NATURAL RESOURCES SYSTEMS PROGRAMME

PROJECT REPORT[1]

DFID Project Number

R8134

Report Title

Barbados case study: The sea egg fishery.
Annex B(III) of the Final Technical Report of project R8134.

Report Authors

McConney, P., Mahon, R. and Parker, C

Organisation

Caribbean Conservation Association

Date

2003

NRSP Production System

Land Water Interface

[1] This document is an output from projects funded by the UK Department for International Development (DFID) for the benefit of developing countries. The views expressed are not necessarily those of DFID.

BARBADOS CASE STUDY: THE SEA EGG FISHERY

P. McConney, R. Mahon and C. Parker

Caribbean Conservation Association (CCA)

in association with the
University of the West Indies
Centre for Resource Management and Environmental Studies (CERMES)
and
Marine Resources Assessment Group Ltd. (MRAG)

2003

Acknowledgements

The authors wish to thank the many participants in the sea egg fishery who shared their time and knowledge with the researchers. The Barbados National Union of Fisherfolk Organisations (BARNUFO) executive members, Angela Watson and Clifton Ifill, made significant contributions to the study. Rosemary Delaney provided much needed research assistance.

Content

Figures

Tables

Boxes

Citation
McConney, P., R. Mahon and C. Parker. 2003. Barbados case study: the sea egg fishery. Caribbean Coastal Co-management Guidelines Project. Caribbean Conservation Association, Barbados. 74pp.

This document is an output from a project funded by the UK Department for International Development (DFID) for the benefit of developing countries. The views expressed are not necessarily those of DFID.

Executive summary

The sea urchin fishery of Barbados has a long history of command-and-control regulation, primarily closed seasons, which have largely been ignored by participants in the fishery. It is a low capital fishery for nearshore sedentary animals that are vulnerable to overfishing. In many ways it seems to be a prime candidate for community-based coastal resource co-management, and in St. Lucia this has been tried with some success. However, Barbados has proven to be quite different in terms of attitudes towards property rights and access, patterns of settlement and community, and attitudes towards regulation. In recent years there have been increasing efforts by several governmental and non-governmental agencies to introduce aspects of co-management. The focus has been mainly upon collaboration in data collection, driven by the fisheries authority, and local and foreign academic researchers.

The fishery has historically been socially and culturally important to the fishing industry and consuming public. Even today it is a vital source of household income for fishing families and fishers off-season suite of livelihood opportunities. Yet, exacerbated by overfishing, the fishery has gone through a series of boom and bust cycles that have become particularly severe since the 1980s. The low periods have prompted multi-season closures, but persistent illegal fishing and high levels of effort during open periods have contributed to little or no sustainable gains being realised. Enforcement, compliance and the reluctance to treat the contravention of the fishery regulations as a serious offence have all contributed to the uncertainty in this fishery.

One of the key conditions for this pre-implementation case to succeed with consultative or collaborative co-management is the strengthening of the capacities of the fisheries authority and fisherfolk organisations to work in management separately and together. For the fisherfolk organisations this means gaining the confidence and active participation of members, while the capability of government enforcement agencies and the judiciary to enhance enforcement would encourage industry participants to view the State as a serious and committed co-management partner.

1 Introduction

1.1 Project background

The purpose of the Caribbean Coastal Co-management Guidelines Project is to ensure that mechanisms for implementation of integrated pro-poor natural resource management in coastal zones are developed and promoted. This is assisted by understanding the requirements for establishing successful co-management institutions for coastal resources under various conditions in the Caribbean. These ideals reflect the policy and objectives of the United Kingdom (UK) Department for International Development (DFID) on eliminating world poverty. The project is part of the Natural Resources Systems Programme (NRSP) Caribbean programme for Land Water Interface (LWI) production systems. This component of the NRSP has the purpose: *"Benefits for poor people in targeted countries generated by application of new knowledge to natural resources management in the land water interface"*. It entails:

- An understanding of livelihood strategies;
- An understanding of natural resource management opportunities;
- Identification of the means to implement management opportunities relevant to the poor.

The project is a response to a September 2001 call for proposals from the NRSP to implement parts of the LWI logical framework (or logframe) (Box 1.1).

Box 1.1 Structure of call for proposals

Output 1: Improved resource-use strategies in coastal zone production systems developed and promoted
Activity 1.3: Mechanisms for implementation of integrated pro-poor natural resource (and pollution prevention) management in coastal zones developed and promoted
Sub-activity 1.3.1: Mechanisms for the improvement of sustainable livelihood outcomes for poor people living in coastal zones through integrated participatory resource management and prevention of pollution developed and promoted
Sub-activity 1.3.1, milestone (b): Understanding the requirements for developing successful co-management initiatives and mechanisms for promoting them
Target region: Caribbean

Source: DFID-Natural Resource Systems Programme

Project implementation is lead by the Caribbean Conservation Association (CCA) under its Coastal and Marine Management Programme (CaMMP). Project partners are the Marine Resources Assessment Group Ltd. (MRAG) of the UK and the Natural Resources Management (NRM) Programme of the University of the West Indies (UWI) Cave Hill Campus in Barbados where the CCA has its office. The execution period is 1 April 2002 to 30 June 2003 (15 months) with a budget of £87,112 (or approximately $125,000 US dollars).

The Caribbean Coastal Co-management Guidelines Project seeks to ensure that people in the Caribbean, especially the poor, can effectively engage in successful partnerships with government for sustainable livelihoods in the context of well-managed coastal resources. The

study addresses both the natural resource and human institutional aspects of co-management. Through a series of participatory investigations in case studies of conditions that favour, or do not favour, the co-management of coastal and marine resources at selected sites the project derives guidelines for developing successful co-management in the Caribbean. Uptake is promoted by interaction with target institutions and potential beneficiaries, and wide dissemination of outputs. The project's main outputs are listed below.

1. Selection of co-management analysis research framework
2. Ecological and environmental assessments of the natural resource systems and their utilisation
3. Institutional, socio-economic, cultural, political and other human dimension assessments
4. Comparison of how the natural resource and human factors assessed in 2 and 3 favour or constrain the establishment of successful, pro-poor and integrated co-management
5. Development of regionally applicable guidelines on successful, pro-poor and integrated co-management in the wider Caribbean
6. Capacity of target institutions and beneficiaries for co-management built through project participatory processes

This case study report is intended for access and uptake by a broad readership. Readers are also guided to the project's newsletters, reports and published papers for further information. The information generated from this and other case studies is synthesised in a comparative analysis. Guidelines for successful co-management are developed from these outputs.

In the next chapter, the research framework and methodology are described, followed by socioeconomic dimensions of the case, including poverty. Resource system and human system institutional analyses precede descriptions of exogenous factors, incentives to cooperate and patterns of interaction. Outcomes and performance are analysed prior to the final chapter discussion and conclusions on the lessons learned about what conditions may favour successful co-management in this case.

2 Research framework

This section sets out concepts that guide the research based on previous work in coastal co-management around the world. It sets the stage for presenting the case study results.

2.1 Definitions and concepts

Definitions of co-management focus on sharing management responsibility and authority between government and stakeholders (e.g. Pinkerton 1989; McConney 1998; Brown and Pomeroy 1999; Pomeroy 2001; Berkes et al. 2001). The fundamentals of what co-management should be, and is in practice, have been extensively researched (Jentoft 1989; Kuperan and Abdullah 1994; Pomeroy and Berkes 1997). Co-management encompasses several possible arrangements that are often depicted as a scale constructed from the relative sharing of responsibility and authority between government and stakeholders (Pomeroy and Berkes 1997; Berkes et al. 2001) (Figure 2.1).

As for participation (Arnstein 1969), there are various positions on the scale, and authors use different terms for co-management and its degrees. For example, the Caribbean Natural Resources Institute (CANARI) uses "participatory management" (see extensive document list at www.canari.org). The terms participatory management or co-management are gaining popularity in Caribbean government and NGO circles, and among some resource users (Almerigi et al. 1999; CANARI 1999; CANARI 2000; CANARI 2001; CCA 2001). These

concepts, however, are not always fully understood by their users. Conceptual and practical research issues therefore include the degrees of co-management and which terms to use.

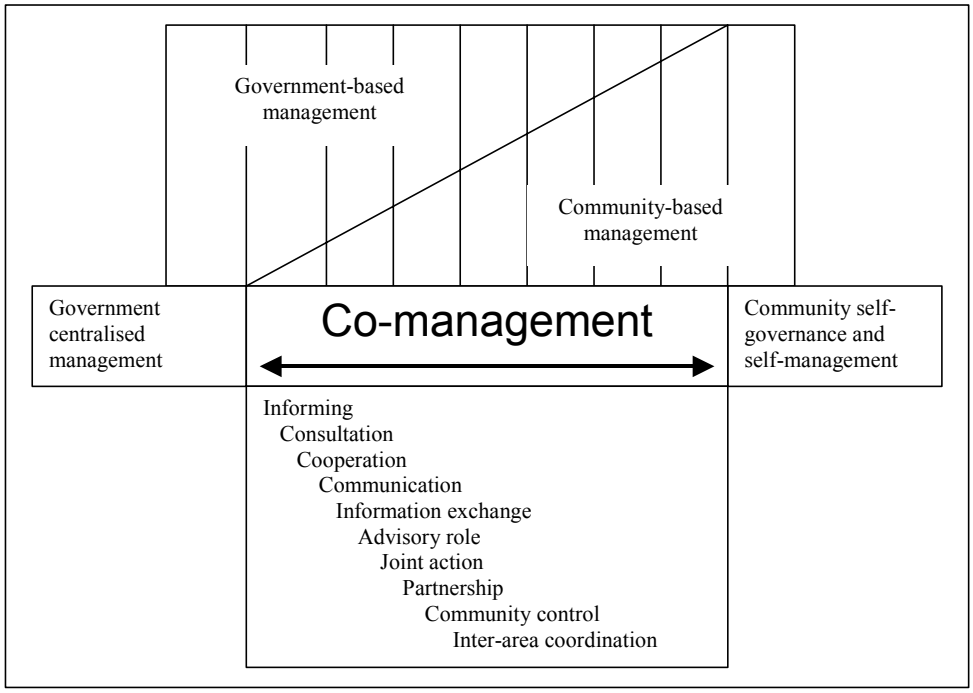


Figure 2.1 Sliding scale showing various degrees of co-management
(based Pomeroy and Williams 1994)

Based on international and Caribbean literature it was determined that three degrees and labels would be appropriate (Figure 2.2). The first is "consultative co-management" which represents what is most common in several locations (Brown and Pomeroy 1999). People commonly use and understand the term consultation.

	Consultative co-management	**Collaborative co-management**	**Delegated co-management**	
Government has the most control	Government interacts often but makes all the decisions	Government and the stakeholders work closely and share decisions	Government lets formally organised users/stakeholders make decisions	*People have most control*

Figure 2.2 Degrees and labels of co-management
Adapted from: ICLARM and IFM 1998

Next is joint action and decision-making. This is where several countries seem to be headed. The term "collaborative co-management" was preferred to "cooperative co-management" because it connotes stronger partnerships, and the use of "cooperative" may be confused with the formal organisation types of the same name (Kurien 1988; McConney et al.1998).

Third is "delegated co-management" that includes, but is not limited to, community-based management since national co-management structures are especially common in fisheries

management (Jacobs 1998; McConney and Mahon 1998). Few cases in the Caribbean appear to be at this level, but it is not uncommon in other areas of the world (Baird 2000).

Establishing successful co-management is seldom immediate. Like most participatory processes it takes time and careful tending. Pomeroy (1998) recognises three phases of co-management and describes the sequence of steps within these in some detail. A much-simplified version is in Figure 2.3.

Pre- implementation →	Implementation →	Post- implementation
Realise need for change	Try out new management	Maintain best arrangements
Meet and discuss change	Educate people in new ways	Resolve conflicts and enforce
Develop new management	Adjust and decide what is best	Accept as standard practice

Figure 2.3 Phases of co-management
Based on: Pomeroy 1998

Like cases in Africa (Normann et al. 1998; Sverdrup-Jensen and Nielsen 1999), the Caribbean is generally at the pre-implementation or early implementation phase (McConney and Mahon 1998; McConney 1998). A few situations such as the Soufriere Marine Management Area (Renard 2000) may be mature enough to be labelled post-implementation. A very significant consequence is that neatly comparing "before" and "after" conditions arising from a co-management intervention such as a discrete project will be less feasible in the Caribbean than other locations such as in Asia where much of the literature on methodology originates (e.g. Pomeroy and Carlos. 1997; Pomeroy et al. 2001).

2.2 Research framework

The International Centre for Living Aquatic Resources Management (ICLARM) and Institute for Fisheries Management and Coastal Community Development (IFM) (ICLARM and IFM 1998) developed the methodology referred to above for the African and Asian cases (Figure 2.4).

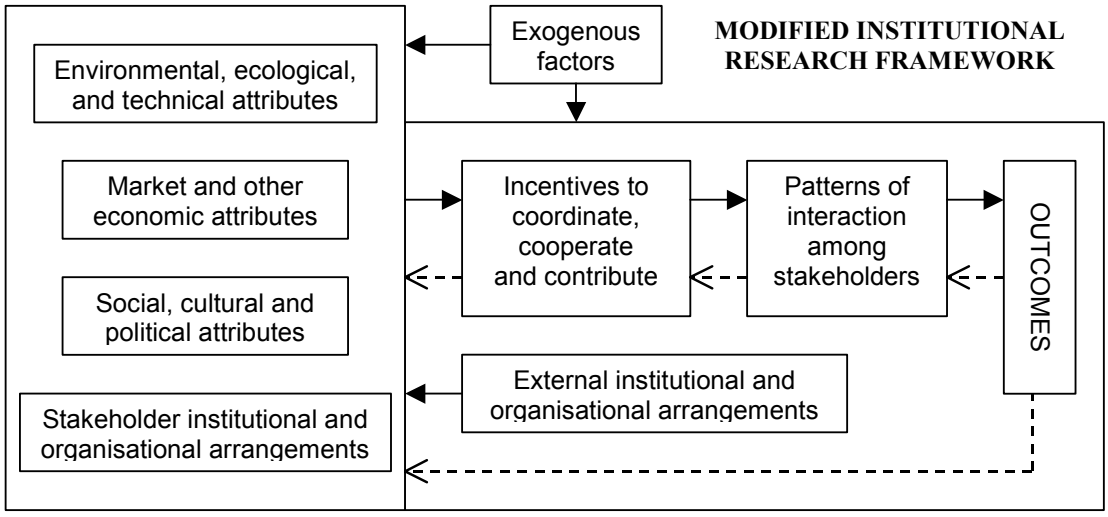


Figure 2.4 Modified ICLARM/IFM Institutional Analysis and Design Research Framework

The main analyses conducted within the framework are in Box 2.1. They are reflected in the logical framework for this project in terms of the assessments to be performed. Institutional analyses are of critical importance in researching co-management (Renard 1991; Noble 2000).

Box 2.1 Main analyses included in the framework

1. Institutional Arrangements Analysis: This component links contextual variables characterizing key attributes of the resource (biological, physical) and the resource users (technology, market, social, cultural, economic, political) with the management institutional arrangements (rights and rules). The contextual variables are each composed of a number of attributes. A causal relationship exists among and between the contextual variables, the institutional arrangements (the focus of the analysis) and the resulting transactional (action) situations. The institutional arrangements and the contextual variables affect the actions of the resource users and authorities responsible for fisheries management by shaping the incentives and disincentives they have to coordinate and cooperate in resource governance, management and use; the incentives, in turn, shape the patterns of interaction and behaviour between the co-management partners, i.e. the types of co-management arrangement established and the way it functions.

2. Co-management Performance Analysis: The co-management arrangement results in outcomes. These outcomes will, in turn, affect contextual variables as well as behaviour of resource users, other stakeholders and public authorities. Time is a critical element. All the contextual variables can change through time. This may cause change in institutional arrangements which, in turn, affect incentives, patterns of interaction and outcomes. The outcomes of co-management institutional arrangements can be evaluated in terms of e.g. management efficiency, equity, and sustainability of resource utilisation.

3. Characteristics of Successful Co-management Institutional Arrangements: The most important aspect of this analysis is the specification of what conditions and processes bring about successful long-enduring, fisheries co-management arrangements. From the analysis we can identify a list of principles and propositions about conditions and processes.

Source: ICLARM and IFM 1998

This project pays particular attention to integrated and pro-poor coastal management. Since poverty concepts may be new to some readers, a few words on the topic are warranted.

2.3 Pro-poor perspectives

DFID-NRSP (2001) emphasises the importance of a systems perspective on what is poverty and pro-poor, and how to address them. The concepts of poverty and the development of pro-poor strategies are complex social, cultural and economic issues (Centre for Development Studies 2000). Eradication or alleviation of poverty is often accompanied by attention to sustainable livelihoods (Carney 1998; Geoghegan and Smith 1998; Dorward et al. 2001).

In the Asia-Pacific region the focus is on alternative livelihoods since coastal resources are severely depleted and habitats are degraded. In the Caribbean, resources are often still adequate for use to be sustainable if supplementary livelihoods are found to ease the pressure without completely changing lifestyles. For example, fishermen displaced by MPAs in Belize are being re-trained to be fly-fishing and nature tour operators to obtain additional income in the tourist season, and facilitate increased compliance with fishing restrictions (Heyman and Hyatt. 1996; Heyman and Graham 2000).

Although the above initiative may be considered a pro-poor strategy it does not necessarily mean that it was specifically intended and designed as such. Poverty and pro-poor orientation by objective and implementation were not prominent in a recent institutional characterisation of Caribbean MPAs (Geoghegan et al. 2001). Statements such as improving welfare and the quality of life, without explicitly mentioning poverty, are more typical of planning documents for small-scale fisheries in the region (e.g. Government of Barbados1993). Research must note direct and indirect, positive and negative impacts on poverty by both public and private sector initiatives. The attention of Caribbean governments to poverty has been relatively recent in most places. Poverty assessment studies from the mid-1990s to the present provide fairly current data for most countries (e.g. Kairi Consultants 1999a and b).

Institutional analysis provides insight into how social and economic institutions interact with each other and contribute either to the perpetuation or reduction of poverty. Poverty in the Caribbean is often associated with youth and female-headed households, making age and gender important variables (Brown 2001). There are chronic, structural and seasonal poor in the Caribbean, with fishers as an example of the latter (Brown 2001). Fishers and other coastal resource users in the informal sector may easily slip through the net of employment surveys.

Often critical to the success of co-management is the extent to which community-based organisations can engage in poverty eradication and alleviation (Centre for Development Studies 2000). This encompasses empowerment and the concept of “voice”. Pro-poor strategies must address causes that operate at the micro as well as the macro levels, and ensure that government policy effectively engages these causes either directly or by creation of an environment that facilitates positive action by other entities (Brown 2001).

3 Case study overview

The six selected case studies, two each in Barbados, Belize and Grenada, are summarised in Appendix 1. The small-scale food fishery for the white sea urchin (locally called “sea egg”) has boomed and declined on several occasions over the centuries of its existence in Barbados. The fishery was one of the first to be regulated in Barbados. Technical management intervention has comprised a closed season from May to August. This regulation, like any other, has proven difficult to enforce due to the widely dispersed, small-scale nature of the fishery. The fact that law enforcement officers and the judiciary do not see sea egg poaching as a serious matter has also contributed to poor compliance with the regulations

The collapse of the fishery in the late 1980s led to a two-year moratorium on sea egg fishing from 1987-1989. During this period, the resource showed some signs of recovery, but was quickly depleted again once the fishery was reopened. This occurred even though the open season was only for a period of four months each year. The fishery remained open with very low catches of sea urchins until August 1998, when a three-year moratorium came into effect. At the same time, it became illegal to use SCUBA gear to harvest sea urchins. The moratorium was extended for two months to the end of September 2001, when the fishery was opened for two months. Following that short fishing season it was closed again until the end of August 2002, opened initially for one month. The season was then extended for a second month to the end of October 2002 and the fishery closed again until the end of August 2003.

Since the early 1990s, the Fisheries Division, and other organizations assisting with the management of the urchin fishery have concluded that fisheries management regulations (e.g. closed seasons) that require considerable government monitoring, control and surveillance, are

unlikely to be successful. The cost of managing the widely scattered fishing activities by command and control would be high and beyond the capacities of the enforcement agencies. The view emerged that a co-management approach to the sea urchin fishery would have the greatest likelihood of success.

An assessment of the potential for co-management of sea eggs, based on with a survey of 35 fishers, indicated that about half of them thought that community-based management groups could be formed or that community action could result in greater cooperation of fishers with management efforts (Vermeer et al, in press). Consequently, the Fisheries Management Plan (Fisheries Division 1997) now espouses a co-management or community-based approach to the sea egg fishery involving fishers and the Fisheries Division. This type of approach, which has met with considerable success in Southeast Asia and the Pacific (Pomeroy 1994), is not widely used in the Caribbean. However, it has been used, with success in managing the sea urchin fishery in St. Lucia (George and Joseph, 1999).

In 1998 a project of the Coastal Zone Management Unit (CZMU) attempted to further the comanagement approach recommended by the FMP. Fishers were sought throughout the island and encouraged to engage in a participatory process to develop a shared vision for the sea egg fishery and a strategic plan for achieving the vision. The fishers' vision was for a thriving well-managed sea egg fishery with an organisation for fishers, strong enforcement and fishers having some impact on pollution. The four strategic directions identified were:

- Cooperating for the betterment of the industry;
- Teaching people the value of the sea egg fishery;
- Improving laws and enforcement;
- Trying new methods.

A fisherfolk organisation was started towards the end of that project, but never functioned as there were minimal provisions and incentives for follow-up to the project. Nonetheless the project demonstrated the willingness of fishers to take part in group processes aimed at improving management of the sea egg fishery and also their interest in becoming involved in comanagement. Subsequently, the Caribbean Conservation Association (CCA), a regional non-governmental organisation, funded projects in 2001 that facilitated collaboration between fisheries authorities and fishers in activities ranging from data collection to management planning.

A critical factor of success is the extent to which both the government and the resource users are willing and able to form and sustain institutions for co-management in what has been a very strongly open access and income supplementing fishery, with low enforcement, in which boom and bust patterns have become accepted. It is a fishery associated with several uncertainties and attitudes that make it challenging for co-management in Barbados despite having some features of a small-scale coastal fishery with potential for community-based management.

4 Research methods

4.1 General

The general action research methods used in the case studies include.

- Document analysis
- Questionnaire surveys
- Semi-structured interviews
- Focus groups, informants
- Workshops and seminars
- Periodic e-mail, newsletters
- Transfer of skills and concepts

The cases in this project are mainly in pre-implementation or early implementation phases of co-management. Emphasis is on understanding the conditions and factors for successful co-management as perceived by the stakeholders at the research sites. Because an objective of the project is uptake of co-management concepts and practices that may lead to success there is active promotion of co-management in addition to research on it. This is action research.

This case made most use of document analysis, key informants, semi-structured interviews, questionnaire surveys, and workshops with all stakeholders. The documents included a few scientific papers, but were mainly popular or grey literature such as newspaper articles, project reports and other unpublished items. Key informants ranged from fishers of many years experience to research scientists and fishery managers. Due to the exploratory nature of the investigation and the emphasis on perceptions, mainly semi-structured and flexible interviews were used in informal settings such as in shops or on the beach. Questionnaires were administered to small convenience samples of respondents (N=40) at Oistins, Silver Sands and Conset Bay. Researchers were aware that the likelihood of respondents confusing this survey with a government activity was high despite any opening statements to the contrary. The study sought to avoid such confusion.

The workshops provided useful avenues for information exchange in settings less likely to cause confusion about the nature of the research. They were used to obtain information from a diverse set of participants and to feedback the results of the survey for validation or correction. The fisheries authority and fishing industry umbrella organisation produced a brochure on sea egg fishery management as an example of collaboration in management. In several instances this project interfaced with others also concerned with sea egg management.

5 Resource assessment

Figure 5.1 illustrates a framework for resource assessment, putting the resource in the context of integrated coastal management and livelihood strategies.

5.1 Geography

Barbados is the most eastern of the Caribbean islands, being entirely surrounded by the Atlantic Ocean and located at latitude 13° 10’ N and longitude 59° 35’ W (Figure 5.2). The mainly low relief and coralline island has a total land area of about 430 square kilometres encompassed by 97 kilometres of coastline. The island shelf is 320 square kilometres, and deep water is found close to shore.

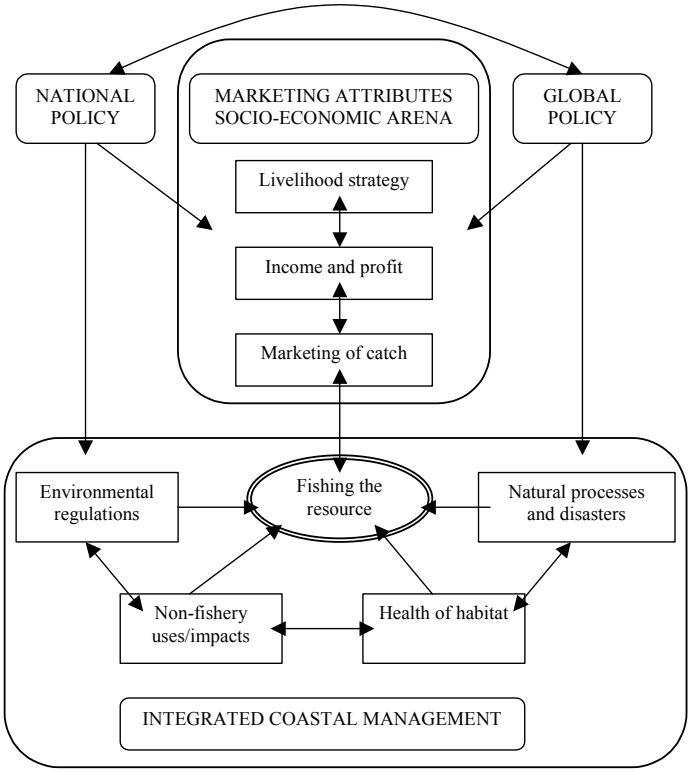


Figure 5.1 Framework for resource assessment

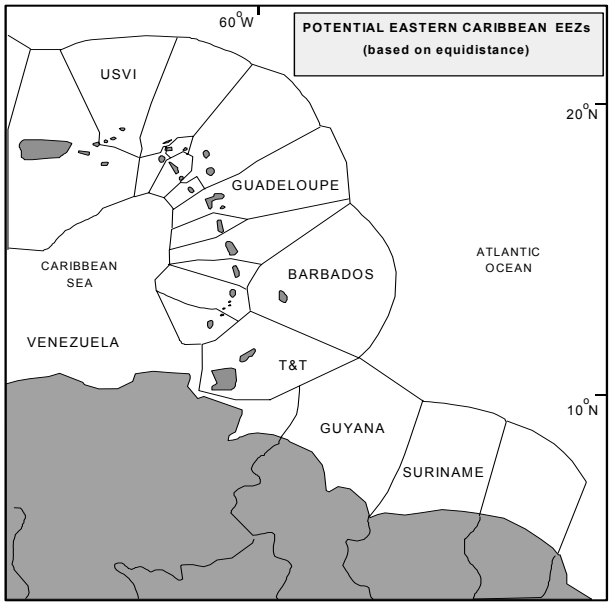


Figure 5.2 Location of Barbados

5.2 Caribbean sea egg fisheries

Sea urchins are highly valued in many countries for sushi and are a well-known product in international seafood trade. There are many fisheries for the species that occur in temperate

waters. Surprisingly, there are only a few Caribbean countries in which fisheries for sea urchins are known to take place: Grenada, Barbados, St. Lucia, Martinique and Guadeloupe. The St. Lucian fishery is the only other for which co-management has been attempted.

5.3 Barbados sea egg fishery

5.3.1 Fishing area

The fishing grounds for Barbados sea eggs are widely dispersed between Oistins in the south, and Speightstown in the northwest (Figure 5.3). They live in a variety of relatively shallow habitats, including sea grass beds, rocky rubble and rock flats. They prefer areas that support dense algal growth. Sea eggs are seldom found on living coral (thus their relative scarcity on the south and west coasts), sand, or at depths greater than ten metres. They can be easily harvested from their preferred habitats at relatively low cost. Thus the resource is vulnerable to overexploitation. In the 1970s and 1980s the abundance of these sea urchins in the fishing areas on the south, southeast and east coasts declined dramatically, to the extent that by the late 1980s the fishery had collapsed (Scheibling and Mladenov 1987).

Figure 5.3 The main sea egg fishing grounds of Barbados (gray shading)

5.3.2 Fishing methods

Sea eggs are harvested by divers operating from shore, from small boats and less commonly, from launches (called day boats) used primarily for other types of fishing. They are landed at numerous points along the shore, many of which are not easily accessible by road.

Traditionally, small boats were used to transport divers to the more distant sea egg fishing areas. The majority of divers, working the sea egg beds closer to shore, would transport their

catches in floating wooden crates or in net bags hung from a maypole (agave flower stalk) for floatation. The sea eggs were “picked” from the sea floor by hand, or forced out of crevices with pieces of iron referred to as “rakes”. They were collected in bags (either made of netting, crocus bags or discarded sugar bags) for transport to the shore.

The traditional harvesting methods for sea eggs have changed over time. The motorization of vessels has reduced the time that it takes to get to the fishing grounds (i.e. search time), thus giving the divers more time on the grounds. Diving was made more efficient with the introduction of masks and snorkels in the 1960’s and later with the introduction of SCUBA. The increased harvesting efficiency that has accompanied each technological improvement has not only assisted the regular harvesters, but also encouraged more divers to harvest sea eggs on a “casual” basis.

5.3.3 Aspects of biology and assessment

There is good technical information, particularly on the biology of the sea egg, upon which to base management decisions. The white sea urchin, and the fishery have been the subject of several studies in Barbados and elsewhere (Lewis 1958; Hunte 1987a, 1987b; Smith and Berkes 1991; Smith and Walters 1991; Hunte et al. 1993a, 1993b; Daniel-Le Priellec 1993; George and Joseph 1999).

Aspects of the reproductive biology of sea eggs are relevant to understanding the high degree of variability that characterises the resource, leading to considerable uncertainty as to whether sea eggs will be scarce or abundant in any year. Sea eggs release their eggs and sperm into the water, and fertilization and development of the eggs and larvae take place in the water column. During this planktonic stage of the animal’s life-cycle the larvae are at the mercy of the currents. They develop through several stages until ready to settle back to the bottom, metamorphose and begin the benthic phase of the life history. At that time, after about four weeks of planktonic existence, the larvae must reach a suitable substrate upon which to settle. If such a substrate is not found in time, the larvae will die. Once the larva settles on a suitable surface, it quickly metamorphoses into a small sea egg. Within a year, the small sea eggs grow into adults and attain sexual maturity. It is assumed that sea eggs, like other organisms with planktonic early life-history stages, exhibit highly variable recruitment due to variability in currents and other conditions in the ocean that affect survival and transportation back to suitable adult habitat at settlement time. However, factors determining abundance of sea eggs at this life-history stage have not been studied.

Another factor that contributes to the variability in abundance and landings from year to year is that sea eggs are short-lived. The maximum age attained may be four years, but the majority of mature individuals are ages one and two. Thus stock abundance depends on the recruitment in the previous two years. When fishing pressure is very high, and most adults are removed each year by the fishery, the yields may be almost entirely dependent on the incoming recruits that are determined largely by the prevailing environmental conditions. High fishing pressure may also reduce the adult stock to low levels that result in increased recruitment variability.

No time series of catch and effort data are available with which to determine the status of the fishery or for more formal stock assessment purposes. However, for a fishery with the characteristics of the sea egg, most conventional assessment approaches will be beyond the capacity of the fisheries management authority. Fixed annual allowable harvests are inappropriate due to the variability in recruitment. There is the need for allowable harvests to track this variability, so as to be low when recruitment is low and vice versa. A fixed annual

harvest would have to be set at a level low enough that in bad recruitment years there was sufficient breeding stock left unharvested to produce recruits for the following year. This would result in substantial unharvested surpluses in good years.

In order to determine the abundance of harvestable sea eggs and adjust fishing effort accordingly, surveys are needed just prior to the opening of the fishing season. There have been surveys of sea egg abundance at various times in the past. The first of these focussed on the southeast of the island in 1985-87 (Scheibling and Mladenov 1987). Subsequent surveys in 1993, 2000 and 2001, have been more comprehensive and used methodology that will allow comparisons. They have been placed in the context of a GIS map of the subtidal substrates of the island shelf that can be related to sea egg habitats and allows estimates of total sea egg abundance. The abundance of sea eggs estimated in the 2001 survey was about 2.5 times that estimated in the 1993 survey.

The approach for limiting fishing effort in the Barbados sea egg fishery is to adjust the duration of the fishing season according to the estimated abundance of harvestable sea eggs. Although less precise than limiting entry or a total allowable catch, this approach is perceived as being the most feasible to implement.

The 1993, 2000, and 2001 surveys are notable in that they were conducted with the assistance of fishers who had been trained in the survey methodology. In the latter two years the use of fishers was a deliberate attempt to involve them in the assessment and management process. In 2001, 18 fishers from several communities were involved. Involving the fishers in monitoring the resource is expected to have several benefits. It should increase their understanding of the process by which the duration of the fishing season is determined. It should lend credibility to the process, and it provides some alternative employment for the divers during the closed season, thus enabling them to benefit from the management process.

5.3.4 Local ecological knowledge

Sea eggs fishers are very knowledgeable regarding the spatial distribution of sea eggs. They know which habitats, including the types of algae, support the greatest abundances and result in the fastest growth rates (Mahon et al. 2003). Local knowledge of urchin reproduction informed the period selected for the closed season of the Sea Egg Preservation Act of 1879. The 1899 consultations with fishers conducted by a parliamentary committee referred to by Parker (2003) also relied on local knowledge to make changes to the law.

Local ecological knowledge has led to five traditional management practises in the sea egg fishery.

- **Testing for ripeness of roes --** Fishers check a few sea eggs from a patch to determine if the sea eggs are ripe and therefore ready for harvesting. If not, no more sea eggs would be taken from the patch.
- **“Cutting the edge” --** The sea eggs around the outer edge of a patch tend to be the ripest. Fishers would harvest these then leave the patch for a few days until those at the outer edge ripened.
- **Leaving the large ones to breed (“chubbing”) --** Fishers would not harvest extremely large individuals leaving them scattered throughout the fishing area as breeders.
- **Moving sea eggs from places of plenty to places with few --** Fishers might, at the end of a diving session, take a few bags of small unripe urchins and drop them off in areas, known to have been fished out.

- **Burying husks on the beach --** Fishers would generally break sea eggs on the beach and bury the husks so that they were not disposed of on fishing grounds. Fishers have observed that live sea eggs leave the areas where broken sea egg shells are disposed of.

On the other hand, some fishers believe that the disease responsible for the depletion of the black sea urchin around 1983 is also responsible for the decline in the white sea urchin population; an example of “ecological misinformation”. Some fishers also believe that that urchins gather to form buoyant aggregations that are transported by currents. This is used to explain sudden disappearances and appearances of adult urchins. There is no scientific evidence of this phenomenon, but the claim is common enough to be worth investigation.

6 Socio-economic attributes

6.1 General

Amerindians from South America settled the island around 1600 B.C. The Arawaks lived along the coast and fished using harpoons, nets, and hooks. Portuguese sailing to Brazil named the island Barbados. The first English ship reached the island in 1625 and claimed it on behalf of King James I. In 1627 an English ship landed with a party of 80 settlers and 10 slaves to occupy the island. The colonists established a House of Assembly in 1639, making it the third oldest parliamentary democracy. Barbados remained a British colony until internal autonomy was granted in 1961 followed by full independence in 1966. It is still a member of the Commonwealth. The Constitution of Barbados enshrines parliamentary democracy based on the Westminster model of Britain. Ideologically the two main political parties are very similar and described as social or liberal democratic. In recent years both have stressed the importance of participation and social partnerships in their policies.

Since the 1630s, sugar cane has dominated agriculture and supported a rich agro-commercial mercantile elite. Black slaves and white indentured servants met the labour demands of agriculture. Slavery, abolished in 1834, was followed by a four-year apprenticeship period. Freedom from slavery was celebrated in 1838, at the end of the apprenticeship period, with over 70,000 Barbadians being of African descent and a significant proportion of the population being poor whites. Today about 80% of the over 270,000 people in the population are classified as black, with another 16% being mixed race, and the remainder white. Protestant religions are most common, but religious diversification is increasing.

6.2 Fisheries development

In colonial Barbados poor social and economic conditions partly motivated the riots of 1937. Brown (1942) describes the fishing fleet as consisting of 371 sailboats and 165 rowboats, employing 1200 fishers. According to the first Fishery Officer appointed in 1944:

> … prior to 1942 little or no attention had been paid to the fishing industry by the Government, so much so, that the Barbadian fisherman found himself in a class below that of the agricultural labourer economically; as such he set his own standards, which to him may have been satisfactory, but to other more intelligent people repulsive, unreliable and uncooperative. It has taken great effort to change this attitude over the last five years, and although some progress has been made, much remains to be done. (Wiles 1949:68)

The intervening half-century saw great technological and economic progress. Social changes are very poorly documented in comparison. Today the average contribution of the fishing industry to the economy, in terms of gross domestic product (GDP), is occasionally up to 1%.

The dollar value tends to be about Bds$30 million per year, or about 22% of non-sugar agriculture and 17% of all agriculture. This is from annual fish landings of about 3,000 to 5,000 metric tons. The fishing industry has historically served as a social safety net, providing work for those unable to find other employment. All fisheries are currently open access and fishing employs about 2% of the island's labour force, which is around 17% of the people involved in agriculture. When fish catches are good, a very mobile male and female opportunistic labour force becomes engaged in both harvest and postharvest operations.

The Fisheries Division has recently sought to register people who work in the fishing industry. When this 2002 database is available for analysis it should provide a more accurate social and economic profile of the fishing industry and a breakdown by the occupations within it. Some statistics are unlikely to have changed much over time, such as most boats being owned by individuals rather than partnerships or companies, with over 90% of owners being male and having only one vessel (McConney 1997). However less than half of boat owners are fishers. This pattern of ownership was reinforced during the 1960s when sailboats became motorised through a loan scheme. Investor ownership has increased as the trend towards larger and more capital intensive vessels has continued into iceboats and pelagic longliners.

6.3 Sea egg fishery

Sea urchins have been harvested in Barbados for centuries. Parker (In prep.) notes the 1879 description of sea eggs as a "cheap and popular article of food" in the announcement of the Sea Egg Preservation Act. There are at least 20 sea egg fishing "communities" (Mahon et al. 2003). Community here means a cluster of harvest groups. Few are well defined spatially, and several are distant from their fishing grounds, the fishing range having increased over the years. Divers live in rural coastal and inland villages, suburban housing developments and residential areas. Fishers harvest in groups of four on average, and there may be several groups operating in any sea egg fishing area. None of them are particularly territorial.

The annual sea egg fishing season is timely for fishers as it comes when the season for flyingfish and the other large pelagics, such as dolphin, is over. In addition, the beginning of the season also coincided with the last weeks of the school summer holidays. Hundreds of Barbadians, including women and children became involved in some aspect of the sea egg fishery. In 1948 the industry was described as employing "almost every available fisherman and their families" (Wiles 1949).

Estimates of the numbers of people seasonally involved have ranged from nearly 1000 in the mid 1950's to just over 200 at present. No other fishery in Barbados so thoroughly engages people of all ages, both sexes and of several other occupations as fully and intensely as the sea egg fishery. Recent estimates of participation have focused more on those who regularly harvest sea eggs and hence may be proportionally lower than earlier, more comprehensive, estimates. There are several categories of sea egg fishers (Mahon *et al*. 2003):

- Seasonal divers who fish for flyingfish and large pelagics for most of the year, and who dive for sea eggs in the off-season as an alternative source of income (79% of fishers encountered)
- Weekend and casual divers, including opportunistic temporarily and youth unemployed, who dive mainly for recreation and personal consumption on weekends but may also offer sea eggs for sale (12%).
- Full-time divers, who harvest a variety of resources by diving, including lobsters, conch, octopus, and sea moss, and who turn to sea eggs during their season (7%)
- Holiday divers, who take their vacation to coincide with the sea egg season as a means of supplementing their salary from their main job (2%)

The traditional roles for the women and children were the processing and sale of the sea eggs on shore. Persons were described by the tasks to which they were assigned i.e. “divers”, “breakers” and “vendors”. There used to be sharper distinctions between these categories of workers in the fishery than there are today. A small survey (N=40) of people active in the 2002 sea egg season at Silver Sands, Oistins and Conset Bay found that many people (40%) combine their roles in the fishery and that few (2.5%) are now sellers exclusively. About 30% each were either only divers or breakers. This reduction in the division of labour over time may also help explain apparently declining participation, but the major reason is due to urchins being scarce in many years.

Divers (almost all male) are the leading figures in this fishery where kin or household work teams often collectively undertake operations in a family tradition. In the same survey over 80% of respondents said they came from fishing families. Their ages ranged from 25 to 81 years (mean of 42) and they had worked in the sea egg fishery from 1 to 50 years (mean of 19). The sample was evenly split between those who achieved primary or secondary school education.

6.4 Market attributes

6.4.1 Sea egg marketing practices

The practices for handling and marketing sea eggs have changed over the years, as have the fishing practices (Parker in prep.). Onshore, the shells were broken open and spoons were used to scoop out the roe. The roe was then packed into cleaned intact “half shells”, also known as husks. It is estimated that, on average, the roe of 15 sea eggs were required to fill one husk. Leaves of the sea grape (*Coccoloba uvifera*) were shaped into cones, then filled with roe and used to cover the husks. Marketing the roe in the “half shell” is believed to date back to 1803. In the early 1940's, the roe was also sold in empty milk cans. From the mid-1980's sea egg roe was packaged for sale in polystyrene or plastic ice cream cartons. These packaging methods rapidly increased in popularity and by the early 1990’s had almost completely replaced the older methods.

In the earlier days of the industry, sea eggs were sold not only on the beach but also by vendors transporting their stock for sale, usually on trays, throughout the major towns and housing areas. Although some persons still find employment as breakers and vendors of sea eggs, the number of, and need for, specialist vendors has greatly reduced and most sea eggs are now sold by the divers directly at the beach. Breakers act as vendors and sell containers while breaking, giving money to the divers. They also have regular customers that leave orders by phone. Fishers therefore have more control over their revenue in this fishery than in the major pelagic fisheries in which they tend to be price-takers subject to the market power of vendors and processors.

Particularly during periods of closure, urchins have been imported from Grenada cooked in the shell. During the last closure frozen urchin roe was imported in bulk from California. This was done under permission from the Chief Fisheries Officer as required by law and usually sold to supermarkets and restaurants.

6.4.2 Earnings from sea eggs

Parker (In prep.) used 2001 survey data to estimate the total abundance of sea eggs around Barbados in that year, and from that figure he estimated the annual earnings of full-time and

part-time sea egg fishers. The total potential monetary value of the 2001 sea egg standing crop was estimated at 98 million Barbados dollars. Potential fisher earnings for the fishing season were calculated from the number of fishing days times the number of sea eggs harvested per day times the weight of roe per sea eggs times the selling price of roes. Based on these calculations, full-time divers could potentially have earned over Bds$40,000, while part-time divers could have earned as much as Bds$23,500, during the legal fishing season. Parker estimated that there were around 201 full-time and 155 part-time active sea egg divers in 2001. Therefore, the estimated total earnings for these two groups of divers together was about Bds$12 million. This is considered by him to be a conservative estimate of the value of the fishery as it does not include fishers operating from boats, nor does it include the catches by the relatively large numbers of casual or holiday fishers. Income was a particularly delicate survey question, eliciting responses ranging from silence and suspicion to obvious bragging and exaggeration (Figure 6.1).

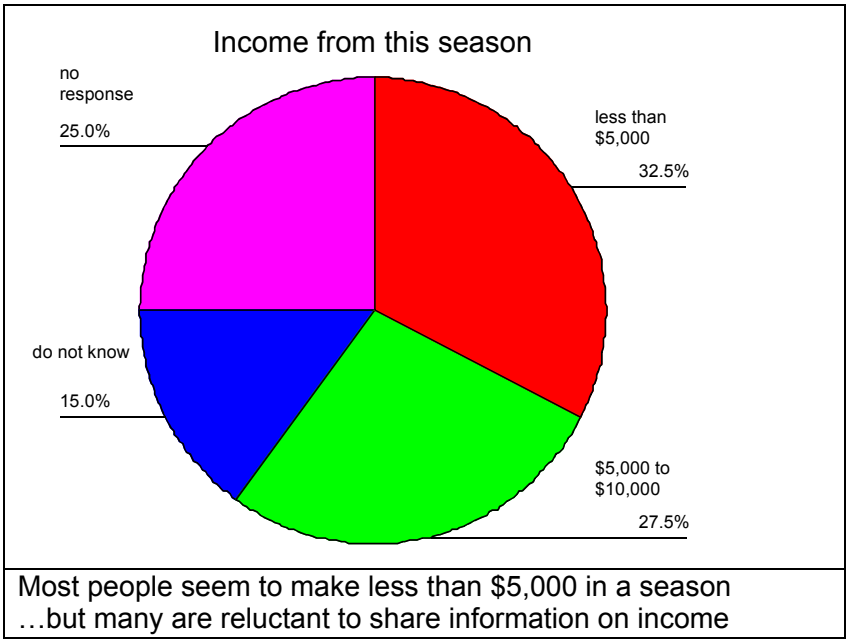


Figure 6.1 Income in 2002 season

At a feedback and follow-up workshop, the participants felt that most regular divers should easily have made $5,000 to $10,000 in the two-month season in spite of poor weather conditions, or low initial yields in some locations. At the individual level, a few decades ago a breaker used to earn 50 cents per $1.50 shell sold and vendors used to take around 200 shells per day to sell in Bridgetown. Today some breakers get $25 from every $120 container sold, but share arrangements vary. Others receive a flat daily labour wage around $60/day.

Reported average daily harvest rates have ranged from 350 urchins by Vermeer et al (in press) to1000 sea eggs per day (Parker In prep.). A regular diver is reported to harvest 5 days per week on average, and to fish daily at the peak of the season. Divers pay boat owners a fee for using their boat, and a diver can supposedly make up to a maximum of nearly $1000 per day if urchins of good quality are abundant and sea conditions are favourable. Yields are reported to decline to about 33% of the optimum when urchins are “running” (actively spawning). Parker (In prep.) estimated that about $2,000 a week could be earned in 1982.

Today's illegal harvesters are said to be very selective in harvest to attain the highest returns for their risk. They are said to expect to sell five $120 containers of roe for every 6 bags of whole urchins, containing 100 each. It takes about 150 urchins to provide a litre of roe. Despite out-of-season possession and sale also being offences, the public demand for illegal urchins is high.

Vermeer et al (in press) estimated that about 500,000 urchins are harvested each week, equivalent to approximately 6 million over a 3-month season. Roe was sold in 1994 at $40 per litre, making earnings per fisher of $600 per week if fishing daily.

A retailed shell of roe was 3 cents in 1938 and 5 cents in 1942. The sea egg price was then controlled at 8 cents per shell retail until 1950, and the price rose steadily after it was deregulated. Price control during and after the war years was one measure of ensuring a nutritious food supply for the poor.

6.5 Barbados poverty profile

The Inter-American Development Bank conducted a poverty assessment in 1996-1997 (IDB 1998) that forms the basis for this summary. The study calculated the average per capita annual poverty line to be Bds$5,503.00, below which Barbadians can be considered "poor". Around 8.7% of the total households live below the poverty line, which means about 35,000 people or 13.9% of the total population (Table 6.1).

Table 6.1 Demographic poverty profile (1996-1997)

	Poor	Non-poor	Total
Household size	5.03	2.98	3.15
No. children < 5 years	0.66	0.28	0.32
No. children 5-14 years	1.31	0.39	0.47
No. members of 60 of age & +	0.29	0.51	0.49
No. employed	1.48	1.34	1.35
No. unemployed	0.66	0.19	0.23
No. non-attending schools 5-18 years	0.14	0.04	0.05
No. inactive of 15 of age & +	0.92	0.75	0.77
Global participation rate (%)	69.9	67.1	67.2
Female participation rate (%)	66.9	61.8	62.2
Unemployment rate (%)	30.8	12.4	14.6
Female unemployment rate (%)	40.1	14.8	19.6
Dependency ratio (inactive per active)	1.4	0.9	1.0
Dependency (inactive per employed)	2.0	1.1	1.2
Female-headed households (%)	58.5	42.6	44.0
Households with non-attending schools 5-14 years (%)	1.3	0.5	0.6
Households with non-attending schools 15-18 years (%)	10.2	3.0	4.0

Source: Statistical Department as reported in IDB (1998)

Gender is linked to poverty in Barbados. Females head most poor households (almost 59%). Within female-headed households, 11.5% are poor, whereas within the male-headed households the rate is 6.5%. The gender composition of the family is linked to marital status since single parents head most of the poor families (57.3%). Poor households tend to have younger heads; persons below 44 years of age head 48.4% of poor households.

Another important factor in Barbadian poverty is education. Most of the poor household heads have only primary or elementary education, accounting for almost 54% of the poor, whereas another 40% only reached secondary level. The employed poor show a higher share of people with only primary education, which is closely tied to their higher probability of being in unskilled occupations than the non-poor. The economy has become increasingly oriented to services where relatively high standards of production and skills are required. High unemployment rates, being closely associated with low income, are characteristic of the poor population.

The mean unemployment rate within poor households is almost two and a half times that of non-poor ones. Poor households tend to make more intensive use of their so-called "secondary labour force" - women and youth. They also tend to have a higher percentage of old people still working. Unemployment rates for poor households are higher in all age groups. If gender is taken into account, it can be seen that unemployment rates are very high for poor females, particularly young ones. Female unemployment is closely linked to poverty in Barbados. The unemployment rate is 40.1% for poor females. A high proportion of poor people are self-employed, which is a close proxy for the informal sector. The poor have a higher percentage working in agriculture and fisheries, and construction and quarrying than the non-poor (Table 6.2).

Table 6.2 Economic characteristics of poverty intensity (1996)

Determinants of Poverty	Proportion of Poor	Poverty Gap	Intensity	Proportion of Households	Contribution to National Poverty		
	(P0)	(P1)	(P2)	Percent	P0	P1	P2
Occupation of Head							
Never worked	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Legislator, senior officials, managers	2.6	0.7	0.3	6.1	1.8	1.9	2.1
Professionals	1.0	0.4	0.2	7.0	0.8	1.2	1.1
Technicians and associate profess.	3.8	0.7	0.2	4.4	1.9	1.4	0.9
Clerks	5.9	1.3	0.5	4.9	3.3	2.8	2.3
Service workers/shop/market workers	11.9	3.1	1.3	8.7	11.8	11.6	11.2
Skilled agriculture and fishery workers	14.5	5.0	2.6	1.7	2.8	3.7	4.4
Craft and related workers	9.6	2.5	1.2	9.2	9.9	9.9	11.3
Plant and machine operators	12.9	3.3	1.3	5.1	7.5	7.4	6.8
Elementary occupations	17.1	4.5	1.8	16.6	32.2	32.1	30.2
Not applicable	6.9	1.8	0.8	36.2	28.3	28.0	30.1
Total	8.8	2.3	1.0	100.0	100.0	100.0	100.0
Industry of Head							
Sugar farming	9.1	2.5	1.2	0.5	0.6	0.6	0.7
Other agriculture (excludes fishery)	15.9	4.4	1.7	3.0	5.5	5.8	5.0
Fishing	8.4	5.6	4.2	0.4	0.4	1.1	1.9
Mining and Quarrying	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Sugar Milling	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Manufacture (excludes sugar)	6.7	1.3	0.4	4.2	3.2	2.3	1.5
Electricity, gas, water	5.0	3.0	2.6	0.8	0.4	1.0	2.0
Construction	10.2	2.7	1.1	5.2	6.0	6.2	5.9
Wholesale and retail trade	6.2	1.6	0.6	6.8	4.8	4.6	4.2
Hotels, restaurants, etc.	7.7	2.2	0.9	5.1	4.4	4.9	4.6
Taxis and rented vehicles	18.7	4.4	1.3	0.4	0.8	0.7	0.5
Other transport	7.5	2.3	1.0	1.7	1.5	1.7	1.8
Other tourism services	2.8	0.1	0.0	0.6	0.2	0.0	0.0
Communications	0.0	0.0	0.0	0.9	0.0	0.0	0.0
Finance	2.4	0.4	0.0	1.4	0.4	0.2	0.0
Insurance and pensions	6.9	2.2	0.8	0.8	0.6	0.7	0.6
Real estate and rental	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Business services	8.0	1.0	0.2	0.9	0.8	0.4	0.2
Public administration and computer	6.5	1.9	1.0	3.1	2.3	2.6	2.9
Educational services	4.5	0.9	0.3	2.9	1.5	1.2	0.8
Health and social work	7.6	1.5	0.5	3.2	2.7	2.1	1.5

Determinants of Poverty	Proportion of Poor	Poverty Gap	Intensity	Proportion of Households	Contribution to National Poverty		
	(P0)	(P1)	(P2)	Percent	P0	P1	P2
Act. of membership	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Recreational, cultural services	19.3	6.5	2.3	0.3	0.6	0.8	0.7
Other government services	6.7	1.0	0.3	4.6	3.5	2.0	1.4
General services	12.7	2.7	0.9	11.2	16.2	13.2	10.2
Total	8.8	2.3	1.0	100.0	100.0	100.0	100.0

Source: Statistical Department as reported in IDB (1998)

6.6 Poverty Alleviation Bureau

In order to assist with the alleviation and eradication of poverty in Barbados the Poverty Alleviation Bureau was established in October 1998 as an agency of the Ministry of Social Transformation. The Bureau seeks to build on community development, empower community organisations and individuals, and to provide them with access to adequate resources and opportunities in keeping with its aims and objectives in Box 6.1.

Box 6.1 Aims and objectives of the Poverty Alleviation Bureau

- To assist in the alleviation and eradication of poverty through the empowerment of individuals and groups by the provision of economic and financial opportunities as well as educational and vocational training.
- To establish cordial and effective working relationships with Government agencies, NGOs, Community Based Organisations, individuals and community groups in an effort to reduce inefficiencies, duplication of efforts and wastage of resources.
- To ensure a faster and more meaningful delivery of services.
- To create the climate for young people to gravitate towards the growth and development of small/micro business enterprises.
- To pioneer the development of a new entrepreneurial class.

Poverty Alleviation Bureau brochure

Officers are aware that poverty alleviation can be little more than thinly disguised political patronage that deepens dependency on government instead of reducing it. The Bureau stresses the importance of partnerships and networks in achieving its aims and objectives. Despite the above poverty statistics that identify fishing as an activity of the poor, the Bureau has not been approached by fisherfolk for assistance. Neither has it observed that poor people are particularly associated with coastal communities. There is no interaction between the fisheries or coastal authorities and the Poverty Alleviation Bureau.

7 Community-level institutional and organisational arrangements

Turning from an emphasis on the resource system, we now focus on the human system. The two are inextricably interwoven. The sections below examine institutional arrangements at different scales of analysis (Figure 7.1). For the purpose of analysis in a location-based case, such as this, the scales larger than community level are referred to as external.

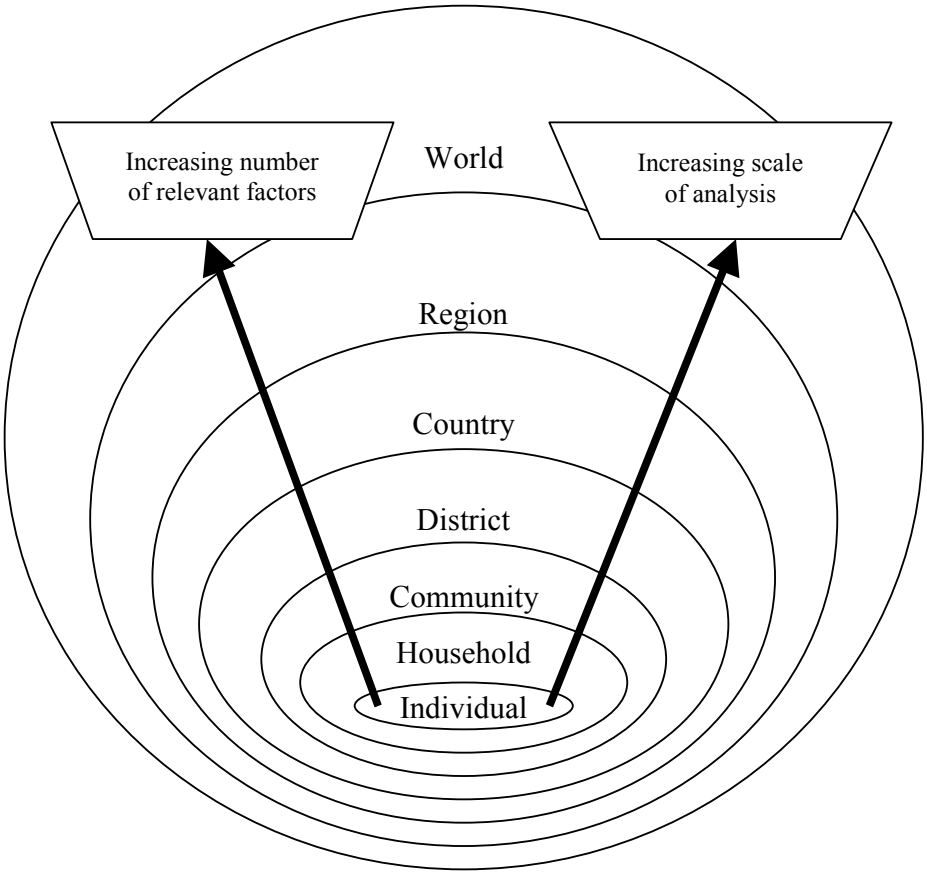


Figure 7.1 Number of factors to be addressed increases with scale of institutional analysis

Institutions are the customary rules and modes of interactions that people develop in order to effectively carry out their functions. Attributes of interest include those in Figure 7.2 that increase in number and complexity of interaction as the scale of analysis increases. They are relevant to how co-management may function, and be sustained, or fail.

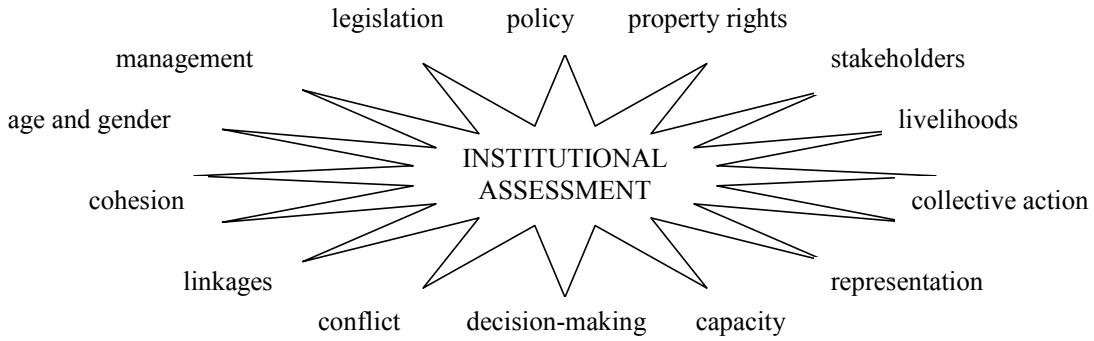


Figure 7.2 Some of the factors to be considered in institutional assessment

7.1 Fishing communities -- Oistins, Silver Sands and Conset Bay

Two areas with high populations of fishers, Conset Bay and Oistins plus nearby Silver Sands, on the southeast and southwest coasts respectively, have long histories of involvement in the sea egg and other fisheries. They were selected for closer investigation in this case study. A structured survey and key informant interviews were undertaken. Of particular interest were perceptions of the similarities and differences between the 2001 and 2002 sea egg seasons given the differences in approach to management employed by the fisheries management authority. Results are reported upon in a later section when discussing incentives for cooperation and patterns of interaction.

Whilst this investigation focussed upon the fishers inhabiting Oistins, Silver Sands and Conset Bay areas, it should be borne in mind that they fish in several coastal areas of Barbados, and not only around where they live. This case study also reports the results of other co-management initiatives and research projects that were national in scope. As previously described, sea egg fishing is not bound by area, and fishers are becoming increasingly wide-ranging through the use of boats for transportation of divers.

7.2 Fisheries Division

Established in 1944, the Fisheries Division is responsible by law for all aspects of fisheries management (conservation and development), administration and services. The Division manages fish landing sites that do not have fish markets. The latter are the responsibility of the Markets Division. Figure 7.3 shows the current organizational structure.

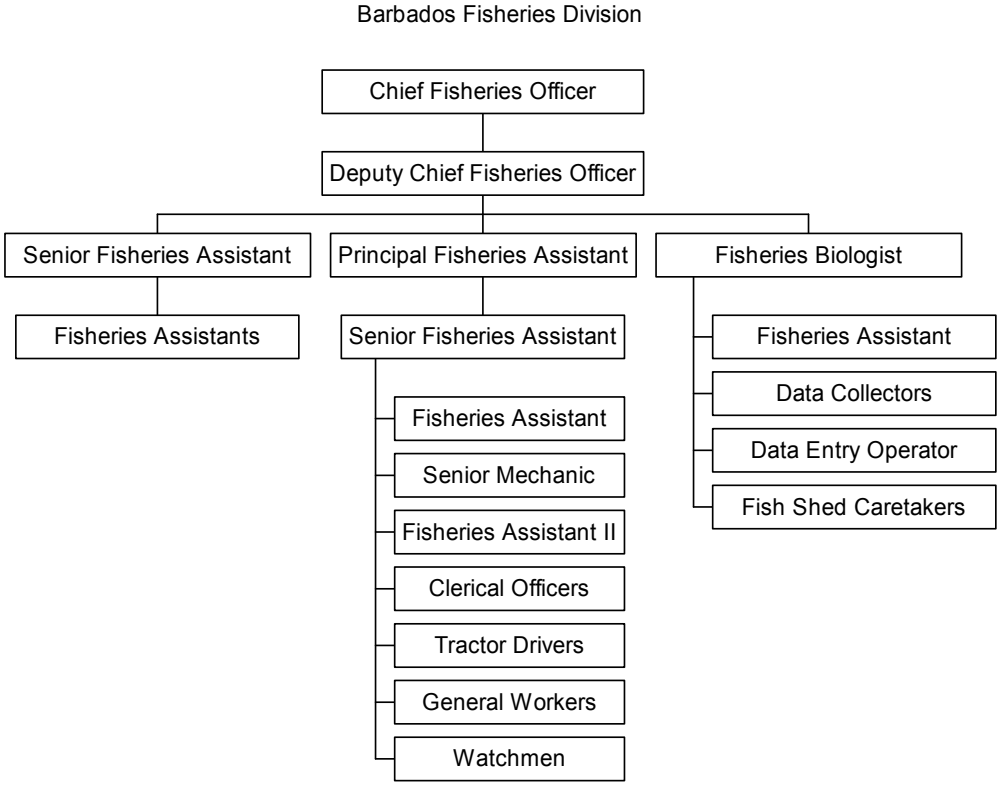


Figure 7.3 Structure and staffing of the Fisheries Division

The annual operational budget of the Division typically ranges between Bds$1.5 to $2 million, with personal emoluments comprising about 60%. In the past the capital works budget has exceeded Bds$20 million, but the Division had no access to or control over these funds used for infrastructure.

Besides the Chief Fisheries Officer being responsible for overall planning and coordination, the Fisheries Division is divided into three sections for:

- Fisheries science, assessment, aquaculture and information management
- Fisheries development, fisherfolk organisations and infrastructure advice
- Fisheries administration, services, incentives, registration and inspection

Of these three sections, the weakest in terms of technical staffing and budgetary allocation is that with responsibility for fisheries science and assessment.

The Fisheries Division, and the colonial administration before it, has paid more attention to the sea egg fishery in terms of management and legal reform than to any other fishery because of its cultural importance, vulnerability and importance to the livelihoods of poor people. Several of these initiatives are described later in this report.

7.2.1 Outline of co-management pilot project

In 2001 the Caribbean Conservation Association, a regional environmental NGO based in Barbados, provided the Fisheries Division with the opportunity to conduct a pilot project on fisheries co-management, and the sea egg fishery was selected as the best candidate. A letter of agreement was signed between the Fisheries Division and the Barbados National Union of Fisherfolk Organisations (BARNUFO) as the co-management partners executing this project. The objectives, planned activities and expected outputs are summarised in Box 7.1.

Box 7.1 Pilot project on co-management of the sea egg fishery

Background

The fisheries authority and fishing industry are interested in instituting community-based co-management, involving fishers in all aspects of management. This may include monitoring urchin size, maturity and population density; determining when and where fishing would be allowed; and otherwise regulating the fishery to the extent that fisher knowledge and observations could be the main inputs to management. This pilot project will assist the stakeholders in pursuing their shared interest in co-management in a manner consistent with the Barbados 2001-2003 Fisheries Management Plan. The Fisheries Division and BARNUFO are already collaborating on surveys at sea.

Objective

The objective is for the fisheries authority and fishing industry to collaboratively determine and demonstrate the feasibility of co-management arrangements for the Barbados sea egg fishery within the period of the 2001-2003 Fisheries Management Plan.

Work plan

- Collaborative surveys (fisheries authority and fishing industry) going from design to execution.
- Workshop on data analysis, generation and use of information as a demonstration of shared learning and to evaluate further development of these collaborative processes.
- Public education will be offered via a newspaper supplement, TV promotion, Fisherfolk's Week panel discussion, brochure, poster, radio or other media, the effectiveness of which will be evaluated.

- The re-formation of a fishing industry organisation or arrangement to address the sustainable co-management of the sea egg fishery will be pursued through a series of community level and centralised forums, supported by appropriate information for participation in management.

Outputs

- Data from the sea urchin surveys in which fishers participate
- Understanding about how information for management decision-making can be generated, shared and used in co-management arrangements
- Increased public awareness about sea urchin management, leading to better compliance
- Establishment of an organisation or arrangement through which resource users and other stakeholders can participate meaningfully in decision-making for the management of the sea egg fishery

Source: Caribbean Conservation Association

7.2.2 Collaborative surveys and analysis

Fieldwork lead by the Fisheries Division's fisheries biologist involved organising fishers from around the island into 4 small teams covering 26 survey sites in specific segments of coastline. The sites were selected for comparison with previous research. The biologist and assistant first explained the research design and methods in the classroom on 4 May 2001, followed by demonstration and practice in the field. A quadrat method was used to estimate population densities, the diameters of the animals were measured and ecological observations made at the sites by the fisher teams. Seventeen of the sites were re-surveyed in September.

The 16 volunteer fishers brought their raw data to the biologist who collated it and conducted analyses in August. These analyses were explained to the survey fishers. Emphasis was placed on how data are converted into information such as size and density distributions useful for managing and planning a sustainable fishery. Fishers entered data into a computer in order to get a hands-on feel for the mechanics of data processing. The information was used for scientific research papers, but never reached the general public as part of the planned public awareness campaign. Project funds were exhausted by previous activities.

The information generated by this collaborative research was used to prepare a policy paper for the re-opening of the sea egg fishery in October 2001, having extended the three-year closed season by one month. The information was also presented by a team comprising the biologist, a sea egg fisher and a fisherfolk organisation leader at an international conference on "Putting fishers' knowledge to work" in Vancouver, Canada, as part of the project package. The International Development Research Centre (IDRC) of Canada funded participation in the meeting. Upon return the conference participants shared their information and experiences with other fishery stakeholders.

The other output that was not achieved during the co-management pilot project was the establishment of an organisation or arrangement through which resource users and other stakeholders can participate meaningfully in the management of the sea egg fishery. Some formal organisational aspects of the fishery are addressed below.

7.3 Fisherfolk organisations

Establishment and sustainability of fishing industry organisations (fisherfolk organisations) has been a major renewed thrust of fisheries policy and management planning since 1997. Local

and externally funded projects have provided assistance. Over a dozen primary producer organisations have been administratively registered with the Fisheries Division (Table 7.1).

Table 7.1 Fishing industry organisations

Fishing industry organisation	Registration date
Barbados Fishing Cooperative Society Limited	18 Feb. 1986
Oistins Fisherfolk Association	4 Nov. 1997
Weston Fisherfolk Association	29 Jan. 1998
Sand Pit Fisherfolk Association	6 Feb. 1998
Northern Fisherfolk Association	20 Mar. 1998
Paynes Bay Fisherfolk Association	4 May 1998
Speightstown Fisherfolk Association	20 May 1998
Tent Bay Fisherfolk Association	12 Jun. 1998
Pelican Fisherfolk Association	24 Jul. 1998
Pile Bay Fisherfolk Association	18 Nov. 1998
Conset Bay Seamoss Group	17 Dec. 1998
Barbados Fisherfolk Divers Association	5 Mar. 1999
Barbados National Union of Fisherfolk Organisations	26 Mar. 1999
Mount Standfast Marine Preservation Association	12 May 1999

Few of these groups are very active mainly for reasons related to the several dimensions of limited capacity, and some exist in name only. According to the current FMP, non-governmental fishing industry organizations promote self-reliance and ensure that stakeholders are adequately represented in interactions with government and the private sector. They are said to be essential for co-management (Fisheries Division 2001).

7.3.1 Barbados Fisherfolk Divers Association

The Fisheries Division's Fisherfolk Organisation Development Project (FODP) and the Coastal Zone Management Unit (CZMU) co-management demonstration project combined forces to act upon the recommendation from community meetings that an organisation of sea egg divers be formed. Since most sea egg divers were involved in other fisheries, and a critical mass was needed to make the organisation sustainable, it was thought best to broaden it to all divers rather than form a more restricted group of sea egg harvesters only. Nevertheless it was clear that the primary focus would be on sea eggs. The draft constitution, based on the template being used for all other organisations under the FODP, was discussed.

Some organisational meetings were poorly attended as fishers were engaged in the main pelagic fishery. Those able to participate officially formed the association and adopted the constitution in March 1999. The persons present did not know each other as they were from different parts of the island, unlike the other fisherfolk organisations that were formed from people operating at a specific site. The members decided to form an interim management committee of five people, lead by a female president, and aim for a general election in July when more people should be available. The Fisheries Division was to provide support for the organisation during this interim period, but this did not happen as planned. The weak foundation of the group resulted in the organisational structure collapsing before an executive could be elected.

7.3.2 Barbados National Union of Fisherfolk Organisations

The Barbados National Union of Fisherfolk Organisations (BARNUFO) is a secondary, or umbrella, fishing industry organisation. It is not a trade union, but an alliance or federation. BARNUFO's mission, according to the written constitution, is to fulfil the requirements of its member fisherfolk organisations with a view to improving their socio-economic conditions based on sustainable development of fisheries "from the hook to the cook". The body was officially formed on 26th March 1999 when it replaced an informal fisherfolk organisation coordinating council. Both bodies were outputs of the Fisheries Division's Fisherfolk Organisation Development Project. The members of BARNUFO are the primary fisherfolk organisations of Barbados, not the individuals in the industry, although a constitutional reform to allow individual membership is being considered. Two persons can be selected from each primary member organisation to be representatives in BARNUFO. The representatives elect Directors at annual general meetings.

According to its current strategic plan (BARNUFO 2002), the strategic directions for BARNUFO over the 2002 to 2006 period are:

- Building human and financial capital
- Strengthening BARNUFO through networking
- Fostering partnerships between government and the industry

The last is particularly pertinent to the sea egg fishery. BARNUFO also sits on government's Fisheries Advisory Committee (see below). The Fisheries Division began to work with BARNUFO as its main partner in sea egg co-management initiatives such as data collection prior to the co-management pilot project. In 2001 and 2002 policy documents and newspaper articles on the sea egg fishery BARNUFO is identified as the organisation most representative of the sea egg divers. However, the Barbados Fisherfolk Divers Association had long ceased to function, and individuals cannot constitutionally be members of BARNUFO. This reported representation is based mainly on the close connections that the two main leaders of the umbrella body, a woman associated with Conset Bay and a man associated with Oistins, have with the sea egg fishery in their areas and organisations. This is therefore informal, rather than formal, representation.

8 External institutional and organisational arrangements

Moving beyond the major co-management partners in the fishery there are several institutions and organisations that impact on the fishery and arrangements as described below.

8.1 Fisheries legislation

The legal-institutional framework is one of the dimensions of the management of the sea egg fishery in Barbados that has received most attention.

8.1.1 Colonial period laws

Concern in the 1870's about the abundance and distribution of sea urchins around Barbados prompted the implementation of the Sea Egg Preservation Act of 1879. This law prohibited harvest between May and August, their suspected reproductive season (Bair 1962). Parker (In prep.) notes that a1900 amendment of the Sea Egg Preservation Act stipulated that police magistrates should appoint rural constables, and allowed penalties (fines) to be paid to the complainant on successful prosecution.

The 1904 Fisheries Regulation Act was the first comprehensive set of fishery regulations, including the conservation of sea eggs. Parker tracks the changes in legislation from colonial times to the present, noting changes in penalties and closed seasons due to war years poverty and other socio-economic considerations.

8.1.2 Fisheries Act, 1993

The Fisheries Act of 1993, as amended in 2000, is based generally on the OECS harmonized legislation. One significant difference is that it does not provide for local area management authorities (LAMAs) to which the management of marine and coastal areas can be delegated by the government. Providing well defined physical boundaries and establishing a territory to control and exclude others from is one of the strongest and most fundamental requirements of many coastal co-management regimes as witnessed in Dominica and St. Lucia marine protected areas. However, in most other respects relevant to this study there is much similarity. The Barbados law covers:

- Fisheries management and development schemes
- The establishment of a fisheries advisory committee
- Fisheries access agreements
- Local and foreign fishing licensing
- Sport (recreational and game) fishing
- Registration of fishing vessels
- Construction and alteration of fishing vessels
- Fisheries research
- Inspection and safety at sea
- Fisheries enforcement
- Obligation to supply information
- Prohibiting the use of explosives, poisons or other noxious substances

Closed seasons, fishing operations, gear restrictions and other matters are left to regulations that the Minister responsible for fisheries has the authority to create for the management of fisheries. Fisheries regulations have been in draft form since the Act was passed. They are frequently added to or edited by the fisheries authority and legal officers, but seem to come no closer to implementation. Absence of regulations is a serious constraint to proper fisheries management and full activation of the provisions in the parent Act.

The exception is the Fisheries (Management) Regulations dealt with below. However, the 1904 Fisheries Regulation Act was repealed in 1993. During the period between the passing of this Act and the regulations there was no legislation governing sea eggs. Due to purposeful lack of information stating otherwise by the Fisheries Division, most people were unaware that the customary annual closed season was not in place as, and continued to act as if it was.

8.1.3 Fisheries (Management) Regulations, 1998

The Fisheries (Management) Regulations of 1998 were formulated and implemented as an output of the 1997 fisheries management planning process that resulted in the first fisheries management plan described in the next section. The box (8.1) below sets out the content of the regulations governing the sea egg fishery.

Box 8.1 Regulations governing the sea egg fishery

The Minister may declare closed seasons and areas for designated species and gears by Notice published in the Official gazette.

8. No person shall fish for any sea eggs

(a) during the closed season

(b) with the assistance of SCUBA or

(c) in a closed area

9. No person shall

(a) have in his possession

(b) sell or expose for sale

(c) purchase

any sea eggs during the closed season unless such sea eggs were obtained with the written permission of the Chief Fisheries Officer.

10 A person who owns and uses

(a) a vessel or

(b) fishing gear

to fish for sea eggs during the closed season or in a closed area is guilty of an offence.

11. No person shall wantonly injure or destroy any sea eggs.

The Chief Fisheries Officer can grant exemption from the regulations for fisheries research operations approved under the Fisheries Act.

Under these regulations all offences have penalties of a fine not exceeding $50,000 or to imprisonment for 2 years or both.

Source: Fisheries (Management Regulations) 1998

Later sections address the critical issues of enforcement and compliance.

8.2 Fisheries management planning

Under section 4(1) of the Fisheries Act, the Chief Fisheries Officer is to "develop and keep under review schemes for the management and development of fisheries in the waters of Barbados". This was first done in 1997 through a fisheries management planning process.

8.2.1 Fisheries Advisory Committee

A mandatory provision of the Fisheries Act is the establishment of a Fisheries Advisory Committee (FAC) to advise the minister on fisheries management and development. Since 1995 there has been a committee, and in 2000 the membership was expanded from seven to nine persons. The fishing industry retains the majority (five members) and, apart from the four individual occupational members, the fisherfolk organisations are represented at the moment by BARNUFO. As illustrated below, the FAC plays a key role in the fisheries management planning process.

8.2.2 Planning process

The flow chart (Figure 8.1) describes the stages of the fisheries planning process agreed on by the Fisheries Advisory Committee during formulation of the first plan. The Chief Fisheries Officer in consultation with the Fisheries Advisory Committee determines the need for, extent of, and approach to the plan formulation process and public review. A major review of the fisheries management plan (FMP) is likely to occur at least once every three years, which is the recommended duration of each plan period.

Figure 8.1 The fisheries planning process

8.2.3 Management measures

The management measures applied to the sea egg fishery under the Fisheries (Management) Regulations (set out above) are derived from the 1997-2000 fisheries management plan. However, not all of the measures identified as having potential were implemented in the first round of planning due to combinations of limited capacity of the Fisheries Division, objection from the fishing industry and the need to prepare both major stakeholders for the additional responsibilities and authority that such measures would entail, particularly if implemented in the context of co-management as recommended in the FMP. See Appendix 2.

In 1993 Vermeer et al (in press) surveyed 35 fishers about their views on management measures. Most favoured gear and season restrictions over licensing or area measures. At that time the established fishers were against use of SCUBA, as is perhaps more likely in the early days of rival technological innovation. During this research respondents and key informants were almost all against the use of SCUBA, recognising that it was used mainly by opportunists and less experienced fishers for indiscriminate harvest. Yet, all claimed to have witnessed increased use of the gear that is now illegal, even by experienced fishers, driven by competition to harvest urchins. Several claimed to be unaware that use of SCUBA was illegal.

From 1879 to the present, a closed season to protect the peak reproductive period has been the primary management measure. Parker (In prep.) notes that the annual closed season was shortened in war years to ensure food supply, but lengthened whenever stocks declined. Multi-year closed seasons were implemented from 1987-1989 and 1998-2001. However, from inception to the present, closed seasons have been observed more in breach than by compliance, and enforcement has been equally poor. Illegal overfishing is rampant, but Vermeer et al (in press) suggest that effective closures will result in rapid recovery of these populations.

Respondents in Vermeer et al (in press) who commented on licensing criteria favoured length of work in the fishery as the main criterion for licence eligibility if limitation was necessary. In interviews during this study there were clear differences of opinion between male divers and female breakers. While men seem more in favour of restrictive licensing now compared to 1994, women generally favour unrestricted access for fishers and others. Reasons in 2002 include:

- "God put sea eggs there" (so you should not stop anyone from taking them)
- "Young men should pick sea eggs not locks" (gainful employment instead of crime)
- There can never be too many fishers (numbers are low now compared to the old days)
- Picking sea eggs introduces young people to the sea (socialisation)
- Many fishers have started fishing careers through sea eggs (reproduction of labour)
- Hotel workers and other opportunists have the right to make money too (equity)

Vermeer et al (in press) undertook the first look at sea urchin co-management in Barbados, but specifically in the form of community-based management such as introduced in St. Lucia. In 1993 respondents in Barbados were not in favour of management areas, did not think that community leaders could encourage cooperation, and rejected the notion of exclusive harvesting rights. In 2002 respondents said that community-managed areas would not work as fishers are even more mobile than before. Also, fishers have networks of family and friends around the coast of Barbados that would operate to blur any artificial boundaries created, especially since the ideas of territorial rights are alien to fishing patterns. Furthermore, they said that closed areas, such as to protect spawning or juvenile populations, could not work because government cannot enforce them and fishers are too busy to police them. Some fishers reported trying to keep secret, for their own later use, the locations of urchins that they thought unsuitable for harvest. But they said that they often decided to harvest them anyway since other fishers would not be as conservative, and they had no way of excluding others from harvesting.

8.2.4 Sea egg fishery annual work plan

In addition to the co-management pilot project described earlier, the Caribbean Conservation Association (CCA) also funded a project in 2001on fisheries co-management annual work planning that included the sea egg fishery. A letter of agreement was signed between the Fisheries Division and BARNUFO as implementation partners. The project outline is in Box 8.2.

Box 8.2 National fisheries co-management annual work planning

Background

Formal and legally-based fisheries management planning commenced in Barbados under the Fisheries Act with the first plan from 1997-2000. A second plan from 2001-2003 is now entering implementation phase following a participatory process of formulation. The fishing industry and fisheries authority are both interested in co-management approaches to plan implementation and see advantages to developing more discrete and manageable sub-plans linked to government's budgetary cycle. This has lead to the recommendation to collaboratively produce

annual work plans based on addressing the issues identified for each of the fisheries in the 2001-2003 Fisheries Management Plan.

Objectives

Generally, provide funding and facilitation (if necessary) for the fisheries authority and fishing industry to collaboratively produce and report on annual work plans (AWP) for each of the fisheries in the 2001-2003 Fisheries Management Plan, including the planning process itself and progress with plan implementation.

Activities

- Nine fishery-specific AWPs of 3-5 pages produced, signed and distributed by 30 June 2001.
- The annual work planning process, and progress with plan implementation from May 2001 to March 2002, documented and evaluated (by participatory methods) by April 2002.

Source: Caribbean Conservation Association

Draft work-plans for sea egg fishery projects were formulated from two stakeholder workshops aimed at answering the focus question: "What sea egg projects can the Fisheries Division and stakeholders do jointly over the next 12 months to implement the Fisheries Management Plan?" (Fisheries Division and BARNUFO 2001). The workshops lead by the Fisheries Division used facilitated participatory methods in which fisheries officers and fishing organisation members were previously trained.

The workshops were well attended and lively, but never progressed beyond paper plans mainly due to lack of human resources and capacity in both the Fisheries Division and fisheries organisation. Finance was not the major obstacle. It was that the persons who were capable of leading the projects had other demands on their time, and many tasks could not be delegated. In addition, there is not an organisational climate of following through on plans in either group. However, the plans and projects drafted provide information on the types of cooperation that the stakeholders considered feasible in the context of the fisheries management plan (Table 8.1).

Table 8.1 Annual work-plans summaries for sea egg fishery projects

Issue in the 2001-2003 FMP	**Activity category**
Poor track record of compliance with and enforcement of conservation regulations	Law enforcement: ♦ Register all divers and create a database ♦ Set up surveillance to monitor compliance with the regulations
Inadequate fishery information and statistics for planning and management	Education: ♦ Prepare easy-to-read biological information on sea eggs ♦ Village discussions with stakeholders to exchange information ♦ Educate public on their role in sustaining the sea egg fishery Resource assessment: ♦ Set up mechanism for collection harvest, biological, social and economic data for decision-making
Stock usually low, highly variable and extremely vulnerable to overfishing	Harvest limits: ♦ Obtain stakeholder agreement on 2002 harvest season and make appropriate legislation ♦ Produce reports to update stakeholders on agreement and progress of harvest
The institutional arrangements	Community participation:

for managing this fishery have not been fully developed	♦ Develop community-based reporting systems to provide feedback and communication among stakeholders

Adapted from: Fisheries Division and BARNUFO (2001)

8.2.5 Other forms of organisation

These fisheries work-planning workshops held in 2001 identified, again, the need for a fisherfolk organisation or arrangement through which sea egg divers could formally cooperate and collectively negotiate with government. Participants recommended that an ad hoc council of community leaders be formed instead of a formal organisation, as there was little chance of a scattered group who interacted infrequently remaining cohesive. The same conclusions were reached in the workshops of this project. However, the question of whether the Fisheries Division is able to establish, assist and work with such a structure still remains. It is noteworthy that the projects of the annual work plan do not include setting up an organisation of any sort.

8.3 Integrated coastal management

The Coastal Zone Management Act requires that a coastal zone management plan be prepared, including the standards for the management of underwater parks and of restricted areas. The Act states that fisheries management plans for living resources outside of restricted areas shall prevail in the case of conflict with the coastal zone management plan. It outlines a 5-year planning cycle and means for public participation. The Act does not specifically address the integration of fisheries issues as encouraged by the Code of Conduct for Responsible Fisheries, but there is scope for this to occur through participatory processes.

One of the major issues that emerged when attempting to engage sea egg fishers in management oriented activities was their insistence that many of the problems encountered by the industry are due to human impacts on the resource and the algae that are its food source (Mahon et al 2003). The problems cited by the fishers included:

- ♦ Discharge of swimming pool water and sewage into the sea,
- ♦ Effects of oil from vessels passing or anchored,
- ♦ Agricultural chemicals in runoff from the land in groundwater that seeps into the sea,
- ♦ Sediments in runoff from the land,
- ♦ Loss of seagrass through burying or erosion of sand when coastal structures are built,
- ♦ The practice (now ceased) of beach cleaners burying algae at the tide line together with juveniles sea eggs that are hidden in the algae.

The importance of these impacts relative to the impact of fishing is not known, although fishing is considered to be the major cause of the decline in sea egg abundance. However, while these mostly illegal practices occur, it is difficult to persuade fishers to comply with fishery regulations

8.3.1 Coastal Zone Management Unit (CZMU)

The Coastal Zone Management Unit (CZMU) was set up in 1983 as a specialized governmental unit specifically concerned with issues relating to coastal erosion and the application of management strategies for dealing with this threat. The objective of the Unit is to design and implement a comprehensive and effective Coastal Zone Management Plan for the island and to ensure that the coast retains its vital and pivotal role in the economic, social and physical development of Barbados. This process is well under way as set out in the Coastal Zone Management Act of 1998 with in the five main operation areas of the Unit, which are.

- ♦ Oceanographic assessment
- ♦ Coastal research

- Consultation on coastal engineering
- Development control
- Education outreach

Its mandate has broadened to encompass climate change and marine protected areas (MPAs). About two-dozen technical and support staff members perform the routine work of the Unit. They also provide critical support during the major, externally funded, research and coastal engineering projects that have occupied the Unit for its entire period of assistance. Although it has become more integrated into being a regular government agency, the CZMU often still operates in the mode of project unit.

The Unit became a stakeholder in the sea egg fishery in 1998 through the implementation of a co-management demonstration project described later. Since then the CZMU has maintained interest in the fishery. Under the current legislation management plans of the Fisheries Division take precedence over coastal management plans in the areas where the fishery takes place.

8.3.2 Co-management demonstration project

The Inter-American Development Bank (IDB) has funded coastal conservation projects in Barbados since the CZMU was established as a project implementation unit. These have been mainly bio-physical and engineering in nature, being aimed primarily at sea defences. In recent times more attention has been placed on legal-institutional, planning and human dimensions. The sea egg co-management demonstration project implemented from 1998 by consultants to the CZMU in collaboration with the Fisheries Division (People Dynamics Associates 1998a and b) is described in Box 8.3.

Box 8.3 Participatory methodology used for sea urchin co-management in Barbados

This project aimed to develop co-management practices for exploited marine fishery resources in Barbados using the sea urchin fishery as a test case. The approach was to work with stakeholders, primarily the fishers, to establish a co-management mechanism that could be operated by the fishers themselves with technical and advisory support from the Fisheries Division. The project used a participatory methodology, the Technology of Participation (ToP), developed by the Institute of Cultural Affairs (ICA). ToP methods used included Focused Conversation and Participatory Strategic Planning. To our knowledge, this methodology has not previously been applied in small-scale fisheries co-management. Fisher involvement was developed in stages: identification of groups of fishers in communities and a contact person for the group; dialogue with individuals and the small groups; discussion in larger groups to derive approaches to management; and full group participation to reach consensus regarding the most appropriate approach to management. Key persons identified in communities helped organise meetings to discuss the sea egg fishery. From these community meetings, individuals were selected to take part in the strategic planning. Two vision meetings with separate groups of fishers, produced similar results. These groups were combined at a planning meeting, where fishers examined the blocks (obstacles) to achieving the vision, developed strategies to overcome them, and an action plan to implement the strategies. Fishers and government officials concluded that the methodology had successfully facilitated the input of both parties and produced a workable, consensual approach.

Source: Mahon et al 2003

Although the formulation of the 1997-2000 fisheries management plan allowed input from the fishing industry, this was the first occasion in which the contributions of those in the sea egg fishery were systematically incorporated into a national perspective from the bottom-up. Of particular importance is the vision that stakeholders had for the sea egg fishery (Table 8.2).

Table 8.2 Elements of the vision for the sea egg fishery

WHAT WE WANT TO SEE IN PLACE FOR THE SEA EGG INDUSTRY IN FIVE YEARS
• Management measures decided and in place, including licensing
• Sea egg divers' organisation established
• Laws more strictly enforced
• Co-management working
• Having some effect on pollution & polluters
• Marketing system set up
• Safer harvesting
• Research & development activities ongoing
• Sea eggs back and divers working

Source: Mahon et al. 2003

8.4 Research institutions

Scientific research by organisations external to the normal fisheries management environment has played a more significant role in shaping the management of the sea egg fisheries than any other fishery in Barbados.

8.4.1 Bellairs Research Institute of McGill University

Scientists and graduate students conducted fisheries related research at McGill's local marine science station, particularly from the 1950s to 1980s. Lewis (1958), who was Director there, conducted the first detailed scientific study of the biology and ecology of sea eggs in Barbados. The mid-1980s populations of urchins were so low that Bellairs Research Institute, UWI and Fisheries Division participated in an International Development Research Centre (IDRC) funded project on fishery rehabilitation and recommendations for management. This lead to the 1987 to 1989 closed period. Bellairs provided field laboratory facilities for UWI students doing research on sea eggs.

8.4.2 University of the West Indies (UWI)

The UWI offers fisheries and environmental research and teaching through undergraduate courses in marine science. Graduate degrees are part of the Natural Resource Management Programme (NRM) offered through the Centre for Resource Management and Environmental Studies (CERMES). Masters and doctoral students in the Biology Department of the campus have done several studies on the urchins and the fishery. Without the input of knowledge from the university, there would perhaps only be local ecological knowledge available as the basis for making management decisions since the research capacity of the Fisheries Division is limited.

8.4.3 Dalhousie University

Sea egg fishery management also gained from the work of scientists from Dalhousie University, in Halifax, Canada. Mladenov and Scheibling (1987) provided estimates of urchin abundance, levels of harvest and the value of the fishery. Their work in association with the UWI, Fisheries

Division and Bellairs Research Institute assisted in supplying justification for the 1987-1989 closure of the fishery.

8.5 Non-governmental organisations

Non-governmental organisations (NGOs) have played several roles in the fishery.

8.5.1 Caribbean Conservation Association (CCA)

The (CCA) is a regional environmental organisation based in Barbados, Established in 1967, the CCA facilitates the development and implementation of policies, programmes and practices that contribute to the sustainable management of the region's natural and cultural resources. The Fisheries Division and BARNUFO implemented the annual fisheries work planning and co-management pilot project under CCA's Coastal and Marine Management Programme (CaMMP) that was described earlier.

8.5.2 Barbados Marine Trust (BMT)

Formed in May 2000, the BMT is interested in the management and conservation of coastal and nearshore resources. The BMT has taken photographs of illegal sea urchin harvest, held a multi-stakeholder meeting on the issue and publicly condemned the practice. The Trust has been well represented in discussions on sea egg management and favours working with fishers to examine issues and alternatives.

8.5.3 Gulf and Caribbean Fisheries Institute (GCFI)

The GCFI is a regional organisation, registered in the USA, that facilitates information exchange on technical and scientific fisheries topics mainly through its annual meetings. Fisheries officers attend these meetings and work such as Vermeer et al (in press) is presented to subsequently appear in the proceedings of the meeting.

8.6 Policy arena

Like the 1987-1989 closure, the decision arising out of the first fisheries management plan to close the sea egg fishery from 1998-2001 was easily taken by policy-makers perhaps because fishers strongly supported the measure having seen the population depleted. The public consultation process was thorough. There was virtually nothing for anyone to lose by these closures as there was little or nothing to harvest.

The policy paper recommending the two-month open season for October and November 2001 on the basis of the surveys was also routinely accepted. In August 2002 the Fisheries Division provided information for a policy paper arguing for a one-month season, instead of two months, due to high levels of poaching during the preceding closed season. The recommendation for a short opening was based on surveys done in July and August 2002, and "reliable fishers" reporting declining numbers of sea eggs prior to the opening. The standing stock was expected to be lower than in 2001 at the time of opening. Fewer juveniles had been seen compared to 2001.

The policy paper stated that the shorter opening, intended to leave back more adults, came from the Fisheries Division in collaboration with BARNUFO which represented the fishers. Although not stated in the policy paper, the Fisheries Division acknowledged in communication to the Ministry that some fishers might consider the one-month opening to be unjust to those who abided by the closed season and did not poach. There was no reason given for opening

the season in September instead of October, as in 2001, but the former has been the traditional month for the season to commence, and pressure to harvest is high once urchins are available.

As soon as the one-month season was announced there were outcries from fishers in the local press about the season's brief duration and timing a month too early. A very brief policy paper was approved near the end of September 2002 to extend the season to the end of October by means of the notice published in the Official Gazette. The policy paper said that due to inclement weather fishers had been contending that they were not able to harvest the crop in the month provided. It asserts that the Fisheries Division agrees with the fishers and advises that the season be extended.

Unlike the previous policy paper there is no reference to conservation, harvest to date, or the possible effects of sea conditions on the urchin populations or recruitment for 2003. Neither is there mention of concurrence by BARNUFO, which was previously cited as the voice of the fishers. Unlike the arguments for the one-month season, there were no strong supporting arguments found at the Fisheries Division for the one-month extension, and BARNUFO is quoted in the press as defending the one-month opening even in the face of criticism from fishers and others.

9 Exogenous events

Exogenous events are those beyond the control of the resource users, fisheries authority and often the entire fisheries management system. They are more than uncertainty in the system, but include sudden shocks and surprises that test the resilience of both ecosystems and human systems. Obvious examples are most types of natural disasters, but macroeconomic and social impacts are also very relevant to the small open economies of Caribbean countries.

9.1 Hurricanes and storms

Barbados lies in the southern extremity of the Atlantic hurricane belt, and has not suffered a serious national impact from a direct hurricane hit since Janet in 1955. However, several storms and near misses of hurricanes (especially Hurricane Allen in 1980) have created sea conditions that impacted the fishing industry (Table 9.1).

Table 9.1 Hurricane and other rough sea events that impacted Barbados

Weather system	**Date**
Hurricane	1675
Hurricane	1780
Hurricane	1831
Hurricane	1898
Hurricane Janet	21 Sep. 1955
Hurricane Allen	3 Aug. 1980
Unidentified rough sea event (depression)	28 Sep. 1983
Unidentified rough sea event (depression)	9 Nov. 1984
Tropical depression (became Hurricane Gilbert)	9 Sep. 1988
Tropical storm Isaac	30 Sep. 1988
Tropical storm Joan	13 Oct. 1988
Weston flood	3 Aug. 1995
Tropical storm Iris	25 Aug. 1995
Hurricane Marilyn	13 Sep. 1995

Dozens of vessels were lost or damaged, and relief measures were put in place to facilitate recovery. The large-scale fleet re-building that took place after Janet in 1955 was also used as an opportunity to accelerate motorisation of the fleet.

The Central Emergency Relief Organisation (CERO) coordinates a network of disaster response agencies of which the Fisheries Division is a part. The Division prepares or updates an annual hurricane plan to safeguard the fleet, including arrangements with the private sector for vessel haul-out, lifting or shelter. There are also annual extension events, such as workshops and simulations, to carry preparedness information into the fishing industry.

Fisherfolk organisations have not played any significant role in hurricane preparedness, but individuals in the fishing industry typically collaborate well with each other, government and the private sector to secure vessels. During the life of the FAC there have been no major rough sea events to deal with, but the committee normally reviews the annual hurricane plan.

9.2 Fish kills

The fish kill events that occurred in several southeastern Caribbean countries between August and October 1999 were accorded the status of natural disasters due to their substantial ecological and economic impacts in most of the countries affected. The issue was discussed at a high political level within the Caribbean Community (CARICOM). In response, the CARICOM Secretariat (CARISEC) through its CARICOM Fisheries Resource Assessment and Management Programme (CFRAMP) in association with the Caribbean Environmental Health Institute (CEHI), the Pan American Health Organisation (PAHO) and government of Barbados agreed to host an emergency one-day workshop to share information and formulate responses as reported in Willoughby (1999). The Barbados fish kill event is summarised in Box 9.1.

Box 9.1 Summary of Barbados fish kill event

- Since Friday 17th September, residents and fishermen have reported large numbers of dead reef-associated fish on a beach along the southeast and east coasts.
- During the first two weeks the fish kill was confined to the southeast and east coasts. Dead fish from this area were taken by current and tides to beaches where fish kills have not been confirmed.
- During the third week the number of dead fish on the southeast and east coast beaches declined to almost zero.
- During the fourth week hundreds of dead fish washed up long the north coast.
- The species composition of dead fish found on the beaches along the southeast and east coasts
  - 33 species from 20 families
  - 18 unidentified species
  - The majority of dead fish were surgeon fishes (47%) followed by Bermuda Chubs (23%), parrot fishes (7%), sea basses (5%), trigger fishes and grunts (each 4%). The other species each represents less than 2% of the dead fish and together only 10%.
- Other observations:
  - Wash-ups occurred mainly at night
  - Green/dirty water was reported prior to and during early stages of the fish kill
  - High sea surface temperatures 28 – 32^0 C during September
  - Reversals of normal NW currents prior the first observed fish kill
  - Pelagics have not been affected so far
  - Gross anatomical examination revealed

- No external abnormalities such as sores or lesions
- Gills and livers were pale in colour
- The stomachs and guts of species sampled (except the Bermuda chub) were empty
- The stomachs of the Bermuda chubs examined were filled with an unidentified algae
- The bile bladder of some samples was ruptured

- Large numbers of the seedlings of an unidentified legume were on the beaches during the initial stages of the fish kill.
- Impact was mainly on adult fish.

Source: Willoughby 1999

In Barbados, microscopic examination revealed several lesions and large numbers of a *Streptococcus* bacterium was confirmed as the primary cause of death. Local and overseas analyses suggested that the bacterium was *Streptococcus iniae*. Fish from non-affected areas on the west coast showed no signs of the bacterium. Orinoco River and the Amazon River outflows moving along the South American coastline develop a series of surface freshwater lenses. These lenses are known to be lower in salinity and oxygen, and higher in temperature than seawater and can be maintained for up to 1 to 2 months.

The countries affected felt impacts on their economies, particularly fisheries and tourism sectors. The news media reported widely on the problem. All fish sales plummeted everywhere in Barbados, not just of affected species or locations. People were reluctant to have sea baths in fear that there was an unknown threat to public health and safety. Recovery, long after the fish deaths had ceased, was facilitated in Barbados by fisherfolk organisations and independent fish processors combining forces to offer free fish samples to the public in a display of solidarity and confidence in their products. Since 1999 there have been much smaller annual re-occurrences in Barbados in areas where the original impacts were greatest. These residual effects are expected to continue during periods of elevated sea temperature.

The 1999 fish kill event and half-million dollar compensation package offered by government to fishing enterprises engaged the attention of the FAC. The identification of eligible recipients and disbursement of compensation funds was implemented collaboratively by BARNUFO and the Fisheries Division. Today it still remains the activity that BARNUFO is best known for.

9.3 International economics and events

As noted earlier, globalisation, trade liberalisation, international terrorism and other external events often and persistently impact negatively upon the economy of Barbados. Impacts were cumulative and severe in 2001, resulting in the negative growth previously reported upon. It is likely that international events will continue to influence the fortunes of the fishing industry through the general economy and features such as credit availability, interest rates, liquidity, spending power and trade regimes.

10 Incentives to cooperate and patterns of interaction

The resource system and human system characteristics described in previous sections provide incentives for the stakeholders to engage, or not to engage, in co-management. Incentives to cooperate, or not cooperate, vary with the stakeholders, particular circumstances, time and other factors. Co-management arrangements are often dynamic. Although incentives vary, they must always exist to ensure that arrangements are effective and sustainable. Finding new incentives to sustain co-management institutions can be a constant challenge for all partners.

Patterns of interaction reflect the nature of these incentives, disincentives and the types of partnerships that may be formed or sustained in co-management. In this case interactions are:

- Among fisherfolk, including their groups and organisations
- Between fisherfolk and the Fisheries Division
- Between the Fisheries Division and the Ministry of Agriculture
- Among all of the sea egg fishery stakeholders, generally
- Between fishery stakeholders and interested parties (e.g. researchers)

Several interactions have been described in previous chapters. Sections below examine additional information collected, and participatory activities undertaken, during this project in respect to understanding these interactions.

10.1 Inception workshop

The multi-stakeholder project inception workshop in May 2002 involved persons employed in the sea egg fishery, the fisheries authority, researchers, enforcement agencies, environmental NGOs and others. In describing what they wanted this project to address, they provided insight into the nature of the fishery that is outlined below in no particular order (Box 10.1).

Box 10.1 Insight from multi-stakeholder inception workshop

- Poor enforcement of existing legislation, especially against powerful offenders (often well-known consumers), encourages continued law-breaking by fishermen who feel protected by the powerful offenders
- Low priority of fisheries enforcement by police and coast guard necessitates innovation to devise non-traditional enforcement involving fishers and coastal users more (e.g. hotline)
- Community council and local area management should be attempted to improve compliance
- Enforcement needs to involve people who know about the fishery and fishing methods
- Education about sea egg conservation regulations may be adequate but is being ignored
- Pollution is perceived as a factor contributing to reduced levels of urchins and their food
- Enforcement officers may not have timely information or right equipment to do job well
- Production of evidence for prosecution may be a problem; not sure about evidence rules
- A training session on evidence rules and requirements for successful prosecution needed
- Good recruitment for this and last year has resulted in urchins overgrazing seagrass beds and depleting their own food supplies, although it seems urchins can survive in marginal areas
- Fishing the urchins hard to reduce populations may be appropriate now, and hence illegal fishing may be a useful occurrence, since the regulations are not flexible enough to easily vary harvest regimes within the current legal framework
- Mysteries remain about mechanisms of urchin mass disappearances observed by fishers
- Based on prior traditional practice, urchin small-scale transplantation experiment suggested
- Long term plan for sea egg management still needs to be developed and fully implemented
- Given high levels of uncertainty about several aspects of the fishery, no one or agency may be willing to invest much money, time, effort or resources into any management initiative
- Personal letters outlining conservation regulations and sent to the people known to be sea egg fishers could stimulate greater compliance based on their fear of secret observation
- The main illegal fishing offenders are the opportunistic occasional fishers or people looking to supplement income from their regular jobs with a quick, low-investment, high-profit activity

10.2 CZMU demonstration project

The demonstration project undertaken by the CZMU was described previously. The vision elements were outlined. The issues, attitudes and actions identified by the participants as blocking the vision from being achieved provide information on the patterns of interaction that act against incentives for cooperation. These are in Box 10.2 below.

Box 10.2 Blocks to achieving the vision for the sea egg fishery

Block No. 1: Divers don't cooperate with one another

- Too many people taking sea eggs
- Recreational divers are taking sea eggs
- Nobody educates young divers
- Fishers doubt their ability to manage the fishery
- Divers are competitive with each other
- "I can do it myself" attitude
- Being our "brother's keepers" is not happening
- Fishers are not organised
- Fishers do not meet frequently
- There is a need for self-control

Block No. 2: Government and fishers don't communicate with each other

- Agreement among fishers regarding management doesn't exist
- Fisheries Division cannot do research alone
- There is no group for Fisheries to work with
- There is a need for cooperation
- Fishers need more awareness for organising
- Fishers are not aware of their own power
- Fishermen don't want to take responsibility
- There is no interaction with sea egg divers and Fisheries
- There is not enough information coming from Fisheries

Block No. 3: Wrong and inadequate rules and regulations

- No licensing procedures for divers or vendors exist
- There are no restrictions on divers
- Government is ignorant (of what will work)
- Laws are not strict enough
- The harvesting season is too long
- Diving systems need changing

Block No. 4: Inadequate law enforcement

- Enforcers are not trained
- Enforcers are not well informed
- There are too few law enforcement personnel
- Police and magistrates are not serious

Block No. 5: Government is not dealing with polluters

- More awareness is needed on the ill effects of pollution
- Trying to stop pollution would be too expensive
- There is poor land management

Block No. 6: Government puts a low value on fisheries

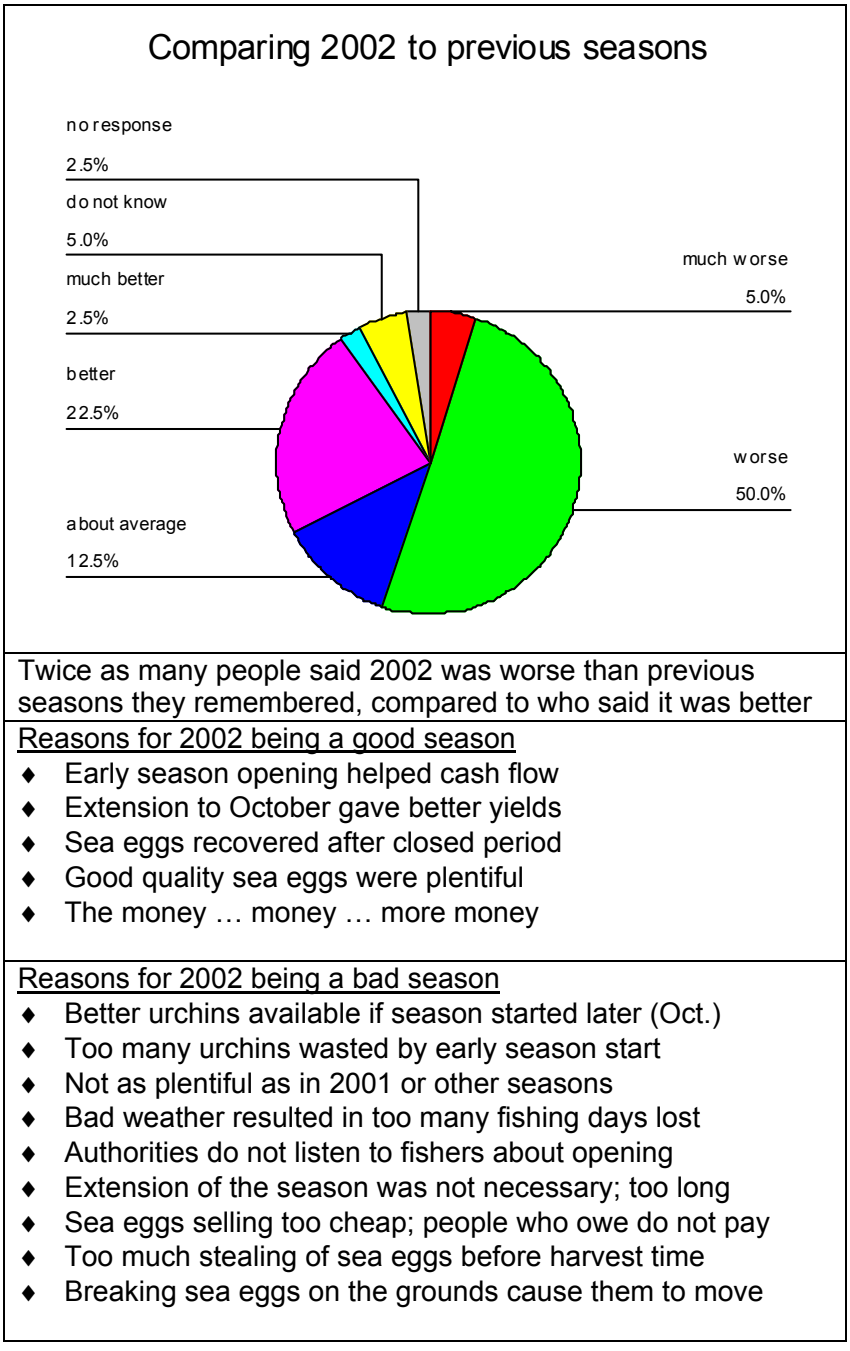
- Sea eggs have a lower value than tourism
- Government favors tourism over sea eggs
- Politicians are not serious about the fishing industry

Source: Mahon et al 2003

10.3 Workshop on the sea egg fishery 2002

Following the extended 2002 sea egg season from 1 September to 31 October, an evaluation workshop was hosted by the Fisheries Division and BARNUFO on 21 November 2002. Like the inception workshop, it was a multi-stakeholder event. The results of the small surveys (N=40) at Oistins, Silver Sands and Conset Bay were presented for feedback and validation. Participants were also asked to make additional observations and recommendations for enhancing future co-management initiatives. Some of the main points are below.

To put 2002 in the context of the recent performance of the fishery, respondents were asked to compare it with other seasons. Perceptions and reasons for the responses are below.



Twice as many people said 2002 was worse than previous seasons they remembered, compared to who said it was better

Reasons for 2002 being a good season

- Early season opening helped cash flow
- Extension to October gave better yields
- Sea eggs recovered after closed period
- Good quality sea eggs were plentiful
- The money … money … more money

Reasons for 2002 being a bad season

- Better urchins available if season started later (Oct.)
- Too many urchins wasted by early season start
- Not as plentiful as in 2001 or other seasons
- Bad weather resulted in too many fishing days lost
- Authorities do not listen to fishers about opening
- Extension of the season was not necessary; too long
- Sea eggs selling too cheap; people who owe do not pay
- Too much stealing of sea eggs before harvest time
- Breaking sea eggs on the grounds cause them to move

Figure 10.1 Comparing 2002 to previous seasons

In the survey, respondents were asked to identify the biggest problems in fishery. Responses, in no particular order, included:

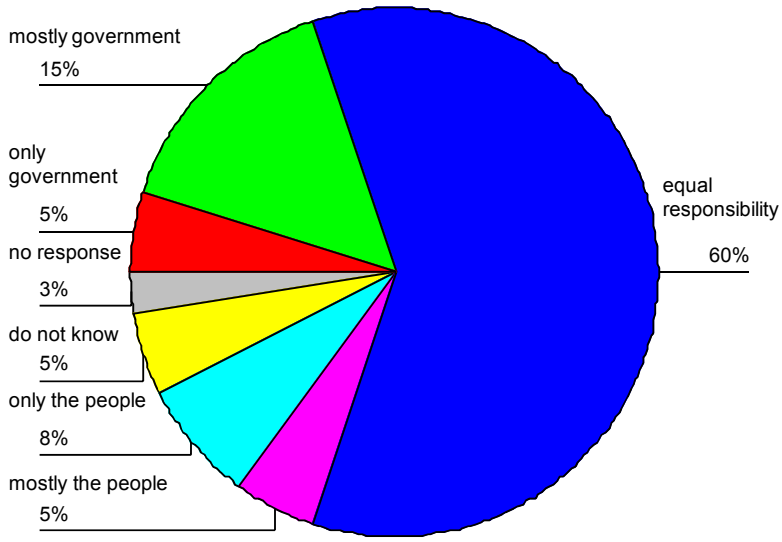
- Rough seas stop you from harvesting

- Not enough moss (seaweed) washing ashore
- Not enough time to fish sea eggs properly
- Reaping sea eggs before they are ripe
- National Conservation Commision (NCC) burying the moss urchins need
- Authorities know nothing about fishing
- Fishers are divided, cannot get together
- Illegal harvesting (out of season, tank divers)
- Not enough enforcement in or out of season
- Pollution from agriculture and hotels
- Too many people with other jobs also picking sea eggs

Respondents were also invited to suggest solutions to the biggest problems. They included:

- More patrols, enforcement and large fines or jail
- Fishers should join organisations
- Use people who live on the coast to patrol
- NCC should carry moss back out to sea
- Sea egg fishers should be licensed
- Always start the season in October
- Extend season from August to November
- Use monitoring teams to advise authorities
- Organised fishers and fisheries authorities need to talk to each other to make better decisions

The term “co-management” is not yet in common use in the fishing industry, and as stated in the research framework, it encompasses a variety of combinations of roles and responsibility and power sharing. Respondents were asked their views on how management responsibility should be shared as shown below (Figure 10.2)



Most people want equal sharing of responsibility with government

Reasons for responses to sharing management responsibility

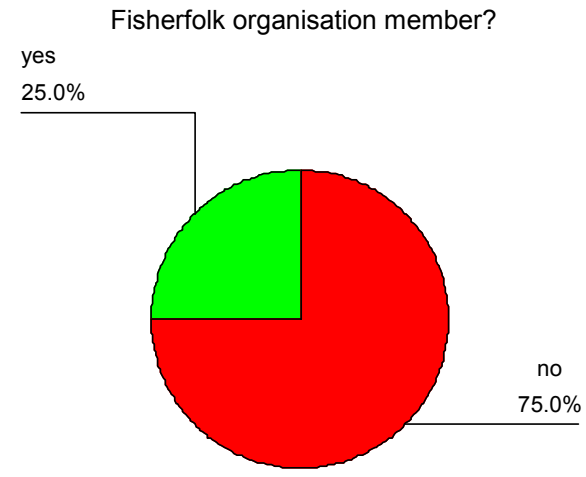
- More to government
  - Fisheries Division should be able to advise government
  - Government may not listen to fishermen
  - Government has the authority and power
  - Fishers always break the law, even those in fisherfolk organisations
- More to the people
  - Fishers know the most about sea eggs
  - Fishers spend more time at sea to see
  - People need to protect own interests
  - Fishers know more about sea eggs, but they cannot enforce without government

Figure 10.2 Views on management responsibility

Anticipating, from previous experience, a preference for collaboration that exceeded what was witnessed in practice, respondents were asked to identify difficulties in collaboration. They said:

- Government is a good listener, not a good doer
- Government does not live up to promises e.g. enforcement
- Government would restrict the open season
- Government chooses the wrong fishers for seeking advice
- People and authority want season open at different times
- People on either side would rather have their own way
- Government only listens to people who went to university
- Government makes plans without involving the people
- When Fisheries Division agrees to something, government does something else

Fisherfolk must be organised in order to participate most effectively in management. The survey determined the proportion of respondents who were organisation members, and asked if organisations can help to manage the sea egg fishery. Results are in Figure 10.3.

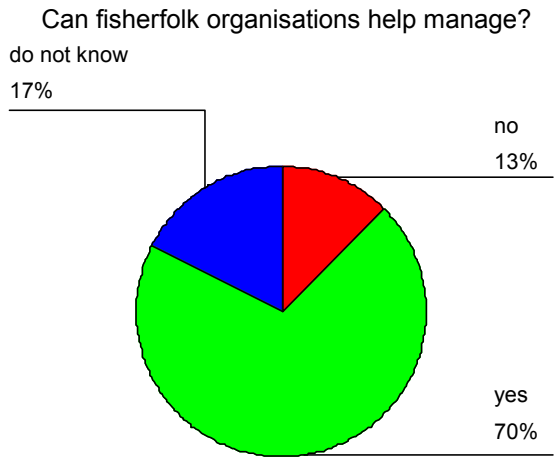


Although 75% of the people were NOT MEMBERS of any fisherfolk organisation, 70% of the people said fisherfolk organisations could help manage the sea egg fishery.

What does this mean?

If people think that fisherfolk organisations can help to improve their situation, why are people not members of organisations trying to make a difference?

What are the barriers?



Management by organisations

- Reasons for "no"
  - Fishers too divided
  - Some organisation members poach
  - Don't know anything about sea eggs
  - No discipline in the organisations for rule-breakers
- Reasons for "yes"
  - Have the knowledge
  - Best for monitoring
  - Should have a say in making decisions
  - Better when people come together
  - Can communicate amongst themselves

Figure 10.3 Organisational membership and roles

From these answers there is a considerable gap between the present and a potential role for fisherfolk organisations in management according to these respondents.

10.4 News media

Cecil (1999) points out that the popular press is an invaluable source of information and perspectives on fisheries issues in Barbados. Articles on the sea egg fishery over recent years of openings provide a glimpse at its location in the social and economic landscape. Articles from the two daily newspapers are annotated in Table 10.1.

Table 10.1Annotated contents of newspaper articles on sea eggs, 2001-2003

Date	Headline	Main points
30 Jan 2001	Sea egg catch costs St. Philip man $500	♦ Barbadian mouths water at mention of sea eggs ♦ Fisher pleads guilty to having urchins out of season ♦ Fined $500 in 6 weeks or 3 months in prison
15 Feb 2001	SOS call to stop sea egg poachers	♦ Representative of Barbados Marine Trust reported saying at sea egg workshop that illegal harvest is common on east coast with out anyone doing or saying anything about it ♦ Advises people be educated in conservation and compliance ♦ Barbados is a leading economy, but stakeholders in other islands are more active in support of conservation
14 Jul 2001	Sea egg probe	♦ Fisheries officials probing mysterious deaths of hundreds of sea eggs that are washing up in Christ Church ♦ Starvation due to overpopulation has been ruled out ♦ Mass mortalities not uncommon when urchins are exposed
12 Aug 2001	Can't wait for those sea eggs	♦ Commentary notes public saying the 3 year closure is rewarding due to high populations of urchins everywhere ♦ Describes how passion for sea eggs starts in school days ♦ Preferences for local to imported sea eggs in supermarkets
26 Oct 2001	Pickers report good sea egg season	♦ Fisheries Division pleased with progress of 2 month season ♦ Fisheries Division in close contact with harvesters to do surveys for forecasting next year's crop

Date	Headline	Main points
		♦ Extension of closed season to 30 Sep 2001 will help 2002 season
31 Oct 2001	Prize egg a sight to see	♦ First-time diver found a giant-sized (1 kg) urchin
1 Dec 2001	Give sea eggs a chance to grow	♦ Fisheries Biologist warns that illegal harvest can wipe out future crops ♦ During the closed season the Fisheries Division is working with fisheries to determine length of 2002 season opening
20 Aug 2002	Father, son plead guilty to harvesting sea eggs illegally	♦ Magistrate chided father for involving son in illegal activity ♦ Were found by Coast Guard swimming with traditional gear ♦ Defence attorney quoted as saying crime of illegal harvest does not "affect or tamper with the moral and social fabric of our society"
27 Aug 2002	Fishermen to face court in November	♦ Four Christ Church fishers charged with illegal harvest ♦ All denied contravening the fisheries regulations
30 Aug 2002	Caught with sea eggs	♦ Father and son plead guilty of illegal harvest a few days before season opening ♦ Father fined $350 in 6 weeks or 6 months in prison and placed on a 2-year bond
1 Sep 2002	Sea egg "squeeze"	♦ Fishers at Silver Sands and Bayfield want 3 month season ♦ Interviewees include 2 men charged earlier with illegal harvest ♦ BARNUFO says one month is enough
2 Sep 2002	Sea eggs galore	♦ Photo story showing smiling female breakers at Silver Sands ♦ Divers flocked to beaches for good season start
2 Sep 2002	High-priced sea egg harvest	♦ Photo story of urchin landing on beach and consumption ♦ Fishers threatening price increases to make enough money in one-month season ♦ Plan to take case for longer season to Prime Minister at a nearby political meeting ♦ Breaker says families depend a lot on urchins for income but price increases are unlikely
3 Sep 2002	Sea egg plea	♦ MP for Silver Sands and Minister of Economic Development asks government to consider fishers' request to extend season ♦ Financial importance of urchins to households reiterated ♦ Need to balance between conservation and immediate benefits to livelihoods ♦ Minister asks fisheries authority to consider local knowledge ♦ Arguments for season extension may vary with location
6 Sep 2002	Divers split on sea eggs	♦ Oistins fishers want season closed and re-opened in October as too many urchins are immature, with low yield ♦ Martins Bay fishers want season extended by a month as they are harvesting mature urchins and young urchins ♦ BARNUFO president says season extension is not justified
7 Sep 2002	Bajans are sea egg crazy	♦ Commentary on popularity of urchins, their social and cultural role in gatherings ♦ Persistent illegal harvest in the closed season well known ♦ Description of culinary preparation and complaint of high price

Date	Headline	Main points
8 Sep 2002	No evidence of sea egg depletion	♦ Letter to the editor from alleged fisher of 20 years experience in disagreement with short season ♦ Challenges knowledge of BARNUFO president about sea eggs and says that silencing her would be better for fishers ♦ Claims "all sorts of people" determining livelihoods of fishers ♦ Urchins are plentiful in northeast areas where seas are too rough for easy harvest, so no depletion
22 Sep 2002	Official urges: bury sea egg shells	♦ Chief Fisheries Officer says public is complaining about sea egg shells left on the sand ♦ Warns breakers to bury shells, and divers not to use SCUBA that increases depletion ♦ Fisheries boasting bumper crops and increased incomes
28 Sep 2002	Another month to catch sea eggs	♦ Minster announces extension by one more month (October) ♦ Decision by Cabinet due to bad weather and storm passage reducing the number of fishing days in September ♦ Extension will result in a shortening of 2003 season
28 Sep 2002	Harvesting period for sea eggs extended	♦ Fishers relieved at extension of season to 31 October ♦ Cabinet decision favouring extension was unanimous
1 Oct 2002	Vendors happy over extra month for sea eggs	♦ Photo story of smiling breakers on the job at Silver Sands ♦ Happy because bills can be paid, children fed and public satisfied
13 Oct 2002	Morning routine ends in tragedy	♦ Sea egg fisher falls out of boat and dies at Conset Bay
1 Sep 2002	Shorter sea egg season this year	♦ Fisheries Biologist reported as saying short season due to poachers plundering crop that had subsequently dwindled ♦ Short season to leave breeding adults to ensure recruits for 2003 season
1 Apr 2003	$250 for having sea eggs	♦ Man pleaded guilty to poaching, resisting arrest and assaulting an officer ♦ Fined $2500 in 6 weeks or 6 months in prison for sea egg offence, also 120 hours of community service
3 Apr 2003	Fisherman to pay dearly for harvesting sea eggs	♦ Fisher pleads guilty to poaching sea eggs ♦ Fined $350 in 2 weeks or 7 days in prison

Source: Nation and Advocate newspapers

10.5 Enforcement and the law courts

At the inception and other workshops, plus in interviews, fishing industry respondents identified the historical lack of enforcement of the fishery regulations, and the closed season in particular, as a reason for scepticism about government being a reliable co-management partner. Vermeer et al (in press) found that fishers highlighted encounters with coast guard that could indicate more active enforcement than is normally perceived, or could just be exaggeration. Coast Guard records queried in this project showed six documented responses in 2001 and five in 2002. Some of these were reports from citizens, and most did not lead to prosecution. The cases that resulted in prosecution are in Table 10.2.

Table 10.2 Cases of successful sea urchin law prosecution June 2001- April 2003

Description	**Case 1**	**Case 2**	**Case 3**	**Case 4**
Ref. date	30 June 2001	30 Aug. 2002	01 Apr 2003	03 Apr. 2003
Offender(s)	Keith Maynard	Leslie Clarke and Simon Clarke	Marvin Kinch	Anderson King
Age	45	51 and 17	27	20
Home address	Work Hall, St. Philip	Bayfield, St. Philip	St. Christopher, Ch.Ch.	Silver Sands, Ch.Ch.
Charge	Harvest out of season	Harvest out of season	Having sea eggs out of season	Harvest out of season
Court	District C	District A	Oistins	District A
Magistrate	Emmerson Graham	Clyde Nicholls	Marva Clarke	Valton Bend
Penalty	$500 in 6 weeks or 3 months in prison	L.C.: 2 year bond of $1000; $350 costs in 6 weeks or 6 months in prison S.C.: reprimand and discharge	$2,500 in 6 weeks or 6 months in prison; and 120 hours community service	$350 in two weeks or 7 days in prison

Source: Nation and Advocate newspapers

Respondents to the survey and key informants also made the following points:

- Compared to opportunists, poachers are conservationists in targeting urchins with ripe gonads in order to make the greatest returns on investment in risk
- Several of the most prominent divers, who call for conservation, are regular poachers
- Divers are using SCUBA more now than before it was prohibited in order to compete
- Police and politicians allegedly partake freely and frequently in poached eggs
- Beach breaking stops when season ends, but less public places and cliff crevices are used

Parker (In prep.) argues that fines, even with the present upper limit of $50,000, have always been small compared to revenue from illegal harvest, and could be paid off in a day or two of diving. He notes that actual, as against potential, penalties have never been significant enough to serve as a real deterrent.

10.6 Brochure for increasing public awareness

One of the project activities was production of a brochure jointly by BARNUFO and the Fisheries Division to increase public awareness of the importance and methods of managing the fishery, including the roles of ordinary citizens. The brochure has information under the headings:

- Background
  - History
  - Scarcity
  - Closure
  - Recovery
- Managing the fishery
  - Collaborative management
  - Seasons
  - Roe quality
  - Gear restrictions

- The laws
  - Sale and harvest
  - Gear
  - Destruction

It is too early to tell what, if any, effect the contents of the brochure will have on the public. The process of preparing the brochure was informative in that the Fisheries Division took on the task almost to the exclusion of BARNUFO in a scenario reflecting a minimally consultative, rather than collaborative, relationship.

10.7 Comparing sea urchin management in Barbados with St. Lucia

It was thought useful for the participants in two Land-Water Interface projects funded by DFID-NRSP (R8134 and R7559) to get together to share and compare experiences with sea egg management. The People and the Sea Project (R7559) concerns sustainable coastal livelihoods and is focused on the community of Laborie on the southwest coast of St. Lucia. Sea urchin management is one of four case studies and experiments carried out by the project. The Caribbean Natural Resources Institute (CANARI) is implementing the project. Local partners include the Laborie Development Foundation, the Laborie Fishers and Consumers Cooperative and the Department of Fisheries in the Ministry of Agriculture, Forestry and Fisheries.

Upon the request of the principal researcher of the Caribbean Coastal Co-management Guidelines Project a group from Barbados visited the project in St. Lucia. The Barbados group comprised the principal researcher, a Conset Bay fisher, an Oistins fisher and the government's Fisheries Biologist. Via the People and the Sea Project, the session on sharing and comparing experiences was a large public meeting hosted by the Laborie Fishers and Consumers Co-operative. A smaller group assembled the next day for a half-day workshop on shared learning about the conditions for co-management in both countries. Participants reached common understanding on the meaning of the co-management condition, and then discussed its features in respect of their country's sea egg fishery. After discussion they assigned a numerical rank to the extent to which the particular condition was a characteristic of their country (Table 10.3).

Table 10.3 Evaluating co-management conditions of Barbados and St. Lucia sea egg fisheries

0 = absent; 1 = present but weak; 2 = present to a fair extent; 3 = strong feature of the fishery

CO-MANAGEMENT CONDITION	ST. LUCIA	#	BARBADOS	#
1. Clearly defined boundaries: of the resource; of the management area; of the "community"	National boundaries, depth, distribution are known; community boundaries are known through customary rights	2	Same but few community boundaries; northern fishers complain more about intruders; pickers live all over, not only where there are eggs	1
2. Membership is clearly defined as to who really has a stake in the fishery (is a stakeholder)	Well defined; e.g. who to invite to various meetings; no formal stakeholder analysis; extensionists know who are key people	2	Stakeholders are well known, including from previous research and the database of fishers	2

CO-MANAGEMENT CONDITION	ST. LUCIA	#	BARBADOS	#
3. There is shared recognition of a resource use problem that needs to be addressed	Recognition of problem declines as resources recovers; old harvesters more convinced of problem and have more sense of ownership	2	No problem recognised if urchins are plentiful; some old fishers accept fluctuations as outside of management control and do not see a problem	2
4. Clear objectives for management can be defined based on the problems and interests	Set out in words clearly in management plan, but means of implementation are not clear	3	Same, but noted that the managers are more familiar with objectives than the fishers	3
5. Good fit between the scale of the resource and feasible management arrangements	Spatial scale national problem as northern areas inaccessible for monitoring illegal harvest	1	Geography makes it easier in Barbados, but still difficult due to low capacity to manage	2
6. Management approaches and measures are flexible to suit changing circumstances	Getting more flexible, especially through variable season openings	3	Extension of the season shows flexibility, even if it was a political decision	2
7. Cooperation exists at the resource user level and in government etc. also	Cooperation in monitoring where fishers want to work with FD, but less from the “opportunists”	2	Fishers do not cooperate amongst themselves (except for harvesting) or with government	1
8. Group cohesion where fishers, managers and others can act collectively within their groups	Main harvesters are cohesive and this was increased by the project	1	Fairly high cohesion in fishing operations but not otherwise	1
9. There are mechanisms for managing conflicts within and among stakeholder groups	Weak informal systems sometimes bring in FD as facilitator	1	Conflicts persist unresolved. Less where fishers are mostly kin	0
10. Communication amongst the stakeholders is effective, and there is adequate networking	Limited to local areas, not national, not very effective	1	Harvesters go to the press rather than talk to fisheries managers	1
11. Coordination between government, local community and other stakeholders is effective	Good coordination overall	3	Poor, even within ministry responsible for fisheries as shown by issues of open season extension	1
12. Trust and mutual respect characterise the relationships among the key stakeholders	Initially little trust amongst fishers, but increasing with project in Laborie	1	Fishers do not rust anyone, little respect for fisheries authority	1
13. Organisational capacity exists for all stakeholders to participate effectively in management	FD has more capacity than cooperative which, in turn, has more than the fishers	1.5	Very uneven, and fishers lack capacity even in the organisations	1
14. Adequate financial, and hence physical, resources are available for management tasks	Monitoring is okay but surveillance is problematic due to difficulty of getting to some locations	1	Finances are not readily accessible and timely; also fisheries personnel constraints not solved by funds	1

CO-MANAGEMENT CONDITION	ST. LUCIA	#	BARBADOS	#
15. External agents provide support for management but do not encourage dependency	External funding important but national agencies who are not stakeholders do not assist	1	Important role of research universities like UWI, McGill, Dalhousie	2
16. Benefits of participation must exceed costs from the levels of individuals up to larger groups	Volunteer assistance of divers helps government to reduce costs	2	Fishery worth far more than expenditure on management	3
17. Individuals, groups affected by management arrangements are included in decision-making	Getting better as methods become more participatory	2	Not broad enough inclusion although trying to improve	1
18. Management rules are enforceable by resource users and the management authority	Acceptance of rules is improving	2	Rule breaking is very prevalent; low regulatory compliance	1
19. Legislation gives users some meaningful level of ownership or control over resource use	None	0	None	0
20. Legislation gives users authority to make management decisions, perhaps shared	Law encourages participation in deciding on contents of FMP only	1	Same as for St. Lucia	1
21. Decentralisation and delegation of authority is part of the policy of resource management	Evidence of encouraging more delegation like SMMA and CAMMA	1	No move towards any types of delegation; no decentralisation	0
22. Co-management has a good social and cultural fit to the circumstances of the situation	Increasingly better fit achieved through project in Laborie only	2	Increasing acceptance among resource users	2
23. Leadership exists at the resource user level and in government etc. also	Informal leaders are prevalent and fairly well developed	2	Issues cause informal leaders to arise. Potential leaders fear responsibility due to high free-ridership	1

Source: CCA, CANARI and LFCC (2003)

After the workshop on comparing co-management, participants appreciated that the variables are more complex than allowing the scores to be added up to see which fishery is “better”. Groups of conditions have different importance and hence weight. They also vary in local importance depending on the type of co-management institutional arrangements being aimed for. For example, a collaborative arrangement is more demanding than a purely consultative one. However, through this evaluation we can see emerging which conditions may be the most critical for improvement to facilitate success in each fishery.

11 Outcomes and performance

Patterns of interaction between co-management parties produce outcomes, such as institutional arrangements, that can be evaluated in terms of performance. Outcomes of greatest interest are those concerned with meeting management objectives and their impacts on the coastal and marine resources plus their users. In some, but not all, situations co-management may perform better than more conventional approaches such as centralised or top-down management. The most common evaluation criteria are efficiency, equity and sustainability (Pomeroy and Williams 1994, ICLARM and IFM 1998).

In this case of the sea egg fishery several attempts have been made at limited forms of co-management, particularly from the mid-1990s onward. These attempts have been lead by government, sometimes in collaboration with research agencies, and mostly at the level of fieldwork and some participatory planning. The initiatives have been frequent, often involving the same players, but not particularly coordinated or packaged into a coherent plan. This may give the impression of sustained effort where there is only opportunism.

After the mid-1980s collapse of the fishery, the two-year closed period from 1987-1989 was not explicitly promoted as an opportunity to change the management system. Emphasis remained on adjusting closed seasons and penalties in order to allow the resource to recover and be maintained at sustainable levels. This contrasts with the 1998-2001 closed period in which it was openly stated that the objective included reforming management to become more participatory.

In terms of the resource, there is uncertainty about several aspects of population dynamics and ecology. However, what is known about the urchins and the recoveries after multi-year closures suggest that, without exacerbation due to overfishing, the natural population fluctuations would not have repeatedly resulted in fishery collapse. Unless the management regime becomes more efficient in reducing overfishing it is likely that the boom and bust cycle will continue indefinitely. Even without overfishing, the management approach must be designed to cope with a high level of natural variability. Given that the concept of fishery management is still fairly new and not vigorously promoted, and that fishers are now accustomed to fluctuations in the fishery, strengthening the management regime in practice may be challenging.

The research by Vermeer et al (in press) revealed attitudes and behaviour towards sea urchin management that clearly were not compatible with local transfer of the community-based approaches introduced in St. Lucia. Although the latter were mainly consultative, involving fishers in surveys that informed management decisions on season openings and licensing, they generally related to particular locations adjacent to communities. In Barbados fishers were willing to participate in population surveys, but there was opposition to managing spatially, establishing ownership rights or restrictive licensing. The notion that “every man has a right to fish” is often communicated, and is deeply rooted in the Barbadian psyche.

The CZMU demonstration project that followed the fisheries management planning process of 1996-1997 and coincided with the Fisherfolk Organisation Development Project of the Fisheries Division has been the most significant effort at co-management to date. The processes of participatory planning and organisation promotion combined to create a groundswell of interest in managing the fishery that was not distracted by harvesting since the fishery had been closed.

The momentum ended abruptly with the absence of support to sustain and strengthen the new Barbados Fisherfolk Divers Association. This group, which was based on forming a coalition from individuals scattered in communities around the island was structurally weak in concept compared to the other associations that were based on a single or a few adjacent locations. Given how divers are dispersed, there is little choice but to have such a structure. However, the Fisheries Division was unable to support the fledgling group, and there was no capacity within the interim executive to carry out the plans of action along the strategic directions developed from the coastal management project.

The survey results that show nominal support for fisherfolk organisations in sea egg fishery management contrast with the fact that few such proponents are actually members of these

groups. Also, several people were quite open in their condemnation of organisation leaders for being ineffective in disciplining memberships that included prominent sea egg poachers whose public views in favour of conservation contradicted their actions of law-breaking. The press made no attempt to obtain the credentials of the persons interviewed and quoted as being in favour of management measures.

Yet fishers reported that they placed more confidence in the press as a channel for communicating with policy-makers than either the fisherfolk organisations or the fisheries authority. They felt that policy-makers would hear neither of the latter two in comparison with the press. They were very aware that a single or a few points of view could appear greatly amplified in popular reporting, and they consciously used this avenue in campaigning for a longer season. This lack of confidence in the components of the co-management structure is a fundamental constraint to its further development.

The inability of the Fisheries Division to actively support fisherfolk organisations and collaborate with them to demonstrate their potential in co-management is perhaps a mixture of low motivation, power and capacity. Fisheries officers are aware that the fishing industry itself is not very supportive of its own organisations that are weak. This is coupled with its own limitations in terms of human resources and time to devote to supporting the groups.

Even when support is strong and mutually beneficial, the officers know that the low status of the Division and the industry result in little power to influence policy decisions. A case in point is the apparently unilateral decision at the policy level to extend the sea egg season without establishing support from either the fisheries authority or fisherfolk organisation. Such action undermines the credibility and power of these stakeholders in the eyes of the industry as illustrated by responses to survey questions.

However, the state as a whole is not perceived as taking the management of the fishery seriously. This ranges from weak enforcement with small penalties imposed on offenders (despite stiff penalties being on the books), to the open and frequent allegations that enforcement officials and policy makers actually encourage law breaking. The press quotation of the defence attorney's observation that contravening sea egg management regulations is not a serious social and moral matter sums up the situation.

Participants in the post-season workshop, as well as at inception, indicated that unless the state demonstrated it was serious about sea urchin management there would be no incentive for fisherfolk to comply with regulations or engage in co-management initiatives that seemed likely to be undermined from within. The reported increasing use of SCUBA and symptoms of "tragedy of the commons" open access competition and overfishing are evidence. Given these institutional deficiencies and uncertainties it is not likely that co-management will be established in this fishery unless conditions fundamentally are altered to favour success.

12 Conditions for successful co-management

The purpose of this project was to suggest mechanisms for the implementation of integrated pro-poor natural resource (and pollution prevention) management in coastal zones that could be developed and promoted through understanding the requirements for establishing successful co-management institutions for coastal resources under various conditions in the Caribbean. In this chapter we present conclusions based on the research framework that guided the study.

12.1 Type of co-management

The research framework summarises the main types of co-management as consultative, collaborative and delegated. The case study outlines several attempts at co-management, none of which sought to delegate authority to the resource users to any appreciable extent. However, the CZMU demonstration and Fisheries Division pilot projects both had strong elements of collaboration. If the Fisheries Division had successfully nurtured the divers association that resulted from the former project, and followed through on its pilot project annual work planning, then collaborative co-management may have been established. All of the attempts have been at least consultative, especially in obtaining the ecological knowledge and observations of fishers. At present there is no co-management of the sea egg fishery because none of these initiatives has been sustained.

12.2 Phase of co-management

Based on the above, the co-management of the sea egg fishery in Barbados could be regarded as remaining at a pre-implementation stage. Government and resource user stakeholders realise the need for change, they have discussed it, and they have tried to develop new management approaches in a limited way through discrete projects. In none of these initiatives has the new approach been sustained long enough or over a wide enough cross-section of the fishery to be institutionalised.

12.3 Conditions for co-management

This final section is based on findings that have been presented above and on the proceedings of a special workshop of stakeholders in this case study where they were asked to discuss and evaluate a list of variables presented to them by the researchers based on previous research on co-management. In this process the workshop participants had the opportunity to add or delete variables that they found to be critical or irrelevant respectively.

The Barbados workshop on the critical conditions for successful co-management included the researchers, Fisheries Division, CZMU and BARNUFO. The proceedings of the meeting are summarised in Table12.1.

Table 12.1 Stakeholders perceptions of critical conditions for success in Barbados

0 = absent; 1 = present but weak; 2 = present to a fair extent; 3 = strong feature of the fishery

CO-MANAGEMENT CONDITION	REMARKS	#
1. Clearly defined boundaries: of the resource; of the management area; of the "community"	• CZM area clearly defined technically • Community less easily defined, especially by outsiders, but done e.g. Weston • Open communities, fishers not exclusionary	2
2. Membership is clearly defined as to who really has a stake in the fishery (is a stakeholder)	• Strong even before registration of fisherfolk • Now better known by authorities • Less clear for minor fisheries	3
3. There is shared recognition of a resource use problem that needs to be addressed	• Usually shared recognition but some stakeholders feel powerless so participate less in sharing • Access to ice an example of lengthy problem • Often not sure what to do about problem	3

CO-MANAGEMENT CONDITION	REMARKS	#
4. Clear objectives for management can be defined based on the problems and interests	• Depends on resource (see FMP) but usually strong	4
5. Good fit between the scale of the resource and feasible management arrangements	• Few exceptions to the good fit • Good for CZMU	2
6. Management approaches and measures are flexible to suit changing circumstances	• FMP calls for 3-year review • Fisheries Act also flexible • Management response too slow generally • Differs by who is to benefit, power exercise	1
7. Cooperation exists, and is adequate, at the resource user level and in government etc.	• High cooperation among CZM stakeholders e.g. Carlisle Bay marine park not officially declared but operating as such due to consensus by negotiation • Okay if problems and perspectives are addressed • Weaker in fisheries due to more personal interests • Low in CZM with the construction industry	1
8. Leadership exists, and is adequate, at the resource user level and in government etc	• Exists but inadequate • Leaders not very active • Diversity in leadership of FFOs • Some powerlessness	1/2
9. Group cohesion where fishers, managers and others can act collectively within their groups	• High variability • CZM unit and stakeholders are internally cohesive • Fairly weak within fisher groups, perhaps occasional and crisis driven	2
10. There are mechanisms for managing conflicts within and among stakeholder groups	• Culture of being relatively docile • Conflicts allowed to just die down over time but remain unresolved • Preference to avoid confrontational conflict leads to buried vendettas • Management through public consultations of information exchange e.g. Speightstown salt pond drainage impacts	1
11. Communication amongst the stakeholders is effective, and there is adequate networking	• Fisherfolk communicate well amongst themselves • Improving between government and resource users but still is deficient • Not really ready yet for co-management as information is withheld by government	2
12. Coordination between government, local community and other stakeholders is effective	• Usually poor across all scales and situations, both government and non-government • E.g. NCC “spring break” on Needhams versus turtle conservation • Lack of coordination within government on sea egg season 2002	1
13. Trust and mutual respect characterise the relationships among the key stakeholders	• Government and users do not trust each other • Too many changes in management to build trust • Often by one part, not mutual e.g. ice machine?	0/1

CO-MANAGEMENT CONDITION	REMARKS	#
14. Organisational capacity exists for all stakeholders to participate effectively in management	• Capacity constrained by lethargy caused by powerlessness or disbelief that things will change • Does capacity differ by scale? • Organisations in fishing industry are weak • Powerful stakeholders get their own way • Most CZM stakeholders have capacity, e.g. hoteliers, but fishers and jet ski operators are weakest	2
15. Adequate financial, and hence physical, resources are available for management tasks	• Finances available to some (often not government agencies) but not used for management purposes • Poorest for research in fisheries and enforcement • CZMU is well off • Budgets are available, but not fully exercised • Human resource constraint even if $ available because of government restrictions on hiring people	2
16. External agents provide support for management but do not encourage dependency	• CZMU says support may erode as agency grows • Support is fair and lack of dependency is strong • Much support for CZM through tourism, less for fisheries as linkages not clear to most people	3
17. Benefits of participation must exceed costs from the levels of individuals up to larger groups	• CZMU a clear yes, but less clear for fisheries • More a matter of potential for fisheries • CZMU sees benefits through tourism • Fisheries stakeholders not paying much cost, so not much benefits either • More a matter of loss prevention than real gain • Much cost in sea eggs but few benefits from management as all left up to nature in the end • Question of claiming benefits if no direct cause	2
18. Individuals, groups affected by management arrangements are included in decision-making	• Good for CZMU as with coastal infrastructure choice of options workshop • Policy and practice of inclusion in decisions at least at technical level	2
19. Management rules are enforceable by resource users and the management authority	• Enforceable but not human resources to execute • Rules of evidence a problem? Not	3
20. Legislation gives users some meaningful level of ownership or control over resource use	• None in law • Customary practices defy the existing laws	0
21. Legislation gives users authority to make management decisions, perhaps shared	• The FAC comes closest but is weak example • Advice tendered but not taken	1
22. Decentralisation and delegation of authority is part of the policy of resource management	• Some in FMPs on sea eggs and reef fish • May come with MMA for MPAs, but may be FAC-like • Graeme Hall near to delegation status	1
23. Co-management has a good social and cultural fit to the circumstances of the situation	• Bajans expect government to do things on its own for them; that is what they want • Expect levels of bureaucracy also	1

The sections below elaborate upon the comments in the table above as overall conclusions that may be used to develop guidelines for successful co-management.

12.3.1 Boundaries

The jurisdictional geographic areas of the Fisheries Division and CZMU are defined in law and the fisheries management plans propose a management unit for the fishery that coincides with the waters of Barbados. Specific sea urchin fishing grounds and the communities of fisherfolk who use them are less well defined since they tend not to be discrete, but definition is possible.

The technological boundary between (illegal) SCUBA divers and free divers is decreasing, as more people seem to be adopting the technology to remain competitive. The technological gap was a factor in the non-SCUBA divers pressing for its prohibition in 1996 but, with enforcement of the SCUBA regulation being absent, this factor in favour of conservation and management is eroding.

The main concern for co-management, however, is the fairly clear preference for open access and free movement between fishing grounds by anyone. Limited licensing and territorial use rights will be difficult or impossible to introduce until this socio-cultural outlook changes. Thus the boundaries that most favour the development of good management and co-management are the most problematic. In the absence of support from the industry it is unlikely that attempts to impose either limited entry or spatial management will succeed due to low compliance and enforcement. Changing attitudes towards these boundaries is a fundamental requirement.

12.3.2 Membership and stakeholders

The above is linked to issues of membership and stakeholders, with the latter being well known, but membership being fairly open. The main illustration of the possibility in closing membership is the view of some full-time fisheries that the opportunistic harvesters should be allowed only enough urchins for personal consumption so that they do not compete with the commercial harvesters and their more indiscriminate harvesting practices would have less impact on urchin populations. Without closing membership in the fishery to limit or exclude the opportunists there is little chance of co-management being established since this category of harvester is dynamic and not easily identified as a group with which to have dialogue, even if they were interested.

12.3.3 Resource use problem

The resource use problem is very clearly identified among fishery scientists and managers who see overfishing as the major issue. However some divers persist in proportioning too much of the cause of decline to pollution and disease where the evidence, repeatedly presented, does not support these as being critical for this species at this time. There is also the view that prevails mainly among the older fisherfolk that there is no problem since population fluctuations are normal and an act of God. If this attitude prevails, there will be little interest in co-management. Therefore action should be taken to reinforce the acceptance of scientific evidence and confidence in fishery management being feasible.

12.3.4 Management objectives

Management objectives for this fishery are clearly stated in the fisheries management plans, but are known only by a handful of people in the fisheries authority because the plans have not been promoted. In the brochure recently developed by the Fisheries Division and BARNUFO to increase public awareness about management there is no mention of the objective. There is no evidence that the fisheries authority is systematically working towards achieving the stated

objective. This weakens the basis for co-management and should be addressed as a matter of urgency given the view that government is not serious about managing the fishery.

12.3.5 Scale of management

The national scale of management in the fisheries management plans is appropriate to both the resource and the resource users given patterns of settlement in both cases. It is unlikely that community-based co-management will develop in this fishery.

12.3.6 Management adaptation

In theory the system of regulations and notices in the Official Gazette that can be placed on the Minister's directive is very flexible and adaptable. Evidence is seen in the swift extension of the harvesting season as the Minister piloted the decision through Cabinet and the legal formality within a week with no or limited interaction with fisheries authorities or organisations. However, the counter-evidence is that ten years after the Fisheries Act being passed several regulations that are fundamental for fisheries management still remain in draft with no known deadline for coming into force set by policy-makers. Therefore adaptation may only apply when there is an existing legal framework and circumstances favour the needs of decision-makers.

12.3.7 Cooperation

Cooperation in coastal zone management as a whole appears to be situation and subject specific. There is perhaps no less cooperation among fisheries stakeholders than among those involved in other coastal uses but, apart from certain watersport operators, most user groups appear to be more effectively internally organised than fisherfolk. The reasons given for fisherfolk doubting the role of organisations in management of this fishery illustrate issues to be overcome in improving cooperation. Between stakeholder groups there appears to be willingness for the fisheries authority and fisherfolk to cooperate, but the mechanisms and modes of cooperation are poorly developed and inconsistent in application. Occasional surveys, meetings and beach visits have not been sufficient to develop the apparent potential for cooperation. Cooperation will most likely improve through more sustained positive interaction.

12.3.8 Leadership

It is clear that leadership potential exists, as demonstrated by the longevity and activism of BARNUFO. However, overall leadership is lacking in the fisherfolk organisations for a number of reasons including skills and the time required to lead while at the same time pursuing a fishing livelihood. As developed in McConney (1995), there is also a spirit of egalitarianism and fear of power abuse or personal aggrandisement that restrains good leaders from demonstrating their abilities. Leaders also experience high levels of free-ridership prevalent in the industry and do not consider the resulting distribution of work to be equitable. Evidence of good leadership in the government agencies may be suppressed by limited capacity to perform numerous competing tasks since this dissipated the focus that a good leader normally exhibits. The low power of the fisheries authority within the public service structure and Ministry of Agriculture may also mask the quality of leadership since both good and bad leaders may appear to be equally ineffectual.

12.3.9 Collective action

Several of the variables discussed above support the conclusion that the quality and persistence of collective action within stakeholder groups is very uneven. Crisis driven responses are prevalent in both government and industry, and in the latter these often feature collective action. The weakness of the fisherfolk organisations suggests that much will have to be done to promote sustained collective action if co-management is to be institutionalised.

12.3.10 Conflict management

Barbadian society is renowned for being relatively free of serious conflicts, although recent commentaries on increasing crime and public calls for conflict resolution suggest that this may be changing. Within the sea egg fishery there was little evidence of conflict, and no evidence of formal mechanisms for its management should conflict arise.

12.3.11 Effective communication

In general, much conflict can be avoided through effective communication. Barbados is a small society and porous community boundaries favour informal communication islandwide as shown by the relatively free sharing of information on fishing among fishers. However, misinformation also travels fast and effectively as illustrated by the 1980s mass mortality of the black-spined sea urchin due to disease being linked to the declines of sea eggs. Effective communication does not exist uniformly between the fisheries authority and fishing industry. The former is accused of secrecy. The fisherfolk want to see more fisheries officers in the field for one-on-one exchanges as their culturally preferred mode of communication. Even it were possible to increase these interactions given the limited human resources of the Fisheries Division, it may actually weaken the conditions that could favour co-management. With individual attention from the fisheries authority there would be less reason for fishers and others to form the groups required for efficient co-management. While acknowledging strong preference for personalised communication, more effort must be placed on acceptance of more institutionalised and collective communication channels.

12.3.12 Effective coordination

Communication is a prerequisite for coordination. The evidence of ineffective coordination reflects deficiencies in communication, and this occurs amongst all stakeholders. In particular, it has not been possible to coordinate the implementation of the fisheries management plans in a manner that promotes co-management. However, there appears to be willingness to coordinate between the Fisheries Division and BARNUFO that is significant. This needs to go beyond the isolated events and projects implemented to date and take on a more strategic character in order to transform the fisheries into one that is more amenable to the co-management that appears to be a shared interest.

12.3.13 Trust and respect

The participating stakeholders ranked this variable quite low, but the reoccurrence of events and projects in which partnerships are formed for implementation suggests that there is a fair degree of trust and respect. However, with this variable perceptions are particularly important. If stakeholders perceive that there is little trust and respect then they are likely to behave on the basis of this perception. The demand of the industry for greater presence of fisheries officers asking for their input on the beaches and wherever they work is seen as evidence of demanding more trust and respect for the inputs of the resource users. While the knowledge of fishers seems to be universally respected by authorities and policy-makers, there may be less trust and respect for them as partners in management given the deficiencies in their organisation.

12.3.14 Organisational capacity

The above speaks directly to organisational capacity being relatively weak among most of the sea egg fishery stakeholders. The Fisheries Division lacks the human resources to do the basic surveys required to inform management decision-making on a regular basis. As long as funds are available it is reasonable to expect that the Fisheries Division will continue to solicit the assistance of fishers in conducting quantitative fieldwork, or at least ask for their observations.

The fishers seem likely to wish to continue with this, and some results suggest that this is as far as they wish to go in the management process (in terms of investing their time and resources) as long as the government makes management decisions that they agree with. Fishers can perform these tasks without being organised, so it is only the approach of the Fisheries Division to them through BARNUFO that make this important as an exercise in co-management. The Fisheries Division also does not have the capacity to support the structures and operations of fisherfolk organisations. This is a serious constraint that must be overcome.

12.3.15 Financial resources

The CZMU is better off financially than the Fisheries Division given its steady flow of major externally funded projects. The Fisheries Division has a small budget, but there is no evidence that lack of funds seriously hinders sea urchin management. The constraint may be that the government's financial system is neither sufficiently quick nor responsive. In the case of the CCA-funded pilot project it was agreed that BARNUFO should be the recipient agency in the partnership due to the Fisheries Division's experience in trying to make urgent expenditures. Fisherfolk organisations have minimal financial resources. The flow of financial resources to conduct the fishery investigations will need to be improved.

12.3.16 External agents

The external agents in this case were funding sources and research institutes. All have been supportive of co-management, and there appears not to be any great dependency upon them. There is no need for continued interventions by external agents. However they would be most useful in promoting fishery co-management at the policy level since this is an area in which local stakeholders have relatively little influence.

12.3.17 Net benefits

Fisheries and coastal management are still new initiatives and participation in them is recent. It is too early to tell whether benefits will exceed costs in the long run. As workshop respondents pointed out, the main concern now with this fishery is to ensure that overfishing does not keep eroding the resource sustainability aimed for by the management agencies. At the individual level, as long as there is acceptance that the fishery is boom and bust by nature, and fishers can get considerable revenue during boom periods since demand always exceeds supply, then the individuals may not perceive the benefits of management to be significant unless they can free ride. This is perhaps why a sea egg council may be the only formal structure that will work for co-management. The individual outlay can be expected to be minimal in this arrangement.

12.3.18 Representation in decision-making

There are significant gaps in representation in the formal decision-making structures. Fisherfolk have not sought to use their organisations as vehicles for representation. BARNUFO is a secondary body, and there are no primary organisation members that have taken up the sea urchin fishery as an issue within this structure. BARNUFO's interest in the fishery is more of an informal and personal nature on the part of its executive officers. However, BARNUFO is represented on the Fisheries Advisory Committee that, by law, is constituted to advise the Minister on fisheries management and development. As shown in the companion case study, this is a weak institution and the Minster may exclude the FAC, BARNUFO and the Fisheries Division in his decision-making as appears to be the case in the season extension. If the arguments to Cabinet are correct, however, the fishers were quite effective in making representation directly to the policy maker. This may demonstrate very effective participatory democracy, but does little to assist the establishment of co-management institutions that can

structure such representation. A key factor for success is to make existing or modified formal structures more relevant.

12.3.19 Enforcement

At present it is not possible for the regulations that govern sea urchin harvest to completely address the requirements of a formal co-management arrangement, and without the passage of the additional regulations it is unlikely that either enforcement or compliance will be optimal. The existing regulations are sufficient, however, to facilitate the sustainability of the resource if well enforced or complied with. According to fisherfolk, enforcement must precede compliance by the weight of the law being felt on a regular basis. This must include successful prosecutions resulting in penalties that are not trivial in relation to the revenue potential of illegal harvest. It is not likely that the enforcement agencies will receive significant strengthening in capacity just for this or any other fishery. Therefore more emphasis needs to be placed on engaging the general public and applying social sanctions within the industry. A precedent worthy of note is the turtle fishery, but this has the advantage of an internationally high conservation profile and low demand as a food item.

12.3.20 Property rights

No property rights exist in law or customary practice in this fishery. Given the preceding observations on boundaries and memberships it will be difficult to develop property rights.

12.3.21 Sharing decision-making

Coincident with representation, decisions are typically not shared in formal structures since the FAC is ineffective as an institution of policy engagement. Relatively few decisions that are not purely technical or scientific are made at the level of the fisheries authority alone. There appears to be willingness at the Fisheries Division level to share decisions with the industry. Both of these parties perceive that only by combining forces can they develop the power necessary to influence policy. They need to find a mechanism to get more of their joint advice into the public arena where policy-makers tend to pay more attention.

12.3.22 Decentralisation and delegation

There is very little decentralisation and no delegation of responsibility and authority by the state to either resource users or the management agency. Limitations in capacity and the legal framework are barriers to decentralisation and delegation. The fisheries regulations need to make provisions for delegation of authority to fisherfolk organisations in order to promote collaboration. These provisions may then be used as leverage to strengthen the organisations provided that there is willingness and leadership to respond. However, if co-management remains consultative the requirements in these respects will be minimal.

12.3.23 Social and cultural fit

It was felt that there is not yet a very good social and cultural fit for fisheries co-management due to the novelty of civil society participation in governance and the persistence of dependency fostered by patronage politics that followed the colonial period. This outlook is changing as more citizens demand a say in how the country is run via letters to the newspapers, call-in radio programs, town hall meetings and other popular mechanisms. However, there is still a large gap between the aspirations of the fishing industry for co-management reported in several studies and the actual effort made by the fisherfolk to move in this direction. Co-management initiatives remain largely driven by government and this does not suggest that the social and cultural imperative to establish management partnerships is firmly established at the grassroots level.

12.4 Priority action

Property rights, perceptions of benefits, development of trust and delegation of responsibility and authority were said by workshop participants to be key areas in which action was urgently needed. One of the ways in which these could be tackled together would be through the promotion of the fisherfolk council of community leaders that many saw as the only likely formal co-management structure for this fishery under present circumstances. Action needed is to demonstrate co-management in order to achieve a common understanding of what it is. Efforts towards establishing and sustaining the council should be within the capacities of the industry and fisheries authority.

13 References

Almerigi, S. R. Mahon, Y. Alleyne, K. Atherley, J. Cumberbatch, and S. Mahon. 1999. Barbados Coastal Conservation Programme (Phase 1), Demonstration Projects. Participatory coastal zone management in Barbados. Coastal Zone Management Unit, 30 pp

Arnstein, S. 1969. A ladder of citizen participation. American Institute of Planners 35:216-224

Bair, R.A. 1962. The Barbados fishing industry. M. Sc. Thesis, McGill University, Montreal, Canada. 85 p.

Baird, I. G. 2000. Integrating community-based fisheries co-management and protected areas management in Laos PDR: Opportunities for advancement and obstacles to implementation. Evaluating Eden Series Discussion Paper No.14. London IIED. 17 pp.

Barbados Fisheries Division. 1997. Barbados fisheries management plan 1997-2000. Ministry of Agriculture and Rural Development. 69pp.

Barbados Fisheries Division. 2001. Barbados fisheries management plan 2001-2003. Ministry of Agriculture and Rural Development. 72pp.

BARNUFO. 2002. Barbados National Union of Fisherfolk Organisations (BARNUFO) Strategic Plan 2002-2006. 10 pp

Berkes, F., R. Mahon, P. McConney, R. Pollnac and R. Pomeroy. 2001. Managing small-scale fisheries: alternative directions and methods. International Development Research Centre, Canada. 320pp

Brown, D.A.V. 2001. Poverty in the Caribbean. On-line lecture. University of the West Indies, St. Augustine Campus. [http://www.caribbeanresearch.com/Social%20Development/]

Brown, D.N. and R.S. Pomeroy. 1999. Co-management of Caribbean Community (CARICOM) fisheries. Marine Policy 23:549-570

Brown, H.H. 1942. The sea fisheries of Barbados. Development and Welfare in the West Indies Bulletin No. 1.

Caribbean Conservation Association. 2001. Report of the Executive Workshop on Co-management (28 - 29 August 2001) and Executive Workshop on Education and Outreach (30 August 2001), hosted by the Toledo Association for Sustainable Tourism and Empowerment (TASTE) in Punta Gorda, Belize. Coastal and Marine Management Program (CaMMP) of the Caribbean Conservation Association. 42pp.

Caribbean Natural Resources Institute. 1999. Principals of Participation and Co-management: A Workshop For Professionals. CANARI Technical Report No. 260:24 pp

Caribbean Natural Resources Institute. 2000. Participatory resource management approaches for managers and decision-makers. Week 1: Building institutions for participatory resource management. CANARI Workshop Report. 3-7 July, 2000, Falmouth, Antigua

Caribbean Natural Resources Institute. 2001. Participatory resource management approaches for managers and decision-makers. Week 2: Designing participatory institutions for effective management. CANARI Workshop Report. 22-26 January, 2001, Tobago

Carney, D. ed.1998. Sustainable rural livelihoods: what contribution can we make? DFID, London. 213 pp.

CCA, CANARI and LFCC. 2003. Learning from sharing and comparing experiences in sea urchin management in Barbados and St. Lucia. Report of the workshops held in Laborie, St. Lucia, 30-31 January 2003. Caribbean Conservation Association, Barbados. 10pp.

Cecil, R.G. 1999. Half a century of fisheries in Barbados: a quest for socio-economic interpretation in the systematic literature and the popular press. Fisheries Division Report No. 1. Fisheries Division, Ministry of Agriculture and Rural Development. 165pp.

Centre for Development Studies. 2000. DfID Support for Pro-Poor Civil Society Organisations: A Good Practice Guide. Manuscript. Department of Economics and International Development, University of Bath

Daniel-le Priellec, P. 1993. Preliminary data about white sea urchin *Tripneustes ventricosus* (Lmak.) biology and exploitation in the insular shelf fishery of Martinique. Paper presented at the International workshop on small island oceanography in relation to sustainable economic development and related coastal area management of small island developing states. Martinique, November 8-10, 1993. 20 p.

DFID-NRSP. 2001. Locating a poverty focus in natural resources systems research. DFID. 12pp.

Dorward, A., S. Anderson, S. Clark, B. Keane and J. Moguel. 2001. Asset Functions and Livelihood Strategies: A Framework for Pro-Poor Analysis, Policy and Practice 1. Contributed Paper to EAAE Seminar on Livelihoods and Rural Poverty, September 2001. [Web doc.]

Economic Planning Division. 2002. Barbados Economic and Social Report 2001. Ministry of Economic Development, Barbados

Fisheries Division and BARNUFO. 2001. Work-plans for sea egg fishery projects (draft).

Geoghegan, T. and A. Smith. 1998. Conservation and sustainable livelihoods: collaborative management of the Mankòtè Mangrove, St. Lucia. 16 pp.

Geoghegan, T., A. Smith, and K. Thacker. 2001. Characterization of Caribbean marine protected areas: an analysis of ecological, organizational, and socio-economic factors. CANARI Technical Report No. 287.

George, S. and W. Joseph. 1999. A new participatory approach toward sea urchin management in St. Lucia, West Indies. Proc. Gulf Caribbean Fisheries Institute 46: 197-206.

Heyman, W. and T, Hyatt. 1996. An analysis of commercial and sport fishing in the proposed Port Honduras Marine Reserve. Belize Center for Environmental Studies. 51pp

Heyman, W. and R. Graham (eds.). 2000. The voice of the fishermen of Southern Belize. Toledo Institute for Development and Environment. Punta Gorda. 44 pp

Hunte, W. 1987a. Rationale for a temporary ban on the fishing of sea eggs in Barbados. Tech. Rep. International Development Research Center, Ottawa, Canada. 4 p.

Hunte, W. 1987b. Towards the rehabilitation of the sea urchin fishery. Tech. Rep. International Development Research Center, Ottawa, Canada 4 p.

ICLARM and IFM. 1998. Analysis of Co-Management Arrangements in Fisheries and Related Coastal Resources: A Research Framework. Report Prepared by the Coastal Resources Co-Management Research Project Core Staff at the International Centre for Living Aquatic Resources Management (ICLARM) and Institute for Fisheries Management and Coastal Community Development (IFM): 21pp.

Jacobs, N. 1998. The Fisheries Advisory Board of Belize – a case study. Unpublished manuscript presented at the CFRAMP Regional Fishery Management Planning Workshop 22-24 April, Barbados

Jentoft, S. 1989. Fisheries co-management: delegating government responsibility to fishermen's organizations. Marine Policy 13:137-154.

Kairi Consultants. 1999. Poverty assessment report: Grenada. Volumes 1 and 2. Report to the Caribbean Development Bank.

Kuperan, K and N.M.R. Abdullah. 1994. Small-scale coastal fisheries and co-management. Marine Policy 18:306-313.

Kurien, J. 1988. The role of fishermen's organizations in fisheries management of developing countries (with particular reference to the Indo-Pacific region). FAO Fish. Tech. Pap. No. 300.

Lewis, J.B. 1958. The biology of the tropical sea urchin *Tripneustes ventricosus* Leske in Barbados, British West Indies. Can. J. Zool. 36: 607-621.

Mahon, R., S. Almerigi, P. McConney, C. Parker and L. Brewster. 2003. Participatory methodology used for sea urchin co-management in Barbados. Ocean and Coastal Management. 46: 1-25.

Mahon, R., S. Almerigi, A. Attapatu, J. Cumberbatch, D. Leslie, P. A. McConney, and C. Parker. 1999. Government of Barbados, Barbados Coastal Conservation Programme (Phase 1) Demonstration Projects Final Report For: Community-Based Sea Urchin Management Coastal Zone Management Unit, Barbados, 102 pp.

McConney, P.A. 1997. Social strategies for coping with uncertainty in the Barbados small-scale pelagic fishery. Proceedings of the Gulf and Caribbean Fisheries Institute. 49:99-113.

McConney, P.A. 1998. Using "common science' in co-management. Proceedings of the Gulf and Caribbean Fisheries Institute50: 1115-1121.

McConney, P.A and R. Mahon 1998. Introducing fishery management planning to Barbados. Ocean and Coastal Management 39: 189-195.

McConney, P.A., A. Atapattu and D. Leslie.1998. Organizing fisherfolk in Barbados. Proceedings of the Gulf and Caribbean Fisheries Institute 51: 299-308.

Noble, B. F. 2000. Institutional criteria for co-management. Marine Policy 24: 69-77.

Normann, A. K., J. Raakjær Nielsen and S. Sverdrup-Jensen (eds.) 1998. Fisheries Co-management in Africa. Proceedings from a regional workshop on fisheries co-management research held 18-20 March 1997 at Boadzulu Lakeshore Resort, Mangochi, Malawi. Fisheries Co-management Research Project, Research Report No. 12.

Parker, C. In prep. UWI doctoral dissertation on the sea urchin fishery. Department of Biology.

People Dynamics Associates. 1998b. Barbados Coastal Conservation Programme (Phase 1), Demonstration Projects. Implementation plan for: Community based sea urchin management. Coastal Zone Management Unit, Barbados: 16 pp.

Pinkerton, E., ed. 1989. Co-operative management of local fisheries: new directions for improving management and community development. University of British Columbia Press, Vancouver.

Pomeroy, R.S. 1994 [ed.]. Community management and common property of coastal fisheries in Asia and the Pacific: concepts, methods and experiences. ICLARM, Manila, Philippines: 188 pp.

Pomeroy, R.S. 1998. A process for community-based co-management. AFSSRN News. ICLARM Contribution #1448.

Pomeroy, R.S. 2001. Devolution and Fisheries Co-management. In R. Meinzen-Dick, A. Knox and M. Di Gregorio (eds.) Collective Action, Property Rights and Devolution of Natural Resource Management – Exchange of Knowledge and Implications for Policy. Zentralstelle fur Ernahrung und Landwirtschaft, Feldafing, Germany.

Pomeroy, R.S. and M.B. Carlos. 1997. Community-Based Coastal Resource Management in the Philippines: A Review and Evaluation of Programs and Projects, 1984-1994. Marine Policy. Vol. 21, No. 5: 445-464.

Pomeroy, R. and F. Berkes. 1997. Two to tango: the role of government in fisheries co-management. Marine Policy 21: 465-480.

Pomeroy, R. S. and M. J. Williams. 1994. Fisheries Co-management and Small-scale Fisheries: A policy brief. International Centre for Living Aquatic Resource Management, Manilla, 15pp.

Pomeroy, R.S., B.M. Katon and I. Harkes. 2001. Conditions affecting the success of fisheries co-management: lessons from Asia. Marine Policy.25: 197-208

Renard, Y. 1991. Institutional challenges for community-based management in the Caribbean. Nature and Resources 27(4): 4-9.

Renard, Y. 2000. Case of the Soufriere Marine Management Area (SMMA), St. Lucia. Prepared for the Seminar Integrating Stakeholders in Participatory Natural Resource Management, Kingston, Jamaica, April 2000. CANARI Technical Report No. 285: 8pp

Scheibling, R.E. and P.V. Mladenov. 1987. The decline of the sea urchin, Tripneustes ventricosus, fishery of Barbados: a survey of fishermen and consumers. Marine Fisheries Review 49(3): 62-69.

Smith, A.H. and F. Berkes. 1991. Solutions to the “Tragedy of the Commons:” sea urchin management in St. Lucia, West Indies. Environ. Conserv. 18: 131-136.

Smith, A.H. and R. Walters. 1991. Co-management of the white sea urchin resource in St. Lucia. Proc. IDRC Workshop on Common Property. Winnipeg, Canada. 12 p.

Vermeer, L.A., W. Hunte, and H.A. Oxenford. In press. An assessment of the potential for community level management of the sea urchin fishery in Barbados. Proc. Gulf Caribb. Fish. Instit. 47: in press.

Wiles, D.W. 1949. The fisheries of Barbados and some of their problems. Proceedings of the Gulf and Caribbean Fisheries Institute, Inaugural Session, Miami, 1948.

Willoughby, S. (ed.) 1999. Report of the Barbados Reef Fish Kill from September to October 1999 and Summary Proceedings of the CARICOM Regional Technical Workshop on Fish Kill

Events held on 16th October 1999 in Barbados. CARICOM Fisheries Resource Assessment and Management Programme (CFRAMP) in association with the Caribbean Environmental Health Institute (CEHI) Pan American Health Organisation (PAHO) and Fisheries Division, Ministry of Agriculture and Rural Development, Barbados. 25pp

14 Appendices

14.1 Appendix 1: Project case study summaries

14.1.1 Barbados

Sea egg fishery — A food fishery for white sea urchins (*Tripneustes ventricosus* locally called "sea eggs") has declined on several occasions. After several closures to facilitate recovery, the government recently initiated co-management. Stakeholder groups include the Fisheries Division and Coastal Zone Management Unit (CZMU) of the government; and the Barbados National Union of Fisherfolk Organisations (BARNUFO).

Fisheries Advisory Committee — Under its 1993 Fisheries Act the government of Barbados activated a multi-stakeholder Fisheries Advisory Committee in 1995. The FAC has struggled to define and meet its co-management mandate. Stakeholder groups include the Fisheries Division of the government; individual and organisational members of the FAC.

14.1.2 Belize

Laughing Bird Caye National Park and Gladden Spit Marine Reserve MPAs — These MPAs in Belize's barrier reef are co-managed by an NGO under co-management agreements with the Forestry and Fisheries Departments. Government stakeholders include the Fisheries and Forestry Departments, Coastal Zone Management Authority and Institute. Friends of Nature, Belize Tourism Industry Association and Belize Fisherman's Cooperative Association are some of the NGOs.

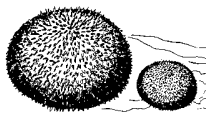
Fisheries Advisory Board — Belize has a Fisheries Advisory Board (FAB) that has been a powerful force in fisheries for over 30 years. However, it has not been well documented as an example of co-management. Stakeholder groups include government Fisheries and Cooperatives Departments, Belize Fisherman's Cooperative Association, members of the FAB.

14.1.3 Grenada

Lobster fishery (focus on Sauteurs location) — At the rural town of Sauteurs government recently started a co-management project to encourage use of more responsible fishing gear for lobster harvest, and the fishing co-operative in the area is presently being revived. Stakeholder groups include government Fisheries and Cooperatives Divisions, the Agency for Rural Transformation, St. Patrick's Fishermen's Co-op.

Seine net fishery (focus on Gouyave location) — The seine net fishery in Grenada is a case of an attempt by government to systematically document traditional fishing rules and customs in order to incorporate them into fisheries management plans and legislation. Stakeholder groups include the Fisheries Division of government, Agency for Rural Transformation, Grenada Community Development Agency, Gouyave Improvement Committee and St. John's Fishermen's Association.

14.2 Appendix 2: Sea egg fishery management and implementation plan 2001-2003



14.2.1 Management Plan for Sea Urchins

Target Species	White sea urchin or sea egg (*Tripneustes ventricosus*)
By-catch	None
Ecology	*Distribution* - Adults live on sea grass beds and coral rubble. Juveniles appear to settle in same areas as adults. The sea urchin is particularly vulnerable to overfishing because it occurs close to shore, is virtually immobile, and is harvested for its gonads. Natural or man-made changes in marine habitats are concerns. *Growth* - Varies according to environmental conditions. Gonads ripen seasonally. *Life span* - 2-3 years (max). *Reproduction* - Sexually mature by one year; eggs and larvae are planktonic for several weeks.
Description of Fishery	The gonads of both sexes are considered a delicacy. *Economic importance* - Revenue from the sea urchin fishery is an important part of some fishermen's income. Based on estimated catch rates (approximately 6 million urchins in the open season alone), an urchin fisherman can earn more than $600 BDS per week if fishing daily. *Vessel type* - When vessels are used, the launch is common, but the moses is also used. The occasional ice-boat is observed. Alternatively, fishers who swim out to the sea urchin ground will often carry a floating log from which bags of harvested urchins will be suspended until returning to shore *Fishing gear and methods* - Sea urchins are harvested close to shore by skin divers using mask, snorkel and fins and by SCUBA divers. The sea urchins are removed from the bottom by hand or metal scraper and are collected in a net bag. *Landing sites* - Sea eggs occur all around Barbados. However, the main landing sites are located on the east and south east coasts. Oistin's, Silver Sands, Conset, Crane, Foul Bay, Long Bay, Martin's Bay, Sam Lord's, Skeete's Bay, Tent Bay and Bath. Stroud Bay on the north-west coast is also used. *Employment* - There are about 220 fishermen in this fishery. In addition, other people crack, clean and sell sea eggs.
Management Unit	Discrete stocks probably exist on the Barbados shelf given its relative isolation from other island shelves.
Resource Status	High demand has led to over-exploitation of the resource despite a two-year moratorium on harvesting between 1987 and 1989. Sea urchins are scarce and potential yield is unknown. Landings have been estimated at 6 million urchins during the open season alone in some years (1980's).
Catch and Effort Trends	No regularly recorded landings statistics are available. Catch and effort fluctuate with highly variable abundance. No clear trends.

Management Policies and Objectives	Rebuild populations and establish a co-management arrangement with fishers to maintain populations at levels which can sustain long term optimum yields for social and economic purposes.
Regulatory History	Moratorium from 1987 to 1989 when harvesting sea eggs was not allowed. Since 1989, closed season, from 1 January to 31 August. During the open season from 1 September to 31 December it was against the law to: - Leave the shell or offal of sea eggs on any bank or in shallow water - Wilfully or wantonly destroy or injure any sea egg However, due to inadequate enforcement and absence of social sanctions, illegal harvesting often started as early as July. Fisheries (Management) Regulations: Provision for closed seasons and areas Prohibition of harvest with the assistance of SCUBA Illegal to have, sell, expose for sale or purchase sea eggs during the closed season unless the sea eggs were obtained with the permission of the Chief Fisheries Officer. Cannot wantonly injure or destroy any sea eggs. Fisheries (Sea Eggs Closed Season) Notice, 1998 Closed season from 1 August 1998 to 31 July 2001.
Selected Management Approaches	Institute an additional closed season (minimum period 1 year) for rebuilding stocks. Co-management measures to be subsequently considered include: - Licensing harvesters - Closed areas and seasons - Minimum size of urchin - Total, individual or area quotas of allowable catches. - Monitoring and management information systems involving harvesters
Constraints	Seasonal, unpredictable abundance. Low populations due to overfishing and possible habitat degradation. Absence of community orientation to facilitate co-management by area. Failure at the attempt to sustain an island-wide fisherfolk divers association.
Opportunities	Market exists for high-priced luxury products, high demand. Low harvest and post-harvest investment required.

14.2.2 Sea urchin Implementation plan for period 2001-2003

ISSUES IDENTIFIED	ACTION STRATEGY	RESOURCES REQUIRED
Stocks usually low, highly variable, and extremely vulnerable to overfishing	- Rebuild and maintain stocks at a level which can sustain fishing - Establish co-management for monitoring and harvest - Perhaps extend the 1998-2001 harvest moratorium to 2002 - Eliminate illegal fishing during the closed season/moratorium	- Funds and personnel for monitoring and enforcement - Time, funds and personnel for working on arrangements for co-management

ISSUES IDENTIFIED	ACTION STRATEGY	RESOURCES REQUIRED
Poor track record of compliance with and enforcement of conservation regulations	- Find more innovative ways to enforce fishery regulations - Public education on sea egg conservation and management - Implement a “coast watch” type of public surveillance system	- Funds for public education programme on conservation - Response capability for “coast watch” - Time for inter-agency and stakeholder forums
Inadequate fishery information and statistics for planning and management	- Improve estimation of catch and effort - Collect biological, economic and social data - Collaborate on data collection and monitoring with fishers - Stock assessment in collaboration with university	- Funds for public education programme on data collection - Additional Fisheries Biologist(s)
Possible habitat degradation and destruction and water pollution	- CZMU to implement legislation for coastal zone management - Collaborate closely with CZMU and environmental agencies on habitat surveys, pollution etc.	- Funds, equipment and SCUBA training for personnel to conduct underwater surveys
The institutional arrangements for managing this fishery have not been fully developed	- Explore possible institutional arrangements in collaboration with all stakeholders - Implement the preferred arrangement(s) as pilot projects for trial, and evaluate to improve	- Access to institutional research partners, fishing industry cooperation and stakeholder collaborators for pilot projects