenance of spawning stock size at high densities and provide a refuge for older specimens which are more reproductive than younger adults (Anon., 1999). Comparative studies in protected and unprotected areas have shown that densities and stock sizes are significantly higher in protected areas. For example, the Exuma Land and Sea Park in the Bahamas was found to support 31 times greater concentrations of Queen Conch than areas outside the park (Stoner & Ray, 1996). In the Turks and Caicos Islands, Queen Conch densities in the East Harbor Lobster and Conch Reserve in South Caicos were almost twice as high as in similar habitats outside the reserve (Wilkinson, 2002). Protected areas can be an important source of larvae and new recruits to exploited areas ('spillover effect') (Stoner, 1997). However, the effectiveness of these management measures depends on the identification of critical spawning sites and nursery grounds. Some areas may depend largely on recruitment from faraway stocks through larval drift, and hence depend on the protection of spawning sites in other regions; therefore, larval transport, retention and physical oceanography must also be considered (Stoner, 1997).

Seasonal closures to protect the stock during the most reproductively active months are in place in several range States. Unfortunately, these closures are not always harmonised across States, which may undermine their enforcement, because Queen Conch taken illegally in one country during a closed season may be landed legally in a neighbouring country. In several States (e.g. Dominican Republic and Jamaica), seasonal harvest closures are supplemented with a seasonal ban on processing, trade and exports of Queen Conch meat during the closed season, which facilitates the enforcement of closed seasons (CITES Secretariat, 2003).

A number of Queen Conch range States have established harvest and/or export quotas to control total fishing effort. Annual (or seasonal) harvest quotas for *S. gigas* are used in Cuba, Jamaica, Mexico, Turks and Caicos Islands, and daily catch limits are used in the Cayman Islands, Puerto Rico, and the US Virgin Islands. Annual harvest quotas are often used in combination with export quotas (e.g. in Jamaica and the Turks and Caicos). Other countries have established export quotas to regulate and control export volumes (the Bahamas, Colombia, Nicaragua), however, these do not necessarily influence fishing effort especially in countries where local consumption is high (e.g. the Bahamas) (CITES Secretariat, 2003).

In reviewing the literature, it is apparent that the conch fisheries in Jamaica and the Turks and Caicos Islands are among the largest and best managed in the region, still maintaining relatively stable populations of Queen Conch.

3.4. Monitoring of Queen Conch Landings and Exports

Non-standarized or insufficient monitoring and reporting of landings, together with insufficient information on the weight of meat yields per specimen upon landing (unprocessed) and in trade (processed), make the monitoring of landings and trade volumes difficult. Prior to export, Queen Conch meat is processed to varying degrees, which can, depending on the processing grade, result in a reduction of the original tissue weight by 50% or more. In some countries specific terms are used to describe the different processing levels. These are, however, not yet standardised. The level of processing and tissue loss is a critical factor for example in calculating quotas and in recording and monitoring harvest and export volumes (CITES Secretariat, 2003). However, the tissue weight of an adult Queen Conch can vary from region to region depending factors such as age of the individual and spatial differences. Several countries, especially those using quotas to manage their Queen Conch fishery (such as Jamaica), have established conversion factors that allow conversion of the weight of declared exports of Queen Conch meat to the number of animals harvested.

3.5. Queen Conch Assessments in the Region

In a number of countries, the status of local Queen Conch populations is either poorly known or not known at all, including in important exporting countries. Low adult densities are reported from fishing grounds of some of the larger exporting countries (CITES Secretariat, 2003).

Several countries have undertaken stock assessments and abundance surveys, and collected morphological and fisheries dependent (Catch and Effort) data. However, stock assessment remains difficult due to certain aspects of the species biology such as its unusual growth pattern and its large change in natural mortality with age (Anon., 1999). Moreover, Queen Conch stocks are patchy in their distribution even within the appropriate habitats, and this patchiness adds to the difficulties in their assessment (CITES Secretariat, 2003).

Surveys undertaken in the 1970s reported adult densities of several hundred or even more than a thousand individuals per hectare (ind./ha). Nowadays, densities are considerably lower in most areas. In fact, adult densities in several range States are now at such low densities that reproduction failure may be a risk. Relatively high adult densities are only reported from a few locations, for example Cuba, the Pedro Bank in Jamaica, the Serrana Bank in Colombia and the Caicos Bank in the Turks and Caicos. Some of these locations host potentially very important populations, such as

the Queen Conch stock at Pedro Bank in Jamaica that is considered one of the largest stocks within the species range and one of the most important Queen Conch producing areas in the region (Stoner, 1997).

3.6. QUEEN CONCH IN SAINT LUCIA

3.6.1. The Saint Lucia Queen Conch Fishery

Although Queen Conch is thought to be distributed around the island, only two significant populations have been identified, one in the north and one in the south, with the former considered to have been more heavily exploited than the latter (Nichols and Jennings-Clark, 1994). As is typical across the region, near-shore populations have been over exploited and most fishermen are targeting stocks in deeper waters using scuba gear (Anon., 1999). Landings over 1994-2001 ranged from 20,000 to 41,400 kg of Queen Conch unprocessed meat (CITES Secretariat, 2003). The catch history data contained in the draft Plan for Managing the Fisheries of Saint Lucia (2006- 20011) shows a peak of more than 60 tons in 2002, declining to just over 40 tons in 2005.

The following features of the conch fishery in Saint Lucia were noted by Joseph (2003):

- The conch fishery total annual landing had been increased steadily since 1996;
- Near shore stocks were over-exploited, although conch was still harvested with gill nets and by free diving in areas along the west and southwest coasts;
- Queen Conch was fished within various areas including off Cas en Bas, Esperance, Grand Anse, Gros Islet, Mennard and Marisule in the north; Vieux Fort and Caille Bleu in the south; and Dennery on the east coast;
- Subsistence exploitation occurred in shallower waters but the extent was not known;
- Queen Conch was landed at three main sites: Gros Islet in the north, Vieux Fort and Laborie in the south;
- Most fishers harvested at deeper depths with SCUBA gear;
- The majority of SCUBA gear used by fishers was unsafe;
- Although distributed around the island, only 2 significant populations had been identified, one in the north and one in the south;
- The north population was thought to have been more heavily exploited;
- Conch was exploited commercially year-round by over 40 fishers in depths ranging from 11 m to 43 m;
- Fishers operated out of open wooden and fibreglass pirogues 7.02-8.45 m long, powered by outboard engines 115-250 hp;
- Full-time fishers dived an average of 4 times per week (alternating rest days); part-time fishers dived an average of twice per week;
- 100-500 conch were landed per trip, depending on number of divers and number of dives per trip;
- The majority of conch harvested were landed whole (live);

- There was a daily demand for the product, and conch were no longer stored in wire mesh cages for later sale;
- There was a thriving illegal trade between Saint Lucia and Martinique from 1997 when the EU imposed trade restrictions for health and sanitary controls for fishery products. However, from 2002, the unauthorised trade appeared to have almost ceased;
- Enforcement of fishery regulations in place since 1994 had focused on the restriction on harvesting of immature conch (i.e. conch without a flared lip);
- Current fisheries data collection included gathering catch, effort and biological data, registration/licensing of fishermen and vessels, SCUBA diving establishments, sports fishing vessels and spear gun fishers;
- Of the 23 landing sites, catch and effort data were collected from eight on a permanent basis, including Gros Islet in the north where the majority of conch were landed;
- Subsidies and incentives in this sub-sector, as for the overall fishing sector, included refund of duty on fuel, duty free concession and consumption tax exemption on fishing gear and equipment; and
- The DOF had implemented a limited entry system by licensing all fishers operating in the industry, and training fishers in proper and safe diving practices, certifying several in SCUBA diving.

3.6.2. Available Data on Queen Conch in Saint Lucia

Information on stocks is still scarce, especially information on density, abundance and distribution, limiting informed management decisions. Data collection programmes have been implemented since 1979, but had significantly improved with the assistance of CFRAMP. Few surveys had been undertaken until 1996 when a two-year study commenced, to collect morphometric data (shell length, lip thickness and meat weights of harvested specimens) (Joseph, 2003).

Under the two year (1996-98) CFRAMP-assisted programme, *Strombus gigas* harvested by commercial fishers from fishing areas in the north and south were sampled (fishers involved in the study were asked to land all sizes of conch). Figure 1 shows the conch fishing areas sampled. Harvesting was done using SCUBA gear only. Data collected included shell length, lip thickness for adults, sex, state of maturity (adult /juvenile), total weight and wet-meat weight. State of maturity was approximated by the presence of a flared lip and immaturity by the absence of a flared lip. For analyses, data were grouped into northern and southern areas (Joseph, 2003).

Joseph (2003) presented results for the 4390 conch sampled under the CFRAMP programme. 7.4% were immature. 45% of 317 were female. Lip thickness was predominantly 15-27 mm, with most in the 24-26 mm range. Very few had a lip thickness less than 5 mm. In both fishing areas, most conch were in 200-280 mm size class. Peaks were 260-279mm in the south and 220-239 mm in the north. More than 99% of the conch had shell lengths greater than 180mm (the minimum size limit). Mean shell length, total weight and meat weight were larger in the south. The analysis found that less than 10% were immature (no flared lip), and less than 0.5% were less than 180 mm total length, so that most of the conch landed exceeded the minimum size limit in the Fisheries

Regulations No. 10 of 1994. It was concluded that stocks were sustaining the current level of fishing, although shallow water stocks have been over exploited.

No visual abundance surveys have been conducted in Saint Lucia to date. There is a need for improved baseline information on the stocks to set quotas or allowable catch levels and to effectively monitor catches.

The findings of the CFRAMP data analysis, as contained in the report by Joseph (2003) informed both the proposals for improved conch fishery management contained in the Draft Plan for Managing the Fisheries of Saint Lucia (2006 -2011) and the selection of restrictions for conch harvesting incorporated into the draft (revised) legislation.

3.6.3. Conch Sales and Export

Exports today should only occur under the CITES restrictions and EU/HACCP standards (Draft Plan for Managing the Fisheries of Saint Lucia (2006-2011)).

In 2002, the conch fishery accounted for only 1.94% of the total annual landing, and Joseph (2003) estimated the fishing sector contribution to GDP to be in excess of EC$24 million in 2002. The major fisheries resources of Saint Lucia comprised demersal, coastal pelagic and offshore pelagic fisheries. More than 75% of the annual landings by weight comprised offshore pelagics most of which are landed in the high season from December to May. During the low season from June to November, large quantities of demersal fishes were landed.

Queen Conch meat was consumed locally but there was also a strong demand for the meat in neighbouring islands (especially Martinique), and in the early 1990s, more than 50% of the total landings was exported to Martinique (Joseph 2003). These exports were permitted only as whole animals, after careful examination of the product by the DOF and presentation of the relevant CITES documents.

Quantities of Queen Conch that were imported from Saint Lucia (according to the UNEP-WCMC CITES Trade Database (2008)) over 1994 -2004 are contained in Table 2. During the same period there were twenty two (22) shipments of shells varying in number from one (1) to fifteen (15) shells. In 2001, Saint Lucia imported 4,994 kg of Queen Conch meat from Saint Vincent and the Grenadines (UNEP-WCMC CITES Trade Database, 2008).

Between February 1999 and March 2002, Saint Lucia was affected by a recommendation of the CITES Standing Committee that Parties suspend imports of specimens of *S. gigas* originating from Saint Lucia and several other Parties, because they failed to respond to certain of the CITES Animals Committee's recommendations. The recommendation was withdrawn for St. Lucia after the country provided sufficient information in response to the Animals Committee's request (Theile, 2002).

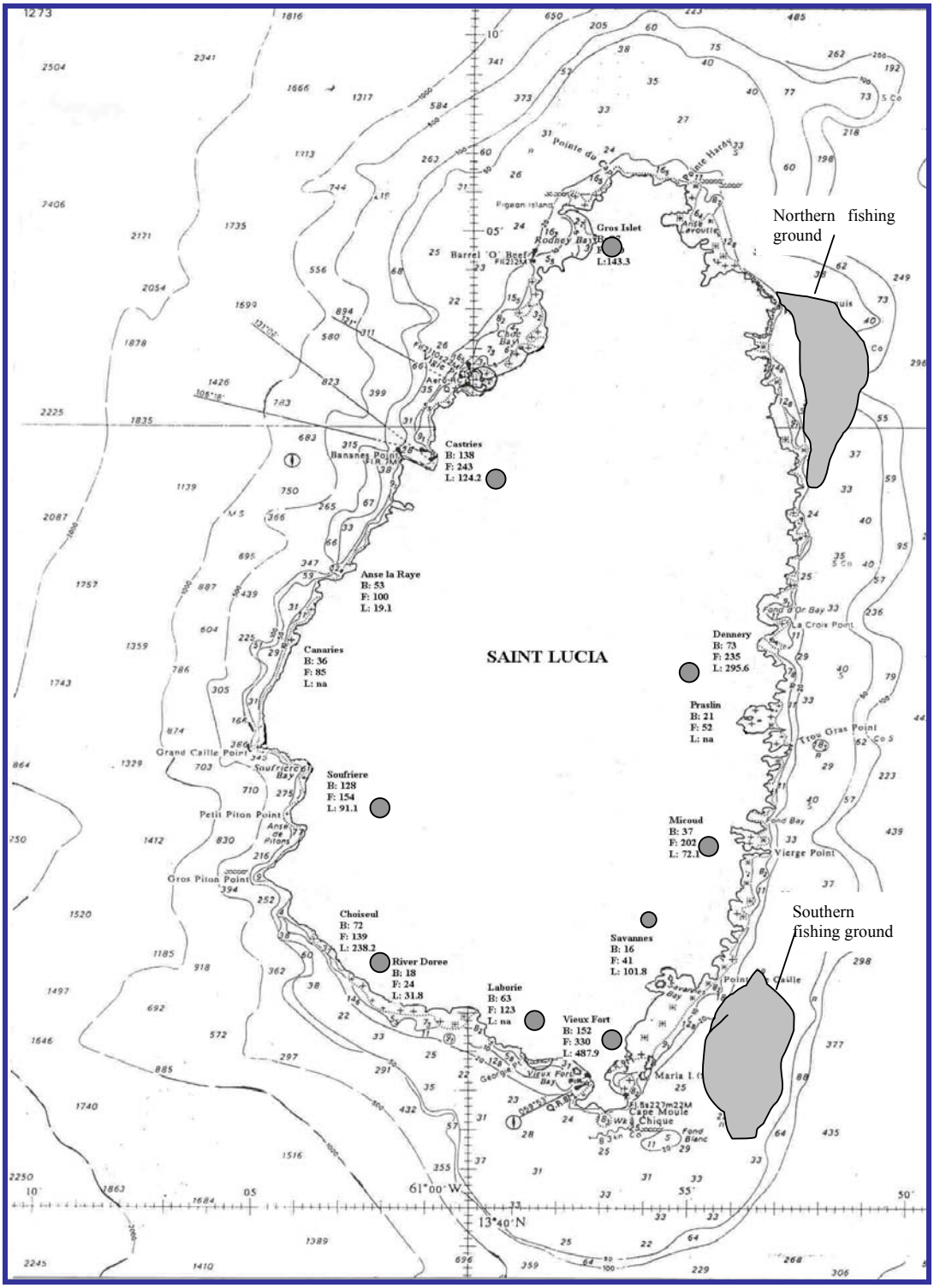

Figure 1. Major Fish Landing Sites in Saint Lucia
Map shows and the number of fishers and vessels at each site. Depths in m. (Source: DOF, Saint Lucia - 2000) - Fish landing data collection sites. Conch fishing areas sampled under the CFRAMP study are superimposed.

Key: B: number of boats; L: Landings (tons); F: number of fishers; na: not available

Table 2. UNEP-WCMC CITES Trade Database Records of Conch Imports from Saint Lucia

Year	Conch meat imported (kg)	Live (L) or meat (M)	Country of import
1994	15,000	M	France
1995	55,395	L	France
1996	8,400 600	L M	France
1997	6,000	M	Martinique
1998	0		
1999	0		
2000	0		
2001	0		
2002	975	M	US
2003	0		
2004	0		

St. Lucia's export trade was also affected by the temporary closure of the EU market for Queen Conch products due to EU Food Sanitary Regulations in 1998. The EU Sanitary Regulations and the Standing Committee recommendations are reported to have resulted in a significant illegal trade of Queen Conch meat between Saint Lucia and Martinique. Joseph (2003) reported however, that from 2002 the unauthorised trade appeared to have almost ceased. Since the withdrawal of the Standing Committee recommendations in 2002, no authorised export in Queen Conch to Martinique had taken place. Concerns had however, also been raised about illegal fishing activities by French vessels from the neighbouring island of Martinique (CITES Secretariat, 2003).

The major market for conch meat was the local market, which served both the tourism sector and nationals. There had been a growing demand for conch meat as a result of activities such as seafood festivals developed in several communities (Gros Islet, Anse La Raye and Dennery) to stimulate their economic development. There was a daily demand for the product, unlike in the past, when conch had to be enclosed in near-shore pens until a sale was obtained (Joseph, 2003).

3.6.4. Policy, Legislation and Enforcement

In 1987, the DOF in Saint Lucia introduced legislation relevant to the Queen Conch fishery in Saint Lucia under the Fisheries (Turtle, Lobster and Fish Protection) Regulation No. 67. The prevailing Fisheries Regulations No. 9 of 1994, Section 35 provides as follows:

"(1) No person shall-:

a) take from the fishery waters, sell, purchase, or at any time have in his possession any immature conch; or

b) take from the fishery waters, expose for sale, purchase or at any time have in his possession any conch during the closed season for conch as specified by the Minister by notice published in the *Gazette* and in a newspaper which is printed or circulated in the State.

(2) I this Regulation -

(a) "conch" includes the whole or any part of the conch;

(b) "immature conch" means a conch with-

- a total weight of less than 1kg;
- meat weight less than 280 gm after removal of the digestive gland;

- a shell which is smaller than 18 cm in length; or
- a shell which does not have a flared lip."

A closed season has not been established, as provided for in the Regulations. The current fisheries legislation allows a maximum fine of $5000.00 for each offence and/or incarceration. In general, fisheries management and enforcement agencies have limited surveillance and enforcement capacities. Enforcement of the legislation focuses only on the flared lip requirement due to the ease of enforcement and implementation in the field.

The policy of the DOF requires all Queen Conch to be landed whole (live) in the shell, but although this is not enshrined in law.

The use of scuba for fishing is regulated by law. Only a certain number of divers are authorised to use scuba gear and those who are require a licence from the DOF. Additional licences are required for fishing vessels and all fishers are to be registered.

Prior to the CITES Standing Committee decision to suspend imports of *S. gigas* from Saint Lucia, vessels were required to export Queen Conch as whole animals. Individuals were allowed to make no more than one export trip per month and export no more than 300 Queen Conch per consignment. Export permits were also required for the export of Queen Conch shells (CITES Secretariat, 2003).

In 2002, the Standing Committee of CITES withdrew recommendations to suspend imports of conch from Saint Lucia and COP 12 agreed that shells of the Queen Conch would qualify as exempt from the provision of Articles III, IV and V of the Convention under the category of personal and household effects. Under Resolution, Conf. 12.9 "Queen Conch (*Strombus gigas)* shell – up to three per person do not require export or import permits, or re-export certificates, for personal or household effects for the dead specimens, parts and derivates." (Joseph 2003).

The fisheries legislation is now under revision. The draft Fisheries Act proposes that:

- a person shall not take from the fishery waters and have on board any fishing vessel or land any conch out of its shell.
- a person shall not remove conch from a designated closed area for any conch.

The draft regulations propose to define immature conch as any conch that -

(a) is a total weight of less than 1 kg;

(b) has a shell which does not have a flared lip; or

(c) has a shell with a lip thickness of less than 5 mm.

This draft legislation proposes to increase the fines to be imposed under the Act.

Saint Lucia is also currently in the process of finalising and institutionalising national CITES enabling legislation. The conch fishery falls under the ambit of the CITES legislation. Queen Conch, "lambi" or *Strombus gigas* is listed in Appendix II under Phylum Mollusca, Class Gastropoda (snails and conchs). The main purpose of the International Trade in Wild Fauna and Flora Act is to set up the infrastructure to implement the Convention on International Trade in Endangered Species of Wild Fauna and Flora, to implement the detailed provisions of the

Convention with a view to ensuring that no species of wild fauna and flora become or remain subject to unsustainable exploitation.

The Act makes provision for a Management Authority, designated by the Minister with responsibility for trade in wild fauna and flora in accordance with Article IX of the Convention and the functions of such a Management Authority are highlighted. Consistent with Article VI(7) the Management Authority may affix a mark on any specimen to assist in identifying the specimen. A Scientific Authority may be designated by the Minister and the functions of the Scientific Authority are set out. The Scientific Authority may co-opt expertise as required.

Registration of scientific institutions, international traders, commercial international traders, non-commercial traders, producers, and pre-Convention specimen owners are provided for in keeping with Article VII(6) of the Convention.

The various categories of permits and certificates are identified in accordance with Articles III, IV, V and VI of the Convention. The Act contains provisions on export permit, import permit, re-export certificate, and introduction from the sea certificate. The Act reflects Article X of the Convention and provides for acceptance of comparable documentation from States which are not party to the Convention. A permit or certificate is non-transferrable and a separate permit or certificate is required for each consignment of specimens in accordance with Article VI(5) of the Convention. A permit or certificate is invalid for reasons identified. Exemptions are listed reflecting the provisions of Article VII of the Convention. This Part includes provisions on grounds for refusal to grant permit or certificate, suspension of permit or certificate and revocation of permit or certificate.

Offences and penalties are created in the Bill and include the offence of illegal trade, illegal possession, false or misleading statements, threatening an enforcement officer, alteration, and defacing of a mark and provide for the minister's power to compound offences.

Enforcement provisions relate to the power of arrest and to search premises, disposal of confiscated specimen, food or drink, expenses, guidance from other laws, showing of identification and power to search specified equipment.

Miscellaneous provisions enable the Minister to designate ports of exit and entry as required under Article VIII(8) of the Convention, and provide for the protection of members of the Authorities and enforcement officers, making of proposals, appointment of committee or similar body, waiver of fees and amendment of Schedule and Regulations.

Fines being proposed in the draft CITES legislation range from EC$10,000.00 – EC$200,000.00, depending on the nature of the offence.

3.6.5. Conch Management Plans

Two management objectives have been defined for the conch resource in the draft Plan for Managing the Fisheries of Saint Lucia (2006- 2011). They are rebuilding the near-shore stocks and ensuring sustainable use of this resource. The following implementation strategy is extracted from the draft Plan for Managing the Fisheries of Saint Lucia (2006- 2011):

Issues	Action	Implementation Strategy
Inadequate monitoring system	Review data collection and management programme being implemented in the Fishery. Refine the existing data collection and management programme based on the review.	Review existing data collection (catch. Effort, biological) and management programme being implemented
Inadequate information on the current status of conch stocks	Determine the status of conch stocks being fished by this Fishery	Using the data from the data management programme, visual abundance surveys and other relevant information, determine the status of the conch stocks. Establish target and limit reference points for the conch stocks being fished by this fishery. Refine the management strategy (limited entry, size restrictions, closed season, closed areas, marine reserves) to achieve the targets set.
Habitat damage and destruction	Control land based sources of marine pollution and mitigate negative impacts from coastal pollution	Collaborate with the Ministry of Physical Planning, Environment and Housing in promoting integrated coastal zone management, the use of EIAs, and support watershed management initiatives and activities to reduce land based pollution.
Lack of data/information on the incomes/revenues being earned, and costs in the fishery.	Determine the costs and earnings of the various operators in the Fishery.	Undertake cost and earning studies in the fishery. If possible, conduct bio-economic assessments and use the information to refine the management strategy to improve the earnings of the operators in the Fishery.
Inadequate enforcement of fishery regulations.	Improve on monitoring, control and surveillance capabilities of the enforcement agencies.	Develop and implement a National Plan of Action for IUU Fishing
Lack of a regional approach to the management of the Fishery.	Improve on DOF's participation in management and related meetings on the fishery.	Seek to ensure DOF participation in the CRFM's Annual Scientific Committee Meetings and in FAO Conch Working Group Activities.
Limitations on access to regional and international markets.	Improve on national quality assurance systems for fish and fish products quality assurance and safety.	Improve on the institutional capabilities of the competent authority and other relevant public sector institutions to carry out their inspectorate and certification functions in the fisheries sector. Provide training and technical assistance, including infrastructure improvement, to fishers, fisher organisations, processors, etc. in order to improve on the quality assurance and safety mechanisms in the post harvest/cold chain.

4. PURPOSE OF THE STUDY

The purpose of this study was to provide more rigorous, scientifically based information and analysis for effective management of fisheries resources in Saint Lucia. The study should satisfy many of the information deficits identified in the draft Plan for Managing the Fisheries of Saint Lucia (2006- 2011).

In particular, the study was designed to:

- obtain a historical perspective of the fishery,
- locate specific areas where conch populations inhabit,
- determine the distribution of conch resources around the island, both within fished and non-fished areas,
- determine the abundance and density of conch within the various populations around the island,
- obtain data on the population structure of the various populations of conch, and
- obtain information on the costs and earnings pertaining to the conch fishery.

5. METHODOLOGY

The Consulting team comprised the following persons:

- Alison King-Joseph, Team Leader/Environmental Consultant
- Nyo Serieux, Statistician
- Andre St. Omer, Dive Specialist
- Geraldine Lendor-Gabriel, Accountant

Three discreet project activities were implemented:

- Historical Survey
- Conch Resource Assessment
- Socio-economic Survey

The methodology applied to each of these activities is described below.

5.1. Historical Survey

Pierre-Nathaniel and Nelson (2006) documented the historical turtle study that sought to capture information on the sea turtle fisheries of Saint Lucia in the past, by focusing on fishers aged 50 years and older; questionaires focusing on social and geographical issues, catch and effort, demand, economics and trade, resource use, awareness and trends were administered to 12 fishers around the island in that survey. The turtle study questionnaire was amended for use with conch fishers by the DOF and a draft historical survey instrument for conch was developed. The Consultants recommended some minor modifications to the draft, and these were agreed upon by the DOF. Data collected included details about fishers' participation and role[2] in the fishery; where, when and how they dove for conch; whether they had ever suffered from the bends and how they were treated; their observations about any changes in conch location and abundance over time; how they sold conch; how they managed juvenile conch; the contribution of conch fishing to their income; how they shared the conch harvest; rules that applied to the fishery at the time, and the extent to which such rules were complied with.

Historical information for this study was taken, in consultation with the DOF, to be data for the period up to and including the year 1989.

The DOF supplied a preliminary list of known conch fishers, both past and present. There were 18 fishers on this list. Of these eighteen fishers, three present day fishers refused to participate as they were of the view that the DOF intended to close or otherwise restrict the conch fishery. Another listed fisher was reportedly in Martinique.

---

[2] Fishers were requested to indicate whether they were an owner, captain, diver or crew. They were requested to indicate all of these roles that may have applied to them.

Additional conch fishers were identified by visits to the landing sites in the communities from which the conch fishers operate (Gros Islet and Laborie), through fisher interviews and through discussions with the DOF's Data Collectors and Extension Officers operating in Gros Islet and Laborie.

The DOF had encountered difficulty in their previous efforts to administer the survey, as the fishermen were not prepared to participate without receiving something in return. The DOF advised that, to encourage the support and participation of fishers (both past and present) in this exercise, they should be paid for each questionnaire completed. It was therefore agreed that EC$50 per interview completed would be paid to fishers.

In the final analysis, a total of twenty eight (28) past- and present-day fishers were identified and interviewed. Six (6) past fishers were identified and interviewed. Eight (8) fishers who responded to the present day survey were also diving conch before 1989, and some of their data was incorporated into the past fisher analysis.

An experienced enumerator was identified through the Department of Statistics. She was briefed jointly by the Consultants and DOF staff on March 17 & 25, 2008. Appointments were made with fishers by the enumerator, and interviews were usually conducted at the fisher's residence. An effort was made to ensure that no other fishers were around during an interview in cognisance of the sensitivity of fisher information, particularly regarding dive sites. Interviews were conducted over March/April 2008. The DOF was represented at several of the fisher interviews by the Project Field Coordinator. Historical survey interviews lasted approximately 45 minutes.

Data was analysed and the results are provided later in this report.

5.2. Socio-economic Study of the Conch Fishery

The consultants developed survey instruments for present day fishers and purchasers, including hoteliers, vendors and wholesalers.

The survey instrument for present day fishers was a substantially revised version of the historical survey instrument, in consultation with the DOF, to incorporate the socio-economic aspects required for this component of the project. Present day fishers were asked about the period over which they had fished conch; fishing trip and catch details; other occupations and income sources; their role in the fishery; boat and gear information; conch fishing locations; time and other inputs spent fishing conch; observed changes in conch locations, sizes and densities over time and likely reasons for these; differences in north and south conch populations and reasons for these; knowledge of laws concerning conch, HACCP and CITES; their opinion on who should make decisions regarding the industry; their level of satisfaction with the catch and their intentions to remain in the industry; whether thy have had the bends and how this was treated; details of their conch sales; how the catch is shared; costs; customers; whether they would encourage family to enter the fishery; and household details.

Fishers interviewed were those identified as described in the previous section. As noted, three present-day fishers refused to participate.

Survey instrument designs for vendors, restaurants/hotels and wholesalers were also completed in consultation with the DOF. The vendor questionnaire (rather than the hotel/restaurant

questionnaire) was administered to conch vendors who did not offer seating within the premises to their patrons. Vendor demographic information was requested (age, household details). Vendors were also asked about how they procured conch, their costs in conch preparation, seasons of availability and demand; perceived changes in availability of conch over time; and their markets. The questionaires administered to hoteliers/restaurateurs and wholesalers were similar to that for vendors, except that personal data relating to respondent age and household was not requested, but details on staffing levels were required.

Several restaurants known to serve conch were identified by the DOF. In addition, all restaurants and hotels listed in the yellow pages of the Saint Lucia Directory were contacted by telephone to ascertain whether they serve conch. An effort was made to survey all who indicated that they do serve conch. Some telephone respondents expressed a preference to have the questionaire sent to them, rather than administered by an enumerator, and this was facilitated. However, the response of these was poor, with only 2 returning completed questionnaires by fax and e-mail. Details of restaurants contacted, whether conch was served, and whether they responded to the survey are provided in Appendix 1.

Vendors were identified through the Town and Village Councils in Gros Islet, Laborie and Dennery. The Vieux Fort Council after some investigation advised that conch was not sold by vendors in the Vieux Fort area. The Councils referred the Consultants to the Vendor Associations in their communities, and these were very helpful in providing contact information for their members. All vendors who were identified as selling conch in these communities were interviewed. Vendors surveyed are listed in Appendix 2.

The survey instruments were administered to 20 restaurateurs, 25 vendors (conch meat and conch shell) and 22 present-day fishers. All fisher, vendor and restaurant/hotel survey instruments were administered by the same enumerator as in the historical survey, with the exception of 2 restaurateurs who had indicated a preference to complete the questionnaire themselves. Survey instruments typically took 15 to 20 minutes to administer.

The questionnaire for wholesalers was administered to managers at the Fish Marketing Complex and Superior Fish and Seafood Suppliers by the lead consultant.

Analysis of these survey results has facilitated an assessment of the socio-economic benefits of the conch fishery, and this is provided later in this report.

5.3. Conch Resource Assessment

A research/consultancy agreement was signed between the DOF and Alison King-Joseph. This facilitated the legal conduct of the required field activities by the Consultant in accordance with the Laws of St. Lucia, and Consultant participation in DOF training activities.

Information gathered from present-day fisher surveys conducted earlier in this exercise indicated the general location of commercial conch dive sites, and this information was used to identify dive site locations for this study[3]. Subsequent discussions with some of the fishers confirmed and

[3] Preferred areas for fishing conch, in order of present-day fisher preference, were Vieux Fort lighthouse, Donkey Beach, Marisule, Cap Estate/ Esperance and Laborie. Other areas noted to contain conch were south-east coast, east coast and Micoud. Some fishers indicated that conch is found all around Saint Lucia. All dive sites, according to the sixty eight

clarified this information. Fishers familiar with the areas assisted in the identification of approximate boundaries of areas known to contain conch. Preliminary dives on the north-east coast off Gros Loup and south-west and south-east coasts off Vieux Fort were conducted to verify fisher information and confirm the presence of conch in the general area. Boundaries of areas described by fishers were delineated on British Admiralty Charts made available by the Saint Lucia Air and Seaports Authority (SLASPA), and the areas were measured.

The dive schedule was delayed from April through June, 2008 by high winds and heavy seas resulting in unsafe dive and/or low visibility conditions. Expeditions were conducted from July through September 2008 to perform density surveys at the selected study sites. Conch fishers were recruited to accompany dive expeditions and identify dive locations known to contain conch. Dive sites were located within the fishing areas identified through the fisher surveys and observed to be in use by conch fishers. The coordinates of the dive sites were determined using a Global Positioning System. Once anchored at the selected dive site water depth was noted and one team of two divers was deployed. All conch (including dead specimens) within the transect were harvested for later biological and maturity analysis. Forms used to record data are attached in Appendix 3.

The methodology initially selected was a modification of that used in the conch survey undertaken in Jamaica in 1997 (Tewfik, A. and Appeldoorn, R. S., 1998), although conch were not harvested in that study. Data taken was designed to be comparable with the previous Saint Lucia survey data, as documented by Joseph (2003). Equipment on board the survey vessel included an underwater camera, global positioning system and depth gauge.

On the first dive, the modified methodology of Tewfik and Appeldoorn (1998) was applied. Divers were equipped with a 100' rope weighted at one end with a stake on the other, and rope bags for conch collection. The pair of divers attempted to swim four 3 m x 100 m transects, one in each of the cardinal directions. The divers were actually able to complete 3 transects with the air available. The first diver in the pair swam out the 100 m rope length anchored by a 1kg weight at the start point in close proximity to the support vessel, and anchored it with the stake at the extreme end. The second diver followed, searching for all conch (live and dead) on or buried in the sediment within 1.5 m on either side of the rope. The transect width was estimated using a length of the diver's outspread arms on either side of the rope. The first diver swam back to meet the second diver, also searching for all conch within 1.5 m of the rope. It was intended that the second diver would take the conch back towards the support vessel, while the first diver returned to the extreme end of the rope, to move it to the second cardinal point, but no conch were found. This procedure was used in three cardinal directions. There was insufficient air to complete in the fourth direction. Harvested conch were to be floated up to the surface by attaching plastic bags filled with air to the bag of conch, but no conch were found.

In subsequent dives, the transect design was varied to suit actual dive (current and substrate) conditions. Table 3 details the dive locations and transect configurations.

---

percent (68%) of fishers surveyed, are within the range of 80 ft (24.4 m) to 100 ft (30.5 m) deep, on seagrass substrates. Nine percent (9%) indicated depths of up to 130 ft (39.6 m). The remainder did not specify depths.

Table 3. Study Dive Locations and Transect Details

Dive	Date	Location	Coordinates	Depth (feet)	Transect dimensions (m)	Transect area (m^2)	Rationale for transect dimension selection
1	16/7/08	Gros loup	N 14°07.117´ W 60° 54.676´	82	3(30.5 x 3)	274.5	This was the methodology originally proposed, as described above.
2	25/7/08	La Brelotte Bay	N 14° 04.584´ W 61° 01.121´	85-90	Rectangle 27.5 x 9	247.5	Original methodology was not feasible as the tape kept snagging on rubble when efforts were made to change cardinal directions. Length was set out with tape and width estimated.
3	25/7/08	Marisule	N 14° 04.217´ W 61° 01.108´	87-94	Rectangle 27.5 x 9	247.5	ditto.
4	8/8/08	Moule a Chique lighthouse	N 13° 42.191´ W 60° 57.378´	87.9	Rectangle 27.5 x 9	247.5	ditto.
5	8/8/08	Moule a Chique lighthouse	N 13° 40.978´ W 60° 56.665´	106	Rectangle 27.5 x 9	247.5	ditto.
6	13/8/08	Gros Loup	N 14° 07.032´ W 60° 54.524´	85	Circle radius 30	2827	Strong currents made pulling the transect line difficult. There was good visibility, and vegetation was sparse with patchy reef. This made observation of the bottom easy. The tape was anchored at the centre of the circle. One diver swam the circle circumference while the other swam within the circle.
7	13/8/08	Esperance	N 14° 06.753´ W 60° 54.108´	100	Rectangle 30 x 9 plus Semi-Circle radius 30	1684	ditto.
8	5/9/08	Laborie	N 13° 43.611´ W 60° 59.848’	98.5	Rectangle 12 x 3	36	Substrate was rubble, and visibility poor.
9	5/9/08	Laborie	N 13° 42.673´ W 60° 59.807´	90.3	Rectangle 30.5 x 10	305	Similar to methodology in dives 2 to 5, but with wider transect.

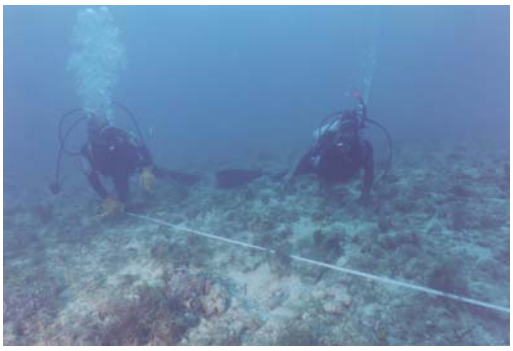

Photo 1. Divers setting out transect
Note substrate at this site (Marisule) was stony bottom, heavily encrusted, macro algae and sponge, little sand.

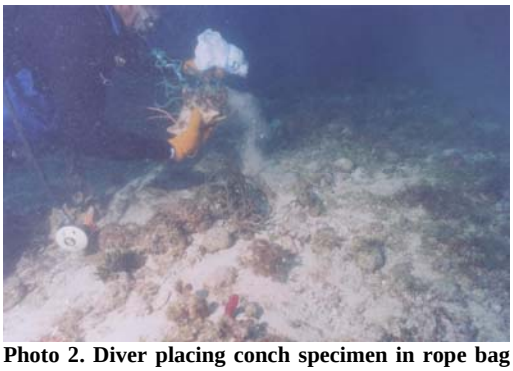

Photo 2. Diver placing conch specimen in rope bag
This was at the Marisule site on 25/7/08.

At all dive locations, divers noted substrate type and topography. On one occasion, a third diver monitored their efforts and took still photographs of some of the diver activity. An average of two dive sites were completed per day.

The conch which were floated to the water surface were placed on board the vessel. Conch were landed at Ganthers Bay at the end of each expedition, and biological data was immediately collected at that site. Time between dive and start of biological data collection was approximately 3 hours. Data collected was as follows:

- Shell length
- lip thickness
- total weight
- wet meat weight
- sex

Weight and lengths were determined using a scale and callipers. All length measurements were measured to the nearest millimetre. The lip thickness was measured approximately 10 mm from the edge of the shell, in line with the bottom whorl. Total shell length was the maximum length measured from the tip of the spire to the edge of the siphonal canal.

Photo 3. Measurement of total shell length

Photo 4. Measurement of lip thickness

Photo 5. Measurement of weight

Photo 6. Determination of sex
This animal's sex was recorded as male.

Weights were measured to the nearest 25 grams. Total weight was determined by weighing the whole animal including the shell. Wet meat weight was determined by weighing the animal excluding the shell but including the viscera. Sex of the conch were determined once the animals were de-shelled. Those with a verge were recorded as male, and those with an egg groove were recorded as female.

Conch harvested was delivered to the DOF.

Estimates of conch density at each site were based on mean number of conch encountered over all transects completed at a site and extrapolated to one hectare (ha=10,000 m^2) for all size/age categories.

DOF conch landing data was also reviewed. The DOF gathers catch and effort data for various fisheries. Data Collectors are given 15 random days per month to collect data from every other fishing boat at the landing site monitored. Data collected includes number of tanks used, duration of trip, number of persons on board, fuel consumption, boat identification, and weight and cost of catch. Data collected is entered into the DOF Trip Interview Programme that estimates total fish landings from the data input. Nine (9) landing sites are routinely sampled.

5.4. Data Management

Data from the survey questionnaires were tabulated in Microsoft Excel as the information came in and these tables served as the source of information for each data framework. Averages and charts were derived directly from the tables.

Dive information was also tabulated in Microsoft Excel, but analyses were done by extracting the relevant data from the dive tables and inputting them into the ANOVA calculator as well as a T-Test calculator. All dive statistics were then reported in the detailed statistical analysis. One way ANOVA was used to test for significant differences between conch siphonal length and lip thickness between dive sites.

6. RESULTS AND ANALYSIS

6.1. The Past Conch Fishery

6.1.1. Demographics of Past Fishers

Past fishers were defined as those who were harvesting conch in the years up to and including 1989. Six (6) past fisher questionnaires were administered. Twenty two (22) present-day fisher questionnaires were also administered. Of the twenty two (22) present day fishers, eight (8) also fit into the past fisher category and some of the data generated from their survey responses were also used in the analysis of past fishers. As such, a total of fourteen past fishers were interviewed.

Fifteen percent (15%) of the fourteen (14) past fishers resided in Laborie. Thirty six percent (36%) of past fishers were residents of the town of Gros Islet. Seventy one percent (71%) of past fishers were resident in the district of Gros Islet[4]. Fisher addresses are depicted in Figure 2 below.

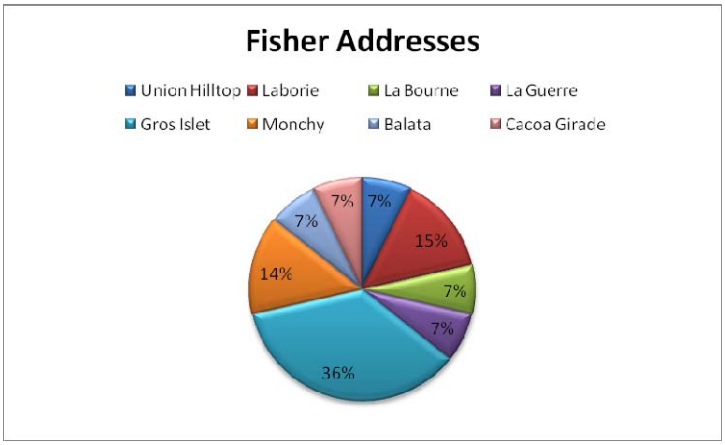

Figure 2. Past Fisher Addresses

The fourteen (14) past fishers interviewed harvested conch for different periods between the years 1957 and 2008. These fourteen (14) past fishers (eight (8) of whom still dived for conch in 2008) ranged in age from 36 to 76 years in 2008. Fifty percent (50 %) had started harvesting conch by the age of 20 years, although the mean age at which they started was 28 years. Years spent in the conch fishery by the fourteen (14) past fishers ranged from a low of 2 years to as long as 37 years to date.

The six (6) past fishers who no longer dived conch in 2008 ranged in age from 41 years to 76 years, with an average age of sixty four (64) years. These six (6) past fishers had harvested conch between the ages of eighteen (18) and twenty nine (29) years of age, and had spent an average of six years in the fishery. They harvested conch between 1957 and 1984.

Of those eight (8) fishermen who were still in the fishery in 2008, they had spent a mean of seventeen (17) years in the industry to date, and were an average age of fifty one (51) years old.

[4] The district of Gros Islet includes Gros Islet (town), Union Hilltop, La Bourne, La Guerre, Monchy and Cacoa Girade)

6.1.2. Past-Fisher Roles in the Conch Fishery

Of the fourteen (14) past fishers interviewed, fifty seven percent (57%) had combined roles of owner, captain and diver. None were solely owners or captains. Just twenty two percent (22%) were crew only. Roles are displayed in Table 4 and Figure 3 below.

Table 4. Distribution of Past Fisher Roles in the Conch Fishery

Roles	No. (%) (N=14)
Owner only	0
Captain only	0
Crew only	3 (22%)
Diver only	2 (14%)
Owner, Captain and Diver	8 (57%)
Captain and Diver	1 (7%)

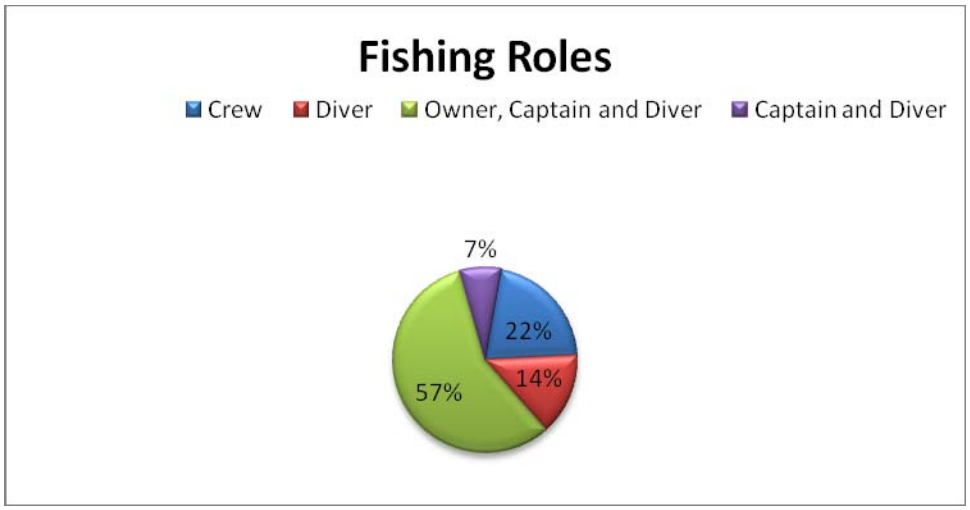

Figure 3. Past Fisher Roles in the Conch Fishery

Twenty nine percent (29%) of the fourteen (14) past fishers dived conch opportunistically while seventy one percent (71%) went out to sea specifically to dive conch. All the past fishers (one hundred percent (100%)) were also involved in other fisheries.

6.1.3. Conch Sites and Substrates Fished by Past Fishers

Sites where past fishers harvested conch were:

- Donkey Beach
- Gros Loup

- Monchy
- Esperance
- Pigeon Point
- Gros Islet
- Marisule
- Rat Island
- Soufriere
- Laborie
- Vieux Fort

See Figure 16 for these locations.

Depths dived as reported by the fourteen (14) past fishers ranged from 60 ft (18.3 m) to 120 ft (36.6 m) using SCUBA and, for three (3) fishers (none of whom were still diving conch in 2008), from 20 ft (6.1 m) to 50 ft (15.2 m) when free diving. None of the eight (8) present day fishers (zero percent (0%)) indicated that they harvested conch by free diving in 2008, but they were not asked whether they had free-dived for conch in the past. Of the six (6) fishers who no longer dived conch in 2008, five (5) were divers. Depths to which four (4) of them dived (that is, eighty percent (80%) of past divers) with SCUBA ranged from 60 ft (18.3 m) to 120 ft (36.6 m), an average of 98 ft (29.9 m). One (1) (twenty percent (20%) of divers) did not respond to this question. Of those six (6) divers still diving in 2008, four (4) (sixty seven percent (67%) of divers) reported that depths dived ranged from 80 ft (24.4 m) to 120 ft (36.6 m), with an average of 96 ft (29.3 m). The other two divers (thirty three percent (33%)) did not respond to this query.

Ninety three percent (93%) of the fourteen (14) past fishers reported that conch were harvested from seagrass substrates. Seagrass was founded on either sand or rock. Of the eight (8) present-day fishers who also fell into the past fisher category, two (2) indicated that they got conch all around Saint Lucia, in seagrass; six (6) of them indicated that conch were found at specific sites/substrates. The substrates cited by past fishers are provided in Table 5. The frequency with which favourite sites were mentioned by the fourteen (14) past fishers is depicted in Figure 4; most favoured location for diving conch was Vieux Fort off the Light House (see map in Figure 16 for location).

Table 5. Conch Substrates Identified by Past Fishers

Substrate	Number of past fishers who no longer dived conch (N=6)	Number of past fishers who still dived conch in 2008 (N=8)
Sandy areas	1 (17%)	0
Coral reef areas	1 (17%)	0
Seagrass bed areas	5 (83%)	8 (100%)
Rocky areas	3 (50%)	0
Other	0	0

Past fishers reported going a distance out to sea to dive conch ranging from one (1) to four (4) miles, with an average distance of two (2) miles reported.

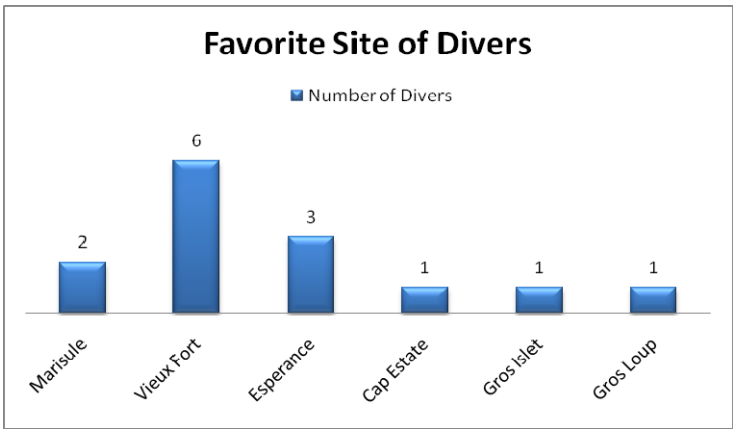

Figure 4. Favourite Dive Sites of Past Divers

6.1.4. Harvesting Practices and Preferences of Past Fishers

When questioned about their harvesting practices, the six (6) past fishers interviewed advised as follows:

- Fishers had no preferred days for harvesting. Fifty percent (50%) went out when the weather was good. Seventeen percent (17%) went out every day unless water was dirty or current was strong. Seventeen percent (17%) went diving when help (crew) was around. Seventeen percent (17%) went out 3 to 4 times per week on no preferred day.
- Fifty percent (50%) of fishers set out to dive conch between 7am and 8 am, and the remainder set out no later than 9 am. Thirty three percent (33%) thought that this was the best time to catch fish. Seventeen percent (17%) thought this was the best time to dive. Thirty three percent (33%) thought that setting out at this hour gave them enough time to fish.
- The number of persons who typically went out on a fishing trip ranged from two (2) to five (5), with an average of three (3).
- Conch was always accessed from a boat.
- Five (5) of the six (6) past fishers interviewed were divers. Four (4) of these (eighty percent (80%) of past divers) combined skin diving with SCUBA diving. All used SCUBA. Three (3) (sixty percent (60%)) were untrained and two (2) (forty percent (40%)) had had training from Fisheries.
- Three (3) of the five (5) past divers (who no longer dived in 2008) (sixty percent (60%)) reported having had the bends. One (1) fisher indicated that he did not know the cost of his treatment in Martinique in 1993, as this was met by the Government. Cost of treatment overseas was EC$20,000.00 in Barbados in the year 2000, and EC$9,000.00 in Martinique in the year 2003.
- Sixty seven percent (67%) of fishers harvested conch throughout the year, unless the weather was poor. Seventeen percent (17%) harvested from August to March, as April to June was the

season for tuna, dolphin and other fish, and more adult conch was observed during January to March. Seventeen percent (17%) harvested conch from December to May, the dry season.

- Moon phases had no influence on the diving choices of sixty six percent (66%) of fishers. Seventeen percent (17%) indicated that there was more conch to be harvested during the full moon phase. Seventeen percent (17%) recalled that the moon was influential, but could not recall during which moon phase there was more conch.

Of all the fourteen (14) past fishers:

- Eleven (11) past fishers (seventy eight percent (78 %)) were divers. No divers (zero percent (0%)) harvested conch by strictly skin diving.
- Of the eleven (11) divers, seven (7) (sixty four (64%)) used SCUBA gear only, while four (4) divers (thirty six percent (36%)) used both SCUBA and skin diving. No other method of harvesting conch was mentioned.
- The usual depth dived by three (3) past divers who also went skin diving ranged from 20 ft (6.1 m) to 50 ft (15.2 m), for periods ranging from 3 to 5 minutes.
- With SCUBA, the depth dived by past fishers ranged from 60 ft (18.3) to 120 ft (36.6 m) for periods ranging from 15 to 40 minutes. No divers reported exchanging tanks while submerged.
- All seven (7) of the divers (sixty four percent (64%)) who used only SCUBA gear were PADI-certified or DOF-trained. Of the four (4) divers (thirty six percent (36%)) who used both methods, only one (1) of them was certified or trained.
- All fishers who used SCUBA gear owned SCUBA tanks, with up to 5 tanks owned.

6.1.5. Conch Observations and Harvests by Past Fishers

Of the six (6) fishers no longer fishing in 2008, responses regarding conch numbers typically observed and harvested are summarised in Tables 6 to 9 below. Fifty percent (50%) of these past fishers reported observing more than 300 conch during a typical fishing expedition, and thirty three percent (33%) would take all that one bag would hold, usually between 101 and 200 animals. Fifty percent (50%) reported seeing more than 48 juveniles during a typical expedition.

Table 6. Numbers of Conch Observed by Past Fishers during a Typical Fishing Expedition

Number of conch observed by fishers	No. (%) of fishers (N=14)
51-100	1 (17%)
210-300	1 (17%)
>300	3 (50%)
No response	1 (17%)
Total	6 (100%)

Table 7. Harvesting Approach of Past Fishers during a Typical Fishing Expedition

Harvesting approach	No. (%) of fishers (N=14)
Take all seen during multiple dive	1 (17%)
Take pre-set number	1 (17%)
Take all that one bag could hold	2 (33%)
No response	2 (33%)
Total	6 (100%)

Table 8. Numbers of Conch Harvested by Past Fishers during a Typical Fishing Expedition

Number of conch harvested during one expedition	No. (%) of fishers (N=14)
51-100	1 (17%)
101-200	2 (33%)
201-300	1 (17%)
No response	2 (33%)
Total	6 (100%)

Table 9. Numbers of Juvenile Conch Observed by Past Fishers during a Typical Fishing Expedition

Number of juvenile conch Observed	No. (%) of fishers (N=14)
37-48	1 (17%)
>48	3 (50%)
No response	2 (33%)
Total	6 (100%)

Two (2) past fishers (thirty three percent (33%)), observed other species of conch, although Queen Conch was most commonly caught. They indicated that there was also a "conch with lots of spikes on the shell".

Queen Conch meat weight most commonly caught ranged from 1 to 2 lbs, with a mean of 1¾ lbs. The two (2) fishers who caught the conch with the spiked shell indicated that weights of these ranged from 1 to 1 ½ lbs. Most fishers did not provide conch lengths most commonly caught. However, two (2) past divers gave lengths of "from the thumb to index finger" for Queen Conch, and "a man's hand" for the "spike shell conch".

None of the past fishers (zero percent (0%)) reported harvesting juvenile conch, and they indicated that this was because they knew it was against the law, or felt it was not worth it.

6.1.6. Trends and Patterns in Conch Populations Observed by Past Fishers

The six (6) past fishers who no longer dived conch were questioned about their observed changes in conch populations over time. Two (2) (thirty three percent (33%)) observed no change while three (3) (fifty percent (50%)) indicated that there was more conch when they stopped fishing. Reasons given for an observed increase were that there were fewer divers or because the conch replaced itself naturally much faster than it could be harvested. Similar trends were observed in responses regarding juvenile conch populations. Three (3) respondents (fifty percent (50%)) observed an increase, and two (2) (thirty three percent (33%)) saw no change in quantities of juvenile conch compared to when they started. Reasons cited for these changes were similar to those cited for the trends in adult conch.

Only one (1) past fisher (seventeen percent (17%)) reported a change in the size of adult conch. He said that conch were smaller when he started fishing, and he attributed the difference he observed to the food the conch ate.

Two (2) fishers (thirty three percent (33%)) saw no change in the depth at which adult conch were found over time. Of the three (3) (fifty percent (50%)) who saw a change, the increase in depth was attributed to the conch moving to greater depths in search of food. One (1) did not respond.

Four (4) fishers (sixty seven percent (67%)) observed no differences between the Queen Conch in the north and those in the south. Of the two (2) (thirty three percent (33%)) who observed a difference, one (1) (seventeen percent (17%)) reported that the conch in the south were bigger and heavier and thought this was because of fewer divers and as such, less fishing. The other fisher claimed that the conch in the north were bigger, and thought this was because of the food they ate.

Only one of the six (6) past fishers (seventeen percent (17%)) reported ever observing conch lining up (marching) underwater. He did not know the reason but thought they were changing locations or habitats.

Responses to several similar questions put to past fishers who were still fishing in 2008 are tabulated in Section 1.2.19.

6.1.7. Past Fishers Awareness of Rules and Laws

Only one (1) (seventeen percent (17%)) of the six (6) past fishers who had since stopped fishing indicated that there were rules/laws regarding conch when they started harvesting conch. The rule was based on a system set up by fishers, and required that juveniles not be harvested as they needed to grow, to reproduce and keep the population growing. He further indicated that illegal harvesting of conch sometimes occurred, and attributed this to divers who were not fishermen picking up "a few". All five (5) others (eighty three percent (83%)) indicated that there were no rules/laws regarding conch when they started.

The six (6) past fishers were asked about the impact of the introduction of laws on the fishery, and specifically about the impact of these laws on the level of illegal fishing/harvest, the level of organization in the fishery, level of conflict or disagreement regarding the fishery and the number of persons in the fishery. One (1) fisher (seventeen percent (17%) indicated that he was unaware of any laws. Two (2) fishers (thirty three percent (3%)) did not respond. The remaining fifty percent (50%) indicated that introduction of laws had no effect other than resulting in a decrease in the number of fishers in the industry.

The six (6) fishers who were no longer harvesting conch in 2008 were asked how they were able to tell if conch was mature prior to 1985. Several methods were put forward by fishers. They indicated that conch was mature if:

- The shell was pink and soft;
- The shell was soft at the edge;

- The shell was big and hard as opposed to small and soft;
- The edge of the shell was thick;
- The conch was large;

One indicated that he was able to differentiate between adult and juvenile Queen Conch in the same way that one always knows a child from an adult.

6.1.8. Storage of Conch Harvested by Past Fishers

All six (6) fishers (one hundred percent (100%)) stored live conch in the shell before use, five (5) (eighty three percent (83%)) of them in a basket in the seawater close to shore, for periods ranging from three days to two months, with an average of 19 days. One (1) fisher (seventeen percent (17%)) kept conch live in the shell overnight.

No fisher reported discarding conch for any reason.

6.1.9. Past Fisher Use of Conch

Two (2) (thirty three percent (33%)) of the six (6) past fishers who responded used conch shells as horns. Four (4) fishers (sixty seven percent (67%)) used conch shells in construction as house foundations, backfill or to fix roads. One (1) (seventeen percent (17%)) discarded the shell on the shoreline. One (1) (seventeen percent (17%)) discarded shells on the reef, and was of the view that this had no effect on the live conch, as it got covered by sand, or got "hard" on the reef. Only one (1) of the six (seventeen percent (17%)) was of the opinion that conch shells discarded at sea "run after the live conch".

Three (3) past fishers (fifty percent (50%)) indicated that conch was a major part of the family's diet, and was eaten once to three times per week. Fifty percent (50%) said that conch was not a major part of the family diet.

6.1.10. Conch Demand, Economics and Trade for Past Fishers

None of the fourteen (14) past fishers (zero percent (0%)) were engaged solely in conch fishing. Thirteen (13) (ninety three percent (93%)) also engaged in other fishing activities, while the fourteenth (seven percent (7%)) was engaged in policing as his primary income earner. Primary sources of income of past fishers are listed in Table 10 below.

Table 10. Primary Sources of Income of Past Conch Fishers

Primary Source of Income	Number of past fishers who no longer dived conch (N=6)	Number of past fishers who still dived conch in 2008 (N=8)
Other fishing (pot, line, net)	4 (66%)	3 (38%)
Conch fishing	2 (34 %)	5 (62%)
Policing	0	1 (13%)

Other non-fishing sources of income for conch fishers were as tabulated in Table 11 below. Other income sources were farming, business and policing. Of the six (6) past fishers no longer diving conch, two (2) fishers (thirty three percent (33%)) were engaged in provision farming as well as fishing for a living. Alternate sources of income were more diverse in 2008 than previously; of past fishers still diving conch in 2008, other sources of income reported were farming (two (2) fishers), business (one (1) fisher) and policing (one (1) fisher). None of the fourteen (14) past fishers (zero percent (0%)) derived all their income from conch fishing, although a greater percentage was able to rely on it as the primary income earner in 2008.

Table 11. Other Sources of Income for Past Conch Fishers

Other (Non-Fishing) sources of income for fishers	Number of past fishers who no longer dived conch (N=6)	Number of past fishers who still dived conch in 2008 (N=8)
Farming	2 (33%)	2 (25%)
Business	0	1 (12%)
Policing	0	1 (12%)

The proportion of fisher income derived from conch fishing is presented in Table 12 below. Past fishers earned between ¼ and ½ of their income from conch. None derived their income solely from conch fishing.

Table 12. Proportion of Fisher Income Generated by Conch Fishing

Proportion of income from conch fishing	Number of past fishers who no longer dived conch (N=6)
¼	3 (50%)
½	3 (50%)
¾	0
All	0

The six (6) past fishers who no longer fished for conch in 2008 gave a number of reasons for not being able to derive a living solely from conch fishing. These included:

- "The depth of the conch was too deep" (one (1) fisher);
- "Sometimes the conch walked into deeper waters" (one (1) fisher);
- "It was not everyday that enough conch was harvested to sustain the family" (two (2) fishers);
- "Both types of fishing were done in the water" (one (1) fisher);
- "Sometimes the boat harvesting conch would not go out" (one (1) fisher).

All of these six (6) past fishers (one hundred percent (100%)) indicated that the most valuable part of the conch in terms of returns was the conch meat. All six (6) past fishers (one hundred percent (100%))

sold the conch meat caught, with three (3) of these fishers (fifty percent (50%)) reporting having sold conch meat in the island of Martinique. Two (2) of these indicated that they went to Martinique to sell; the other did not provide details. All the fishers sold conch locally. Conch meat sold to locals was typically sold out of the shell and un-cleaned, as a cost ranging from EC$1.50 to EC$8.00 per lb. Conch meat sold to visitors, hotels and restaurants was either sold out of the shell and un-cleaned at a cost ranging from EC$0.50 to EC$5.00 per lb, or out of the shell and cleaned with the only reported price being $8.00 per lb. Past-fisher conch markets and selling prices are listed in Table 13.

None of the fishers sold, bartered or exported conch parts or products, or used a middleman for conch sales.

Table 13. Conch Fisher Markets and Selling Prices for Past-Fishers who no Longer Dived Conch in 2008

Market	No. (%) of past-fishers	Price range (EC$ per lb or as stated)
Gros Islet Fisheries	3 (50%)	Not provided
General public	5 (83%)	$1.50 -$8
Hotel/restaurant	5 (83%)	$0.50-$8
Sell in Martinique	3 (50%)	20 francs/lb

Four (4) of the six (6) past fishers (sixty seven percent (67%)) searched for pearls inside the conch, but none of them ever found. The other two (2) (thirty three percent (33%)) did not search. None of the conch fishers (zero percent (0%)) were involved in production of craft from conch products.

6.2. The Present Conch Fishery

6.2.1. Demographics of Present-Day Fishers

Present day fishers were those who had harvested conch in the years since 1989, and may have still been harvesting conch in 2008. Twenty-two (22) present-day fishers were interviewed.

Most present day fishers were resident within the district of Gros Islet[5] (fifty five percent (55%)), or Laborie (27%). Fisher addresses are depicted in Figure 5 below.

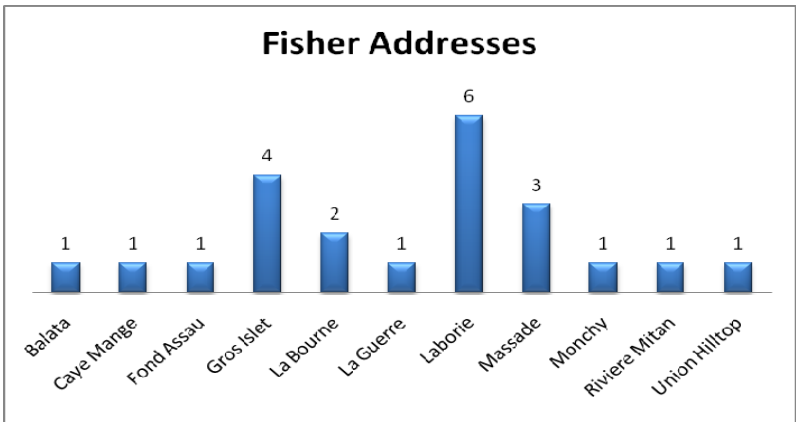

Figure 5. Addresses of Present-Day Fishers

Of the twenty two (22) present-day conch fishers surveyed, eight (8) (thirty six percent (36%)) started diving conch between the ages of 15 and 20, six (6) (twenty seven percent (27%)) between the ages of 21 and 26; seven (7) (thirty two percent (32%)) between the ages of twenty seven (27) and thirty two (32) and one (1) (five percent (5%)) gave no response. These results are depicted in Figure 6 below. The mean age at which they started diving conch was twenty three (23) years.

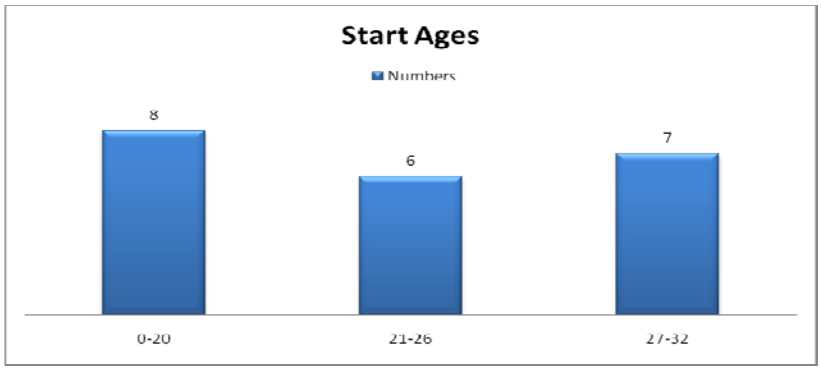

Figure 6. Age at Which Present-Day Fishers Started Harvesting Conch

[5] Caye Mange, Gros Islet, La Bourne, La Guerre, Massade, Monchy and Riviere Mitan are in the district of Gros Islet

Present-day fishers interviewed ranged in age from twenty (20) to sixty three (63), with an average age of thirty nine (39). Thirty-five percent (35%) of the persons surveyed were less than thirty (30) years old. More than sixty percent (60%)) of the fishers fell within the under-forty age group. However twenty two percent (22%) were over age fifty (50), with one (1) aged sixty three (63).The years of conch diving covered by fishers interviewed ran from 1971 to 2008. Years spent in the industry to date by present-day fishers ranged from one (1) year to thirty seven (37) years, with a mean of fifteen (15) years spent in the industry to date. Of the present-day fishers interviewed, three (3) (fourteen percent (14%)) had stopped diving conch, all due to having had the bends. The remainder still dived for conch, and had done so continuously from the time they had started.

All of the twenty two (22) present-day fishers interviewed (one hundred percent (100%)) indicated that they intended to continue for the number of years indicated in Figure 7 because:

- it was a good living (19 fishers, eight six percent (86%)).
- he enjoyed doing it (1 fisher (five percent (5%)).
- there were not many divers (1 fisher (five percent (5%)).
- one still made a profit no matter what was caught (1 fisher (five percent (5%)).

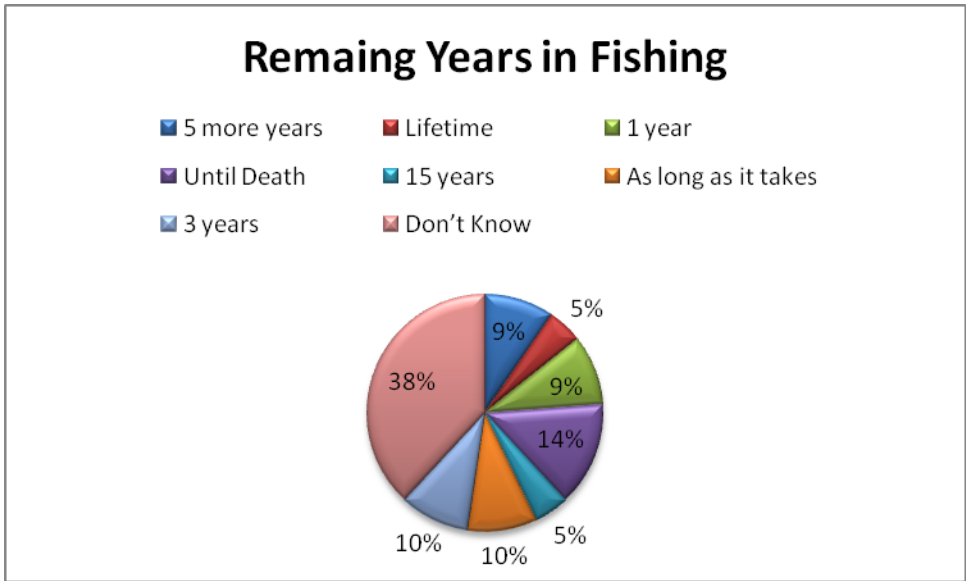

Figure 7. Additional Years that Present-Day Fishers Intend to Continue to Harvest Conch

All twenty two (22) present-day fishers (one hundred percent (100%) planned to remain in the conch fishery. However, thirty eight percent (38%) did not know how long they would continue. Others planned to remain for a period from as short as one year, to as long as they lived.

Eleven (11) present-day fishers (fifty percent (50%)) would encourage their son, nephew or other relative to also get involved in the conch fishery because they found it to be profitable and a good form of business. Eleven (11) (fifty percent (50%)) would not encourage their relative to become involved

because of the danger and risk. Of those who would not encourage their relatives, eighty two percent (82%) were divers. Those who would encourage relatives would do so because:

- the relative was very interested and wanted to be like his father (one (1) respondent (five percent (5%))
- the relative would be self employed (one (1) respondent (five percent (5%))
- there is money in fishing and diving/the living is good/very profitable (eight (8) respondents (thirty six percent (36%))
- the relative may decide to (one (1) respondent (five percent (5%)).

Seven (7) respondents (thirty two percent (32%)) indicated that they were related to another crew member. There were three (3) brothers, a father and son, and two (2) cousins involved in the conch fishery.

Eighteen (18) of the conch fishers (eighty two percent (82%)) interviewed were registered fishers. Twelve (12) (fifty five percent (55%)) were members of a Fisherman's Cooperative, and of those, ten (10) (forty six percent (46%)) belonged to the Gros Islet Fishermans Cooperative and two (2) (nine percent (9%)) belonged to the Laborie Fisherman's Cooperative. All eight (8) boat owners interviewed were members of a Fishermans' Cooperative. Four (4) divers who did not own boats were also members of a Cooperative, while the remaining ten (10) were not members.

6.2.2. Present Day Fisher Income and Occupation

Primary fisher occupations are depicted in Figure 8. Fifteen (15) of the twenty two (22) fishermen interviewed (sixty eight percent (68%) indicated that conch harvesting was their main occupation, and their most important source of income, while four (4) fishers (eighteen percent (18%)) indicated that other forms of fishing were their most important source of income. One (1) (five percent (5%)) indicated that construction was his most important source of income and two (2) (nine percent (9%)) were members of the Royal St. Lucia Police force, which provided their primary income. Conch fishers were asked about the proportion of their income that came from conch. Their responses are tabulated in Table 14 below. Three (3) fishers derived their income solely from conch fishing.

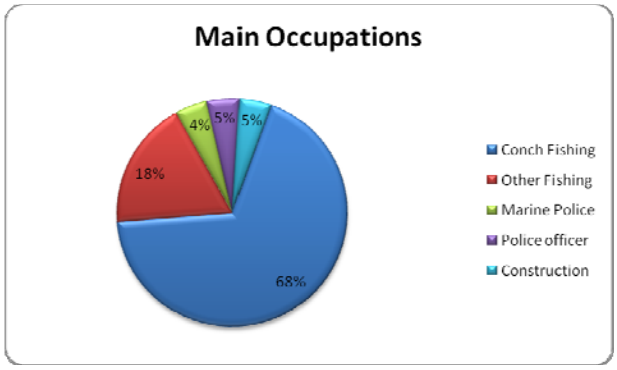

Figure 8. Primary Occupations of Present-Day Conch Fishers

Table 14. Proportion of Present-Day Fisher Income Derived from Conch

Proportion of income	No. (%) of present day fishers (N=22)
¼	5 (23%)
½	7 (32%)
¾	7 (32%)
All	3 (14%)

6.2.3. Socio-economic Information for Present-Day Fishers

Eighteen (18) fishers (eighty two percent (82%) interviewed were the main providers for their households. Four (4) (eighteen percent (18%)) were not. Household sizes ranged from 1 to 7, with an average of 4 persons per household.

Three (3) (fourteen percent (14%)) had no formal schooling; fourteen (14) (sixty four percent (64%)) attended primary school; four (4) (eighteen percent (18%)) attended secondary school; and one (1) (four percent (4%)) attended tertiary schooling.

Ten (10) fishers (forty five percent (45%)) owned land, while eleven (11) (fifty percent (50%)) did not and one (1) (five percent (5%)) gave no response. Twenty (20) (ninety one percent (91%)) owned the house they lived in, while one (1) (five percent (5%) rented and the other five percent (5%) gave no response. Nineteen (19) fishers (eighty six percent (86%)) lived in a house with a galvanized roof, while one (1) (five percent (5%)) had a Caribbean Metals or similar roof; one (1) (five percent (5%)) had a concrete roof; and one (1) (five percent (5%)) gave no answer. Five (5) (twenty three percent (23%)) of the fishers lived in a house with outside walls of concrete, while eleven (11) (fifty percent (50%)) had wooden external walls on their house. Four (4) (eighteen percent (18%)) had a combination of both wall and wooden outside walls. Type of outside wall is depicted in Figure 9 below.

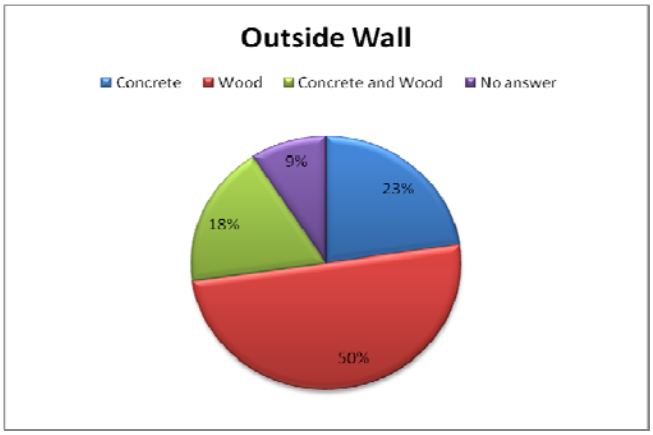

Figure 9. Outside Wall Material of Conch Fisher Houses

Fishers were questioned as to whether they had various amenities in their home. The results are depicted in Figure 10 below. More than ninety one percent (91%)) of present-day fishers had water, electricity, television, cablevision, cell phone, stove and refrigerator in their homes.

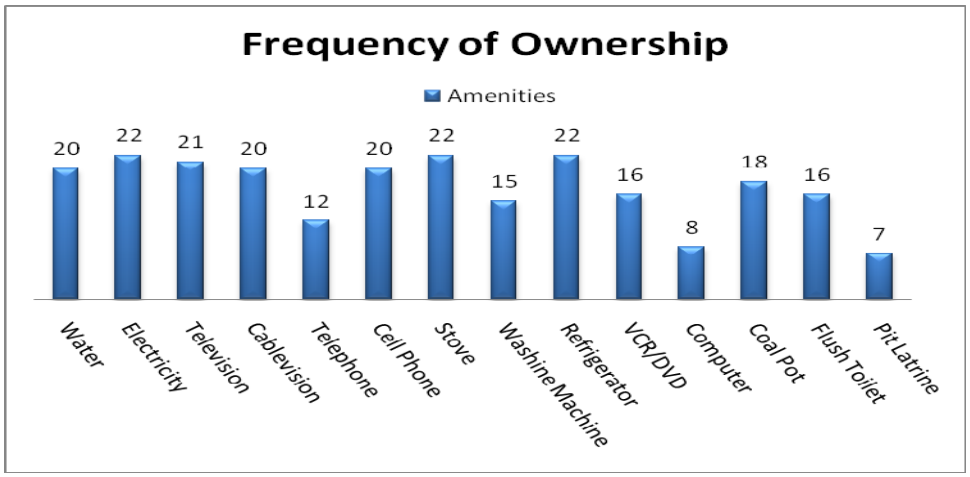

Figure 10. Frequency of Ownership of Various Amenities by Present Day Conch Fishers

6.2.4. Fisher Role in the Present-Day Conch Fishery

Present-day fishers interviewed indicated that their roles were as depicted in Figure 11 below. All boat owners were also divers, with most of them also being captains. Sixteen (16) (seventy two percent (72%)) of the present-day fishers interviewed were divers. Five (5) (twenty three percent (23%)) were crew.

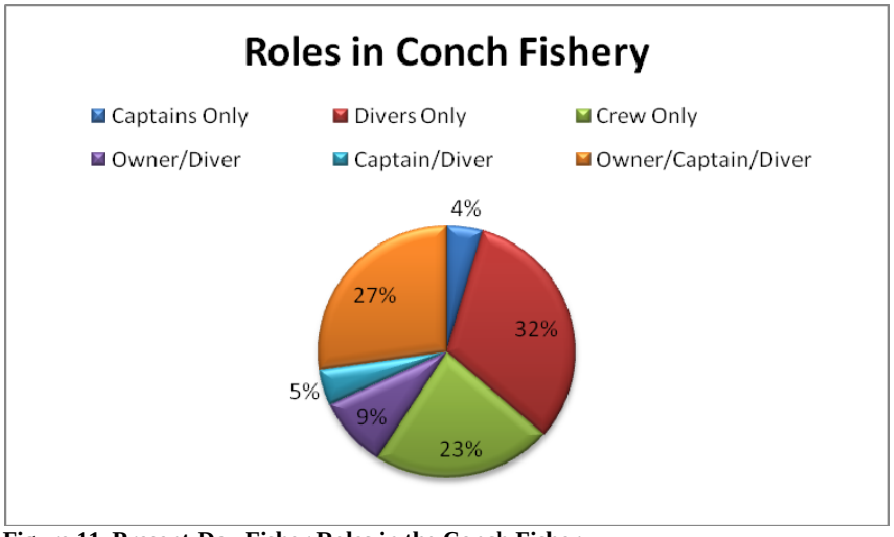

Figure 11. Present-Day Fisher Roles in the Conch Fishery

The present-day fishers surveyed used eleven fishing boats between them. The number of fishers who went out on a conch harvesting trip consisted of:

- one (1) captain;
- one (1) diver (as reported for two (2) (eighteen percent (18%)) boats) or two (2) divers (reported for four (4) boats (thirty six percent (36%))); and
- one (1) crew member (reported for four (4) boats) (thirty six percent (36%)) or two (2) crew members (on three (3) boats (twenty seven percent (27%))).

Two (2) of the boats (eighteen percent (18%)) went out with just the owner (who was both captain and diver) and one (1) crew member.

Two (2) fishers (nine percent (9%)) (both of them crew) indicated that they worked on more than 1 boat to harvest conch, noting that they both worked on 2 boats.

6.2.5. Present-Day Diver Information

All sixteen (16) present-day divers (one hundred percent (100%)) used SCUBA to harvest conch. No other method was used to harvest conch.

Divers were asked if they were certified or trained in the use of SCUBA. Four (4) (twenty five percent (25%) of divers) were uncertified and untrained. Twelve (12) (seventy five percent (75%)) indicated that they were. All twelve (12) were certified by PADI or NAUI and two (2) (twelve percent (12%)) had also received DOF training.

Six (6) present-day divers (thirty eight percent (38%)) reported having had the bends. Incidents of bends occurred in the years 1983, 1995, 2006, and three cases in 2007. Treatment was obtained in Martinique (for two (2) divers), Barbados (for two (2) divers) and Saint Lucia's Victoria Hospital (for one (1) diver), with one (1) diver indicating that he was treated with a home remedy. Cost of treatment varied from EC$0.00 for the home remedy to EC$65,000.00 in 2006 in Barbados, with an average cost of EC$24,295.93. Treatment in Saint Lucia cost EC$850 in 2007. Three (3) divers (nineteen percent (19%)) stopped diving conch after having had the bends.

6.2.6. Present-Day Fishing Effort and Fisher Satisfaction

Fishers were asked about the number and length of conch harvesting trips they made in the different months of the year. The number of trips reported did not vary over the year for six (6) fishers (twenty seven percent (27%)). Two (2) fishers (nine percent (9%)) who were also divers did not make any conch harvesting trips during several months of the year. One (1) (four percent (4%)) dived conch from January to May, and the other (four percent (4%)) from September to January and April to May. Thirteen (13) fishers (fifty nine percent (59%) made conch harvest trips throughout the year, but the trip frequency varied at different times of the year. However, there was no discernable pattern in the monthly frequencies reported. Average numbers of trips per week reported by fishers are shown in

Table 15 below. One (1) fisher (four percent (4%)) did not respond to this section of the questionaire. Length of conch fishing trip varied significantly, from 2 to 5 hours per trip, as shown in Figure 12 below, although most fishers (sixty four percent (64%)) made four hour long trips.

Table 15. Number of Weekly Conch Harvesting Trips Made by Present-Day Fishers

Number of Trips Per Week	No. (%) of Fishers (N=22)
1-2	3 (14%)
2-3	3 (14%)
3-4	8 (36%)
5	7 (32%)
Not given	1 (4%)

Figure 12. Average Length of Conch Harvesting Trip by Present-Day Fisher

All twenty two (22) fishers (one hundred percent (100%)) reported travelled distances ranging from a half mile to 5 miles, an average of 2.22 miles, to conch diving locations. Time to travel to the conch dive site varied from 15 minutes to 45 minutes, an average of 25 minutes. Distance off-shore at which conch was harvested was provided by ten (10) fishers (forty five percent (45%)), and this ranged from 1 to 5 miles, an average of 2.9 miles. Time spent actually diving conch varied from 1 to 5.5 hours, an average of 3.75 hours.

Number of tanks carried on board ranged from 2 to 10, with an average of 5.5; all twenty two (22) fishers responded to this query. According to the nineteen (19) (eighty six percent (86%)) fishers who responded, number of tanks used ranged from 2 to 5, with an average of 3. Length of time submerged per tank varied from 25 to 40 minutes, with an average of 29 minutes. Number of conch harvested per trip, as reported by fifteen (15) fishers (sixty eight percent (68%)), varied from 50 to 300, with an average of 137.

Seven (7) fishers (thirty two percent (32%)) reported spending more time harvesting conch compared to 2 years ago, and attributed this to:

- the conch moving to deeper waters (4 fishers, eighteen percent (18%)),
- bad currents (1 fisher, five percent (5%) and

- a decrease in the conch population (2 fishers, nine percent (9%)).

Two (2) fishers (nine percent (9%)) reported spending less time. Thirteen (13) fishers (fifty nine percent (59%)) reported spending the same amount of time.

All but one (1) of the fishers (ninety five percent (95%)) considered the harvest and sale of conch today to be worth the effort with the only one (1) (five percent (5%) claiming that it was not because of the danger and risk involved.

All present-day fishers (one hundred percent (100%)) are generally happy with the number of conch they catch when they go out. All (one hundred percent (100%)) are generally happy with the size of conch they catch when they go out.

6.2.7. Conch Handling and Storage by Present-Day Fishers

Typically (according to seventeen (17) respondents (seventy seven percent (77%)), a crew member de-shelled the conch. One (1) fisher (four percent (4%)) indicated that everyone on board cleaned the conch; four (4) (eighteen percent (18%)) indicated that the responsibility for cleaning was shared between crew and divers. All twenty two (22) fishers (one hundred percent (100%)) indicated that the buyer cleaned the conch.

Conch were not stored by present-day fishers, but sold upon landing.

6.2.8. Present-Day Conch Harvest Share

According to fifty percent (50%) of fishers, the cost of gas was deducted from the catch money before the remainder was shared. The most common methods of sharing the catch (each reported by twenty three percent (23%) of fishers) were:

i) deduction of gas money with one share each paid to captain and crew, and two shares to the diver.

ii) deduction of gas money with one share each paid to boat, owner and crew, and 1 ½ shares to the diver.

Fourteen percent (14%) indicated that the owner, captain and crew received one share, and the diver received two shares.

Other less common methods of sharing (each reported by four percent (4%) of fishers) were:

i) one share to captain, owner, crew and boat, and two shares to diver;

ii) one share to captain, crew and boat, and two shares to diver;

iii) one share to captain, owner, crew, boat and loan, and two shares to diver;

iv) equal share to boat and diver, and crew shares remainder;

v) deduct gas money and share the remainder equally; and

vi) deduct gas money, half of reminder to divers, and half shared between the others.

Three (3) fishers (fourteen percent (14%)) did not respond to this query.

Boat owner responses about how the catch was shared are depicted in Figure 13 below.

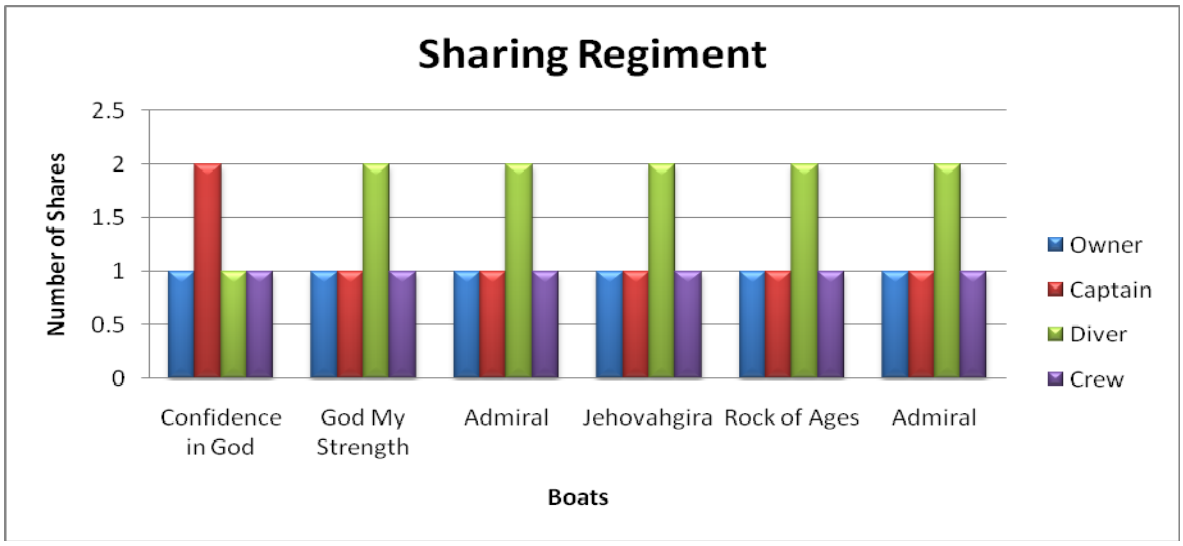

Figure 13. Sharing Regiments Used by the Conch Fishers

6.2.9. Present-Day Conch Demand, Economics and Trade

Only one (1) present-day fisher (four percent (4%)) had sold conch to other islands in the past, and none did currently. The fisher who had, went to Martinique to sell conch meat at the price of 50 francs per lb. He reported no problems, but did not indicate why he had stopped.

Table 16. Conch Fisher Markets and Selling Prices

Market	No. (%) of Fishers	Price Range (EC$ per lb)	Proportion of catch usually sold to this market
Fish Marketing Complex	0	NA	0
General public	21 (95%)	12-14	All (10 respondents (45%)); Varies (11 respondents (50%))
Hotel/restaurant	6 (27%)	10-16	Varies
Fish fry	5 (23%)	12-14	Varies
Fish vendor	2 (9%)	14	Varies
Export	0	NA	0
Other	1 (4%) uses at shop for BBQ		

Twenty one (21) fishers (ninety five percent (95%) sold their conch in retail. One (1) (five percent (5%)) sold both wholesale and retail. Fishers indicated the markets listed in Table 16 for their conch. Ninety five percent (95%) sold variable quantities of conch to the general public. Half of these indicated that they sold all their catch to the general public. About ¼ of fishers sold to hotels/restaurants and a similar number sold to fish fry vendors. Conch selling prices reported by

fishers varied from EC$10/lb to EC$16/lb, depending on the fisher and the market. Average fisher selling price of conch was estimated at EC$14/lb.

Seventeen (17) fishers (seventy seven percent (77%)) indicated that they had always sold to these markets. Five (5) others (twenty three percent (23%)) indicated that they used these markets because of reliable buyers. All fishers indicated that they were paid in full for the conch at the time of sale.

6.2.10. Importance of Conch Parts and Products to Present-Day Fishers

All fishers (one hundred percent (100%)) indicated that conch meat was definitely important to them. Five (5) (twenty three percent (23%)) indicated that the shell was somewhat important, while seventeen (17) (seventy seven percent (77%)) said the shell was not at all important. Twenty (20) (ninety one percent (91%)) indicated that the pearl was important to them, but all of these fishers indicated that they had never found one. However, DOF records of CITES Permit applications revealed that more than 10 pearls were exported to Canada by one individual over 2007 and 2008 (personal communication).

6.2.11. Present-Day Fisher Knowledge of Fishing Laws

Five (5) fishers (twenty three percent (23%)) indicated that there were no laws regarding conch. All of those who indicated that there were laws claimed that the only law was that juvenile conch should not be harvested. None of the fishers (zero percent (0%)) had heard about CITES. Only four (4) fishers (eighteen percent (18%)) were aware of permit requirements for the import or export of conch, and indicated that a permit was required from DOF if conch was to be exported. Three (3) fishers (fourteen percent (14%)) had heard about HACCP. Of these only one (1) (four percent (4%)) indicated the impact of these requirements, which was simply that he did not export conch.

6.2.12. Present-Day Boat/Crew Information

The twenty two (22) fishers interviewed worked on one or two of the eleven (11) conch fishing boats identified. Eight (8) boat owners and one (1) captain (of a boat whose owner did not participate in this survey) provided details about ten (10) boats used in the conch fishery. Ten (10) boat owners were identified. Nine (9) owners (ninety percent (90%) of known owners) owned one boat, and one (1) owner (ten percent (10%) of known owners) owned two boats. All ten (10) of the boats described by persons surveyed had J6 numbers and were registered with the DOF. Nine (9) of these boats (ninety percent (90%)) were licensed in 2008, while no response was given regarding the license of the tenth boat. All of the boats were fibreglass coated bow and stern boats, ranging in length from 24 ft (7.3 m) to 32 ft (9.7m) with seventy-two percent (72%) being 27 ft (8.2 m) in length.

According to respondents, seven (7) of the ten (10) boats (seventy percent (70%)), boats were purchased between the years 1983 and 2008, with boats being in their possession an average of 11

years. Purchase prices of boats ranged from EC$16,000.00 to EC$65,000.00. The average boat cost was estimated to be EC$44,600. The variations in the prices of the boats cited were quite significant. The cost of the boat appeared to depend on factors such as the size, and age and condition when purchased.

Engine horse power ranged from 75 to 200, with an average horse power of 101. The preferred engines of fishers surveyed were 75 horsepower Yamaha engines. Thirty-six percent (36%) of the boats surveyed had an engine of between 150 and 225 hp. Engines were purchased from as far back as 25 years ago to as recently as 2008, with an average engine age of 8.25 years (based on the responses of eight (8) boat owners. Engine prices ranged from EC$9,000 to EC$25,000, with an average price of EC$15,280 (based on five (5) responses). The cost of the engine was dependent on the size or horse-power, and age and condition when purchased.

The boat owners all indicated that the replacement cost of their boat was significantly higher than the original cost of the boat. This meant that the fishers' ability to replace their existing equipment (boat and engine) would require a significant capital investment.

6.2.13. Fishing Gear

The ten (10) owners/captain who participated in this survey were asked about gear on board their boats. Their responses are in Table 17 below.

Table 17. Gear on Board Conch Fisher Vessels

Gear	Number (%) of boats having gear
Compressed air tanks	10 (100%)
Buoyancy control device	10 (100%)
Regulator	10 (100%)
Depth gauge	10 (100%)
Air pressure gauge	9 (90%)
Weights	10 (100%)
Life jackets	10 (100%)
Compass	9 (90%)
Flares	10 (100%)
GPS	7 (70%)
Cell phone	9 (90%)
Water	10 (100%)
Food stores	10 (100%)

It was difficult to assess the average cost of gear better than a gross estimation as costs of many gear items required (ropes, safety equipment) were not quoted. In addition, the fishers' indication of the cost of gear replacement varied widely, from a low of EC$5,000 to a high of EC$40,000. The average cost of gear replacement was EC$15,100.

The majority of Queen Conch divers appeared to carry the required gear and safety equipment, based on the responses tabulated in Table 17 above. The average SCUBA diver engaged in conch diving owned his own Buoyancy Control Device (BCD), depth gauge, weights and SCUBA tanks. The

estimated cost of the gear per trip depended on the devices utilised. In the absence of VHF which is expensive to procure and maintain, cell phones served as an affordable and widely used alternative.

6.2.14. Present-Day Trip Expenses

Fishers were asked to specify the costs/amounts of their inputs per trip. Responses are given in Table 18 below. Information was not provided on costs of compressed air or transport.

Table 18. Range of Estimated Inputs Required for a Conch Harvesting Trip

Inputs (per trip)	Average	Low end of cost range	High end of cost range
Gas	25 gallons	10 gallons	47 gallons
Oil	3 quarts	1 quart	6 quarts
Food and water	EC$21.25	EC$20	EC$30

The responses for trip expenses varied widely with very low levels of consistency. Although the nine (9) owners interviewed indicated that they used between 10 and 45 gallons of gas per trip, most of these respondents (five (5) out of the nine (9) or fifty six percent (56%)) indicated that they used between 10 and 16 gallons per trip. A cost of EC$600 was recorded as the highest cost of gas consumed per trip, and the lowest cost quoted was EC$120. When the cost of oil was added, the cost of oil and fuel was, on average, EC $381 per trip. The most significant component of the fishers' operational cost was fuel.

The average gear cost per trip was EC$57.30 and included items such as ice, scuba tanks and scuba gear. Ice was not very expensive nor was it consumed in large quantities. The average food cost per trip was EC$22. Fishers took a small lunch for the trip, either prepared at home or purchased from vendors.

6.2.15. Recurrent Expenses

Four (4) owners (forty four percent (44%) or owners or eighteen percent (18%) of fishers) reported having loans on the boat or gear. Loan repayments varied from EC$550 to EC$1,000 per month (average EC$816) from only three (3) responses. One of these indicated that the term of the loan was 4 years.

Fishers indicated that license, maintenance, insurance and replacement costs were as shown in Table 19.

Table 19. Range of Estimated Annual Costs of Fisher Operations (License, Maintenance) and Replacement Costs

Item	Average cost (EC$)	Low end of cost range (EC$)	High end of cost range (EC$)
Annual maintenance cost for boat and gear	5611.00	1500	15000
Annual insurance cost for boat and gear			
Annual license fee	5.00	5.00	5.00
Boat replacement	45833.00	30000.00	80000.00
Gear replacement	15857.00	4000.00	40000.00
Engine replacement	18957.00	13000.00	45000.00

Insurance costs were not provided. It is not known whether fishers did not take out insurance on their boats and gear.

In most cases the fishers interviewed did not provide an indication of the cost of maintaining the equipment. Estimates of annual repairs and gear costs were dependent on the memory of the fisher and were estimated from recent major expenses. Maintenance costs ranged from repainting costs to major overhauls of their engines. These expenses varied greatly and many fishers did not keep accounts of smaller purchases. Thus descriptive statistics such as averages are not anticipated to be very accurate. The average of the estimates of yearly expenses given by the fishers was EC$1,847. The average annual gear cost was estimated by fishers at EC$2,600. It is estimated based on prevailing material costs, that repainting the boat and engine servicing alone, would cost approximately EC$6,714 per year.

6.2.16. Dive Sites Used by Present-Day Fishers

Fishers indicated that conch were harvested at Donkey Beach, Marisule, Laborie, Vieux Fort (Light House), off Cap Estate, Esperance and Micoud (see map in Figure 16 for these locations). The most frequently cited location was Vieux Fort by nineteen (19) fishers (eighty six percent (86%)), followed by Marisule (cited by thirteen (13) fishers (fifty nine percent (59%)), and then Laborie (cited by twelve (12) fishers (fifty four percent (54%))). All fishers indicated that other fishers also used their dive sites. All fishers indicated that conch were found in specific locations, and the substrate most commonly cited was seagrass. The "favourite site" of ten (10) fishers (forty five percent (45%)) was Vieux Fort (Light House) at depths of 90 ft (27 m) to 100 ft (30 m) in seagrass. Reasons given for favouring sites varied. Fisher dive sites are tabulated in Table 20. Substrates cited are listed in Table 21.

Table 20. Frequency with Which Present-Day Fishers Cited Conch Dive Sites, and Favourite Dive Sites

Dive location	No. (%) of fishers (N=22)	No. (%) who choose this site as "favourite" (N=22)
Vieux Fort	19 (86%)	10 (45%)
Marisule	13 (59%)	3 (14%)
Laborie	12 (54%)	0
Donkey Beach	6 (27%)	4 (18%)
Cap Estate	6 (27%)	1 (4%)
Esperence	1 (4%)	1 (4%)

Table 21. Frequency with Which Present-Day Fishers Cited Conch Substrates

Substrate	No. (%) of fishers (N=22)
Seagrass	20 (91%)
Coral reef	1 (4%)
Rocky	2 (9%)
Sandy	1 (4%)
None mentioned	2 (9 %)

The most common reason for favouring a site, given by eleven (11 fishers ((fifty percent (50%)) was that there were more conch in the favoured area. Favoured area for this reason was Vieux Fort/Moule a Chique for nine (9) fishers (forty one percent (41%)). Marisule and Cas en Bas were mentioned by the other two (2) (nine percent (9%)). Four (4) fishers ((eighteen percent (18%)) favoured sites such as Marisule, Esperance, and Donkey Beach that allowed them to burn less gas. Two (2) fishers (nine percent (9%)) preferred Cas en Bas and Marisule to Esperance as these were wide banks. One (1) fisher (four percent (4%)) indicated that he favoured Vieux Fort because he was able to harvest conch at shallower depths. Another favoured Cas en Bas because the conch weigh more there. Yet another had no favourite site, but selected sites based on currents. Two (2) fishers (nine percent (9%)) did not have favourite sites.

6.2.17. Conch Observations by Present-Day Fishers

Table 22 provides information on fisher observations about changes in adult/mature conch populations when they first started harvesting compared to 2008. Reasons for a reported increase in adult conch populations were that there were not many divers and that the conch replenished itself. Those fishers who indicated a decrease in adult conch populations thought that this was because there was an increase in the number of divers.

Table 22. Observed Changes in Adult Conch Populations Since Present-Day Fishers Started Harvesting Conch

Observed Changes	No. (%) of fishers (N=22)	No. of older fishers (started pre- 1989) (N=8)
More when they started	5 (23%)	2 (25%)
No change	13 (59%)	5 (63%)
More in 2008	2 (9%)	1 (12%)
No response	2 (9%)	0

Responses with regard to juvenile conch are in Table 23. Reasons for a reported increase in juvenile conch populations were because of the law regarding juvenile conch.

Table 23. Observed Changes in Juvenile Conch Populations Since Present-Day Fishers Started Harvesting Conch

Observed Changes	No. of fishers (N=22)	No. of older fishers (started pre- 1989) (N=8)
More when they started	1 (4%)	1 (12%)
No change	7 (32%)	4 (50%)
More in 2008	9 (41%)	1 (12%)
No response	5 (23%)	2 (25%)

Table 24 provides information on fisher responses regarding observed changes in conch locations over time. Eleven (11) fishers (fifty percent (50%)) indicated that there was no change in location of conch over time. Seven (7) (thirty two percent (32%)) reported that the locations had changed because the conch moved to find food and to spawn, and also because of changing currents and weather conditions.

Table 24. Observed Changes in Locations of Conch Populations Since Present-Day Fisher Started Harvesting Conch

Observed Changes	No. of fishers (N=22)	No. of older fishers (started fishing pre- 1989) (N=8)
Change	7 (32%)	4 (50%)
No change	11 (50%)	4 (50%)
No response	4 (18%)	0

Fishers were also asked about observed differences between conch in the north and south of Saint Lucia. Results are in Table 25. They attributed these differences to the difference in type and quantity of food consumed in the north and south or because there were more divers in the north. As far as twelve (12) fishers (fifty four percent (54%)) were concerned, these differences had always been. One (1) said these differences had not always been there. Nine (9) (forty one percent (41%)) did not respond.

Table 25. Present-Day Fisher-Observed Differences between Conch Populations in the North and the South

Observed differences	No. of fishers (N=22)	No. of older fishers (started fishing pre- 1989) (N=8)
No difference	3 (14%)	1 (12%)
Conch from the south were heavier	7 (32%)	3 (37%)
Conch in the south were tougher/older	3 (14%)	2 (25%)
Conch in the north were heavier	2 (9%)	1 (12%)
No response	7 (32%)	1 (12%)
Differences had always been there	12 (55%)	4 (50%)
Differences had not always been there	1 (4%)	1 (12%)

No fishers reported any difference in species of conch observed in Saint Lucia's waters over time.

Table 26. Present-Day Fisher-Observed Differences in the Size of Adult Conch Over Time

Observed Differences	No. of fishers (N=22)	No. of older fishers (started fishing pre- 1989) (N=8)
No difference	18 (82%)	7 (88%)
Adult Conch smaller in 2008	4 (18%)	1 (12%)

As shown in Table 26 above, eighteen (18) fishers (eighty two percent (82%)) indicated that there was no difference in size of adult conch observed in 2008 compared to when they first started harvesting. Four (4) (eighteen percent (18%)) reported that the mature conch were smaller in 2008 and they attributed this to the food consumed. Most of those who observed differences though that conch were smaller in 2008 and attributed this to type or availability of food, although one fisher thought it was because of the family the conch came from.

Fisher responses regarding change in dive depth for conch are in Table 27.

Table 27. Observed Differences in Dive Depths for Conch since Present-Day Fishers Started Harvesting Conch

Observed Differences	No. of present-day divers (N=16)	No. of older present-day divers (started pre-1989) (N=6)
Diving deeper	6 (38%)	3 (50%)
No change	7 (44%)	1 (17%)
Diving in shallower waters	2 (13%)	2 (33%)
Depends on area	1 (6%)	0

Current dive depths cited by fishermen ranged from 80 ft (24.4 m) to 130 ft. (39.6 m), with most of the fishers citing depths of 80 ft (24.4 m) to 100 ft (30.5m). Reasons cited for an increase in depth were weather conditions and the movement of the conch. Those who indicated that depth they dived had decreased attributed this to the fact that they had suffered the bends and now could not dive deeper. One (1) of the older divers indicated that there were no conch in the shallow water; two (2) others attributed it to currents; three (3) gave no reason. Of the younger divers, only three (3) had a view as to why they had to dive deeper, and the reasons they put forward were that the conch moves, or waters were muddied due to weather.

6.2.18. DOF Conch Landing Data

Conch was routinely landed at Gros Islet and Laborie landing sites. DOF data for total fish and conch landings in Saint Lucia over the period 1996 to 2007 is presented in Figures 14 and 15 below.

In 2007, 38.59 tonnes of conch (94.1% of total conch landed) were landed in Gros Islet and 2.42 tonnes (5.9% of total conch landed) in Laborie. The DOF since 2000 had estimated ex-vessel prices of fish landings for the landings depicted in Figures 14 and 15. These estimates are provided in Table 28 below:

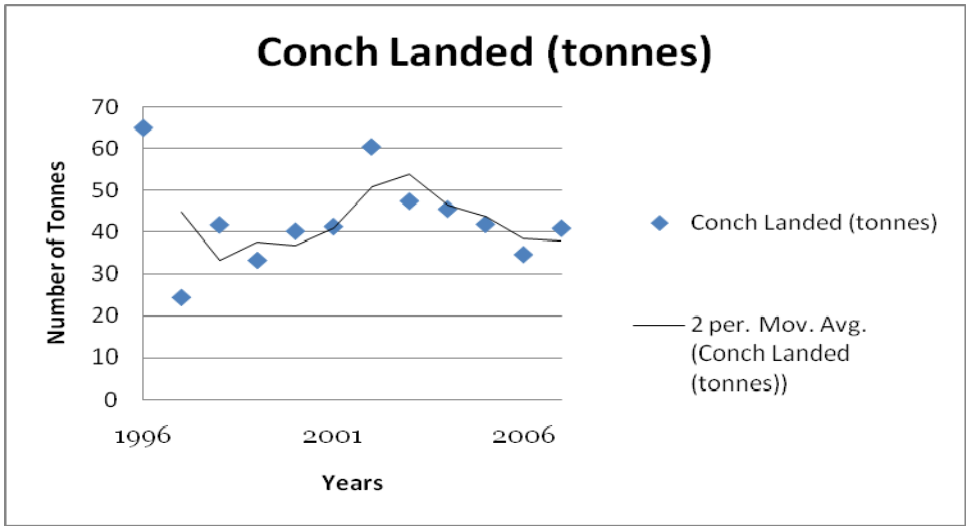

Figure 14. Scatter Graph of Conch Landed as Recorded in DOF Fish Landing Database (2008)

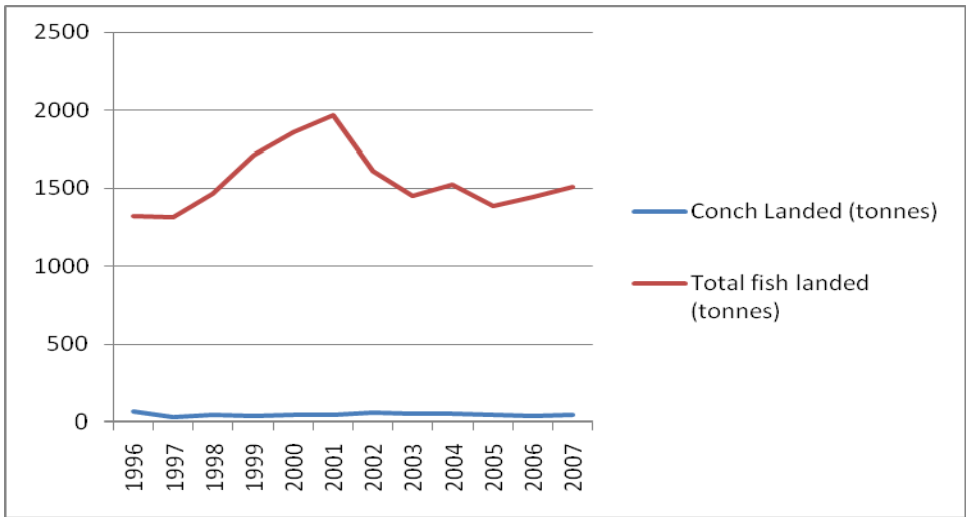

Figure 15. Comparison of Conch and Total Fish Landed as Recorded in DOF Fish Landing Database (2008)

Table 28. Estimated Ex-Vessel Values for Conch and Total Fish Landed over 2000 to 2007, extracted from DOF Fish Landing Database (2008)

Year	Ex-vessel value of conch landed (EC$)	Ex-vessel value of fish landed (EC$)	Conch value as a % of total fish value	Conch landed as a % of total fish landed (by weight)
2000	620,991	22,687,569	2.7	2.2
2001	773,700	22,354,500	3.5	2.1
2002	1,323,505	16,267,620	8.1	3.8
2003	1,043,389	15,767,298	6.6	3.3
2004	1,087,667	16,432,169	6.6	3.0
2005	1,013,155	15,927,116	6.4	3.0
2006	854,909	18,261,649	4.7	2.4
2007	1,071,677	19,560,097	5.5	2.7

The data obtained from the DOF reveals that for the period 1998 to 2007, the local Queen Conch harvesting industry landed a minimum of thirty-three (33) tonnes of Queen Conch per annum. The value of the conch fishery estimated by the DOF ranged between EC$620,991 and EC$1,323,505 per annum over the period 2000 to 2007. The value of conch in relation to the value of total fish landed varied from 2.7% to 8.1% for the same period, while the proportion of conch to fish landed (by weight) varied from 2.1% to 3.8%.

6.2.19. Conch Resource Assessment

As noted earlier, the majority of present-day fishers surveyed indicated that conch were found from Laborie to Micoud in the south, and Vigie to Esperance in the north, in depths ranging from 80 ft (24.4 m) to 100 ft (30.5 m). These areas were plotted and measured on the British Admiralty Charts, and reproduced on the map in Figure 16. Although present-day fishers also indicated that conch were found in seagrass but not on reefs, such locations within the demarcated areas on the map in Figure 16 were

not factored into these conch area estimates, as sufficient information on reef and seagrass locations and extent was not available.

Areas such as Anse La Raye and Grand Anse down to Praslin were described by some as "too deep" to dive for conch, although some others were of the view that conch could be found on the entire east coast. A few fishers indicated that conch could be found all around the island, at depths of 80 ft (24.4 m) to 130 ft (39.6 m), once suitable substrate (seagrass) was available. The Fisheries Extension Officer for Micoud, Praslin and Dennery informed that fishers in Dennery did not get much conch. They used bottom gill nets and sometimes picked up 10 to 15 on a trip. One fisher indicated that divers avoided Micoud waters which they believed to be shark-infested.

Areas that were not specifically mentioned by surveyed fishers as containing conch were not included in the conch areas shown in Figure 16. Areas defined in this way measured 4,700 ha in the south and 3,200 ha in the north.

Dive sites investigated in this study (numbered 1 through 9) are also shown in Figure 16. Appendix 4 contains select photographs of study sites and conch landed. Appendix 5 provides a summary of dive site information and results. Biological data is contained in Appendix 6.

One way ANOVA was used to test for significant differences between siphonal length and lip thickness between dive sites. A significance level of 0.05[6] was observed, so there is a 95% probability that the conclusions drawn are correct.

A total of 54 live conch individuals were included in the survey. Conch were most abundant at Site 3 Windjammer) in the north.

Conch densities were calcuated for each dive site and these results are shown in Figure 17. Density calculations for the north, the south and the island as a whole are contained in Table 29 and charted in Figure 18.

6 0.05 is a standard accepted level of significance

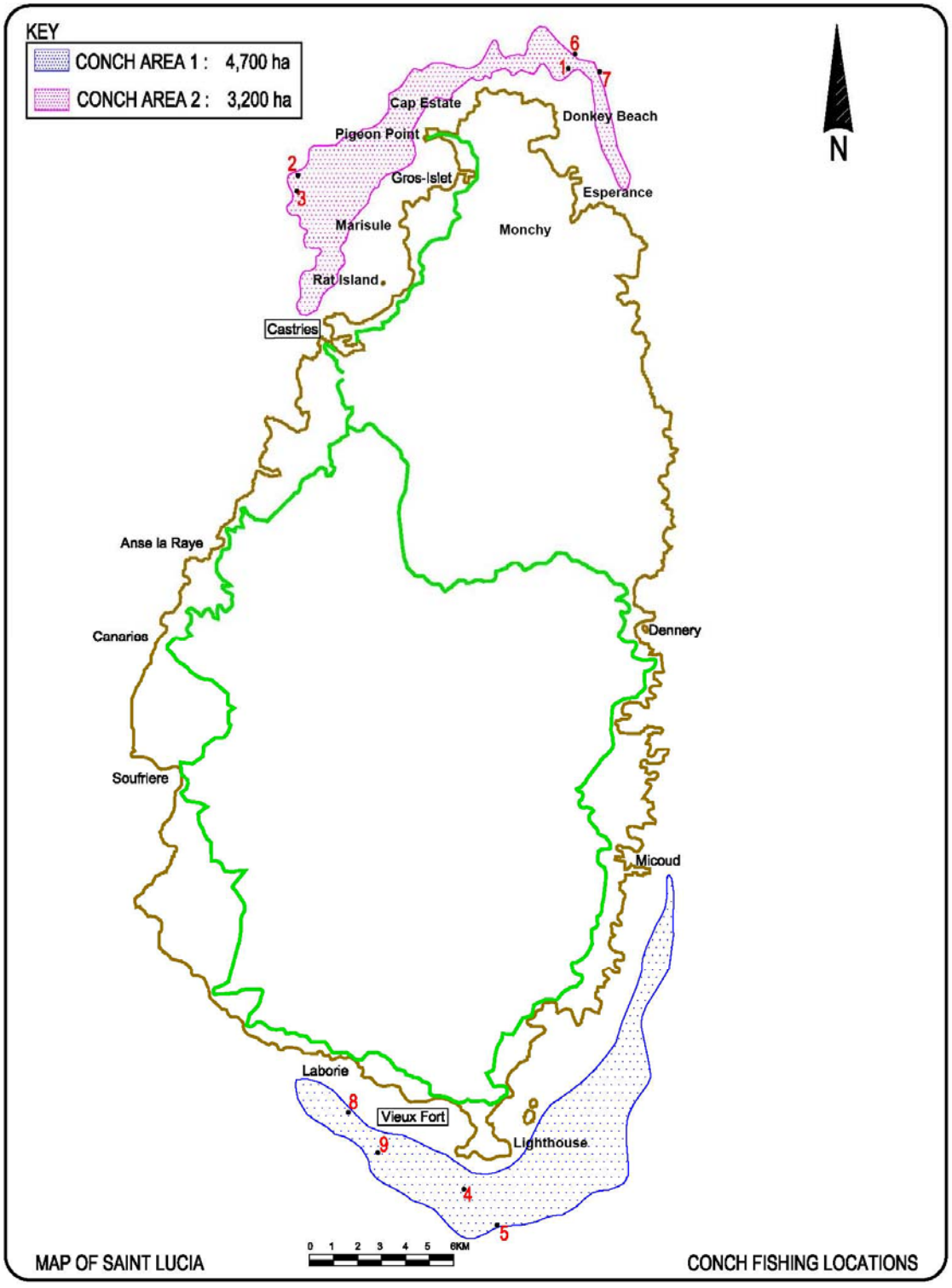

Figure 16. Map of Saint Lucia with North and South Conch Locations

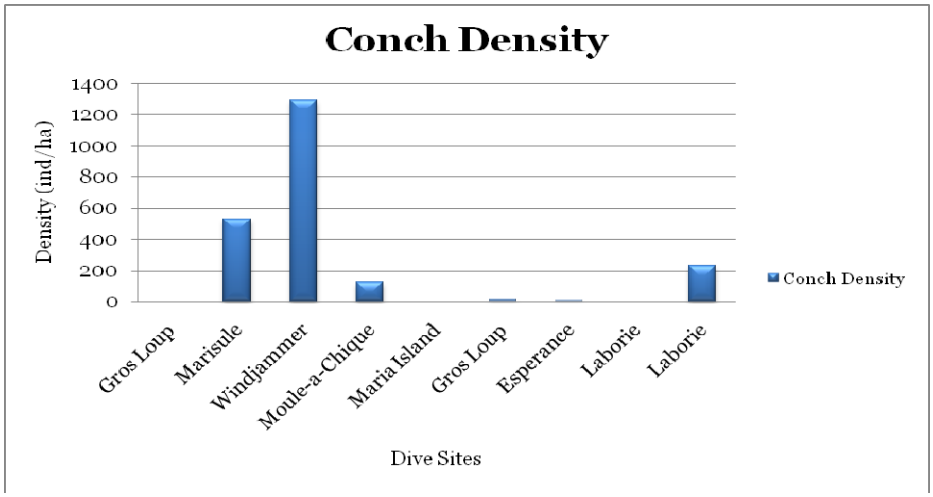

Figure 17. Conch Densities (ind/ha) at Study Dive Sites

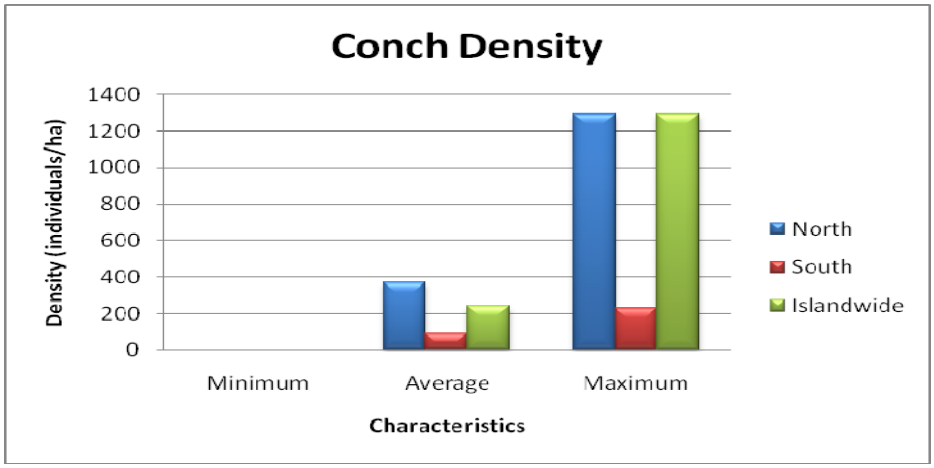

Figure 18. Conch Densities for the North, South and the Island as a Whole

Table 29. Conch Densities for the North, South and the Island as a Whole

Density (inds/ha)	Minimum	Average	Maximum
North	0	366.95	1292.93
South	0	87.68	229.51
Islandwide	0	242.87	1292.93

Mean siphonal lengths across the study dive sites are plotted in Figure 19. Calculations of mean siphonal lengths for the north, the south and the island populations are contained in Table 30 and charted in Figure 20.

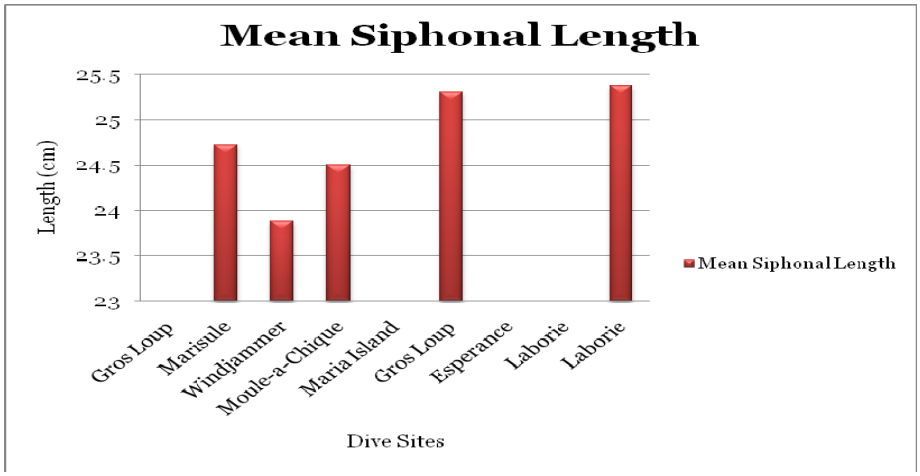

Figure 19. Mean Siphonal Length (cm) of Conch at Study Dive Sites

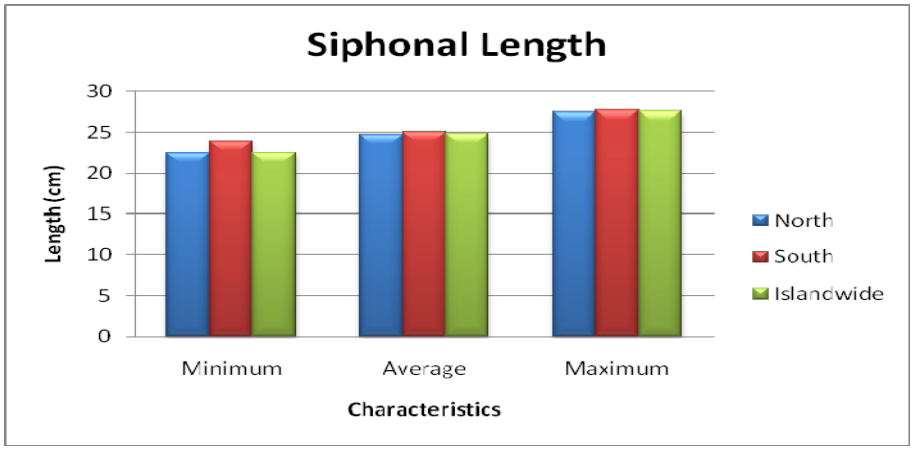

Figure 20. Conch Siphonal Lengths in the North, South and Islandwide

Table 30. Conch Siphonal Lengths

Siphonal Length (cm)	Minimum	Average	Maximum
North	22.4	24.7	27.4
South	23.8	25.1	27.7
Islandwide	22.4	24.75	27.6

Mean lip thickness at each of the nine (9) study sites is shown in Figure 21.

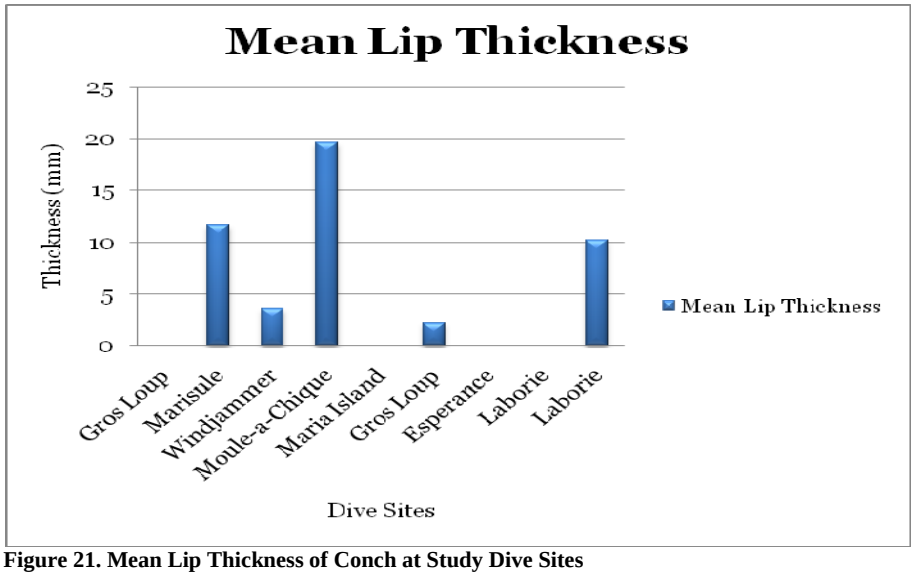

Figure 21. Mean Lip Thickness of Conch at Study Dive Sites

Statistics for lip thicknesses measured in the north, the south and island populations are contained in Table 31 and Figure 22.

Table 31. Conch Lip Thickness

Lip Thickness (mm)	Minimum	Average	Maximum
North	0.4	6.04	16.1
South	4.1	13.1	27.4
Islandwide	0.4	9.51	27.4

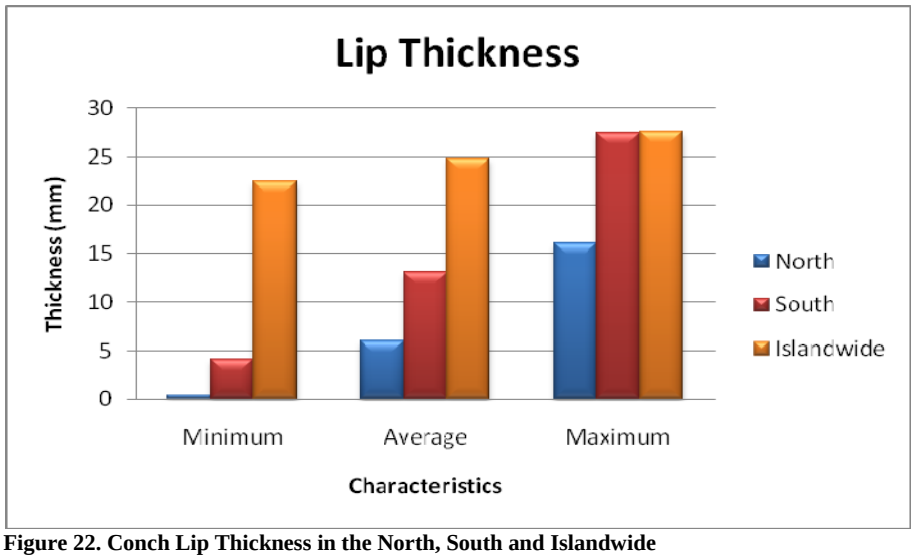

Figure 22. Conch Lip Thickness in the North, South and Islandwide

Proportions of juveniles, sub adults and adults were calculated for north, south and island populations. Results are contained in Table 32 and Figure 23 below.

Table 32. Maturity of Conch Populations

Maturity	% Juveniles[7] in population	% Sub Adults[8] in population	% Adults[9] in population
North	35	22	42
South	0	10	90
Islandwide	29	20	51

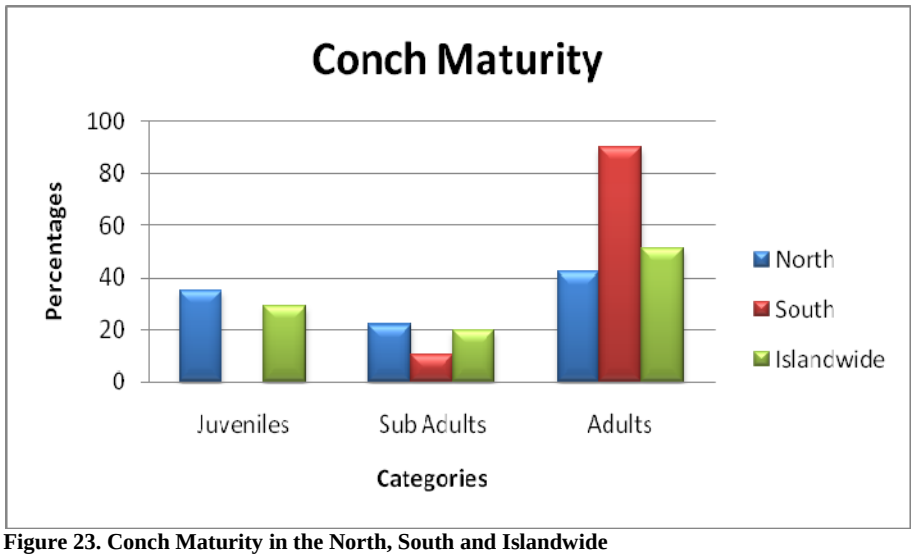

Figure 23. Conch Maturity in the North, South and Islandwide

Mean meat weight at each of the 9 study sites is shown in Figure 24. Statistics for meat weight and total weight for the north, the south and the island, are contained in Tables 33 and 34 respectively. Figures 25 and 26 chart meat weights and total weighs for the north, south and islandwide.

Table 33. Conch Meat Weights

Meat Weight (kg)	Minimum	Average	Maximum
North	0.325	0.629	0.95
South	0.3	0.442	0.575
Islandwide	0.3	0.505	0.95

Table 34. Conch Total Weights

Total Weight (kg)	Minimum	II.1. Average	II.1. Maximum
North	1.60	2.26	3.70
South	1.62	2.33	3.05
Islandwide	1.60	2.25	3.70

[7] defined as not having a flared lip

[8] defined as having a flared lip less than 5mm thick

[9] Defined as having a flared lip of 5mm or more in thickness

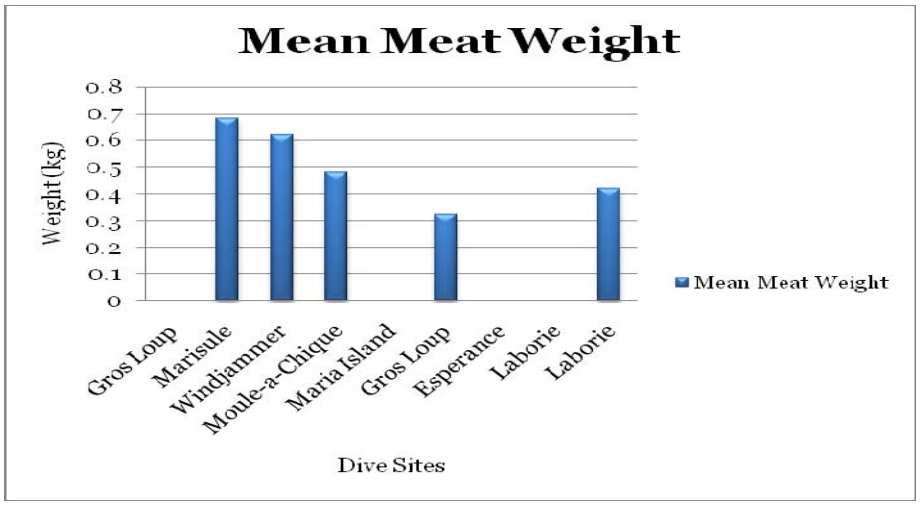

Figure 24. Mean Meat Weight of Conch at Study Dive Sites

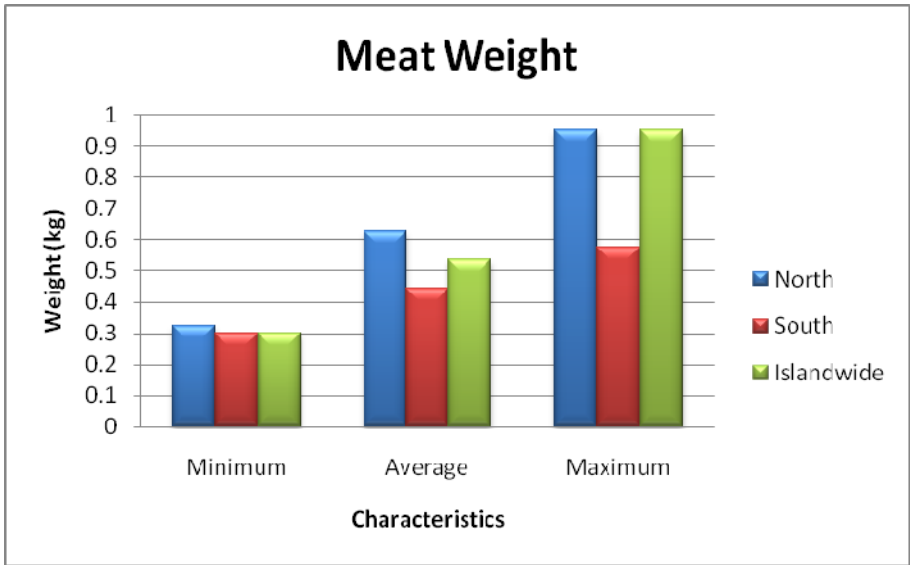

Figure 25. Conch meat weights in the North, South and Islandwide

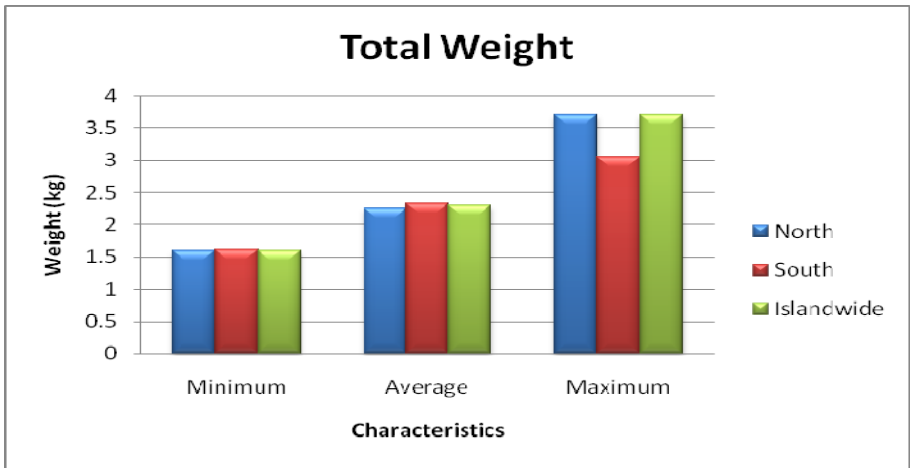

Figure 26. Conch Total Weighs for the North, South and Islandwide

With regard to sex, twenty eight (28) of the conch surveyed were female and twenty six (26) were male (see Figure 21 below). These results are not significantly different from the ratio of 1:1 that is expected between male and female conch ($\chi_2 = 0.074074$ at 5% significance level).

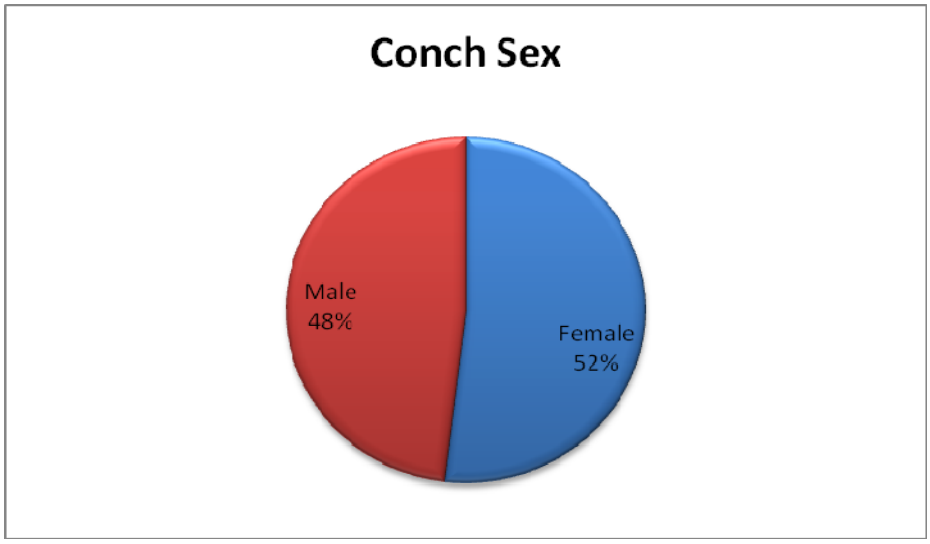

Figure 27. Distribution of Conch Sex across the Samples Collected

6.2.20. Management of the Conch Fishery

Fishers were asked who should make decisions on managing the conch fishery. One (1) (four percent (4%)) said that government should, six (6) (twenty seven percent (27%)) said fishers should, while fifteen (15) (sixty eight percent (68%)) were of the view that both Government and fishers should.

6.3. Post-Harvest Sector

6.3.1. Middlemen

Raw conch was usually sold by the fishers on the dock upon landing from a fishing trip. Only one middleman from Vieux Fort who bought raw conch for sale to other buyers was identified and briefly interviewed. He was not included in the survey. He supplied a variety of seafood to Superior Fish and Seafood Suppliers Ltd (SFSSL). He was unwilling to divulge much information about his conch sources, but indicated that most of his conch originated from Laborie fishers, although he obtained from fishers in other southern communities as well. He supplied up to 400 lb of conch per month to SFSSL, and likely supplied other customers as well.

6.3.2. Demographics of Conch Vendors

Twenty three (23) cooked conch meat vendors and two (2) conch shell vendors were interviewed. All vendors of cooked conch meat operated in a fish fry[10] environment.

Place of residence of conch vendors is contained in Table 35. Most conch meat vendors were resident within the district of Anse La Raye (eight (8) vendors) or Dennery (eight (8) vendors). One of the two conch shell vendors was resident in Anse La Raye and the other in Castries.

Table 35. Place of Residence of Conch Vendors

Location of residence	No. (%) of vendors (N=25)
Dennery	8 (32%)
Anse La Raye	9 (36%)
Laborie	4 (16%)
Gros Islet	3 (12%)
Castries	1 (4%)

Conch meat vendors interviewed in April/May 2008 ranged in age from 32 to 53 years, with an average age of 44 years. The two conch shell vendors were 53 and 59 years old.

6.3.3. Vendor Sources of Income

Vending was the only or primary source of income for twenty one (22) respondents (eighty eight percent (88%)), including the conch shell vendors. Others listed Corrections Officer, teaching and house-keeping as their primary sources of income. Conch sales as a proportion of total vendor sales are as tabulated in Table 36.

[10] Fish fry refers to once weekly street activities in Gros Iset, Anse La Raye, Dennery and Laborie

Table 36. Proportion of Vendor Sales from Conch

Proportion of total sales from conch	No. (%) of vendors (N=25)
Less than ¼	9 (36%)
¼	11 (44%)
½	1 (4%)
No response	4 (16%)

The vendor who indicated that half of his income came from conch sales was a vendor of conch shells in Anse La Raye.

6.3.4. Vendor Purchasing Practices

The conch meat vendors surveyed started purchasing conch in years ranging from 1982 to 2006, but on average, they started purchasing conch for re-sale 7 years prior to the 2008 survey. Of twenty three (23) meat vendors, most (twenty one (21) respondents or ninety one seven percent (91%)) went directly to the fishers or the Fish Market to purchase conch. One (1) vendor (four percent (4%)) purchased only from the Saint Lucia Fish Marketing Corporation (SLFMC). Three (3) vendors (thirteen percent (13%)) including the one who purchased from Dennery fishers, patronised fishers in more than one location. Vendor sources of conch meat are contained in Table 37.

Table 37. Vendor Sources of Conch Meat

Source of conch meat	No. (%) of vendors (N=23)
Gros Islet fishers	15 (65%)
Laborie fishers	7 (30%)
Dennery fishers	1 (4%)
Castries fish market	2 (9%)
SLFMC	1 (4%)

Purchasing patterns of vendors were explored and are charted in Figure 28 and tabulated in Table 38 below.

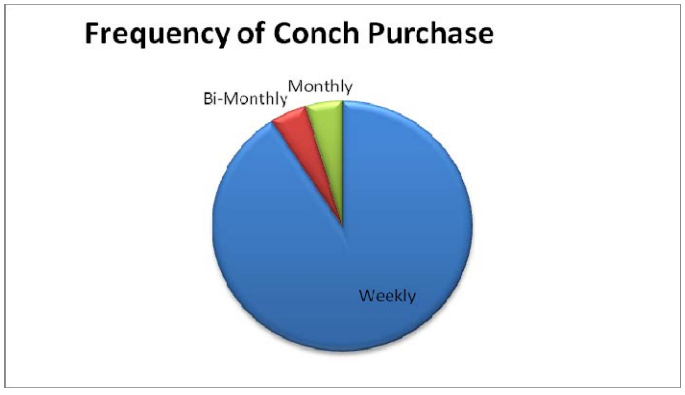

Figure 28. Frequency of Conch Meat Purchase by Vendors

Table 38. Frequency of Conch Meat Purchase by Vendors

Frequency of Conch purchase by vendors	No. (%) of conch meat vendors (N=23)
Weekly	20 (87%)
Bi-monthly	1 (4%)
Monthly	1 (4%)
No response	1 (4%)

No vendors indicated that they purchased the pearl. For those who bought conch meat once per week, amounts purchased varied from 10 lb to 72 lb, an average of 24 lbs. For those buying less frequently, amounts purchased varied from 10 lb to 15 lb, with an average of 13 lbs. Vendors who purchased on specified days every week did so because they chose to make their purchases close to the fish fry day in their community. Those who purchased less frequently did not give specific reasons for the selection of the day of purchase.

Price paid per lb varied from EC$11 to EC$22, with an average of EC$14 per lb paid. Thirteen (13) conch meat vendors (fifty six percent (56%)) indicated that there was a seasonal variation in price, with higher asking prices during the months of November to May. Prices were as high as EC$14 per lb from the fishers and EC$22 per lb from the SLFMC.

Fourteen (14) conch meat vendors (sixty on percent (61%)) bought more conch in 2007/2008 than when they first started vending, because of an increase in demand. Three (3) (thirteen percent (13%)) bought less because of the high cost of purchasing conch, one (1) (four percent (4%)) because of a decrease in availability and one (1) (four percent (4%)) because of reduced demand.Four (4) vendors (seventeen percent (17%)) indicated they bought the same amount of conch in 2007/2008 as they did when they started.

6.3.5. Availability of Conch to Vendors

Although it is noted in the previous section that fourteen (14) (sixty one percent (61%)) conch meat vendors were actually purchasing more in 2007/2008 than when they started vending, vendors indicated that the availability of conch had decreased. This was according to fifteen (15) vendors (sixty five percent (65%)), although three (3) vendors (thirteen percent (13%)) thought it was the same. Many of the vendors who felt that there was a decrease in conch availability thought this was for reasons such as deeper conch, an increase in Martiniquan customers and increased demand. One (1) vendor (four percent (4%)) reported an increased availability as she thought that conch was very scarce in the past.

Eighteen (18) conch meat vendors (seventy eight percent (78%)) indicated that conch availability was not seasonal. Four (4) (seventeen percent (17%)) indicated that availability was seasonal, with three (3) of them (thirteen percent (13%)) indicating higher conch availability for periods of four to six months during the months from November to July. Seasonal availability and demand affected the fisher selling price, with increased demand from Martiniquan customers seen by vendors as one of the greatest factors affecting price. Of the twenty-three (23) Queen Conch meat vendors interviewed, thirteen (13) (fifty six percent (56%)) indicated that the fisher-asking price for conch meat was higher during the months of November to May. This period also coincided with the high tourist season.

Only one (1) (four percent (4%)) of all the twenty-three (23) vendors said that she would not be able to sell more conch if it was available.

6.3.6. Handling and Storage of Conch by Vendors

Conch purchased was usually only de-shelled by the fishers, according to all eighteen (18) vendors (seventy eight percent (78%)) who responded to this query. Vendors typically did all the cleaning. Vendors did not lose conch in any other way, such as spoilage, theft or low sales.

Ten (10) vendors (forty three percent (43%)) stored conch in the freezer in quantities ranging from 10 lb to 60 lbs with an average of 19 lbs stored, for periods between 2 days and 1 week, an average of 5 days.

6.3.7. Sale of Conch Shells by Vendors

Only two (2) vendors interviewed sold conch shell. One (1) vended in Anse La Raye and the other near Pointe Seraphine. The Anse La Raye Shell Vendor bought 45 shells at a time at a cost of EC$1.00 per shell. Over the previous three years he had sold on a Friday, polished shells and conch trumpets, in the price range of EC$5.00 to EC$10.00 per shell. At the time of interview, he had 3 adult shells and no juvenile shells on display. The shell size most preferred by his customers was 'big'.

The other shell vendor (at Pointe Seraphine) went to fishers in Gros Islet and collected shells from any of them, every 2 to 4 years, and had been doing so since 1980. He obtained them free and took what was available. His selling prices for shell and trumpets were very flexible. He had 5 shells on display, ranging from US$1 to US$5. There was no customer preference for a size of shell, and he sold only on a Thursday, when there was a cruise ship in port.

6.3.8. Conch Sales by Vendors

None of the vendors surveyed exported conch parts or products. None of the vendors surveyed had heard of CITES, or were aware of permit requirements for import or export of conch.

All conch meat vendors interviewed sold conch on all the days they vended. Twenty one (21) conch meat vendors (ninety one percent (91%)) only vended one day per week. Days of vending are displayed in Figure 23. Conch vendors did not vary their vending location through the week, and sold in the locations tabulated in Table 39.

Table 39. Vendor Locations

Vending location	No. (%) of conch meat vendors
Dennery	8 (35%)
Anse La Raye	9 (39%)
Gros Islet	3 (13%)
Laborie	3 (13%)

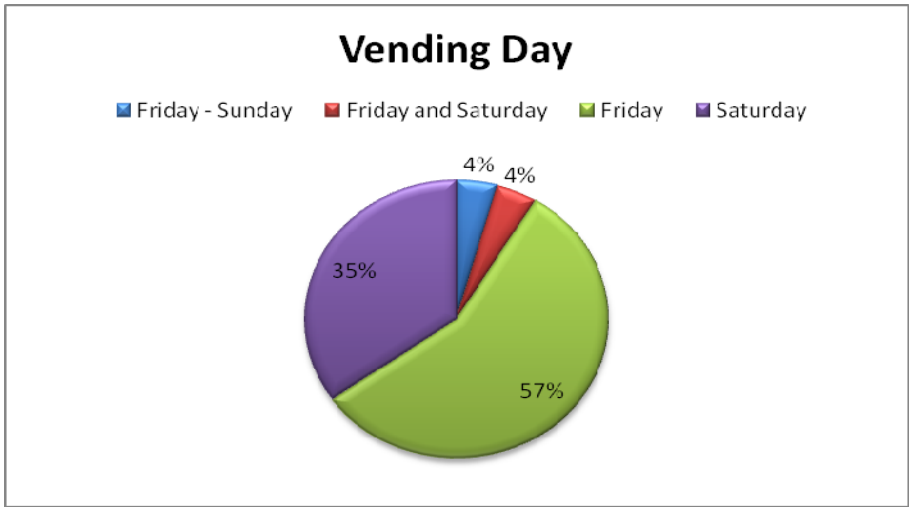

Figure 29. Vending Days of Conch Meat Vendors

Conch meat vendor activity was based solely on fish fry and street activities. It determined both vending location and days of sale for twenty (20) vendors (eighty seven percent (87%)). Only three (3) vendors (thirteen percent (13%)) had their location determined by other factors. In one case it was proximity to a sister's establishment, in another it was the vendor's business place and for the third, the location was near the vendor's home.

Sixteen (16) vendors (seventy percent (70%%) indicated that there was no high season for conch demand, five (5) (twenty two percent (22%)) reported that the demand was always high and two (2) vendors (nine percent (9%)) reported that there was in fact a low season (a seasonal low in September to November was claimed by one (1) vendor).

Vendors prepared conch for sale in a variety of ways, as shown in Table 40.

Table 40. Conch Preparation by Conch Meat Vendors

Preparation	No. (%) of respondents (N=23)
Stewed	9 (39%)
Soup	8 (35%)
Barbecued	7 (30%)
Garlic	1 (4%)
Curried	1 (4%)
Fish Cake	1 (4%)
Steamed	1 (4%)

Vendors were also questioned as to whether their consumers were local or tourists. As can be seen from Table 41 below, a high proportion of vendors' customers were local.

Table 41. Ratio of Local Customers to Visitors who Patronise Conch Meat Vendors

Ratio of Locals : Tourists	No. (%) of respondents (N=23)
1:0	4 (17%)
¾: ¼	12 (52%)
½: ½	3 (13%)
¼: ¾	3 (13%)
0:1	1 (4%)

Vendors were asked about the weekly costs of conch preparation. They indicated that these costs ranged from as low as EC$17.50 to as high as EC$760 with an average weekly cost of EC$109. Vendors indicated that their profits from conch sales in a week varied from EC$0 to EC$300.00, with eight (8) vendors (thirty five percent (35%)) reporting a difference in profit between periods of high and low demand. Five (5) vendors (twenty two percent (22%)) did not know their profits from conch sales, and two (2) (nine percent (9%)) did not respond to this question.

6.3.9. Vendor Socio-Economic Information

Twenty (20) of the twenty five (25) vendors interviewed (eighty percent (80%)) were the main providers for their households. Five (5) (twenty percent (20%)) were not. Household sizes ranged from two to eleven persons, with an average of five persons per household. Fourteen (14) (fifty six percent (56%)) attended primary school, five (5) vendors (twenty percent (20%)) attended secondary school, two (2) (eight percent (8%)) attended a tertiary level of schooling and four (4) (sixteen percent (16%)) did not indicate level of schooling.

Occupations for only five (5) vendor partners (twenty percent (20%)) were reported and one of them worked as a seamstress while the other four (4) (sixteen percent (16%)) also worked as vendors.

Nine (9) vendors (thirty six percent (36%)) owned land. Fourteen (14) (fifty six percent (56%)) did not. Twenty-one (21) (eighty four percent (84%)) owned the house they lived in. Two (2) (eight percent (8%)) did not; one (1) (four percent (4%)) of these lived in a rented house. Twenty-three (23) vendors (ninety two percent (92%)) lived in a house with a galvanized roof, while one (1) (four percent (4%)) had a Caribbean Metals or similar roof. Ten (10) vendors (forty percent (40%)) lived in a house with outside walls of concrete, nine (9) (thirty six percent (36%)) had wooden external walls on their house while five (5) (twenty percent (20%)) had a combination of wood and concrete.

Vendors were questioned as to whether they had the following fourteen (14) amenities in their home: Water, Electricity, Television, Cable-vision, Telephone, Cell Phone, Stove, Refrigerator, Washing Machine, VCR/DVD, Computer, Coal Pot, Flush Toilet, and Pit Latrine. The results are displayed in Table. 42 and Figure 24 below.

Table 42. Amenities Owed by Conch Vendors

Amenities	No. (%) of vendors (N=25)
Electricity	22 (88%)
Refrigerator	22 (88%)
Stove	22 (88%)
Television	21 (84%)
Water	20 (80%)
Cell Phone	20 (80%)
Cablevision	20 (80%)
Coal Pot	18 (72%)
Flush Toilet	16 (64%)
VCR/DVD	16 (64%)
Washine Machine	15 (60%)
Telephone	12 (48%)
Computer	8 (32%)
Pit Latrine	7 (28%)

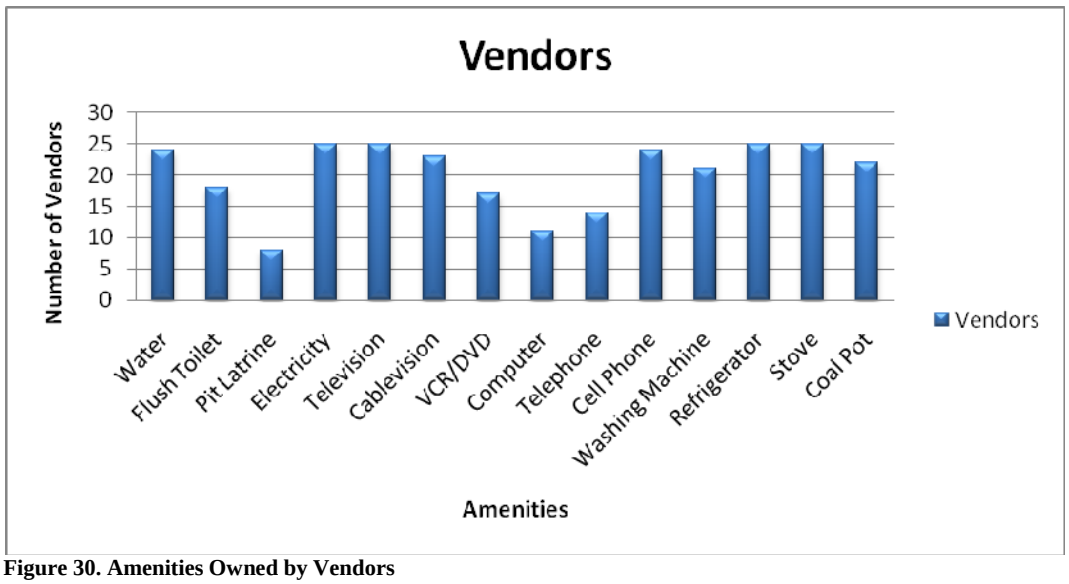

Figure 30. Amenities Owned by Vendors

More than eighty percent (80%) of vendors had water electricity, television, cablevision, cell phone, washing machine, refrigerator, stove and coal pot.

6.3.10. Restaurant Characteristics and Peak Periods

Restaurants were differentiated from conch vendors as having premises with seating for their patrons. A total of twenty (20 restaurateurs were interviewed; five (5) of these (twenty five percent (25%)) were incorporated within a hotel. Restaurant locations were spread across Saint Lucia. Restaurants were opened as far back as 1980, and one as recently as 2007. In 2008, the number of

full-time employees in these restaurants ranged from 0 to 70, with an average of 13. Five (5) (twenty five percent (25%)) had part-time employees, each of these reporting 2 part-time employees. Three (3) restaurants (fifteen percent (15%)) had seasonal employees ranging in number from 1 to 4.

Two (2) restaurants (ten percent (10%)) had an off-season (the month of September) when the restaurant was closed. Restaurateurs were asked about their peak business periods. Four (4) (twenty percent (20%)) indicated there was no peak period, One (1) restaurateur (five percent (5%)) reported his peak period to be on a particular day (Tuesday) and another two (2) (ten percent (10%)) claimed an average of 80% occupancy throughout the year. Those who had peak months responded as shown in Table 43. Based on responses from only eight (8) restaurateurs (forty percent (40%)) the average number of guests during peak periods ranged from 50 to 400, with an average of 168. Average number of guests during off-peak periods, based on information from the same eight (8) respondents, ranged from 12 to 200, with an average of 49.

Table 43. Peak Periods Reported for Restaurants

Peak Period	No. (%) of respondents (N=20)
Dec-April	4 (20%)
Dec-Jan	2 (10%)
May-Aug	1 (5%)
Nov – June	1 (5%)
Oct – April	1 (5%)
Oct – Dec	1 (5%)
Aug – Dec	1 (5%)
May	1 (5%)
Oct – Feb	1 (5%)
Dec and July	1 (5%)
May – Aug	1 (5%)

6.3.11. Conch Purchasing Practices of Restaurateurs

Restaurateurs surveyed started purchasing Queen Conch an average of eleven years prior to the 2008 survey. Most restaurateurs (fourteen (14) respondents or seventy percent (70%)) bought conch directly from fishers. Nine (9) (forty five percent (45%)) purchased from the SLFMC. One (1) (five percent (5%)) also bought from St. Vincent. Amounts purchased monthly varied from 10 lbs to 320 lbs. Quantities of conch typically purchased at one time varied from 10 to 100 lbs, with an average of 35 lbs. Eleven (11) restaurateurs (fifty five percent (55%)) indicated that they purchased conch in the quantities indicated based on customer demand. Other reasons cited included West Indian customers, cost factors, and purchase size dependent on what was available.

Price paid by restaurateurs per lb for raw conch varied from EC$10 to EC$25, an average of EC$14 per lb. This is consistent with prices reported by fishers and retailers. Five (5) restaurateurs (twenty five percent (25%)) indicated that there was a seasonal variation in price that they paid, with lower

fisher-asking prices over a period of four to five months, between the months of March to October. Prices as low as EC$8.00 per lb were reported by some of these respondents.

Purchasing frequency of restaurateurs was explored, and the results are shown in Figure 25 below. Forty seven percent (47%) purchased twice per month, with the remainder purchasing weekly or bi-weekly.

Figure 31. Frequency of Conch Purchase by Restaurateurs

Seven (7) restaurateurs (thirty five percent (35%)) bought more conch in 2008 than when they first started their business, because of higher demand. Ten (10) (fifty percent (50%)) bought less because there was less available (one (1) (five percent (5%)) thought this was because of overfishing), price had increased, there was an increased number of vendors or there were fewer fishermen. Three (3) (fifteen percent (15%)) still bought the same amount.

6.3.12. Handling of Conch by Restaurateurs

The conch purchased was usually only de-shelled by the fishers (according to twelve (12) respondents, or sixty percent (60%)). One (1) restaurateur (five percent (5%)) purchased conch meat partially cleaned (digestive glands removed), while seven (7) (thirty five percent (35%)) bought it fully cleaned from the SLFMC. Six (6) restaurateurs (thirty percent (30%)) did not clean the conch. Thirteen (13) (sixty five percent (65%)) cleaned it. One (1) (five percent (5%)) did not respond. Restaurateurs indicated they did not lose conch in any other way, such as spoilage, theft or low sales.

Sixteen (16) restaurateurs (eighty percent (80%)) stored conch in the freezer in quantities ranging from 5 to 100 lbs with an average of 37 lbs stored, for periods between 2 days and 3 months. Four (4) (twenty percent (20%)) did not store conch.

Restaurateurs prepared conch in a variety of ways, as shown in Table 44.

Table 44. Methods of Preparation of Conch by Restaurateurs

Preparation	No. (%) of respondents (N=20)
Curried	8 (40%)
Stewed	6 (30%)
Barbecued	6 (30%)
Soup	5 (25%)
Salad	3 (15%)
Creole	2 (10%)
Steamed	2 (10%)
Roti	2 (10%)
Fritters	2 (10%)
Boullion	2 (10%)
Pickled	1 (5%)
Chowder	1 (5%)
Skimpy	1 (5%)
Raw	1 (5%)

6.3.13. Availability of Conch to Restaurateurs

According to sixteen (16) (eighty percent (80%)) of the twenty (20) respondents, availability of conch has declined; three (3) respondents (fifteen percent (15%)) reported no change or "average" availability throughout the year; and one (1) respondent (five percent (5%)) did not answer to this query. None reported an increased availability. Six (6) restaurateurs (thirty percent (30%)) attributed the perceived decrease in availability to an increase in demand, and two (2) (ten percent (10%)) to an increase in French customers. Two (2) (ten percent (10%)) said that availability had decreased because of an increase in the number of vendors. One (1) (five percent (5%)) thought there were fewer fishermen, and one (1) other (five percent (5%)) attributed it to overfishing. Four (4) restaurateurs (twenty percent (20%)) cited no reason for the decline.

Twelve (12) restaurateurs (sixty percent (60%)) felt that conch availability was not seasonal. Five (5) (twenty five percent (25%)) reported a season, but cited a number of different low-availability periods between March and October, or high availability periods ranging from two to six months between October and May; four (4) (nineteen percent (19%)) of them attributed the low availability at certain times of the year to overfishing, the hurricane season, the frequency of visits by middleman and the movement of conch to deeper waters. Three (3) (fifteen percent (15%)) did not know whether there was a seasonal availability.

6.3.14. Conch Sales by Restaurateurs

Most of those who had Queen Conch on their menu did so because of the high demand for it. The other reasons given for its inclusion on their menu were high protein and to meet the needs of French and local clients. Only three (3) restaurants surveyed (fifteen percent (15%)) had Queen Conch on the menu daily. Seventeen (17) (eighty five percent (85%)) did not, citing limited availability as a contributing factor. Nine (9) restaurateurs (forty five percent (45%)) indicated that there is a seasonal demand for conch, but the seasons reported were highly variable. Ten (10) (fifty percent (50%)) said there was no season, and one (1) (five percent (5%)) did not know. Sixteen (16) restaurateurs (eighty percent (80%)) would be able to sell more conch if it was available. One (1) (five percent (5%)) was not sure. The others did not respond to this query.

Selling prices of conch by restaurateurs varied from EC$8.00 to EC$200.00 per lb (prices were typically given for a meal with a quarter lb of conch), with the most popular serving size of a quarter lb. All-inclusive establishments did not have a selling price as the price of meals was included in the package offered to guests.

Restaurateurs were questioned as to whether their consumers were local or tourists. They responded as tabulated in Table 45. There was a higher local than visitor demand for conch at the restaurants surveyed.

Table 45. Ratio of Local Customers to Tourists Patronising Restaurants

Proportion of Customers (locals : tourists)	No. of respondents (N=20)
1:0	6 (30%)
¾: ¼	7 (35%)
½: ½	2 (10%)
¼: ¾	2 (10%)
0:1	3 (15%)

Restaurateurs were asked about the other weekly costs of conch preparation. Although many of them felt that it was difficult to estimate, and responses were highly variable, ranging from EC$20.00 to EC$680 (units were given).

Restaurateurs indicated that their high season profits from conch sales in a week varied from EC$50 to EC$4000. Low season profits ranged from EC$50.00 to EC$1000.00. Responses regarding proportion of conch sales to total restaurant sales were as tabulated in Table 46 below. The restaurateur who registered the highest profit from conch sales (up to EC$4000.00 per week in the high season) reported conch sales as an insignificant proportion of the restaurant's total sales.

Table 46. Proportion of Total Restaurant Sales from Conch

Proportion of total sales from conch	No. (%) of respondents (N=20)
Not significant	15 (71%)
Less than ¼	1 (5%)
¼	2 (10%)
½	2 (10%)
¾	0
All	0

6.3.15. Saint Lucia Fish Marketing Corporation

The SLFMC had been in operation for the 22 years prior to 2008. It employed approximately 50 persons full-time, 16 of whom worked at the Vieux Fort Complex, with the remainder employed at the Castries outlet. SLFMC employed up to an additional 6 persons during the high fish season from November to June.

6.3.16. SLFMC Conch Sources

SLFMC had not been able to purchase conch locally since 2003, at the price of EC$6 per lb that it was prepared to offer fishers. At that time, SLFMC sold the locally procured conch for EC$25 per lb. Local suppliers were Gros Islet fishermen who at that time could get up to EC$10 per lb for conch on the street.

Conch had been imported by the Complex from Grenadine Seafood Distributers in Bequia and from Ocean Fresh Trading Corporation in Miami. Quantities purchased frozen from Miami ranged from 5000 lb to 8000 lbs per shipment. Up to 5000 lb of chilled conch had been imported from Bequia in one shipment (the supplier would require 2 to 3 weeks notice). This quantity of conch would last the SLFMC for 8 to 9 months, stored in the company freezers. Bequia wholesale conch prices were typically EC$13.50 per lb, while Miami conch cost was US$8 per lb. Conch importation by the Complex was exempt from import duty and consumption tax, although a 5% service charge was levied. The price paid to these overseas suppliers did not vary over the year.

Records were not available for imports from Miami. SLFMC records of conch imports from Bequia for the period 2000 to 2005 were as shown in Table 47.

Table 47. SLFMC Imports from Bequia

Year	2000	2001	2002	2003	2004	2005
Total imported (lb)	799	11,000	Not available	16,000	4,000	10,000

The SLFMC had not purchased conch in significant quantities since 2005 as management was not prepared to pay the prices being asked.

6.3.17. SLFMC Conch Sales

SLFMC sold conch whole. Conch purchased from Bequis was usually 85%[11] processed (head, claws, bag, skirt and most of skin removed), and was washed and packaged for freezing and sale by the SLFMC. Costs in conch preparation for sale by the Complex were not available, but were reportedly not high.

In the opinion of the SLFMC respondent, conch was a fast seller. The SLFMC's largest buyers (hotels and restaurants) would buy up to 600 lb at one time. Despite the demand of its larger customers however, by 2008, conch was seldom if ever on the SLFMC shelves.

There was no high season for either availability or demand of conch, according to the SLFMC respondent.

6.3.18. Superior Fish and Seafood Suppliers (SFSSL)

This business had been selling seafood since 1999, but had been operating under the name Superior Fish and Seafood Suppliers Ltd (SFSSL) since 2005. The company had 20 full-time employees, and sold wholesale from premises at Massade, Gros Islet, and retailed from premises in the Castries Market.

6.3.19. SFSSL Conch Sources

SFSSL sold conch meat, ninety percent (90%) of which was purchased locally through a middleman from Vieux Fort. He was able to supply 400 lb orders within one or two days. Sometimes he called SFSSL if he had conch on hand; otherwise he was called and an order placed. An order of this size was usually purchased once monthly. The price asked by this middleman had recently increased from EC$16 per lb to EC$17 per lb. His conch was either unprocessed or 50% processed (see Appendix 7 for processing grades used).

SFSSL started importing conch from Bequia in 2007. There was one shipment of approximately 1400 lb in 2007. In mid-2008, 1400 lb arrived in the first shipment, and a second shipment of 2000 lb had recently been ordered. The Manager advised that it was possible to get all the conch that SFSSL required locally, but the price from Bequia was competitive, even after payment of consumption tax and service charge[12]. The conch from Bequia was 65% processed (see Appendix 7 for level of processing according to Jamaica conversion factors).

The Manager reported no difficulty in getting conch sufficient to meet his customers' needs, and ordered conch as required. Both availability of conch and customer demand were constant over the year, with no significant peaks.

---

[11] This is according to the Jamaica scale contained in Appendix 9

[12] Import duties do not apply for intra-regional imports. They would apply to SFSS purchases from extra-regional sources

More conch was purchased in 2008 than when the business started, as the customer base broadened and business improved. More than 4000 lb of conch was purchased annually. Up to 2000 lb of conch was stored frozen at one time.

6.3.20. SFSS Conch Sales

Overheads were freight for imported conch, transportation (including deliveries to customers and the market store outlet), cleaning and bagging/packaging for sale, and freezer storage.

Conch was sold whole, at EC$21/lb unprocessed, and EC$26/lb if 65% processed (see Appendix 7 for processing scale used). Wholesale and retail prices were the same.

Local retail buyers purchased about ¼ of SFSSL's conch, while restaurants and hotels purchased about ¾ of the company's conch stocks. Large conch purchasers over the previous year included:

- The three Sandals properties
- Papillon
- La Dera
- Charthouse
- Discovery
- Landings
- Coco properties
- Bay Gardens
- Caribbean Pirates
- The two Almond properties
- Rada
- Debbies
- Belle Jour
- Lime

There was 1 occasion during the previous year when French nationals on a vessel at Rodney Bay purchased a variety of SFSSL products including conch.

Conch sales were an estimated 1% of total sales. The profit margin on conch was approximately 20%, and profit from conch was less than 1% of total profit. Conch was part of the company's product portfolio, and was part of the diverse offerings of the company.

6.3.21. Estimate of Added Value

In addition to the economic benefit gained by the fishers, a number of other sectors purchased conch and derived added economic value. These included vendors, restaurateurs and retailers. An effort was made to estimate total annual demand for conch meat, based on the information gathered through the various surveys, in Table 48 below. Very little information was available on quantities consumed on festival days, by French visitors and by the general public, and the figures used in Table 48 were best estimates, with a high margin of error. It was assumed that the largest percentage of conch purchased from fishers was by the general public for their own consumption, based on information derived from the various surveys undertaken. The assumptions and results for this calculation are contained in Table 48.

Table 48. Estimate of Conch Demand and Value-Added by Fisher Customers for 2007/2008

Market	Estimated demand (lb per annum)	Estimated Added Value of Conch to the Local Economy by Fisher Customers (EC$ per annum)	Assumptions
Vendors	28,704	144,900	23 vendors purchase average of 24 lbs every week. Vendors earn an average of EC$150/week from conch sales, selling 42 weeks of the year.
Fisher	10,400	72,800	1 fisher keeps some of his conch harvest to BBQ and sell himself. Although his harvest is estimated at 35,000 lbs based on survey results, it is assumed that he only sells 200 lbs cooked conch per week (or 10,400 lb annually). He sells cooked conch at an estimated EC$20/lb; estimated profit is EC$7/lb. His landings have already been adjusted (42/52 weeks) so this adjustment is not made again here.
Restaurants /Hotels	59,520	2,380,800	31 restaurants purchase an average of 160 lbs every month at EC$12/lb. Their costs are estimated at EC$20/lb. Conch is sold at an average EC$68 /lb by restaurants; profit is EC$40/lb. Sales are 52/52 weeks.
Retailers	4,800	33,600	SFSSL purchases 400 lbs per month locally; SLFMC buys none. Conch is sold at EC$21/lb unprocessed. Profit is EC$7/lb. Sales are 52/52 weeks.
General public	129,456	0	Demand is 1.5 times the total amount consumed by vendors and restaurants (half the fishers sell to general public, and half sell to vendors, hotels and restaurants as well as general public). These purchasers do not sell conch, but consume it, so there is no value added.
Journet Kweyol, community days and Jazz Festival	1250	320,000	20% of 40,000 patrons consume ¼ lb each, subject to availability. Vendors sell at EC$30/lb. Profit is estimated at EC$16/lb.
French visitors	5,200	0	3 customers per week purchase 20 lb each (vendors inform that they buy by the bucket). Conch is consumed by these buyers so the value added is 0.
Total	**239,330**	**2,952,100**	

These trade pathways are depicted in Figure 32 overleaf.

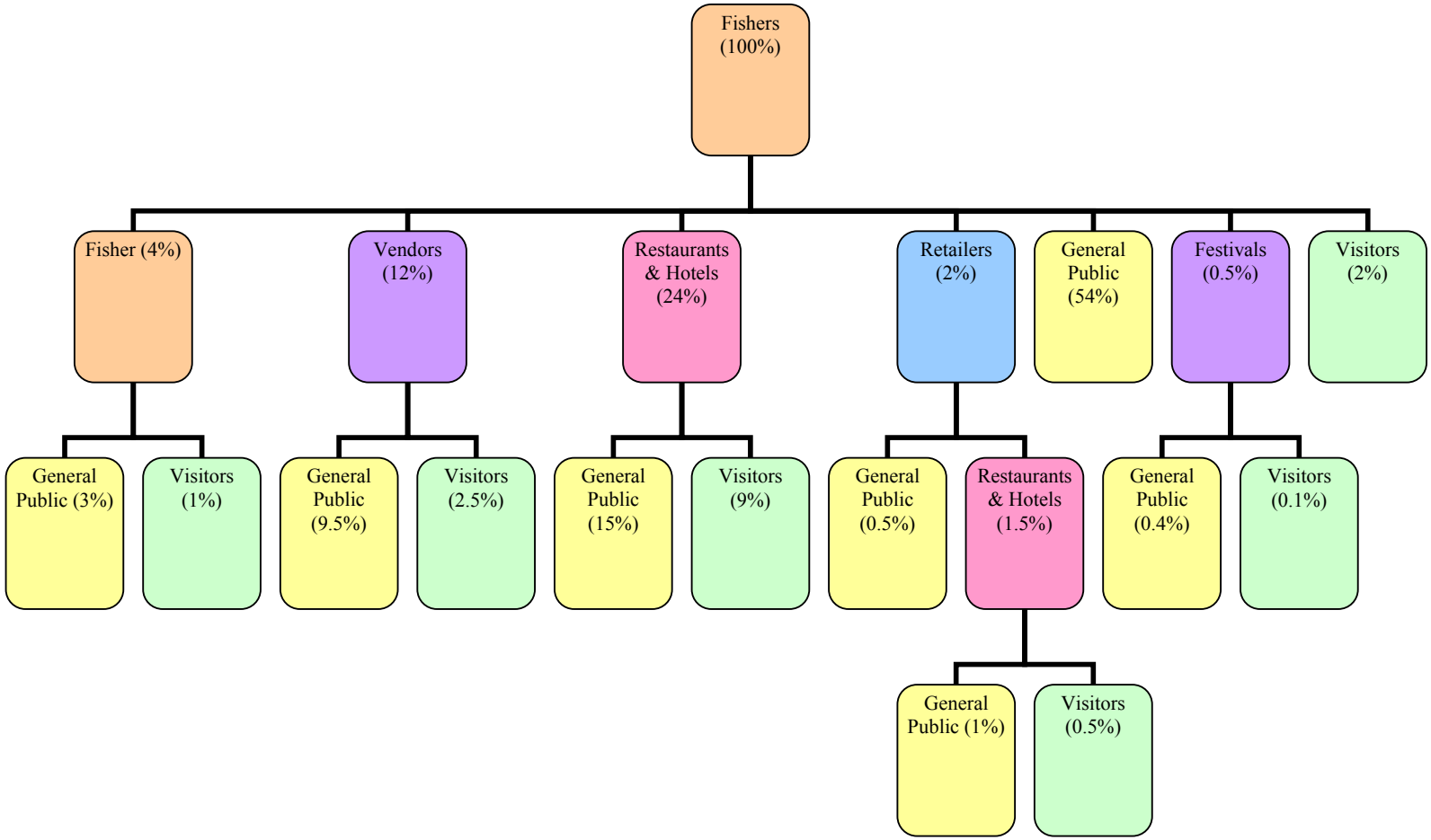

Figure 32. Trade Pathways of Queen Conch from Fishers to Ultimate Consumers

7. DISCUSSION AND CONCLUSIONS

7.1. The Conch Fishery (Past and Present)

7.1.1. Conch Fisher Demographics

The results of the present-day survey indicated that in 2008, there were twenty three (23) active conch fishers (including those who did not participate in the survey), of whom twenty one (21) were full-time fishers; fifteen (15) (sixty eight percent (68%)) of these were full-time conch fishers. Joseph (2003) indicated that there were over forty (40) fishers involved in the conch fishery in 1999. Of the fourteen (14) past fishers interviewed in this study, twenty nine percent (29%) of them dived conch opportunistically while seventy one percent (71%) went out specifically to harvest conch. None of the six (6) past fishers (who no longer harvested conch in 2008) were engaged solely in conch fishing, and they derived between ¼ and ½ of their income from conch sales; all were engaged in other forms of fishing, and four (4) of five (5) reported income sources other than fishing.

The majority of conch fishers (past and present) originated from Gros Islet, and landed their conch there. Most of the other conch fishers originated from Laborie. Of the fourteen (14) past fishers identified under this project, seventy one percent (71%) were resident in the district of Gros Islet, and thirty six percent (36%) were resident in Gros Islet town. Fifteen percent (155) were resident in Laborie. In 2008, twenty seven percent (27%) of present-day conch fishers surveyed were resident in Laborie, and fifty five percent (55%) were resident in the Gros Islet district. However, most conch were landed in Gros Islet. According to the DOF Fish Landing Database (2008), of the 41 tonnes landed in 2007, only six percent (6%) was landed in Laborie, with the remaining ninety four percent (94%) landed in Gros Islet. This is explained by the fact that only two of the eleven boats involved in the industry were launched from Laborie and these were both owned and operated by part-time fishers with other primary occupations. It is concluded that the majority of conch fishers, both past and present, were resident in Gros Islet and/or landed their conch harvests there. Although Laborie fishers comprised twenty five percent (25%) of fishers, the share of conch landed by Laborie fishers was disproportionately low.

The number of conch fishers declined from 1999 to 2007 although annual conch landings had not decreased according to the DOF Fish Landing Database (2008). Whereas past fishers (pre-1989) appeared not to be able to make a living solely off conch fishing, a significant proportion of conch fishers (forty six percent (46%)) were in 2008 able to generate ¾ to all of their income from the conch fishery, and as shall be seen later, were able to sustain a decent quality of life.

Fishers in 2008 were remaining involved in the fishery for longer than fishers of the past. The past fishers who no longer harvested conch had spent an average of six years in the fishery. Those past fishers who were still in the fishery in 2008 had spent an average of twenty seven years in the fishery. Younger fishers who had entered the fishery after 1989 had already spent an average of ten years in the fishery.

Three (3) of the present-day fishers (nineteen percent (19%)) no longer harvested conch because they got the bends. All the others indicated that they would continue to harvest conch for periods

varying from 1 year (9% of respondents) to the time of their death (14% of respondents). It appears that the bends was the main reason that would prompt a fisher to leave the fishery.

The DOF started registering fishers in 1992, and eighteen (18) present-day fishers, or eighty two percent (82%) were registered. Twelve (12) present-day fishers (fifty five percent (55%) of those surveyed) belonged to a Fishermans' Cooperative. Members of Cooperatives interviewed were either divers or owners. All boat owners were members of a Fishermans' Cooperative. Fishers who were members of a Cooperative benefited from fuel incentives, and this was clearly an incentive to boat owners to join. Other fishers were more likely to be registered with the DOF than to be a member of a Cooperative.

7.1.2. Fisher Role in the Fishery

Of past fishers surveyed, sixty four percent (64%) combined the role of diver with captain and/or owner, and twenty one percent (21%) were crew. In 2008, thirty six percent (36%) combined the role of diver with owner and/or captain, while 23% were crew; all owners were captains. There were more divers (thirty-seven percent (37%)) who did not own boats in 2008 than there were in the past (twenty one percent (21%)). However, there were no absentee owners in the past or the present, and the fishers themselves, most of them divers, were the investors in the equipment required for their participation in the conch fishery.

Sixty eight percent (68%) of present day fishers were of the view that Government and fishers together should make decisions on managing the conch fishery, while twenty seven percent (27%) said that fishers alone should. Whether this is an acknowledgement of their role in protecting and sustaining the fishery, or a reflection of their desire to minimise Government control of their harvesting practices is not known.

7.1.3. Diving and Harvesting Practices

All past and present fishers dived conch from a boat. Fishers in the past would go out as far as 4 miles to sea, an average of 2 miles, with an average of three (3) persons on the boat. In 2008, fishers went out up to 5 miles, an average of 2.22 miles, also with an average of three (3) persons on board. There was no significant difference between the past and the present in this regard. However, some fishers in 2008 were diving deeper to retrieve conch. Thirty eight percent (38%) of present-day divers admitted to diving deeper for conch than before. Fifty percent (50%) of older present-day divers indicated that they were diving deeper in 2008 than when they started. This may be because the conch fishery was being depleted in shallower waters, and/or fishers were expanding the areas exploited for conch.

Of the five past divers who no longer dived conch in 2008, only forty percent (40%) had had training from DOF, and sixty percent (60%) had had the bends. Sixty percent (60%) had had no training in use of SCUBA.

Despite the requirement by the DOF for fishers using SCUBA gear to be licensed, it appears that unsafe diving was still practised by a number of divers in 2008. Notwithstanding the efforts of the DOF at training conch divers, the percentage of untrained divers had not changed significantly by 2008. Twenty seven percent (27%) of the eleven (11) past divers using SCUBA were untrained or

uncertified. All present-day divers used SCUBA only, and twenty five percent (25%) of them were untrained or uncertified. The number of untrained SCUBA users in 2008 was still too high, increasing the risks associated with the use of this equipment. Three (3) of the past divers had had the bends; six (6) present-day divers (thirty eight percent (38%) of divers) had had the bends, causing three (3) of them (nineteen percent (19%)) to stop diving conch. Nine (9) incidents of the bends had occurred between 1983 and 2007, eight (8) of these since 1993. Seven (7) of the nine (9) cases were treated outside of Saint Lucia.

As noted earlier, several past divers interviewed combined skin diving with SCUBA (eighty percent (80% of those who no longer dived in 2008, and thirty six percent (36%) of all past divers) while the remainder used SCUBA only. Present-day divers used SCUBA only, with thirty three percent (33%) indicating that they were diving at greater depths than in the past for conch. It is not known whether this is because there was now no significant conch found at these shallower depths due to overfishing at these depths, or because it was simply more lucrative to dive at deeper depths using SCUBA. However, it appears that the fishers had determined that in 2008 it was no longer feasible to harvest conch commercially without SCUBA in Saint Lucia, with conch being harvested primarily at depths exceeding 80 ft (24.4 m). Present-day fishers reported harvesting an average of 137 conch per expedition. Past fishers indicated an average of about 100 per expedition. Harvest size per expedition appears to have increased slightly over time, but this may simply be a result of the transition from using both skin and SCUBA diving in the past, to using SCUBA only in 2008.

Despite a DOF policy (not contained in any legislation) that fishers de-shell conch on land, several fishers advised the enumerator that they de-shelled the conch at sea. Conch shells were not found in significant numbers in conch fishing areas studied, and fishers in subsequent discussion advised that although they de-shelled conch at sea, they discarded the shells close to shore, as they believed that live conch "would not stay" in areas where empty conch shells were found. The Gros Islet Data Collector corroborated that most conch is landed de-shelled.

One fisher informed in a subsequent discussion that they typically dive an area for conch for about two weeks and leave it for at least one month to regenerate, before returning.

7.1.4. Conch Storage, Use and the Market

Five (5) of the six (6) past fishers (eighty three percent (83%)) indicated they stored conch in near-shore baskets for up to two (2) months prior to sale. None (zero percent (%)) of the present-day fishers stored conch, indicative of the increased demand for conch in 2008. It can be concluded that demand exceeded supply in 2008.

Three (3) of six (6) past fishers (fifty percent (50%)) indicated that conch was important to the family diet. Three (3) (fifty percent (50%)) indicated that it was not. Present-day fishers were not asked. All past fishers sold their conch catch; two (2) (thirty three percent (33%)) of the past fishers reported selling conch in Martinique. Only one (1) (five percent (5%)) present-day fisher had sold in Martinique in the past, and none (zero percent (0%)) reported selling in Martinique in 2008. The reason for his stopping was not given. It is concluded that fishers no longer exported conch to Martinique in 2008. This may have been for a variety of reasons, including the comparative ease of sale on the local market in 2008 at competitive prices, compounded by the increased difficulty involved in legally exporting to Martinique.

For all past fishers (one hundred percent (100%)), the conch meat was the only important conch product, and was the only conch part or product that was used or sold by fishers. Some past fishers used conch shells as horns, for house foundations, backfill or to fix roads. All fishers (past and present) valued the pearl but none of those surveyed indicated that they had never found one. DOF records reveal that conch pearls have been exported in very small numbers. Only twenty two percent (22%) of present-day fishers thought the shell was somewhat important, while meat was definitely important to all of them. There were only two (2) known conch shell vendors in 2008, presumably because the demand for shells and other products had been, and still was, low, but may have been slowly growing. One of the two conch shell vendors reported paying EC$1 for shells. The other conch shell vendor did not pay for shells.

Past fishers reported that selling prices (pre-1989) for unprocessed conch ranged from EC$1.50 to EC$8 per lb to locals and EC$0.50 to EC$5 per lb to visitors, hotels and restaurants. Present-day fishers sold unprocessed conch at prices ranging from EC$12 to EC$14 per lb to locals and EC$10 to EC$12 per lb to hotels and restaurants. Half of the present-day fishers surveyed sold all their conch meat to the general public, while most of the others (forty five percent (45%)) also sold to other local customers (vendors, hotels and restaurants). One fisher (1) (five percent (5%)) kept part of his conch harvest to barbecue and sell. No fisher (zero percent (0%)) sold to the SLFMC or export markets. Fishers indicated that they had supplied their chosen markets for a long time, and had reliable buyers. It can be concluded that the present-day fishers' markets were very stable and easily accessible. The value of conch had increased, and there was a higher local demand by 2008, with the market seeking out the fisher's harvest, rather than the fisher pursuing the market. The SLFMC could no longer procure conch meat locally at the price it was prepared to offer. Selling prices to hotels and restaurants were more variable than those to vendors and the general public, ranging from EC$10 per lb for some fishers, to EC$16 per lb for one fisher. The reasons for this were not requested. It may be that hotels and restaurants customers typically bought in larger quantities, and/or were guaranteed customers, and therefore usually benefitted from a wholesale price.

7.1.5. Fisher Awareness and Observations

The survey results demonstrate that fishers had a low awareness of external policies and decisions that potentially impacted the conch fishery, and ultimately, their livelihoods, although it may be argued that awareness of CITES and even HACCP was not a requirement in 2008 as those fishers were neither importing nor exporting conch. Past fishers were either unaware of laws or felt that when laws were introduced, they had no impact on the level of illegal practices, or on the level of organisation of the fishery, but caused a decrease in the number of conch fishers. Twenty three (23%) of present-day fishers said that there were no laws regarding conch in 2008, although the Fisheries Regulations had been in place since 1994. None of the present-day fishers had heard of CITES; only eighteen percent (18%) of present-day fishers were aware that there were permit requirements for import or export of conch. Fourteen percent (14%) were aware of HACCP.

Eighty three percent (83%) of past fishers reported either no change or an increase in the size of adult and juvenile populations over time None reported a decrease. Fifty nine percent (59%) of present-day fishers indicated that there had been no change in the abundance of adult conch, while twenty three percent (23%) said that adult conch populations had decreased. Both past and present

fishers who noted stable or higher conch populations attributed this to there being fewer divers, and the conch replenishing itself. It is noted though, that a greater proportion of present-day fishers noted an increase in juvenile conch populations than in adult populations (41% versus 9%) over time. This increase in juvenile conch populations over time may be as a result of the law prohibiting the harvesting of juvenile conch.

Three (3) of five (5) past divers (sixty percent (60%)) said that conch dive depths had increased, and attributed this to conch moving in search of food. Thirty eight percent (38%) of present-day divers were diving deeper for conch than before[13]; seven present-day fishers (thirty two percent (32%)) spent more time harvesting conch than in the past (thirteen (13) (fifty nine percent (59%)) indicated that they spent the same amount of time). While a significant number of divers observed that in 2008 they had to dive deeper for conch, they believed that the conch had simply moved to deeper waters in search of food or because of weather conditions. Only two (2) fishers (nine percent (9%)) thought that they had to spend more time harvesting conch because the conch population had decreased.

One (1) past fisher (seventeen percent (17%)) noted an increase in adult conch size over time. Eighty two percent (82%) of present-day fishers indicated that the size of adult conch had not changed, but eighteen percent (18%) observed a decrease in the size. They attributed this to the type and availability of food consumed, and genetics.

The statistics quoted here indicate that, with a few exceptions, fishers did not believe that Queen Conch stocks were decreasing, that conch were decreasing in size, or that their harvesting practices were adversely affecting the fishery. This needs to be contrasted with the prevailing vendor and restaurateur opinion that conch was less available to them in 2008 than in the past. The extent to which conch availability to purchasers had been affected by increasing demand, or by reduced quantities of conch landed, is not known.

7.1.6. Differences in Queen Conch Populations in the North and South

Two (2) past fishers (thirty three percent (33%)) noticed one other species of conch. Present-day fishers were not asked whether they had observed conch species other than Queen Conch. However, none of the present-day fishers noticed any differences in species of conch observed in Saint Lucia's waters over time.

Only two (2) of six (6) past fishers (thirty three percent (33%)) observed differences between conch in the north and the south, although the observed differences reported were not consistent. Fifty five percent (55%) of present-day fishers observed differences between the north and south populations, but again the differences cited were inconsistent, with more saying that conch from the south was heavier, or tougher, bur others saying that conch in the north was heavier. Heavier conch was usually attributed to differences in food by fishers.

---

[13] Thirteen percent (13%) of present-day divers said they were diving at shallower depths than in the past, but this was because they had had the bends.

The biological data supports the conclusion that there were significant differences between conch in the north and in the south as indicated by some fishers, also made by Nichols and Jennings-Clark (1994). There was little evidence to show significant differences ($f = 0.7777$, $p = 0.51$) in the siphonal length of *Strombas gigas* between dive sites. There was no statistically significant difference ($t = 1.0537$, $p = 0.2968$) in siphonal length between conch in the north and conch in the south. There was also no statistically significant difference ($t = 0.382$, $p = 0.70$) in total weight between conch in the north and south. However, there was a significant difference ($f = 19.31$, $p < 0.0001$) in lip thickness of *Strombas gigas* between dive sites. There was a very significant difference ($t = 3.4687$, $p = 0.0010$) in lip thickness between conch in the north and conch in the south. There was also significant difference ($f = 7.735$, $p = 0.0003$) in the meat weight of conch between dive sites. There was an extremely statistically significant difference ($t = 4.12$, $p = 0.0001$) between conch meat weights in the North and South.

Mean lip thickness in the south (0.52 in (13.1 mm)) was greater than in the north (0.24 in (6.04 mm)). Using lip thickness as a measure of maturity, the conch taken from sites in the south was significantly more mature. Despite this however, meat weights from the south samples were lower (at a mean of 0.99 lb (0.449 kg)) than from the north (at 1.39 lb (0.629 kg)). There was no significant difference in conch length (9.72 in (24.7 cm) in the north and 9.88 in (25.1 cm) in the south) or total weight (2.26 kg in the north and 2.33 kg in the south) between north and south populations sampled. The ratio of average total weight to average meat weight was 5.27 in the south, compared to 3.59 in the north.

It can also be concluded that, if the sites surveyed are representative of the situation in the north and south populations, and assuming that lip thickness is an accurate measure of maturity, the conch population in the north was younger than that in the south, which may be consistent with the statement made by Joseph (2003) that conch populations in the north were more heavily exploited.

7.1.7. Conch Sites and Substrates

The Saint Lucia conch fishery is, and has historically been deepwater stock. Sites where past fishers harvested conch were Donkey Beach, Gros Loup, Monchy, Esperance, Pigeon Point, Gros Islet, Marisule, Rat Island, Soufriere, Laborie, and Vieux Fort (see Figure 16 for these locations). Eighty three percent (83%) indicated that conch was found in seagrass, but rocky, sand and coral reef areas were also cited. Depths at which conch was harvested by past fishers ranged from 60 ft (18.3 m) to 120 ft (36.6 m)[14], with most frequently cited depths ranging from 80 ft (24.4 m) to 100 ft. (30.5 m). All past fishers used SCUBA, but some combined skin with SCUBA diving, suggesting that conch were also harvested at shallower depths. Those past divers (thirty six percent (36%)) who harvested conch by skin diving as well as with SCUBA, would free dive to depths ranging from 20 ft (6.1 m) to 50 ft (15.2 m). It may be concluded that conch were available at those depths at that time, but even then would not yield sufficient quantities for the commercial

[14] Joseph (2003) found that conch was being harvested at depths of 11m to 43 m in 2001. No fisher in this survey reported diving conch at less than 60' (18.3m).

diver. Present-day fishers mentioned all the sites mentioned by past fishers, as well as Micoud and the south-east coast (these last two areas were only mentioned by thirteen percent (13%) of fishers). Substrates indicated by present-day fishers were primarily seagrass (ninety one percent (91%)), with less than nine percent (9%) mentioning other substrates. Although most present-day fishers also cited typical dive depths of 80 ft (24.3 m) to 100 ft (30.5 m), some thirteen percent (13%) dived to depths of 110 ft (33.5 m) to 130 ft (39.6 m) in certain areas. The "favourite site" for the majority of both past (sixty four percent (64%) of respondents) and present-day fishers (fifty three percent (53%) of respondents) was Vieux Fort (Light House), and they said it was because the conch were more abundant there (this was not borne out by the results for the sites investigated in this study).

It can be concluded that fisher dive sites and substrates of the past and the present are very similar, except that

- no commercial diving now occurs at depths of less than 80 ft;
- some fishers are also diving slightly deeper, with maximum dive depths increased from 120 ft (36.6 m) to 130 ft (39.6 m); and
- by 2008, some new sites on the south-east coast were also being exploited by fishers.

Based on data gathered from fishers, it is concluded that conch is most usually found between the 80 ft (24.4 m) and 100 ft (30.5 m) depth contours, within an estimated 4700 ha in the south, and 3200 ha in the north of Saint Lucia, as delineated on the map in Figure 16, once suitable seagrass substrate exists. This is consistent with past research (Nichols and Jennings Clark (1994), Joseph (2003)) which concluded that Saint Lucia had two conch populations, one in the north and one in the south. Within these delineated areas, it is expected that conch would not be found if substrate was unsuitable.

7.1.8. Conch Densities and Abundance

The results of the physical resource assessment undertaken for this study reveal that conch distribution, even within areas with suitable substrate, is patchy. In all instances where there were conch fishers in the vicinity of the study dive site, they were bringing up conch even if none was found within the study transect. The study found conch densities in the north varying across five (5) sites from 0 ind./ha to 1293 ind./ha and between 0 ind./ha and 229.5 ind./ha across the four (4) south sites, with an average of 242.87ind/ha for the north and south sites combined.

Most fishers (past and present) indicated that the Vieux Fort Lighthouse site was a favourite because conch is plentiful there. This was not borne out by these results. However, the dive data did not account for the level of harvesting that may have recently occurred within the area. A present-day fisher indicated that fishers harvest conch in an area for about 2 weeks and then leave it for about 1 month to recover. Joseph (2003) noted a similar practice by fishers at that time. Fishers had been very active in the Gros Loup area in the period leading up to the study dives, and that may account for the low numbers found there. Fishers reportedly had not been diving the Marisule site recently, and that may account for the relatively high numbers found there. This may suggest that sites were recovering during no-harvest periods. It is not known how long the Marisule site had been left to recover; this information would have facilitated crude estimation of a recovery rate.

It is possible, according to some fishers surveyed, that conch may have been found in areas outside of those delineated in Figure 16, once suitable conditions prevailed (that is, depths of 60 ft (18.3 m) to 130 ft (39.6 m) and a seagrass substrate), but no investigation was conducted outside of the delineated areas (see Figure 16) to confirm this. Near-shore stocks were not investigated, but are not commercially exploited, presumably because they are small or non-existent.

Selection of sites within the areas delineated was not entirely random, as fishers accompanied the study vessel to known dive sites. In addition, although an estimate of conch areas in the north and south is made, the proportion of seagrass substrate (the habitat within which conch was most commonly found by preset-day fishers), within these areas was not known. In light of this, it would be inappropriate to use the densities obtained to estimate abundance.

7.2. Socio-Economic Contribution of the Queen Conch Today

7.2.1. Occupation and Dependency on Conch

Most of the present-day fishers interviewed (eighty eight percent (88%)) stated that their primary occupation was fishing. A large percentage (sixty eight percent (68%)) of the present-day conch fishers surveyed had a heavy dependence on Queen Conch fishing, and this was their primary or sole source of income, year-round. The survey results show that conch fishers dived conch at similar rates throughout the year, weather permitting. Only two other occupations were identified that part-time fishers used to supplement their income: policing (nine percent (9%) of the persons surveyed) and construction (five percent (5%) of the persons engaged). In the case of the Coast Guard officer, there is a high degree of compatibility between this occupation and fishing. It can be concluded that very few fishers turned to other sectors to supplement their income. There appears to be a greater tendency for other occupations to turn to fishing as a supplementary income source than for fishers to have an alternative livelihood. This may be due to the skills gained in the fishing occupation not being readily transferable, or simply due to lack of interest on the part of fishers. The concern in relation to this finding is that in the event the conch fishery faces any significant challenges, the available occupation options for full-time conch fishers seem limited to a movement to other types of fishing.

7.2.2. Age and Dependence

An analysis of the age distribution of the present-day fishers indicates that thirty-five percent (35%) of the persons surveyed were less than 30 years old. Further it reveals that more than sixty percent (60%)) of the fishers fell within the under-forty age group. However twenty two percent (22%) were over 50, with one (1) aged 63. An analysis of the age of the fishers and their sole dependence on Queen Conch fishing revealed that there was no statistical relationship. Many of the fishers were young enough to be able to acquire new skills or alternative ones if required to do so. It is vital that the younger conch fishers pay attention to national insurance, pensions and other sources of saving in order to sustain them when they can no longer engage in this activity. The older fishers may be more vulnerable, and less resilient to changes in the fishery.

When asked by the fishers “how many persons depended on them for their sustenance” the numbers varied from one to eight persons. In addition to the twenty two fishers (22) known to be involved in the fishery, more than 86 additional persons depended directly on the revenue generated from Queen Conch fishing.

Overall, forty one percent (41%) of the fishers interviewed were boat owners and the remainder (fifty nine percent (59%)) worked as divers, crew or captains. Results show that the average number of persons per fishing trip was generally between three and four consisting of persons who functioned as captain, diver and owner along with one or two crew members. Of the boat owners interviewed seventy-two percent (72%) were below the age of 30. It is also important to note that eighty-nine percent (89%) of the boat owners were also divers. This indicates a high tendency for divers to invest in the necessary equipment required to catch Queen Conch.

7.2.3. Fisher's Material Style of Life

Ninety-one percent (91%) of the fishers interviewed owned the house they lived in. Fifty percent (50%) of the respondents owned houses with wooden outer structures, whilst forty one percent (41%) had houses constructed of wall and/or wall and wooden structures. Information was collected on the household items owned by the respondents as this is indicative of their quality of life. An analysis of the amenities which the fishers owned revealed that more than ninety one percent (91%)) of them had water, electricity, television, cablevision, cell phone, stove and refrigerator in their homes. At least sixty eight percent (68%) of the fishers owned washing machine, VCR/DVD and flush toilet. Thirty two percent (32%) of the fishers interviewed indicated that they also had pit latrines.

Overall, from the data collected, the Queen Conch fishers appeared to have a "reasonable" standard of living. However, opportunities exist for government to provide additional assistance to this sector provided that it will result in the upgrading of the standard of living of the most disadvantaged amongst them.

7.2.4. Annual Harvest, Revenue and Fisher Satisfaction

From the data gathered from conch fishers surveyed in 2008, the crude estimated total number of Queen Conch which had been landed in Saint Lucia during the prior year (2007/2008) amounted to approximately 210,000 animals (see Appendix 8), or 133 metric tonnes of conch meat. This significantly exceeds the quantity of 41 tonnes estimated by DOF for 2007, and the maximum estimated annual conch landing during the last decade (60 tonnes), according to the DOF Fish Landing Database (2008). These higher estimates are derived on the basis of information provided by fishers on the number of boats involved in the fishery, number of fishing trips per week and the average number of conch landed per trip. It is assumed that the fishers went out for an average of 42 weeks per year[15], although fishers did provide estimated number of trips for each month of the year, and the average number of trips per week used in the calculation of conch landings was based on that figure. This estimated total landing of Queen Conch for 2007/2008 is then used to estimate the revenue generated by the fishers on the basis of an average price per lb of EC$14 and an average meat weight per conch of 1.4 lbs[16]. On the basis of these assumptions it is estimated that the conch fishery earned gross revenues of approximately EC$4.1 million during 2007/2008, for conch sold at EC$14 per lb.

A further analysis is undertaken to estimate the revenue which the conch harvest could have generated in 2007/2008 had conch been sold for EC$22 per lb by the fishers, which was the highest price it had reportedly fetched on the local market. On this basis, the maximum gross revenue this conch harvest could have generated over 2007/2008 is estimated at EC$6.45 million.

---

[15] Fishers may be unable to go out to sea during periods of bad weather, sickness, public holidays, vacation and boat down time for maintenance.

[16] The average meat weight of adult conch collected in this assessment was 1.4 lb.

Appendix 8 provides the calculation for each boat known to be involved in the conch fishery. For conch sold at EC$14/lb, assuming a share regime where the cost of fuel is deducted, the captain crew and boat each receive one share, and the diver receives two shares, it is estimated that, in 2007/2008, gross annual revenue earned by a full-time captain or crew ranged from EC$34,962 to EC$139,720, and by a full time diver, from EC$69,924 to EC$279,439. Part-time fishers[17] were estimated to earn between EC$10,063 and EC$64,487. The wide variance seen is attributed to the variances in number of trips made and number of conch landed per trip across vessels. For the twenty seven percent (27%) of fishers who combined roles of boat owner with captain and diver, they could earn between EC$40,252 for a part-time fisher and EC$558878 for a full-time fisher, according to these results. These are gross individual earnings and do not reflect fisher expenses incurred in the fishery, except for fuel. The expenses of boat owners and divers were significant, while those of captain and crew were minimal.

Although these estimates for 2007/2008 based on fisher-reported landings significantly exceed those of the DOF for 2007 taken from the DOF Fish Landing Database (2008), it is noted that the proportion of conch landed in Laborie (in boats 10 and 11 in Appendix 8) is 10,500 animals out of 210,000 animals, or 5% of the total landed. This is consistent with the ratio of 6% yielded by DOF database. The significant difference between DOF data and that generated from fisher reported landings is difficult to explain. It is possible that the DOF landing data underestimates the actual conch landings; it may be that the DOF method of data collection and manipulation is flawed, or that fishers are under-reporting their catch to Data Collectors and the DOF. In relation to the results of this study, it may be that surveyed fishers overestimated the quantities typically harvested, or the average number of weekly trips over the year. It is not expected that fishers kept a log of their actual activities in the fishery, and the information used in this analysis relied solely on their powers of recall.

All, but one (1) of present-day fishers (ninety five percent (95%) of respondents), considered conch fishing to be worth the effort, and all indicated their intention to remain in the fishery. All fishers were satisfied with the number and size of conch they caught. However, only fifty percent (50%) would encourage close family to get into the fishery, most of them because it was a profitable business to be in. Fifty percent (50%) would not because of the risks involved. Eighty two percent (82%) of these were divers. This information demonstrates the ambivalence of the fishers, particularly divers, involved in the industry. It was a good wage earner, but could be dangerous for divers. This was acknowledged in the double share typically earned by the divers.

[17] It is assumed here that part-time fishers do two or less conch fishing trips per week.

7.2.5. Fisher Costs and Expenses

The average boat was estimated to cost about EC$44,600 and the average engine cost was approximately EC$14,000. The variations in the prices cited for boats and engines were significant. All boat owners indicated significantly higher replacement costs. This means that the fishers' ability to replace their existing equipment (boat and engine) would require a significant capital investment.

It is difficult to assess the average cost of gear as costs of many gear items required were not quoted, and the costs of gear replacement provided by fishers varied widely. The average cost of gear replacement was EC$15,100.

Fisher responses regarding trip expenses varied widely with very low levels of consistency. The average gear cost per trip was EC$57.30. The average food cost per trip was EC$22. By far, the most significant component of the fishers' operational cost was oil and fuel, averaging EC$381/trip. It is therefore expected that the recent increases in the price of fuel will impact fisher operational costs.

In most cases the fishers did not provide the cost of maintaining their equipment. The average estimate of yearly expenses for maintaining equipment given by the fishers was EC$1,847. The average annual gear cost was estimated by fishers at EC$2,600. It is estimated based on prevailing material costs, that repainting the boat and engine servicing alone, would cost approximately EC$6,714 per year.

Boats were repainted and fiber-glassed usually once or twice a year and engines were serviced professionally when needed. Many fishers attempted to service their engines and repaint/fiberglass boat themselves rather than getting it done professionally. If the fishers possess the skills to do these effectively, this would significantly reduce expenses incurred. Additionally the proper maintenance of gear is another way fishers can save money.

It is concluded that the fishers made a significant investment in the conch fishery, and were themselves the owners of the required boats and gear. Generally financial institutions were not averse to lending monies to fishers. Further, Government offered a number of incentives to encourage fishers to participate in the sector. These included:

- a fuel rebate established in the late 1970's, set at EC $0.75 on each gallon in 2008, up to a maximum of 4500 gallons annually;
- an oil duty refund;
- a waiver of import duty on gear engines, boats and engines and other items; and
- a waiver of import duty on value-added plant and equipment procured in accordance with the Fishing Industry Incentive Act #33 of 1972.

Fisherman cooperatives were also eligible for incentives on certain imports. Boat owners and divers interviewed were members of either the Gros Islet Fisherman Cooperative or the Laborie Fisherman's Cooperative, presumable to benefit from such incentives.

7.2.6. Market Orientation by Fisher Preference (Reliability, Price, Convenience)

The majority of fishers in 2008 continued to sell from their traditional locations to their traditional markets, whether those were the general public or specific purchasers such as restaurateurs or vendors. The fishers simply de-shelled and landed the conch for sale. Sales were quick, and no storage was required prior to sale by the fishers. The fishers considered their markets to be reliable and stable.

According to the data obtained from some vendors (seventeen percent (17%)) and restaurateurs (twenty five percent (25%)), the price and availability of conch was seasonal, but seasons quoted were highly variable. Restaurateurs indicated that there was more conch available between October and May. Vendors indicated that more conch was available between November and July. Buyers consistently indicated that conch availability highs occurred in November and December. Interestingly, conch prices were higher during this period of high conch availability, according to the few who responded regarding seasonal prices of conch. Perhaps seasonal prices were determined more by the tourist season than conch availability. One restaurateur indicated that the fisher asking price could drop to as low as EC$8 per lb between June and October, although no fisher had reported a selling price of lower than EC$10 per lb. It is interesting that some fishers continued to offer a slightly lower price to hotels and restaurants, and to offer a lower price at certain times of the year. This was probably unnecessary, with the demand for conch apparently being so consistently high through the year. The demand for conch by its ultimate consumers appears not to be price sensitive, evidenced by the fact that the retailers and restaurants seemed to be able to demand the price that they wanted for their conch meat; conch meat fetched EC$22 per lb unprocessed at the retailers, and up to EC$200 per lb in some restaurants.

It is clear that the fishers no longer saw the SLFMC as a viable outlet for their catch. What is also noteworthy is the price that the SLFMC paid for imported Queen Conch was much higher than the price of Queen Conch on the local market, or than the price they were prepared to pay local fishers. An analysis of the price of conch on the local market and the price of importation should be heartening for fishers as it indicates the possibility for the fishers to increase their prices without becoming uncompetitive.

7.2.7. Demand from the Post-Harvest Sector

There was a very high local demand for Queen Conch, throughout the year. Many fishers (forty five percent (45%)) listed the general public as their sole market, with the remainder selling to the general public, vendors and restaurants. The contribution of Martiniquan visitors to the conch demand is not known. Although fishers themselves did not mention conch sales to French visitors, several vendors and restaurateurs were of the view that a significant number of French nationals purchased conch during visits to Saint Lucia, to take back to Martinique. It is difficult to accurately gauge quantities that were taken into Martinique in this way.

Sixty five percent (65%) of vendors and eighty percent (80%) of restaurateurs indicated that availability of conch has declined, although many of them (sixty one percent (61%) of vendors and thirty five percent (35%) of restaurateurs) were actually buying more conch than in the past. Ninety six percent (96%) of vendors and eighty percent (80%) of restaurateurs indicated that they would

be able to sell more conch if it was available. This was due to high customer demand, including an increase in demand at cultural and touristic events such as the Jazz Festival, fish fry and Journet Kweyol which attracted significant crowds. Conch supplies were usually exhausted well before these festivities are over. Only fifteen percent of restaurants surveyed offered conch daily, due to limited availability. The remainder offered conch less frequently due to limited availability.

Most vendors purchased conch from fishers rather than retailers. Twenty (20) out of twenty three (23) vendors interviewed indicated that they go to the fishers to purchase Queen Conch. One (1) purchased from the SLFMC and the other two (2) patronised both the Corporation and the fishers. Fourteen (14) restaurateurs (seventy percent (70%)) purchased from fishers, and the remainder from retailers. It is presumed that some restaurateurs preferred the convenience of purchasing from a retailer, likely in larger quantities than would be available from the fisher in one purchase, and were prepared to pay the price difference for that convenience. Many restaurateurs purchased relatively large quantities and stored for later use. The restaurateur mark-ups likely allowed them the luxury of purchasing at the higher price demanded by retailers.

The mark-up placed by restaurants on conch was high, and a higher proportion of their clientele (compared to vendor clientele) comprised visitors; vendors sold to a greater proportion of locals and did not place as large a mark-up on conch, as evidenced by the relatively small profits reported by vendors. However, the contribution of conch sales to total income was more important to vendors than to restaurateurs. The income from conch was not significant for seventy one percent (71%) of restaurateurs, but comprised a ¼ to ½ of total income for forty eight percent (48%) of vendors, throughout the year.

In addition to the vendors and restaurants the other persons engaged in the purchase of Queen Conch on a regular basis were the retailers, SLFMC and SFSSL. The SLMFC in 2008 imported conch on an infrequent basis, and did not buy local conch, despite the high demand from consumers. The SFSSL was a large purchaser of local conch from a middleman, supplemented by imported supplies from Bequia in the Grenadines. The retailers bought conch in bulk and stored in freezers for long periods.

The demand analysis undertaken yields an estimated total annual demand of 239,330 lbs (108,540 kg) in 2008 (See Table 48). Although based on fairly broad assumptions about the quantum of demand of different conch consumer groups, this estimated demand is nonetheless in the same order of magnitude as the estimated total conch landed based on fisher data, which predicts that 293,000 lbs (132,880 kg) of conch will be landed in 2007/2008. Based on data generated under this study, the projected demand and landing figures for 2008 are similar.

What is clear is that, in general, all sectors of the market had indicated an increase in the demand for Queen Conch as their customer base broadened and business improved. Both availability of Queen Conch and customer demand were constant over the year, with no significant peaks, and the fishers were able to sell all their harvest on the local market, throughout the year.

7.2.8. Economic Contribution and Trade

Fishing, including Queen Conch fishing, although still artisanal in nature, was an important social and economic activity in Saint Lucia. The artisanal fishers typically operated small boats of less than 25ft (7.5 m) in length and used traditional fishing methods such as the fish pot. However, the

local fishing sector was a significant supplier of fish for the growing tourism industry, as well as for local consumption.

According to the Saint Lucia Social and Economic Review, fish landings contributed EC$19.6 million to the GDP in 2007. The DOF Fish Landing Database (2008) indicated that the Queen Conch fishery contributed only 2.7 % of the fish landed in Saint Lucia In 2007. However, in light of the relatively high value of Queen Conch, this was estimated by DOF to represent six percent (6%) or EC$1.07 million of the fishing sector's contribution to GDP. The DOF Fish Landing Database (2008) indicated that a total of 41.01 tonnes of conch was landed in Saint Lucia which, if sold at an average of EC$14 per lb, contributed an estimated EC$1.26 million to the fisheries sector. It is believed, based on the findings of this study, that the DOF conch landing and ex-vessel value figures are underestimated; an estimated 133 tonnes would be landed in 2007/2008, with total gross earnings of fishers estimated at EC$4.11 million, using data provided by fishers.

Although Queen Conch landings in Saint Lucia had reportedly not increased significantly over the decade leading up to 2008, there was a greater market demand, expressed by most of the conch meat buyers and evidenced by the ability of fishers to immediately sell all conch landed without any need for storage. This increased demand was driven by the increase in population, an increase in the number of fish-fry and other festival activities held across the island, and the growth of the tourism industry. Queen Conch was considered a luxury item and was included on the menu of 31 of restaurants and hotels throughout the island.

The small vendors as well as the hotels and restaurants were significant players in the local economy. They depended, for at least ninety-five percent (95%) of their conch supply (in the case of restaurateurs), on the local conch fishers. They all made significant revenues from their sales, and the conch fishery was of economic and management significance to them. The survey has revealed however, that there exists significant price differentiation in the various markets. There existed a difference in the price paid to the fishers by the general public and vendors as compared to that paid by restaurants and hotels. Furthermore, the same product fetched a significantly higher price when sold by a restaurant as opposed to by a vendor. It is clear that the hotels and restaurateurs were the ones who obtained the largest return on their investment in the purchase and sale of conch meat. Their margins were significantly larger than any other sector. The analysis in Table 48 reveals that although they only purchased an estimated twenty five percent (25 %) of the locally harvested conch it is estimated that they generated eighty one percent (81%) of the added economic benefit. The disparity in the margins made by the vendors as compared to the restaurateurs and retailers is indicative of the ability of vendors to increase their price substantially without necessarily affecting customer demand. However the reality is that it was a very competitive sector and as such the ability of vendors to control their selling price was limited. The barrier to entry of new vendors into this sector was very low, placing pressure on existing vendors to maintain their margins at a low level.

All of the hotels and restaurants that offer conch on their menus were not included in the analysis in Table 48, and it is therefore expected that this estimated value-added may be lower than actual. Notwithstanding this limitation of the analysis, the information provided in Table 48 is a fairly good estimate of the contribution of conch to the local economy in addition to that already gained by the fishers. It is estimated that EC$2.95 million of additional revenue is generated in the local economy through the re-sale of locally harvested conch meat, either in its raw form or cooked.

There was no evidence of a significant level of trade (legal or illegal) in Queen Conch between Martinique and Saint Lucia, although there was anecdotal evidence that Martiniquans took the opportunity to purchase conch when visiting Saint Lucia by boat. Several survey respondents were of the view that this was a significant contributing factor to conch scarcity in Saint Lucia. A small proportion of Queen Conch on the Saint Lucia market was imported by retailers into Saint Lucia from Bequia (Saint Vincent and the Grenadines), as well as Miami. One restaurateur also bought conch from sources in Saint Vincent, but the method of procurement was not specified.

This survey has contributed to understanding the socio-economic importance of the conch fishery to the various stakeholders. The fishers themselves had made significant investments in the industry through the ownership of boat and gear, and the Queen Conch fishery in 2008 represented a year round, primary source of income to the majority of fishers engaged in this fishing sub-sector, and a significant source of additional income to the few fishers engaged in the sector on a part-time basis. There existed a number of vendors and restaurants, and at least one retailer, who also generated significant revenue from the sale of Queen Conch. It is concluded that the conch fishery was of great social and economic importance to the fishers and various stakeholders actively engaged in the purchase and sale of conch.

There had been significant investment in the tourism sector in recent times, resulting in an economic environment that seemed conducive to continued strong growth in the conch fishery. The result of this study reveals the ability of the fishers to sell all conch landed and this situation is likely to improve with the continued growth in the tourism sector and associated improvements in the local economy. The extent to which the Queen Conch fishers can take advantage of these opportunities will depend on their level of organization, the degree to which they see themselves as price setters as opposed to price takers, and their ability to sustain the fishery.

Although the Queen Conch product which was most widely traded and from which the greatest economic return was derived is conch meat, there were other by-products, namely the shell and the pearl, from which economic value was derived. In light of the limited revenue generated by the sale of the shell coupled with the limited data available on the pearl, no detailed analysis is undertaken on these two by-products. However, preliminary investigations suggest that an additional EC$150,000 could be generated annually from their sale.

7.3. Conch Fishery Management

Fisher registration by the DOF commenced in 1992. The ten (10) boats described by respondents under this survey were registered, but only nine (9) (ninety percent (90%)) were confirmed as licensed in 2008 (no information was provided concerning the tenth boat in this regard).

Conch fishers were not differentiated from other fishers in the DOF register. The database up to December 2007 listed 1365 full-time fishers and 867 part-time fishers as registered, with part-time fishers being defined as those who had other occupations of greater importance than fishing. Fishers were only removed from the DOF registration list when they were known to have died, and the DOF acknowledged that the list likely provided an inflated estimate of numbers of fishers and needed to be updated. This study revealed that there were only twenty three (23) active conch fishers, three (3) of whom were part-time. Eighteen (18) (eighty two percent (82%)) of present-day conch fishers surveyed were registered. It is concluded that the number of fishers involved in the conch fishery was relatively small; conch fishers comprised approximately one percent (1%) of all registered fishers. This may be in part because of the DOF requirement for SCUBA divers involved in the fisheries sector to obtain a permit issued by the DOF. However, it is also concluded that the register may have over-estimated the number of fishers in Saint Lucia, even if all present-day fishers were not registered. There is a need to update the register and make an effort to capture all present-day fishers under the registration and licensing exercises.

Although the DOF had indicated to fishers that conch should be landed whole, this was not the law, and was not practised by the majority of fishers in 2008. Landing of whole conch would facilitate measurement of the shell lip thickness; the draft regulations propose to limit conch harvested to those with a lip thickness exceeding 5 mm (0.20 in), as conch meeting this criteria are sexually mature. This criterion is easy both to comply with and to monitor. However, the fishers may resist landing conch whole, as disposal of shells on shore becomes an issue for them.

Catch and effort data in 2008 was recorded at conch landing sites by DOF Data Collectors. At that time, the catch and effort data did not document conch maturity as conch was not landed whole, and it was not known by the DOF what proportion of the conch harvest actually comprised juvenile conch.

It is generally believed that the DOF has a good knowledge of the fishers engaged in the sector. This, in addition to the fact that the number of fishers engaged in the sector is not very large, means that continued and upgraded socio-economic monitoring of the Queen Conch fishery is quite feasible. To be effective however, it is required that the mechanisms used to monitor the fishery be strengthened and expanded to include socio-economic monitoring data. This will serve to show the full importance of this activity to the local economy as well as inform proper management of the sector. Any decision to change the management regime for the sector should be based on the availability of quality time series data which shows trends in catch and effort as well as the benefits to fishers and the sustainability of their livelihoods.

There was some level of resistance on the part of some fishers to provide the information required to monitor the sector. In this instance, three present-day fishers refused to participate in the survey. Although the fact that they are in the minority is heartening, in order for the socio-economic monitoring of the sector to be effective and accurately capture the required data, this must be

addressed. An effort should be made to work with fishers to develop participatory monitoring and management regimes. Sixty eight percent (68%) of present-day fishers surveyed were of the view that Government and fishers should jointly make decisions on the conch fishery management. Twenty seven percent (27%) thought it should be left to fishers. There is therefore a willingness on the part of many fishers to work with the Government. Fishers as a group are very knowledgeable about the fishery, and the authorities should engage them before taking management decisions that will affect the fishery and their livelihoods.

Future research should be directed at measurable factors influencing the Queen Conch population's rate of increase, such as spawning stock location and size. Spawning sites have not been identified in this study. It is likely that they would be located in waters of less than the 80 ft (24.38 m) depth investigated here, as the literature indicates that conch migrate to shallower waters during spawning.

8. RECOMMENDATIONS

8.1. Review of Conch Prices and Opportunities to Add Value

Fishers have not changed how they have sold conch over time, and appear very comfortable and secure with their markets. There is an opportunity for fishers to increase their asking price of conch, and the need for wholesale and seasonal rates is questionable, as the demand for conch appeared to exceed supply throughout the year. Fishers, perhaps via their Cooperatives, should also explore the market for processed conch so that they may vary the product they sell, and increase the value added to their sales.

Fisher costs have undoubtedly increased significantly over 2008 with increases in fuel prices, and this alone would justify an increase in their asking prices for conch meat. Fishers should be engaged by the DOF to identify the extent to which increases in the cost of fuel and other inputs are impacting on their livelihoods, and to determine possible strategic responses they and the DOF can employ to address this challenge.

The conch shell is of significant value in other Caribbean territories, and the opportunities to use this by-product should be explored and encouraged. The conch shell is usually discarded in shallow waters by fishers. Markets for conch shells should be explored, and possible ways of adding value to the conch shell investigated. In some countries, intricate carvings/etchings are made on the conch shell. If it had value, fishers would be more likely to retain the shell and thereby conform with the DOF policy/future regulations to land conch whole, facilitating improved DOF monitoring of the fishery and adding further value to the conch fishery.

The conch fishery contributes significantly to the income of twenty three (23) conch meat vendors and two (2) conch shell vendors. It also contributes to a lesser degree to the income of the owners and employees of at least thirty one (31) restaurants. Vendor mark-ups are currently far lower than those of restaurants, and although they operate in a different market environment, there may also be an opportunity for vendors to increase their asking prices for cooked conch.

8.2. Conch Fishery Management

DOF efforts at monitoring, regulating and enhancing the fishery should be intensified. Notwithstanding the conclusion that may be drawn from fisher survey data that conch stocks are not under pressure, conch meat purchasers are of the view that supplies are limited and diminishing. Only by regularly monitoring stocks can the situation be properly assessed. It is recommended that:

- Catch and effort data collection should be improved by also gathering data on conch dive sites, and conch maturity information. Monitoring should also be expanded to include information on areas fished by all commercial conch vessels.
- Stocks should be monitored intermittently, to ascertain the impact of harvesting at current levels.
- Registration and licensing regimes should be improved to ensure that the majority of fishers are captured, and are compliant with license conditions. Most fishing boats were registered and licensed. Several fishers (sixteen percent (16%)) were not registered. An effort should be made to rectify this, and the DOF register should be re-designed to capture conch fishers separately from other types of fishers.
- Collection of conch resource as well as socio-economic information should be continued to ensure that:
    - the status of the resource as depicted by the fishers is accurate;
    - an assessment of how existing management measures are affecting the stock and stakeholders can be made; and
    - any new management measures required may be instituted on a timely basis.

  This will facilitate an adaptive management approach to the management of the conch resource, and must be adopted if the resource is to be preserved.
- Future research should identify spawning sites, as protection of these is critical to the sustainability of the fishery. Research is also needed to determine recovery rates, conch behaviour and other conch sites. Another SFA 2003-funded project is mapping coastal and marine habitats. This will yield information on location of seagrass areas (potential conch substrates including spawning sites) that should be investigated in the future for conch populations.
- Further effort should be made by DOF to ensure that all SCUBA users are certified, use appropriate gear, and are re-trained intermittently, as a condition of their permits. All commercially harvested conch is by diver using SCUBA gear. Despite many divers (seventy five percent (75%)) in 2008 being certified or having undergone some training by the DOF, many exhibited unsafe diving practices, by remaining underwater for too long, doing too many consecutive dives, or undertaking dives too close together. Twenty five percent (25%) of SCUBA users diving conch were untrained.
- Fisher awareness activities should be initiated. Fisher awareness of conch biology and behaviour, and of requirements under CITES and HACCP was very low. Twenty two

percent (22%) were unaware of the existing laws governing the fishery. Fishers should have a clearer understanding of the Queen Conch biology and behavior so that they may understand the rationale for existing laws and restrictions.

- Conch fishers should be more engaged in DOF decisions regarding the fishery to foster stewardship and to improve the sustainable management of Queen Conch, in their best own interest. Several fishers were suspicious of the motives for, and thus refused to participate in this survey. The DOF must therefore continue to engage the fishers with the ultimate objective of passing on relevant information to the fishers, equipping them with new skills as well as assuring them that the DOF is working in their best interest.
- Efforts of the DOF should also seek to offer conch fishers training in the following areas:
    - Simple accounting, record keeping and business management
    - Planning for retirement
    - Boat and gear maintenance
    - Health and safety
- Conch vendor awareness and training activities should also be considered. They are important stakeholders in the conch fishery. If vendors are more informed about conch biology and management issues, they may better appreciate conch fishery sustainability concerns, and share such information with their customers. They would also benefit from training in small business management.

REFERENCES

www.nmfs.noaa.goc/pr/species/invertebrate/ queenconch.htm (website of the NOAA Fisheries Office of Protected Resources)

www.cites.org

draft Plan for Managing the Fisheries of Saint Lucia (2006-11), Department of Fisheries, Ministry of Agriculture, Forestry and Fisheries.

Fisheries Regulations (No. 9 of 1994)

Draft fisheries regulations, Department of Fisheries, Ministry of Agriculture, Forestry and Fisheries.

Draft International Trade in Wild Fauna and Flora Bill, Department of Forestry, Department of Fisheries, Ministry of Agriculture, Forestry and Fisheries.

SPAW Protocol.

CITES Convention.

Anon. (1999). Report on the Queen Conch Stock Assessment and Management Workshop. Belize City, Belize, 15-22 March 1999. Caribbean Fisheries Management Council and CARICOM Fisheries Resources Assessment and Management Programme. http://www.strombusgigas.com/belizeConchWGreportFinal. pdf

Appeldoorn, R.S. (1988). Age determination, growth and mortality and age of first reproduction in adult Queen Conch Strombus gigas L., off Puerto Rico. Fish Res. 6: 363-378.

Appeldoorn, R.S. (1994). Queen Conch management and research: Status, needs and priorities. In: R.S. Appeldoorn and B. Rodríguez (Eds.). Queen Conch biology, fisheries and mariculture, Fundación Científica Los Roques, Caracas, Venezuela. pp. 301-320.

Brownell, W.N. (1977). Reproduction, laboratory culture and growth of Strombus gigas, Strombus costatus and Strombus pugilis in Los Roques, Venezuela. Bull Mar Sci 27: 668-680.

Davis, M. and Stoner, A.W. (1994). Trophic cues induce metamorphosis of Queen Conch larvae (Strombus gigas Linnaeus). J Exp Mar Biol and Ecol 180: 83-102.

Joseph, W. (2001). Conch Data Collection and Research Activities for Saint Lucia, Department of Fisheries, Ministry of Agriculture, Forestry and Fisheries.

Joseph, W. (2003). Saint Lucia Conch Assessment and Management Activities Report for 2nd Lobster and Conch Working Group Meeting, Department of Fisheries, Ministry of Agriculture, Forestry and Fisheries.

Mitton, J.B., Berg, C.J. and Orr, K.S. (1989). Population structure, larval dispersal, and gene flow in the Queen Conch, Strombus gigas, of the Caribbean. Biological Bulletin 177: 356-362.

Nichols, K. and Jennings-Clark, S. (1994). An overview of the Conch Industry in Saint Lucia, West Indies. In: RS Appeldoorn and B. Rodríguez (eds.). Queen Conch biology, fisheries and mariculture, Fundación Científica Los Roques, Caracas, Venezuela. pp. 25-28.

Oxenford, H. A., Fields, A., Taylor, C., amd Catlyn, D. (2007). Fishing and marketing of Queen Conch (*Strombus gigas*) in Barbados. Centre for Resource Management and Environmental Studies (CERMES), UWI, Barbados.

Pierre-Nathaniel, D. and Nelson, T. (2006). Sea Turtles: A Historical Perspective. The Case of Saint Lucia, Department of Fisheries, Ministry of Agriculture, Forestry and Fisheries.

Randall, J.E. (1964). Contributions to the biology of the Queen Conch Strombus gigas. Bull. Mar. Sci Gulf. Carib. 14:246-295.

Saint Lucia Social and Economic Review (2007), Government Printery.

Sandt, V.J. and Stoner, A.W. (1993). Ontogenetic shift in habitat by early juvenile conch Strombus gigas: patterns and potential mechanism. Fish. Bull. 91:516-525.

Stoner, A.W. (1997). The Status of Queen Conch, Strombus gigas, Research in the Caribbean. Marine Fisheries Review 59(3) 14-22.

Stoner, A.W. and Glazer, R.A. (1998). Variation in natural mortality: implications for Queen Conch stock enhancement. Bull. Mar. Sci., 62(2): 427-442.

Stoner, A.W. and Ray-Culp, M. (2000). Evidence for Allee effect in an over-harvested marine gastropod: density-dependent mating and egg production. Mar. Ecol.Prog.Ser.202:297-302.

Stoner, A.W. and Waite, J.M. (1990). Distribution and behavior of Queen Conch Strombus gigas relative to seagrass standing crop. Fish. Bull. US 88:573-585.

Stoner, A.W., Ray, M. and Waite, J.M. (1995). Effects of a large herbivorous gastropod on macrofauna communities in tropical seagrass meadows. Mar Ecol Prog Ser 121: 125-137.

Stoner, A.W., Ray, M., Glazer, R.A. and McCarthy, K.J. (1996). Metamorphic responses to natural substrata in gastropod larvae: decisions related to postlarval growth and habitat preference. J Exp Mar BioL Ecol 205:229-243.

Tewfik, A. and Appeldoorn, R. S. (1998) 1997 Queen Conch (*Strombus gigas*) Abundance Survey and Potential Yield Estimates for Pedro Bank, Jamaica (Final Draft Report)

UNEP-WCMC (2001 and 2002). CITES Annual Report Data showing net trade compiled by UNEP-World Conservation Monitoring Centre, Cambridge, GB.

PERSONS INTERVIEWED/MET[18]

Fisheries Department:

Susanna de Beauville-Scott, Fisheries Biologist

Sarita Williams-Peter, Fisheries Biologist

Patricia Hubert-Medar, Fisheries Assistant

Daniel Medar, Fisheries Assistant

Rufus George, Deputy Chief Fisheries Officer

Petronella Polius, Fisheries Extension Officer

Marcel Edwin, Fisheries Extension Officer with responsibility for Micoud, Praslin and Dennery

Saint Lucia Fish Marketing Complex:

Claudius McCombie, Marketing Representative

Superior Fish Seafood Suppliers Ltd

David Hippolyte, Manager

Seafood Supplier

Abi Simeon

Fishers

Colins "Admiral" Prospere

Erskine "Ski" Bernard

[18] Survey respondents are not included

APPENDIX 1 RESTAURANTS CONTACTED AND SURVEYED

#	Restaurant name	Title	Conch on menu (Y/N)	Responded to Survey (Y/N/NA)
1.1	Bay Garden Hotel	Executive Chef	Y	Y
1.2	La Dera Resort, Dasheene	Executive Chef	Y	Y
1.3	Debbie's Homemade Food	Cook	Y	Y
1.4	Golden Inn Restaurant	Manager	Y	Y
1.5	Resting Place restaurant	Manager	Y	Y
1.6	Cotter Refreshment Bar	Purchaser	Y	Y
1.7	Discovery at Marigot Bay	Executive Chef	Y	Y
1.8	Caribbean Jewel	Chef	Y	Y
1.9	East Winds Inn	Chef	Y	Y
1.10	Caribbean Pirates	Owner	Y	Y
1.11	Hardest Hard Restaurant	Manager/ Purchaser	Y	Y
1.12	Le restaurant De Romantique	Assistant Manager	Y	Y
1.13	Jackie's Place	Chef	Y	Y
1.14	Majorie's Family Restaurant	Purchaser	Y	Y
1.15	Breadfruit Corner	Proprietor	Y	Y
1.16	Ginette's Place	Owner	Y	Y
1.17	Plante Place	Purchaser	Y	Y
1.18	Real Fishery	Purchaser/Chef	Y	Y
1.19	The Market Place Restaurant	Manager	Y	Y
1.20	Francis St. Lovis (close to Glass Motors)	Chef	Y	Y
2.1	Bay Gardens Inn	Chef	Y	N
2.2	Village Inn and Spa	Chef	Y	N
2.3	Royal St. Lucian	Chef	Y	N
2.4	Sandals Halcyon	Chef	Y	N
2.5	The Buzz	Owner	Y	N
2.6	Reef restaurant		Y	N
2.7	Almond Smugglers Cove	Chef	Y	N
2.8	Rex St Lucia Papillon	Chef	Y	N
2.9	Ti Kaye Village	Chef	Y	N
2.10	Ti Bannane Caribbean	Food & Beverage Administrator	Y	N
3.1	Café Claude	Owner	N	NA
3.2	Marigot Beach Resort	Chef	N	NA
3.3	Chateau Mygo	Bartender	N	NA
3.4	Anse Chastanet	Chef	N	NA
3.5	Casa del Vega	Manager	N	NA
3.6	Coco Creole	Financial Comptroller	N	NA
3.7	Coconut Bay	Chef	N	NA
3.8	Auberge Seraphine	Chef	N	NA
3.9	Fond Doux Plantation Resort	Manager	N	NA
3.10	Fox Grove Inn	Owner/Manager	N	NA
3.11	Ginger Lily Hotel	Receptionist	N	NA
3.12	Green Parrot Restaurant	Receptionist	N	NA
3.13	Harmony Suites	Chef	N	NA
3.14	Hummingbird Beach Resort	Chef	N	NA
3.15	JJ's Paradise	Bartender	N	NA

#	Restaurant name	Title	Conch on menu (Y/N)	Responded to Survey (Y/N/NA)
3.16	Juliette's Lodge	Manager	N	NA
3.17	Kimatrai Hotel	Manager	N	NA
3.18	La Haut Plantation	Food & Beverage Manager	N	NA
3.19	MJI Hotel		N	NA
3.20	Rendevous	Chef	N	NA
3.21	Sandals Grande	Sous Chef	N	NA
3.22	Coal Pot	Waitress	N	NA
3.23	Friends Café and Patisserie	Cashier	N	NA
3.24	Froggie Jacks Ltd	Accountant	N	NA
3.25	Golden Harvest Restaurant	Waitress	N	NA
3.26	Green Peppers Restaurant	Waitress	N	NA
3.27	Kimlans Restaurant	Supervisor	N	NA
3.28	Jambe de Bois	Waitress	N	NA
3.29	Sandals Regency	Chef	N	NA
3.30	Stonefield Estate Villas	Food & Beverage Manager	N	NA
3.31	Villa des Piton Hotel	Chef	N	NA
3.32	Village Inn and Spa	Chef	N	NA
3.33	Windjammer Landing	Chef	N	NA
3.34	Beach Facilities Co Ltd	Chef	N	NA
3.35	Bon Manger	Chef	N	NA
3.36	Castaways	Owner	N	NA
3.37	Pirates Cove Restaurant	Waitress	N	NA
3.38	Scuttlebutts		N	NA
3.39	Shernells Cafeteria	Waitress	N	NA
3.40	Spinakers	Owner	N	NA
3.41	The Wharf	Waitress	N	NA

APPENDIX 2 VENDORS INTERVIEWED

Number	Vending Location	Vendor Name
1.1	Anse La Raye	Terrencia Mederick
1.2	Anse La Raye	John Mitchell
1.3	Anse La Raye	Florentia Arthur
1.4	Anse La Raye	Jostina Magloire
1.5	Anse La Raye	James Alexander
1.6	Anse La Raye	Eulaluis Bascom
1.7	Anse La Raye	Uris Augustin
1.8	Anse La Raye	Adriana Augustin
1.9	Anse La Raye	Julitta Joseph
2.1	Laborie	Bernard Jn Baptise
2.2	Laborie	Roseline Modeste
2.3	Laborie	Martina Clerice
2.4	Laborie	Raphaelina Fadlin
2.5	Dennery	Nelcia Nelson
2.6	Dennery	Paulevette
2.7	Dennery	Valentina alphonse
2.8	Dennery	Jennef Sylvain
2.9	Dennery	Alison Edwin
2.10	Dennery	Sonia Henry
2.11	Dennery	Celine Monel
2.12	Dennery	Rita Joseph
3.1	Gros Islet	Lydia Alcide
3.2	Gros Islet	Patsy Raphael
3.3	Gros Islet	Berthilia Steven

APPENDIX 3 FORM FOR CONCH RESOURCE DATA COLLECTION

Dive No:

Date:

Dive time:

Biological data collection time:

Transect details:

Substrate:

Topography:

Weather:

Depth (feet):

Coordinates:

#	Flared lip Y/N	Shell length cm	Lip thk mm				J/A [19]	Tot wt kg	Sex M/F/U	Meat wt kg	Notes
			i	ii	iii	avg					
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											

[19] Juvenile J or Adult A

APPENDIX 4 SELECT PHOTOS OF CONCH DIVE SITES AND LANDINGS

Fishers in the vicinity of the Gros Loupe dive site on 16/7/08. Although no conch was picked up within the transect, 5 fishing boats in the vicinity were all harvesting conch.

Conch taken from 2 dive sites on 25/7/08 at Marisule/La Brellotte Bay.

Conch taken from Moule a Chique on 8/8/08.

Conch taken from Esperance on 13/8/08. Two of the three specimens were dead, with severely eroded shells.

Conch taken from Laborie/Vieux Fort on 5/9/08. One of these although apparently undamaged, did not contain an animal.

APPENDIX 5 SUMMARY OF DIVE SITE INFORMATION AND RESULTS

The table below summarises dive site information and results. Biological data is contained in Appendix 6.

Dive	Date	Location	Coordinates	Depth (feet)	Transect area (m^2)	Topo.	Substrate	Conch fishers in vicinity	No. of conch in Transect
1	16/7/08	Gros Loup	N 14°07.117′ W60° 54.676′	82	274.5	flat	stony on sand bottom, little vegetative cover	4 boats	0
2	25/7/08	La Brelotte Bay	N 14° 04.584′ W61° 01.121′	85-90	247.5	quite flat	stony bottom heavily encrusted, macro algae and sponge, very little sand	1 boat	13 live
3	25/7/08	Marisule	N 14° 04.217′ W61° 01.108′	87-94	247.5	Flat	do.	1 boat	31 live 1 dead
4	8/8/08	Moule a Chique lighthouse	N 13° 42.191′ W60° 57.378′	87.9	247.5	flat	stony bottom heavily encrusted, macro algae (more than other sites to date)	1 boat	3 live
5	8/8/08	Moule a Chique lighthouse	N 13° 40.978′ W60° 56.665′	106	247.5	flat	do.	1 boat	0
6	13/8/08	Gros Loup	N 14° 07.032′ W60° 54.524′	85	2827	Flat	dense stony bottom, little vegetation, patchy coral heads	1 boat	1 live 2 dead
7	13/8/08	Esperance	N 14° 06.753′ W60° 54.108′	100	1684	flat	do.	1 boat	1 dead
8	5/9/08	Laborie	N 13° 43.611′ W60° 59.848’	98.5	36	quite flat	boulder bottom heavily encrusted, macro algae, very little coral, very little sand visible under boulders	None	0
9	5/9/08	Laborie	N 13° 42.673′ W60° 59.807′	90.3	305	quite flat	do.	none	6 live 1 dead

APPENDIX 6 BIOLOGICAL AND MATURITY DATA FOR CONCH SPECIMENS TAKEN FROM 9 DIVE SITES

Dive 1: 0 conch

Dive 2:

No	Juvenile /Adult	shell length (cm)	lip thickness (mm)				total weight (kg)	meat weght (kg)	sex (M/F)	Flared lip	erosion of lip
			i	ii	iii	avg					
1	J	25.9	1.7	1.6	1.8	1.7	2	0.5	F	N	did not check
2	J	24.9	0.7	0.8	0.9	0.8	1.6	0.4	F	N	did not check
3	A	22.8	13.7	14	14.6	14.1	2.5	0.5	M	Y	did not check
4	A	22.4	13.4	13.5	13.1	13.3	2.5	0.6	M	Y	did not check
5	A	24.3	12.8	14.2	12.8	13.3	2.5	0.55	F	Y	did not check
6	A	24.9	14.8	14.9	14.3	14.7	2.4	0.8	M	Y	did not check
7	A	24.5	9.8	11.6	9.4	10.3	2.7	0.8	F	Y	did not check
8	A	25.9	13.7	12.4	12.7	12.9	3.2	0.7	F	Y	did not check
9	A	25.9	11.9	11.3	11.3	11.5	3.1	0.8	M	Y	did not check
10	A	23.1	14.1	14	14	14.0	2.2	0.8	M	Y	did not check
11[20]	A	27.4	16	16.2	16.1	16.1	3.3	0.6	F	Y	did not check
12	A	24.5	15.5	15.6	15.6	15.6	2.8	0.95	F	Y	did not check
13	A	24.8	14.9	13.6	14.1	14.2	2.9	0.8	M	Y	did not check

Dive 3:

No	J/A	shell length (cm)	lip thickness (mm)				total weight (kg)	meat weght (kg)	sex (M/F)	Flared lip	erosion of lip
			i	ii	iii	Avg					
1	J	25.7	3.3	3.6	3.1	3.3	2.2	0.6	F	N	did not check
2	J	22.6	3.8	2.4	2.5	2.9	2	0.55	M	N	did not check

[20] intestines not included in meat weight

No	J/A	shell length (cm)	lip thickness (mm)				total weight (kg)	meat weght (kg)	sex (M/F)	Flared lip	erosion of lip
3	J	24.4	2.3	1.6	2.2	2.0	1.8	0.6	M	N	did not check
4	J	25.1	1.9	2	2.1	2.0	2.3	0.6	F	N	did not check
5	SA	24.9	1.1	1.6	1.9	1.5	2	0.6	F	Y	did not check
6	SA	23.7	2.8	2	2.6	2.5	2	0.7	F	Y	did not check
7	A	24.3	6.1	5.7	6.1	6.0	2.2	0.7	M	Y	did not check
8	A	26.4	3.9	3.8	33.2	13.6	2.5	0.65	F	Y	did not check
9	SA	24.9	1.5	1.5	1.6	1.5	1.9	0.5	M	Y	did not check
10	SA	25.8	2.4	1.5	2.4	2.1	2.5	0.55	F	Y	did not check
11	J	24.4	1.2	1.3	0.9	1.1	1.8	0.6	M	N	did not check
12	SA	23.4	0.8	1.4	1.9	1.4	2.2	0.6	M	Y	did not check
13	J	24.4	2	1.4	1	1.5	2.1	0.7	M	N	did not check
14	A	24.7	4.9	5.1	5.4	5.1	2.2	0.7	M	Y	did not check
15	J	24.8	2.4	1.7	1.8	2.0	2	0.5	M	N	did not check
16	J	24.3	1.3	2	2.2	1.8	1.9	0.6	F	N	did not check
17	A	25.7	8	7.8	7	7.6	2.6	0.8	M	Y	did not check
18	J	25.7	2.1	1.3	1.2	1.5	2	0.7	F	N	did not check
19	SA	25.4	4.2	3.3	3.7	3.7	2.1	0.6	F	Y	did not check
20	SA	25.4	4.3	2.4	2.3	3.0	2.3	0.6	F	Y	did not check
21	J	23.9	0.2	0.5	0.4	0.4	1.7	0.5	M	N	did not check
22	A	27.4	12.9	13.6	14.4	13.6	3.7	0.9	M	Y	did not check
23	SA	23.6	4	3.8	4.2	4.0	1.9	0.5	M	Y	did not check
24	J	23.9	0.8	0.9	0.7	0.8	1.7	0.55	F	N	did not check
25	A	23.7	15.4	14.4	13.6	14.5	2.7	0.75	M	Y	did not check
26	J	23.6	1.3	1.3	1.3	1.3	1.65	0.45	M	N	did not check
27	J	25.6	1.4	1.2	1	1.2	1.95	0.5	F	N	did not check
28	A	23.2	7.1	7.2	7.2	7.2	2.1	0.7	F	Y	did not check
29	SA	25.2	3.4	3.4	3.5	3.4	2.5	0.7	F	Y	did not check
30	SA	25.1	4.1	4	4.7	4.3	2.4	0.7	M	Y	did not check
31	J	23	0.7	1.2	1	1.0	1.6	0.5	F	N	did not check
32	A	Dead								Y	did not check

Dive 4:

No	J/A	shell length (cm)	lip thickness (mm)				total weight (kg)	meat weght (kg)	sex (M/F)	Notes	flared lip	erosion of lip
			i	ii	iii	avg						
1	A	24.6	28.5	26.8	26.9	27.4	3.05	0.5	F		Y	Y
2	A	25	11.3	10.5	12.1	11.3	2.5	0.5	M		Y	Y
3	A	23.9	22.5	19.3	18.9	20.2	2.7	0.45	F		Y	N

Dive 5: 0 conch found

Dive 6:

No	J/A	shell length (cm)	lip thickness (mm)				total weight (kg)	meat weght (kg)	sex (M/F)	flared lip	erosion of lip
			i	ii	iii	avg					
1	J	25.3	1.8	2.4	2.5	2.2	1.675	0.325	F	N	N
2	Dead										Shell very eroded
3	Dead										Shell very eroded

Dive 7:

No	J/A	shell length (cm)	lip thickness (mm)				total weight (kg)	meat weght (kg)	sex (M/F)	Notes	flared lip
			i	ii	iii	avg					
1	Dead										Shell very eroded

Dive 8: 0 conch found

Dive 9:

No	J/A	shell length (cm)	lip thickness (mm)				total weight (kg)	meat weght (kg)	sex (M/F)	Flared lip	erosion of lip
			i	ii	iii	avg					
1[21]	A	25.8	7.1	9.9	7.9	8.3	1.575*	NA	NA	Y	N
2	A	23.8	15.1	15	17	15.7	1.9	0.375	M	Y	N
3	A	23.9	9.3	9.7	8.8	9.3	2	0.425	M	Y	Y (Slight)
4[22]	SA	26.1	3.5	4.2	4.6	4.1	1.625	0.3	F	Y	N
5	A	25.3	12.2	12.3	11.9	12.1	2.525	0.475	F	Y	N
6	A	25.1	5.4	5.3	5.9	5.5	1.9	0.375	M	Y	N
7	A	27.6	17.1	16.9	16.2	16.7	2.775	0.575	F	Y	Y (Slight)

[21] No animal in shell; shell undamaged

[22] Meat weight excludes claw

APPENDIX 7 MEAT GRADES, TISSUE LOSS, MEAN TISSUE WEIGHT AND CONVERSION FACTORS FOR QUEEN CONCH PROCESSING USED IN JAMAICA[23]

Processing grade	Tissue loss	% of Tissue loss	No. ind./kg	Mean tissue weight	Conversion Factor
Unprocessed	None, animal removed from shell	N/A	6.1	165g/meat	0.85
50% Cleaned	Removal of claw and viscera	0	7.2	140g/meat	1.00
65% Cleaned	All the above plus head and parts of mantle	11.3	8.0	126g/meat	1.11
85% Cleaned	All of the above plus verge, remaining mantle and parts of skin	28.2	9.2	109g/meat	1.28
100% Cleaned ("fillet")	Only pure white muscle remains	42.9	10.2	98g/meat	1.43

[23] Note: Only 50% grade has been verified by field sampling (N= 2,718, M:F ratio 1:1.2) and is used as base unit; "unprocessed" grade simply refers to total tissue removed from shell; (Source: Tewfik, 1996; Smikle, 1997)

APPENDIX 8 ESTIMATED TOTAL CONCH LANDINGS AND GROSS REVENUES FOR 2007/2008 BASED ON FISHER SURVEY DATA

Boat no.	Boat name	Landing site	No. of fishing trips per week	Annual fuel cost[24] (EC$)	Avg. no. of conch per trip	No. of conch per annum[6]	Weight of conch per annum (lbs)	Gross annual value of catch @ EC$$22 /lb (EC$)	Gross annual value of catch @ EC$14 /lb (EC$)	Annual value of catch at EC$14/lb after fuel cost deducted (EC$)	Single share at EC$14/lb[25] (EC$)	Double share at EC$14/lb[7] (EC$)
1	Ocean Hunter	Gros Islet	4.7	75209	150	29610	41454	911988	580356	505146	101029	202058
2	Advantage	Gros Islet	4.7	75209	150	29610	41454	911988	580356	505146	101029	202058
3	Rock of Ages	Gros Islet	4	64008	80	13440	18816	413952	263424	199416	39883	79766
4	In God We Trust	Gros Islet	4.7	75209	200	39480	55272	1215984	773808	698598	139720	279439
5	Jehovahgira	Gros Islet	1.5	24003	150	9450	13230	291060	185220	161217	32243	64487
6	Admiral	Gros Islet	3.7	59207	150	23310	32634	717948	456876	397669	79534	159067
7[26]	Confidence in God	Gros Islet	3.4	54407	175	24990	34986	769692	489804	435397	87079	174159
8	God My Strength	Gros Islet	4.2	67208	70	12348	17287	380318	242020	174811	34962	69924
9[27]	?	Gros Islet	4	64008	100	16800	23520	517440	329280	265272	53054	106109
10	Great Minds	Laborie	2	32004	50	4200	5880	129360	82320	50316	10063	20126
11	No Excuses	Laborie	2	32004	75	6300	8820	194040	123480	91476	18295	36590
-[28]	Claudette	Gros Islet	0	0	0	0	0	0	0	0	0	0
Total	-	-	-	622476	-	209,538	293,353	6453770	4106944	3484464	-	-

Note: rows shaded yellow relate to part-time fishers

[24] Assumes fisher goes out 42 out of 52 weeks in the year

[25] Captain, crew and boat each earn a single share under this regime. Diver earns a double share under this regime. Selling price assumed here is EC$14/lb

[26] Data provided by captain or diver as owner did not participate in survey

[27] Data assumed for this owner who did not participate in survey

[28] No longer dives conch since got the bends