CARICOM FISHERIES RESOURCE ASSESSMENT AND MANAGEMENT PROGRAM

Subproject Initiation Mission Report and Background Review for Spiny Lobster and Conch

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CONTENTS

ABSTRACT

The Subproject Initiation Mission for lobster and conch was undertaken in March/April 1995 by the CFRAMP biologist who visited all of the participating countries except Guyana. A consultant accompanied the biologist to five of the countries. The purpose of the mission was to evaluate the current status of these two fisheries in each country and to identify data gaps and information needs for the assessment process in each fishery. An assessment strategy was developed for the next 3-4 years which was comprised of the following elements:

1) the acquisition and analysis of fishery statistical data, i.e. catch and effort
2) the acquisition and analysis of biological data sets, i.e. size-frequency, sex
3) the analysis of existing biological data sets from previous assessment work
4) the establishment of spiny lobster post-larval monitoring programs in selected countries
5) resource abundance surveys for conch
6) the use of lobster "condominiums" for habitat enhancement.

An overview of the two fisheries in each country is given followed by specific recommendations for the assessment of the fisheries. The roles of CFRAMP and the Fisheries Departments are outlined in the assessment process. A summary of the consultations with each of the participating countries as well as background material on the ecology and fishery biology of spiny lobster and conch are provided.

1. INTRODUCTION

1.1 RAU Objectives

The Lobster/Conch resource assessment subproject has two principal objectives:

1) to provide the basic information required for fishery management decision-making and
2) to develop and enhance the national and regional capability for ongoing data collection and interpretation of fishery information, including the provision of fishery management advice.

1.2 Subproject Initiation Mission

The spiny lobster and conch Resource Assessment Unit (RAU) was established in Belize in late November 1994. During the period March 6 - April 4, 1995, the CFRAMP biologist of this RAU visited all of the participating countries, with the exception of Guyana, to consult with the Fisheries Divisions (FD's), the fishers, and non-governmental organizations (NGO's)in some countries. A consultant accompanied the biologist to the following five countries: Jamaica, Antigua and Barbuda, St. Kitts and Nevis, St. Lucia and Dominica. The purpose of the mission was to: 1) determine the present status of the fishery for spiny lobster and conch in each country 2) examine past and present assessment activities for these two fisheries 3) evaluate the fishery management objectives and requirements for these fisheries and 4) develop a strategy for the assessment of lobster and conch resources for the next three to four years. This subproject initiation mission report provides an approach to the assessment of the fisheries for the lobster and conch resources in the CARICOM region and seeks to develop some generalizations regarding the formulation of assessment and management programs in the participating country.

1.3 Overview of the Fisheries

The fisheries for spiny lobster and conch have considerable importance to the CARICOM countries. They are based primarily on the Caribbean Spiny Lobster, Panulirus argus and the Queen Conch, Strombus gigas. Both of these resources have high market value (lobster being the greater of the two) and the demand for these species frequently provides the impetus for a valuable export trade which contributes significant foreign exchange earnings for a number of countries in the region. The relative importance of these fisheries in each country is dependent upon the degree to which the stocks have been exploited, the existing strength of the local and export markets, and the availability of habitats for these resources. In most countries, the demand for these species appears to significantly exceed the supply and in basic economic terms, this situation has generally driven prices upward over time. Most of the lobsters harvested in the region are destined for the export or tourism sector and are typically beyond the financial means of many islanders. Conch are generally more available to the local people due to their lower price but they also have become significant in the tourism sector where there is not an established export market. The means of harvesting these two resources differs in most countries (mainly traps for lobster vs. diving for conch) such that they present two separate fishery assessment and management issues and they require fishery specific solutions. The use of traps to harvest lobsters brings into play all of the attendant issues and problems involved in the management of a trap fishery. Table 1 presents the landings and exports (where available) for these two resources.

Table 1. Approximate landings of conch and lobster by area. Year is 1994 unless specified.

Country	Lobster landings	Conch landings
Antigua & Barbuda	74 mt	69 mt
Barbados	n/a	n/a
Belize	667 mt	149 mt
Dominica	n/a	5 mt (1991)
Grenada	6 mt (1993 exports)	26 mt (1993 exports)
Montserrat	0.3 mt	<0.05 mt
Jamaica	400 mt (1986) 130 mt (1986 exports) .	2000-3000 mt (all exported)
St. Kitts/Nevis	8 mt (St. Kitts only) 30 mt (Goodwin et al 1986)	16 mt (landings have reduced due to inability to export to French Islands)
St. Lucia	n/a	13 mt
St. Vincent & the Grenadines	37 mt	32 mt
Trinidad and Tobago	n/a	n/a

2. STRATEGIES FOR ASSESSMENT

The strategy adopted in the conduct of this mission was to initially determine the relative importance of these fisheries and to identify gaps in the assessment process in each country. This was accomplished by interviewing key members of the Fisheries Divisions as well as fishers, and by examining their fishery statistics. This provided a first level assessment of the relative status of these fisheries. The elements of the assessment strategy were as follows:

2.1 Fishery Statistical Data

Fishery statistical data such as catch and effort are the first elements in the assessment process. The provision of catch and effort data is essential for the generation of reliable catch per unit effort (CPUE) estimates needed to make a broad level assessment of the status of the stocks. When an adequate time series of CPUE is available, it will enable a surplus production model analysis of the fishery to assess its status and to estimate sustainable yield. In all countries, some landings statistics were available but the length of the time series of the fishery statistics and the specificity of the data were variable. Many countries have improved the quality and accuracy of their landings data and this process is expected to continue with further refinements in the data collection systems. Adequate fishing effort data for lobsters (e.g. number of trap hauls) and for conch (e.g. dive time) were not often available and the existence and quality of the effort data in these fisheries was the first element of the assessment process.

2.2 Biological Data

The acquisition of biological data from exploited stocks can allow for more refined assessments of the fisheries for these populations. These data provide important insights into the status of the population (e.g. declining mean size of catch in a time series); they yield important information on reproductive sizes and seasonally and they can indicate the distribution and extent of juvenile and adult habitats. The determination of the existence of biological data sets (e.g. size frequency, sex) and the acquisition of such data was the second element of the assessment strategy. Some countries have biological data from earlier research but, where such data sets do not exist, it was deemed important to examine the means by which existing data collection systems might procure such data with a minimum of extra effort and resources. CFRAMP has already established a program for biological data collection under another sub-project and it is considered practical to include lobster and conch in this broad data collection process.

2.3 Analysis of Data Sets

The analysis of existing biological data sets from previous assessment work is considered an important step in determining longer term trends in a fishery by comparing the status of a population some years in the past with the present day situation. Where such data sets exist, the

computerization of these data and the appropriate analyses can often yield valuable insights. Such analyses should be conducted as a matter of priority in the light of planned further biological data acquisition to provide guidance for further work and to ensure that the appropriate data are collected. This is one of the assessment issues which CFRAMP can help to facilitate, to bolster national and regional fishery data analysis capability.

2.4 Spiny Lobster Post - Larval Monitoring

This element in the assessment strategy is concerned only with spiny lobster. The possibility of establishing puerulus monitoring programs in selected countries throughout the region should be investigated. Successful monitoring programs have been in place in several different parts of the Caribbean region for a number of years. Where sufficiently long time series exist, it has proven possible to use puerulus settlement data to forecast future catches in a fishery. This work was pioneered by the Australians in the Western Australia rock lobster fishery. The Cuban lobster fishery has apparently been able to establish a sufficiently strong correlation between settlement and catches that it can be of predictive value in managing their fishery (Raul et al 1995). Due to the generally recognized desirability of moving toward a regional approach to the management of spiny lobsters, it is advisable to standardize the puerulus collectors used in such a program to ensure comparability of data. A limited number of countries have already had some experience with these programs and this can greatly facilitate the re-establishment of a program for puerulus monitoring. A significant advantage of these programs is that they are not overly labour intensive and do not require expensive equipment to run. The results have the potential to provide valuable data for use by fisheries managers in the region. Recognizing the importance of critical juvenile habitat in the life history cycle of spiny lobster, the puerulus monitoring program can also be a useful aid in identifying coastal zones where settlement of pueruli is high and this can provide a scientific basis, along with other information, for defining areas of the coastline which should be protected from development to promote future productivity of the lobster stock.

2.5 Resource Abundance Survey

This element in the assessment strategy is concerned primarily with conch. Resource abundance surveys have traditionally been used in the determination of size-structure and in the estimation of the biomass of conch stocks. These data coupled with adequate statistics allow biologists and managers to determine the abundance of these contagiously distributed organisms (Appeldoorn, 1994). Surveys of this type have been carried out by the FDs of many of the participating countries (i.e. Belize, Jamaica, St. Kitts and St. Lucia). Therefore it is considered practical for the countries and CFRAMP to share joint responsibilities in carrying out surveys of this type.

2.6 Habitat Enhancement for Spiny Lobsters

The use of lobster "condominiums" on an experimental basis is the last element of the assessment strategy. In circumstances where suitable habitat may be limiting or has been degraded, it may be possible to use structures with multiple shelter holes for habitat enhancement in defined areas. Using this approach, it may be possible to decrease natural mortality rates, particularly in the

juvenile stages, by providing more refuges. There is still debate about the actual mechanism involved. In those countries with sufficient resources, the FD or an NGO should conduct experimental baseline studies to carefully evaluate the .effectiveness of this technology. Commitments should not be made to proceed with this approach until appropriate experimentation has been completed. It may also be possible to link elements of the puerulus monitoring program with this approach through spatial coupling of these structures. Data from puerulus collectors can be compared with data obtained from condominiums and ultimately with landings.

3.0 COUNTRY EVALUATION

3.1 Evaluation Procedure For each participating country.

The evaluation procedure included the following components:

1) a review and analysis of the present status of the spiny lobster and conch fisheries.
2) identification of the information gaps and needs to enable further assessment.
3) the development of a plan of action for the assessment of each resource including the order of priority of assessment activities. The accomplishment of these activities are the expected outputs from assessment.
4) the assignment of the roles and responsibilities for the Fisheries Division, NGO's and for CFRAMP in the assessment process
5) the determination of the effectiveness of the existing management regime and the identification of additional components, if necessary, to improve the management environment

3.2 Justification of programs by country

The level of resource assessment and management activities varies considerably between countries. This stems primarily from the relative importance of the lobster and conch fisheries to the economy of each country. The justification for the differential level of activities of the lobster / conch RAU is based on this assessed importance and is related to the present level of development of these two fisheries in each country, the resources available in the Fisheries Divisions to conduct the programs and their willingness to commit to these assessment activities in an agreed time frame. These matters will be determined at the Subproject Specification and Training Workshop.

In order to clarify the choices which the RAU must make in terms of funding assessment activities, the following list is provided indicating the relative level of importance of the lobster and conch fisheries to each country. In a predominant and directed fishery the resource is targeted by large numbers of fishers. The fishery is a major fishery with high catches and of high economic importance to the country. In a small directed fishery, the resource is targeted by some fishers (not large numbers); it is not considered a major fishery for the country. In a by-catch fishery, fishers do not target the resource. For example, lobsters are commonly found in traps, however, fishers do not set or bait the trap specifically to target these lobsters.

Lobster

1) predominant and directed fishery - Belize, Jamaica, Barbuda, the Grenadines
2) small directed fishery year round or only seasonally directed - Antigua, Grenada, St. Kitts & Nevis, St. Lucia
3) primarily a by-catch fishery with few fishers targeting the resource - Barbados, Dominica, Trinidad & Tobago
4) by-catch fishery only – Montserrat

Conch

1) predominant and directed fishery - Belize, Jamaica
2) small directed fishery - Antigua, Grenada, the Grenadines, St. Kitts, St. Lucia
3) directed fishery but only a few fishers involved - Barbuda, Dominica, Nevis, Montserrat, Trinidad & Tobago

3.3 CFRAMP Implementation Schedule

A number of the participating countries have the resources in place to commence some of the recommended assessment activities within the next few months. Several countries expressed an interest and willingness to start these activities, after they have been agreed with the RAU, but before the workshop is held. In other cases, countries will have to wait until discussions are held at the Workshop and programs are agreed before proceeding with assessment activities. A proposed plan for implementation of activities is presented for review (*table 2).*

Table 2: Lobster and Conch RAU – Implementation Activities

	Implementation: 1995 / 96 FY						
	Frame Survey	Strengthen Catch and Effort	Biological Sampling	Analysis of previous data sets	Maturity Study	Puerulus Monitoring	Abundance Survey
Duration:	2 months	Ongoing	Two years	2-3 months	1 year	2½ years	1 -2 months
Lobster Assessment Activities							
Antigua and Barbuda			1			1	
Barbados		1					
Belize			1				
Dominica		1					
Grenada		1	1				
Jamaica		1	1	1		1	
Montserrat							
St. Kitts and Nevis			1	1			
St. Lucia		2		1	1	1	
St. Vincent and the Grenadines		1	1				
Trinidad and Tobago	1						
Conch Assessment Activities							
Antigua and Barbuda			1				5
Barbados							
Belize			2				5
Dominica							4
Grenada		1	1				5
Jamaica		1	1	1			
Montserrat							
St. Kitts and Nevis			1	1			
St. Lucia		1	3				
St. Vincent and the Grenadines		1	1				5
Trinidad and Tobago	1						

1= Activities to commence for lobster / conch assessment
2 = Catch & effort to be collected from specific fishers RAU and FD
3 = Activity to commence w / in existing resources of the FD
4 = CFRAMP to develop survey design
5 = Proposed assessment activity (w / support from

4.0 OVERVIEW OF FISHERIES BY COUNTRY AND RECOMMENDATIONS FOR ASSESSMENT PROGRAMS

The brief overview of each country presented here is based on the evaluation of information obtained during the Sub-Project Initiation Mission. The recommendations for the lobster and conch fisheries of each country are provided in order of priority or importance. In some cases, different assessment activities may be conducted concurrently. The FD of each country, in conjunction with the RAU, will determine its own assessment schedule. The countries visited on this mission are listed in alphabetical order. The recommendations provided are based on the findings from the country consultation and are not restricted to assessment activities to be supported by the lobster/conch RAU. Those activities listed in the recommendations that can be supported by the RAU are indicated.

4.1 Antigua and Barbuda

4.1.1 Antigua

The lobster fishery is based primarily on traps, some fishers target lobster and the remainder take lobster as a by-catch. Most lobsters are landed at night and are sold to fish houses. Some are also sold directly to hotels so that data collection is more difficult. The present price is about EC$26.40/Kg (ECS12.00 /lb). It is estimated that 50-60 % of the lobsters landed are exported. The FD inspects lobster exports which are shipped live. The French islands are the primary destination. Berried females and undersized lobsters are frequently landed but only go into the local market. Biological data collected on an ad hoc basis from 1988-91 were sent to SVG RAU for analysis. The FD believes that the lobster stock is not presently overexploited. Antigua is deemed to be an appropriate site for puerulus monitoring (a CFRAMP assessment activity) as a preliminary program has already been conducted on the island (Bannerol et al., 1991). This provides baseline data for future work and the geographical location of the island within the Caribbean is considered suitable for helping to assess regional patterns of settlement and abundance.

The conch fishery is conducted by a small number of boats (6 -8) in well defined areas (S and W) of the shelf. SCUBA diving for conchs takes place in the 18 - 33 m (60 -110 ft) depth range. Unsafe diving practices (e.g. extended bottom times, inadequate surface intervals) are reported. Repetitive diving schedules appear to be a particular problem. The majority of conch landings are of unprocessed meats and all go to the local market. The present price is about EC$11.00/Kg (EC$5.00/lb).

Lobster Recommendations:

1) Commence biological sampling on a regular basis at the fish house next to the FD. Analyze the biological data collected earlier (with possible assistance from CFRAMP) to provide a comparative basis for this present data collection effort. (RAU support)

2) There is a need for an education program regarding illegal lobster landings and the detrimental effects of these practices. Additionally, more active enforcement should be carried out to support existing regulations.

3) A puerulus monitoring program should be considered only after the biological sampling is well advanced and the data is being used in active management. (RAU support)

Conch Recommendations:

1) Biological sampling of the stock should be started to determine whether immature conch are being taken and what proportion of the landings are represented by sexually immature conch. These data could also be used to assess whether the present regulation regarding legal meat , weight is adequate or requires revision.

2) Active extension work with conch divers can help define the annual spawning period through the observation and documentation of the occurrence of egg masses. This information ,may be used in a future management scheme to define a closed season. (RAU support)

3) A resource assessment survey should be considered to provide a first estimate of the conch population biomass. CFRAMP could provide some support to the FD in carrying out this survey.

4) The encouragement of safe diving practices for conch divers should be pursued through active extension work (FD has already started this program). Investigate mandatory diver certification of conch fishermen to reduce injury and disability.

4.1.2 Barbuda

The lobster fishery is the dominant fishing activity in Barbuda and forms an essential element of the economy along with tourism. All lobsters are landed whole and live. The majority of the landings are still thought to be taken by SCUBA diving but the use of traps has been increasing steadily in recent years. It was estimated that in 1990, 2 -3 traps set for a one week soak would yield 182 - 227 Kg (400 - 500 Ibs) of lobster. In 1995, 10 - 15 traps would be required to obtain the same catch. It is estimated that 80 % or more of the landings are exported, primarily to the French islands. An export tax of EC$1.10/Kg ($0.50/ Ib) is levied on all lobsters. They are inspected and weighed before shipment thus providing very accurate records. This tax goes to the Barbuda Council. Juvenile "chicken" lobsters from Codrington Lagoon are regularly landed in violation of existing regulations but all are consumed locally. This is a "cultural" activity of the Barbudians. Discussions with FD revealed that they are considering the possibility of the closure of Codrington Lagoon to lobster harvesting. The conch fishery is very limited and consists mainly of free diving for conch but only for local consumption.

Lobster Recommendations:

1) Examine correlation between export figures derived from tax collection and landings figures collected by FD to assess accuracy of landings. Refine collection of statistical data with regard to the use of traps versus diving to take lobsters and use to evaluate the apparent trend toward an increase in the use of traps.

2) Collect biological data from the commercial fishery to define the present size/sex structure of the population. With only two landing sites, coverage of the fishery for biological sampling should not be difficult to arrange. Also investigate the possibility of sampling the lagoonal lobster population. (RAU support)

3) Establish a puerulus monitoring program around the island using a local person with a background in biology. CFRAMP could support this program by providing materials for the collectors as well as technical information. (RAU support)

4) Assess current diving practices of lobster fishermen to determine if violations of repetitive diving schedules are having adverse effects on fishermen. Provide information about safe diving practices through extension work.

4.2 Barbados

A study of the lobster fishery in Barbados, found that the fishery is highly seasonal (June-October). Lobsters are caught off the east coast primarily by free-diving and secondarily by SCUBA. Off the west coast, lobsters are taken primarily by fish pots (Mitchell, 1992). This study also found the spotted spiny lobster *(Panulirus guttatus)* to be the most prevalent species taken on the east coast while the larger Caribbean spiny lobster *(P. argus)* was the dominant species taken in the west coast pot fishery. The smoothtail spiny lobsteTfP. *laevicaudd)* is the second most abundant species in the catches on both coasts. Barbados also imports approximately 26 mt of lobsters per year from Belize (tails and meat) and Grenada and Cariacou (whole lobsters) (Mitchell, 1992). Much of the lobster landings are not recorded, and data collectors place any landings data collected in the "others" category.

The conch fishery is a small one, taken as incidental bycatch by spear fishermen. The conch are taken primarily for the shells which are used for artwork and sold in the tourist industry. Because this fishery is an incidental one it is considered too small to expend personnel and financial resources to pursue assessment activities.

Lobster Recommendations:

1) The status of this small but valuable fishery is unknown. Strengthening the existing data collection system to include catch and effort data on the lobster fishery would allow for a preliminary assessment of the stock. The program should focus on the fishers who target the resource. This should be done within the context of the existing data collection program.

4.3 Belize

The lobster fishery is the most valuable fishery for Belize. In 1994, lobster contributed approximately 55% (US$7.3 million) of the total value of exported seafood products from Belize. Belize started exporting lobsters around 1920 (Gordon, 1981). This fishery is considered a commercial operation utilizing approximately 500 vessels and 2,000-3,000 fishers. The resource is fished both by free divers and with the use of wooden lobster traps. Fishers also use various shelters (i.e. tires, boards, oil drums) to aggregate the lobsters. Fishing occurs along the reef system (i.e. reef crest and back reef) and the three adjacent atolls in depths of 1.5-10 m. Very little fishing occurs in the deep waters off the fore reef. Catches for the last ten years have fluctuated, with an increasingly pronounced dip approximately every three years, however, the value of the fishery has increased due to price increases on the world market. Most of catches are landed at the fishermen's cooperatives which are responsible for the processing and marketing of this product, the product is sold either tailed or cooked whole. The majority of the product is destined for the export market, however, with tourism on the rise in Belize, the local demand has been increasing. Data on landings have been collected for at least twenty years; effort was collected in that time period on an ad hoc basis only. The current data collection program does collect effort data on this fishery. The CFRAMP snonsored data entry operator is currently working on an assessment of the fishery using the catch and effort data.

Conch is the second most valuable fishery in Belize. In 1994 conch contributed approximately 9% (US$1.2 million) of the total value of exported seafood products of Belize. The resource is fished by skin divers along the back reef and seagrass beds of the main reef system and the three adjacent atolls. Conch was first exported in 19601 py the 1970's, Belize was one of the largest producers of the Queen conch, Strombus gigas, with exports of over 454,545 Kg (1 million pounds) per year in 1972. This was followed by decreases in landings in the 1980s and the fishery was considered overexploited. Current conch landings fluctuate between 90,909 -204,545 Kg (200,000 - 450,000 Ibs) per year. Conch is exported, yet local sales are increasing. Most of the conch is landed at the fishing cooperatives, where it is processed and marketed. Data on landings have also been collected for at least twenty years, with effort being collected on an ad hoc basis in that time period. The current data collection program collects both catch and effort data from this fishery. The CFRAMP sponsored data entry operator is currently working on an assessment of the fishery using the catch and effort data.

Draft Lobster Recommendations

1) Commence biological sampling (i.e. size frequencies) at the fishing cooperatives. This data can be easily coupled with the catch and effort data already being collected. (RAU support)

2) A larval monitoring program can be established. There are a number of marine reserves and research stations (Hol Chan Marine Reserve, Coral Cay Conservation, Glovers Reef Marine Reserve) in Belize that regularly conduct field sampling activities, it is recommended that the possibility of incorporating the lobster larval monitoring program into their work program be investigated. (RAU support)

3) Investigate the use of lobster "condominiums" for habitat enhancement if appropriate baseline work can be conducted first in order to allow for an evaluation of the effectiveness of this technology. (RAU support)

Draft Conch Recommendations

1) A survey of the conch ground was carried out in the early 1980's. This survey provided valuable information on the biomass and distribution of the resource. The survey proposed here will provide an assessment of the current biomass and distribution of the stock and will attempt to identify juvenile areas. This information coupled with data on catch and effort currently being collected will allow for analyzing the abundance of the stock. Where possible the. study proposes to survey the fishing ground previously surveyed, thereby allowing the FD to look at trends in the fishery by comparing the status of the population fifteen years ago with the present day situation. (RAU support)

2) Commence biological monitoring to include weight frequencies and sex ratio as well as length and lip thickness of shells - where possible. Weight frequency analysis is possible if one assumes that the fishing grounds are well established and the population is homogeneous (Appeldoorn pers. comm.).

4.4 Dominica

The majority of lobsters landed are taken with traps but there is apparently no directed fishery for them as the market is said to be limited. Lobsters are sold to hotels/restaurants at ECS22.00 - 24.20/Kg (EC$10-ll/lb). Some diving for the spotted spiny lobster, *Panulirus guttatus,* occurs on the east coast (Calibishie). Traps are set in deeper water for *P. argus* but trap loss is reportedly high due to strong currents on the narrow shelf. Lobster fishing is seasonal (mainly September to January) because fishers shift their effort to pelagics starting in January. Catch and effort data for lobsters appears not to be consistently recorded.

The conch fishery is said to be very limited with only a handful of fishers participating. One of the remaining conch fishers pointed out that many divers have left the industry since conch abundance has declined in shallow water. Most conch diving occurs in the Portsmouth area (NW coast) mainly by free diving but SCUBA, which is prohibited by policy, may be used by some fishers. Presently, most conch diving is only done when an order is received from a hotel or restaurant. All of the conchs, which are landed whole, are consumed locally and the shells are often used for making artwork, lamps, etc. An inspection of conch shells for sale at Indian River revealed that juveniles, sub-adults and adults were harvested. The decimation of conch numbers in shallow water (i.e. free diving depths) was believed to be caused by illegal fishing by French fishers. It is speculated that there may still be a deeper water sub-population which has not yet been fished. This may provide an important spawning biomass reservoir which could contribute to the maintenance of the local stock. The very narrow shelf area of Dominica probably limits the population size of both lobsters and conch.

Lobster Recommendations:

1) Identify "lobster" fishers and establish a sampling protocol for catch and effort as well as biological data using standardized gear and bait i.e. arrowhead traps and cowhide bait. Much of this information can be collected by using existing data collectors and extension officers working with selected fishers. (RAU Support)

2) Refine the existing data collection system, which is already well developed, to include more detailed information on fishing effort for lobsters, e.g. number of trap hauls, soak time, etc. This could provide information to assess trends in catch per unit effort on an island wide basis.

Conch Recommendations:

1) Refine existing data collection system on conchs to generate more accurate catch and effort statistics. Biological data collection at landing sites could be started, if staff are available, as conchs are landed whole. CFRAMP could help strengthen data collection capability by providing appropriate background information and training. (RAU support)

2) Investigate possibility of conducting conch abundance survey on available shelf area using divers. Attempt to determine if deeper water sub-population of conch exists below free diving depths. CFRAMP can assist in the sampling survey design, FD can provide boat, fuel and divers.

4.5 Grenada

Lobsters are caught by divers (both SCUBA and free divers) using loops and by fishers using trammel nets. Although, most of the catch is taken on the south coast, lobsters are also caught in the Grenadines (Cariacou) and on the north and east coasts of Grenada. Conversations with the FD suggest that divers follow unsafe diving practices and some have experienced the ends. The lobsters are either exported or sold locally. Processors must receive an export license from the FD, therefore export figures are collected; however, landings sold locally are unqualified. In 1993, approximately 11,295 Kg (24,848 lbs) of whole and tailed lobster were exported (16,942 Kg or 37,272 lbs whole lobster assuming 25 % of exports are frozen tails) worth EC$373,000. Exports are primarily to the French Islands although some exports to the United States, Trinidad and Barbados also occur. Fishery statistical data (i.e. catch, effort) are not collected from the landing sites on the south coast and in the Grenadines.

Conch are fished by divers using SCUBA mainly in the Grenadines and on the south shelf of Grenada, Most of the landings are not recorded. Many divers fish for conch during the lobster closed season (May 1 to August 31). Most of the conch landings are thought to be sold locally with some exports occurring. The Fisheries Division reports exports for 1993 to be 6,127 Kg (13, 479 lbs) worth EC$112,000. Examination of conch shells at landing sites in the south found large numbers of juveniles (yearlings, 2 years old and 3 years old) in the piles.

Lobster Recommendations:

1) Strengthening of fishery statistical data (i.e. catch and effort) to help quantify the value of the fishery and to begin an assessment of the status of the stock. (RAU support)

2) Collection of biological data (size, sex) to refine and support the assessment of the status of the stock. (RAU support)

3) The Fisheries Division has attempted to train some of the SCUBA divers but apparently with limited success. The FD must be encouraged to continue with this important work regarding the safety of fishers who dive.

Conch Recommendations:

1) There is a need for more enforcement accompanied by extension work to sensitize the industry and the community about the detrimental effect of landing undersized conch.

2) Strengthening of fishery statistical data to allow for a preliminary assessment of the status of its stock. (RAU support)

3) Collection of size frequency data at the landing sites in the south where large numbers of juveniles are landed. This data in conjunction with information on fishing grounds will allow the identification of potential juvenile habitats. These can be verified by subsequent ground truthing surveys. Once juvenile grounds have been identified, the FD can recommend to government appropriate steps to protect these grounds. (RAU support)

4.6 Jamaica

It is estimated that 60 - 70 % of total lobster landings come from Pedro Bank but during the present lobster season there are reportedly only 2-3 industrial boats fishing for lobster. The industrial fishery is for tails only and the majority are exported. However, the only measure for minimum legal size is carapace length. The industrial lobster fishery has apparently undergone a significant decline recently but the reasons are unclear. Statistical data on the industrial lobster catch is reportedly inadequate. It is thought that artisanal production of lobsters has increased considerably (possibly comprising up to 40% of total landings) but that the present data collection system, which does not adequately capture catch and effort, may be significantly underestimating artisanal landings. It is speculated that 10-20% of total landings may be going to hotels and restaurants with the increase in local market demand in the past five years. Most artisanal landings are from the south coast and lobsters are taken by diving and with traps. Contravention of regulations are common and illegal lobsters (e.g. those taken out of season or undersized) usually enter the market as wrung tails.

The conch fishery is dominated by the activities of industrial fishing boats on Pedro Bank. The FD grants a limited number of licenses for industrial conch fishing; presently, nine companies have been granted licenses. Conch are now being taken in the 18-21 m (60 -70 ft) depth range by teams of divers using hookah rigs and SCUBA. Meats are removed at sea and processed to varying levels prior to being landed. Industrial boats are landing up to 27,273 Kg (60,000 lbs) of meats per 12 day

trip. Meats can be processed to five different levels of cleaning depending on the market to which they are being exported. Approximately 80% of conch landings are exported to the French islands (Martinique, Guadaloupe). The conch fishery is presently operating under the terms of the CITES convention with an interim quota set at 1,500 mt pending the results of a resource survey for conch conducted on Pedro Bank in the fall of 1994. The present data collection system gathers information on conch exports but catch and effort data are only collected on an *ad hoc* basis. The FD is planning to implement a fishery statistical data collection system which is to include the use of logbooks and observers on industrial vessels. Purchase logs for processing plants and data collectors on key fishing beaches are also planned. The level of assistance requested by the FD of the lobster/conch RAU is limited, at this time, to assistance with the analysis of the data.

Lobster Recommendations:

1) A study of the morphometric relationship between carapace length and tail size and weight should be conducted to allow for an effective means of assessing lobster landings for conformity to size regulations and to permit better enforcement. (RAU support)

2) An initial analysis of the biological data collected by the FD lobster project on Pedro Bank which started in 1989 (originally sponsored by ICOD but not completed) should be conducted to evaluate this data set. This analysis should determine if there is some significant benefit to completing this project or whether available resources should be directed to current areas of interest (RAU support)

3) Mandatory reporting of lobster statistics by industrial license holders in a defined time frame could be made a prerequisite for future licensing to ensure compliance with data reporting requirements. To this end, the FD should pursue a more active extension role with industrial producers to ensure that the required statistics are provided in a timely manner.

4) The monitoring program should be strengthened to improve the collection of catch and effort data for lobsters to allow for a better assessment of the stock. These efforts should be made through enhancing existing links between data collectors and the artisanal fishery.

5) A puerulus monitoring program is suggested for Jamaica because of the large directed lobster fishery and its central geographic location in the region. The south coast is recommended as a more suitable site to commence the program, rather than Pedro Bank, because of better logistical support operating from the coast versus offshore. FD staff could be made responsible for the project which could run on a cooperative basis with students from the Center for Marine Studies, UWI, Mona. (RAU support)

6) Investigate the use of lobster "condominiums" for habitat enhancement if appropriate baseline work can be conducted first in order to allow for an evaluation of the effectiveness of this technology. (RAU support)

Conch Recommendations:

1) A monitoring program for catch and effort must be undertaken. Regular observer trips at sea by FD staff will be required to validate these data. Industrial producers are known to have accurate records and should be willing to cooperate in data collection. Log book forms have already been produced but there needs to be a follow-up to determine the levels of compliance.

2) The analysis of the conch fishery data set (catch, effort, biological data) from Pedro Bank, based on the work conducted by graduate student Alex Tewfik, needs to be completed for inclusion in the stock assessment process. (RAU support)

3) Conch meats are frequently landed in unprocessed form. This provides an ideal dockside biological sampling opportunity as meats can be weighed and sexed. A determination of sexual status (immature / mature) can be made from an inspection of the genital anatomy. These data are of considerable significance in evaluating the status of the fishery. (RAU support)

4) Initiate assessment activities recommended in the report produced on the resource survey for conch conducted on Pedro Bank in November 1994.

4.7 Montserrat

Although lobsters are not a targeted species, they are fished on the island shelf primarily by traps and, to a lesser extent, by divers. Occasionally, they are caught incidentally in gill nets. Fishers have observed increased landings in traps during the latter part of the year. Lobsters are landed at the two primary landing sites, Plymouth on the west coast and Carrs Bay in the north. Catches recorded for whole lobsters for 1994 and 1993 were 38 Kg (83 lbs) and 33 Kg (73 lbs) respectively. Although these figures are probably underestimates, landings in Montserrat are not significant. Fishers are of the opinion that two different species of lobsters, with differing mean sizes, are being landed. However, this could not be confirmed during the visit. Regulations for this fishery are in draft form. They are to be harmonized with the regulations of other DECS countries.

Conch are targeted by approximately 8 conch divers, either free diving or with SCUBA. These divers harvest conch primarily when they get an order to provide this product. Conch is also a by-catch of divers with spear-guns harvesting finfish. Most of the conch are landed in Plymonth and are sold for EC$6.60/kg ($3.00/lb). In 1994 and 1993, recorded catches were 302 Kg (664 Ibs) and 422 Kg (928 Ibs) respectively. Although landings data are recorded, effort data are not yet collected. Regulations for this fishery are presently in draft form and, in common with lobsters, they are to be harmonized with the other OECS countries.

Lobster Recommendations:

1) The lobster fishery is primarily an incidental one and is too small to expend personnel and financial resources to conduct biological assessment of the fishery at this time.

Conch Recommendations:

1) The monitoring program should be strengthened to allow for the collection of effort data. This will allow for a first assessment of the status of the stock. Once a time series of data are available, the FD can use catch per unit effort (CPUE) as an initial index of abundance.

4.8 St. Kitts and Nevis

4.8.1 St. Kitts

The FD estimates that 90 % of the lobster catch is taken by traps. Lobsters are apparently targeted on a seasonal basis (September to March) with most trap fishing occurring on the north and east coasts. Traps are set in 36 m (120 ft) depth on top of the shelf out to 145 m (480 ft) on the shelf edge. Traps are hauled by hand from locally built wooden boats with outboard engines which may work from 20 to a maximum of 35 traps per boat. Less than 10 fishers dive for lobsters. Unsafe diving practices are reportedly common in the industry. Present regulations (9 in. total body length, 1 Ib. wt.) need to be evaluated for their effectiveness in managing the stock. About 50 % of the lobster landings go to hotels while the other half is exported. Lobster trap fishers at Dieppe Bay report no clear trend of declining abundance over the past 8-10 years. The FD is concerned about habitat degradation of juvenile lobster habitat as a result of foreshore development along the S.E. Peninsula. A research project into the fishery biology of spiny lobster and queen conch conducted in conjunction with the FD from 1985-87 generated useful data on the stock but the analysis of this data set has not been completed for use in assessment and management.

The conch fishery is conducted by ten boats and all of the product is presently going into the local market except for one exporter (to USVI). This loss of the export market has come as a result of the CITES requirements being imposed. Previous to CITES regulation, it is estimated that 60 % of conch landings were exported. Conch divers are not full time, they only dive 1 -2 times per week. Unsafe diving practices, particularly violations of repetitive diving schedules, appear to represent a significant liability to fishers. There are no conch regulations in place at present.

Lobster Recommendations:

(1) The data from the lobster research project conducted in 1985 - 87 needs to be captured and transcribed into DOS format for analysis. This will provide valuable information about the status of the stock in those years which can be compared with planned data collection this year. CFRAMP can help facilitate this process of data transcription. The FD wants to be involved in the data analysis; CFRAMP and the OECS Fisheries Unit can assist in conducting this analysis for stock assessment purposes.

2) The above analysis should be initially directed at obtaining estimates of the fishery parameters most applicable and useful for assessment and management of the stock e.g. reproductive seasonally, size at first maturity, mortality estimates, etc.

3) A short term intensive sampling effort for a period of 1-2 months should be made to generate a data set from present day landings to compare with the results of the analysis discussed above. This would allow an evaluation of the changes which have occurred in the population parameters over the past 8 - 10 years, e.g. changes in mean size, sex ratios, etc. (RAU support)

4) A long term biological sampling program should be started as soon as practicable. The FD has staff with previous experience in this work and they are able to commence the program without any further training from CFRAMP. (RAU support)

5) Information should be compiled on the use of artificial habitats for lobsters to evaluate their utility in habitat enhancement projects in areas of coastal habitat degradation. CFRAMP can provide information and background for this evaluation.

Conch Recommendations:

1) Determine CITES requirements for the export of conch from St. Kitts and initiate the procedure to meet these standards to enable the export trade to become re-established.

2) Obtain the original data set generated from the conch research project conducted in the mid - 1980's and complete the analysis to obtain a better insight into the status of the stock at that time. It is recommended that the minimum legal size be increased to 220 mm shell length based on earlier published information (Wilkins et al, 1987) from the above project. (RAU support)

3) Active extension work should be pursued to inform and educate fishers about safe diving practices, particularly conch fishers.

4.8.2 Nevis

It is estimated that 65 % of the lobsters landed are taken by divers. Commercial lobster divers use SCUBA in the 23-29 m (75 - 95 ft) depth range. Traps may be set as deep as 45 m (150 ft) for lobsters. There are about seven commercial lobster diving boats around the island. The majority of the lobsters are taken from the bank to the south of the island. Divers report seasonal changes in abundance which they speculate may be associated with a seasonal migration on and off the bank. Most lobsters are brought to the Fisheries Complex in Charlestown and are often stored in cars before going to market. Fishers receive ECS22.00-26.40/Kg (EC$10.00-12.00/lb) for lobsters sold in the local market. The price paid for lobsters exported by the Complex is US$11.00/Kg (US$5.00/lb). The whole, live lobsters are exported mostly to the French islands and Anguilla. They are subject to an E.G. $0.33/Kg ($0.15 /lb) export tax and every shipment is certified by the FD. The 1984 Fisheries Act was amended in 1992 but regulations are still in draft form. These regulations

are intended to be harmonized with other OECS countries. One of the regulations pending is to change to a minimum legal carapace length of 95 mm as the present measures (9 in. overall or 1 lb wt.) are considered inadequate. There is a high incidence of landing undersized lobsters but they are all landed whole. There is no enforcement of fisheries regulations but the police are empowered to conduct enforcement. Lobster data collection commenced in November 1993 and the FD feels that the present data collection system captures most of the landings data adequately.
The conch fishery is conducted by SCUBA diving both north and south of the island. The normal depth range is 18-27 m (60-90 ft) and conch are processed at sea and landed ready for shipment. Divers average three dives per day and typically take a surface interval to clean conchs between dives. Up until a year ago, approximately 34,091 Kg (75,000 Ibs) per year were exported to the French islands. At present, about 4,545 Kg (10,000 Ibs) per year are exported to the U.S. Virgin Islands at a price of US$6.60/Kg (US$3.00/lb). The large reduction in exports appears to be the direct result of the implementation of CITES requirements for trade in conch. There are presently no regulations in place for conch but there are plans to incorporate the OECS harmonized regulations.

Lobster Recommendations:

1) Biological data collection should commence as soon as adequate training can be arranged for the data collectors. This can probably best be accomplished by sampling at the Fisheries Complex where the majority of lobsters are landed. CFRAMP has a sub-project in place at the present time to conduct such biological training and it is anticipated that the training will be completed within several months. (RAU support)

2) As two-thirds of the lobsters are taken by diving, it is suggested that the FD inform and educate fishermen regarding safe diving practices and possibly facilitate a training program for certification.

3) The landing of undersized lobsters is prevalent. Active extension work should be undertaken to discourage this practice and to help increase the yield from the stock.

Conch Recommendations:

1) Determine requirements to comply with CITES regulations to enable the export trade to the French islands to be re-established. The loss of this market represents a significant decline in earnings for some of Nevis' fishers as well as in foreign exchange. CFRAMP may be able to assist in clarifying the CITES requirements and in facilitating this process.

2) Biological sampling should be started as soon as possible to generate data for assessment and management purposes. These data will be necessary to determine if the planned draft regulations are adequate. (RAU support)

3) Introduce the concept of using lip thickness as an indicator of sexual maturity to enhance the regulatory environment for the fishery. This should be feasible as there are presently no conch regulations in force. Lip thickness should be incorporated in the biological sampling program to validate its utility in determining sexual maturity. (RAU support)

4.9 St. Lucia

The majority of lobster landings come from traps which are set in depths down to 45 m (150 ft). Most lobster fishing occurs on the east and south coasts. Lobsters are required to be landed whole and live. All lobsters are sold in the local market as demand exceeds supply. As a result, lobsters are imported from St. Vincent to meet the local demand. Some fishers target lobsters using woven bamboo Z - traps and cowhide for bait. These traps, which can be set in large numbers (up to 100 traps between two fishers), are fished seasonally from September to December. When the pelagic fishing season starts in January, effort is greatly reduced. Lobsters are also taken as a by catch in fish pots. The use of trammel nets to take lobsters is now illegal and the FD is working to phase out this destructive gear type. The closed season (April 30 - September 1) is fairly well enforced as are the other lobster regulations. The Fisheries Complex will only buy legal-size lobsters and mostly from licensed fishermen. Basic biological sampling (size, sex, reproductive condition) is conducted by the FD at the Complex during the early part of the open season. The FD has not observed any significant decline in landings, nor in mean size of lobsters, in the past 5 years.

The conch fishery is comprised of less than 10 boats which work out of two sites at the northern end of the island. Fishers use SCUBA in the 24-36 m (80-120 ft) depth range and appear not to follow safe diving practices i.e. extended bottom times, repetitive diving violations, etc. The FD is providing information to conch divers and encouraging them to get proper diver training. At Gros Islet in the north, fishers reported that landings of 200 conch per trip were common. Conch sells for EC$17.60/Kg (EC$8.00/lb). There are minimum size and weight limits in place for conch but they are not used in practice; only the flared lip is used as an indicator of sexual maturity for harvesting. Most conch landings are exported to Martinique under a CITES certificate; the FD must certify all shipments. Martinique has strict control over the importation of conch from St. Lucia. Conch meats are also sold at Gros Islet for a Friday-night street party and food fair, and the Fisheries Complex. No importation of conch is permitted at present. Nichols and Jennings-Clark (1994) reported that two distinct conch populations exist, with the northern population having a significantly larger mean weight. Based on a preliminary analysis, the FD does not think that the northern conch population is presently over-harvested. There is no commercial harvesting of the southern population at this time but some free diving at subsistence level reportedly takes place.

Lobster Recommendations:

1) The FD have collected biological data from the Fisheries Complex at the opening of the season for the past 3-5 years. These data sets should be analyzed to provide insights into the status of the population - the FD has plans to do this. CFRAMP can help facilitate this analysis.

2) Continue season opening biological data collection at the Fisheries Complex to extend this time series of data.

3) Enhance data collection from fishers using woven bamboo traps to target lobsters to generate improved catch per unit effort (CPUE) measures. Select fishers who target lobsters with this gear type and through active extension work, attempt to collect detailed catch and effort data for a defined part of the season (e.g. September - October).

4) Data collection on reproductive seasonality should be pursued through sampling at sea to determine if the present closed season is adequate. There appears to be a lack of consensus about the peak reproductive period. (RAU support)

5) Encourage development of data collection system on lobsters from hotels and restaurants to increase accuracy of lobster landings figures.

6) The FD should be commended for implementing a ban on the use of trammel nets which is a highly destructive gear type. The few remaining fishing vessels which are still reportedly using this gear should be forced to comply with the ban within a time period defined by the FD.

7) A puerulus monitoring program could be established using existing staff and resources at the FD. They are willing and able to conduct this program once CFRAMP provides the specifications for the collectors and standardizes the sampling protocol. (RAU support)

Conch Recommendations:

1) As there is a lack of evidence of overharvesting, careful monitoring of the conch fishery should be continued. Limits on an increase in existing fishing effort should be considered if deemed necessary by the FD.

2) Improve data collection on catch and effort to refine assessment of fishery and collect biological data if it can be incorporated into existing data collection without a significant increase in sampling cost.

4.10 St. Vincent & The Grenadines

The important commercial fishery for St. Vincent and the Grenadines in terms of landings, value and national priority is the fishery for pelagic species. However, fishing for lobsters is an important economic activity for the Grenadines (i.e. Musdque, Union Island, Bequia, Petit St. Vincent, Tobago keys, and Palm Island). Lobsters are harvested by SCUBA divers using a stainless steel wire noose. The catch is usually kept in crawls until it is sold to a trader, who exports most of the catch to the French Islands. A tariff of EC$2.20/Kg (EC$1.00/lb) is placed on all lobsters exported. All exports are required to be inspected by the FD ensuring that they meet the legal requirements. Catch data are collected by the FD from the export forms and from a data collector stationed in Bequia. The corresponding effort data is only collected in Bequia. The FD intends to commence the collection of catch and effort data on the island of Mustique where a major lobster fishing camp exists. There are reports of decreased landings and fishers have had to dive deeper (up to 36 m/120 ft) for their harvest. As a result, unsafe diving practices such as extended bottom times and short surface intervals in repetitive diving are predominant. Many divers have reportedly experienced the bends. Landings of 31,965 Kg (70,324 Ibs) were reported for St. Vincent and the Grenadines in 1994.

Conch is harvested by the divers who fish for lobsters although not all lobster divers engage in this activity. Conch diving is done primarily in the lobster closed season. Divers have also had to dive to deeper depths to harvest conch although they report that conch harvesting depth range (18-30 m/60-IOO ft) is somewhat shallower than lobsters. The catch is exported or sold locally. Some of the conchs destined for export are sold to trading vessels at sea and do not go through any landing sites. Otherwise, conch destined for export to the French Islands must be accompanied by a CITES certificate. A tariff of EC$ 1.10/Kg (EC$0.50/lb) is charged for all conch exported. Catch data can be obtained from the exports and from Bequia, where a data collector is stationed. As with lobsters the corresponding effort data can only be collected from Bequia. The Fisheries Division intends to use the data collection program to be developed in Mustique to collect effort data as well. In 1994, reported landings for conch were 36,956 Kg (81,304 Ibs).

Lobster Recommendations:

1) Improve catch and effort data collection especially at the primary landing sites i.e. Mustique and Union Island. Standardized catch per unit effort can be used as an initial index of abundance.

2) Biological sampling (i.e. size frequencies, sex) of lobsters can be started, especially as the Fisheries Division inspects all lobsters destined for export. The Fisheries Division has suggested that this activity be started without waiting for the Subproject Specification and Training Workshop. (RAU support)

3) The Fisheries Division has worked with the divers to inform them about safe diving practices and to get them certified. However, as unsafe diving practices still persist, the FD should be encouraged to continue in this program

Conch Recommendations

1) Strengthening of fishery statistical data collection to include the collection of catch and effort data, especially from the primary landing sites.

2) Consider a resource abundance survey to provide an assessment of distribution and abundance of conch in the main fishing grounds of the Grenadines. CFRAMP could provide some support to the FD for this activity.

3) Data on conch sold to the trading vessels are not recorded. The government does not receive the tariffs from these exports and the FD cannot properly assess the value and status of the fishery. The government is encouraged to stem this activity either by extension work or by enforcement.

4.11 Trinidad & Tobago

4.11.1 Trinidad

Very little information is available about the lobster fishery (i.e. landings, species caught, fishing practices, high seasons, marketing and distribution) in Trinidad. Much of the information obtained or this report was gathered for the first time during the visit of the lobster/conch biologist, 30 March & 1 April, 1995. Lobsters are fished in some areas of the north and east coasts. In the east, they are harvested by divers using SCUBA and free diving. They are also a by-catch of the trap fishery on the north coast (eg. Ortoire Bay) and fishers have noted increased landings in the latter part of the year. Although landings data are unknown, a purchaser claimed to buy about 227 Kg (500 lbs) per week in the high season. Observations of landings found two species of lobsters, *P. argus* and *P. guttatus* in the catch. Fishers claim that at least two other species of lobsters are commonly found in the landings.

There does not seem to be any fishery for conch, *Strombus sp.;* however, a small fishery for the crown conch, *Melongena sp.* in the estuarine areas of the west coast exists. These conch are picked up from the muddy substrate during low tides. This fishery is very small and probably not significant enough to expend personnel and financial resources to conduct an assessment at this time.

Lobster Recommendations:

1) Conduct a frame survey of the lobster fishery, including landing sites, fishing grounds, gear types, species caught, fishing practices, high/low seasons. This survey could be conducted within the framework of the current data collection sampling program. The results of the survey would assist the FD in determining the feasibility of implementing a catch and effort data collection program for lobsters. (RAU support)

4.11.2 Tobago

In common with Trinidad, some of the information documented in this report was obtained for the first time during the visit by the lobster/conch biologist (3 rd April, 1995). Much of the lobster landings are taken as a by-catch of the pot fishery, with increases in landings being observed in the latter part of the year. A few fishers will set the traps to target the lobsters during these latter months. Some fishers also target lobsters by setting oil drums (smashed with holes in bottom and sides), however, the interviews conducted suggest that this practice is decreasing. Lobsters are also caught, as a by-catch, by divers (using SCUBA or free diving). However, from interviews with the fishers, it appears that a small number of divers do target lobsters. The lobsters are sold locally in Tobago or Trinidad, and it is unclear if any are exported. Data on landings are lacking probably because lobsters are quickly placed in igloos and spirited away from the landing sites. Descriptions of the lobsters suggest that two species are being landed *(P. argus & P. guttatus)* but this was not confirmed.

An established conch fishery existed in the 1960's-70's but the FD believes the resource was over-fished. Currently, conch are landed as a by-catch by divers who target finfish. Very few individuals target conch and, during the interviews, only two conch divers were identified. However, it appears that some divers, will target conch if they have been given an order from a purchaser to do so. Data on conch landings are not collected.

Lobster and Conch Recommendations

1) Conduct a frame survey of the fisheries, including landing sites, fishing grounds, gear types, species caught, fishing practices and high/low seasons. This survey could be conducted by the CFRAMP- sponsored data collectors. The results of the survey would assist the FD in determining the feasibility of implementing a catch and effort data collection program. (RAU support)

5.0 SUMMARY

The relative importance of the lobster and conch fisheries to the countries of the CARICOM region varies greatly. In some countries, these are the predominant fisheries and exceed finfish in economic importance while in other countries, they are of minor importance in the fisheries resources sector. Those countries where there is a predominant and directed lobster fishery, viz. Belize, Jamaica, (Antigua &) Barbuda and (St. Vincent and) the Grenadines all demonstrate a significant economic dependence on this fishery in terms of employment and contribution to the local economy. In terms of scale, it is clear (based on the most recent figures available) that Belize and secondly, Jamaica dominate amongst the CARICOM countries in terms of total lobster production with Belize recording landings of 667 mt in 1994. Almost all of this production is destined for the export market. The Jamaican figures are not as recent or accurate but the 1986 figure showed lobster landings estimated at 400 mt. In _ Barbuda, the lobster fishery appears to form one of the twin pillars of its economy along with tourism. Virtually all of the lobsters caught in Barbuda are exported. In other countries, there is a small or seasonally directed lobster fishery e.g. Antigua, Grenada, St. Kitts and Nevis and St. Lucia. These islands are not as dependent on their lobster fisheries because finfish form a major" component of their marine resource base. However, the lobster landings are important for the local economies. The nature of the fishery, whether lobsters are caught primarily with traps or by diving also influences the assessment process. The fishery management issues which arise with a trap fishery for lobsters will have to be evaluated in the light of recommendations made concerning the use of fish pots by the CFRAMP Sub-Project on reef fishes. In many islands, fish pots are used to catch both finfish and lobsters. Lobsters are a high-valued fishery product and with regional and worldwide demand for lobsters increasing, they have become, over the past years, an important item in the foreign exchange earnings of a number of countries as a large proportion of total landings are exported. In the CARICOM region, the French islands of Martinique and Guadeloupe, appear to be the principal destinations for many of the lobster exports from the eastern Caribbean islands. This trade is almost exclusively in whole, live lobsters. The United States is the main destination for Belizean production which is almost entirely exported as frozen tails.

The queen conch is second only to the spiny lobster in export value in the Caribbean. Total landings in the Caribbean region are estimated to be around 4,000 mt (Appeldoorn, 1994). However, a recent assessment of the status of queen conch stocks (Appeldoorn and Rodriguez, 1994) indicates that many countries consider their populations over-fished. An examination of the most recent estimates of conch landings from the Caribbean indicates that Jamaica far surpasses all of the other countries with a landings estimate of 2,000-3,000 mt. This is largely because of the development of the industrial level fishery for conch on Pedro Bank. Belize has the second highest conch landings at 149 mt. As with lobsters, the majority of conch landings are exported. Similarly, the French islands are the principal export destination for most of the CARICOM conch producers although Belize exports mainly to the United States. The recent imposition of CITES regulations with regard to trade in conch has had a significant impact on the export markets of several islands e.g. St. Kitts, Nevis with a resultant decline in exports and loss of foreign exchange earnings. There is a need to assess the conch stocks of many countries to formulate management programs as relatively little information is available except landings figures. An attendant problem associated with the conch fisheries are the unsafe diving practices which are common amongst conch divers. These lead to injury and disability for fishers with long term effects. There is a pressing need to educate and facilitate proper training for these fishers to reduce the incidence of diving mishaps. The Fisheries Departments of the region can play a central role in this regard through active extension work.

The allocation of CFRAMP resources to each country for assessment purposes is dependent on the evaluation of the status of the lobster and conch stocks and their local importance. The level of support and assistance will depend on the country's existing resources and its ability to conduct assessment and management activities. However, users are cautioned that the data collection and stock assessment models do not always yield the results expected. Yet, given the economic importance of these fisheries, it is imperative that the countries of the CARICOM region move toward assessing their individual fisheries to enable them to obtain long term benefits by enacting fishery management measures which are sensitive to the biological and socio-economic realities of each country. If the assessment activities recommended in this report can be conducted in a timely manner and within an agreed time frame established by CFRAMP to accomplish its objectives, it should be possible to make significant progress in developing and strengthening each country's ability to evaluate the information it collects about its fishery resources. This information can be used to implement active management measures, or to enhance existing measures, for the maximum benefit of the people and the economy of the country.

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APPENDIX I - Summaries of consultations with participating countries.

Antigua and Barbuda

March 8 - 10, 1995
Antigua Fisheries Department, Ministry of Agriculture, Fisheries, Lands and Housing,
Mr. E. Royer, Chief Fisheries Officer; Ms. D. Black, Graduate Assistant; Ms. C. Bamwell, Fisheries Officer

The various elements of the lobster fishery were discussed including the fact that Barbuda had a directed fishery for lobster where the majority of the landings were taken by divers. Most of these lobsters are exported live to the French islands. In contrast, Antigua has some targeted lobster trapping while the remainder of the landings come from the by catch of the fish pot fishery. There is no closed season for lobster and the FD does not think it necessary at this time. Data collection is better in Barbuda due to the directed nature of the fishery and the regularity of the fishing. In Antigua, there are a small number of fishermen who specialize in conch diving with SCUBA. In 1994, the reported landings of lobster and conch were similar but lobster is considered more important overall because of its higher value. The FD believes that the lobster stock is not presently overexploited. They are interested in collecting biological data again after having collected on an *ad hoc* basis in 1988-91. The fish house adjacent to the FD was visited and appears to be an ideal location to sample lobsters. Visits were made to the St. John's fish market on two occasions and several different conch divers were interviewed about their fishing and diving practices. Visits were made to two landing sites in Antigua, Jolly Harbour and Urlings Beach, were conch fishermen were interviewed and conch piles were examined to assess the maturity of the conch taken'. Mr. Royer stressed that he had limited staff to conduct assessment activities and he wondered whether CFRAMP might provide a replacement for an officer on study leave as the FD was unable to do this. He would like the lobster biological data analyzed by CFRAMP (St. Vincent RAU). A rationale for biological sampling for conch at Jolly Harbour was presented and agreed to in principle (Ms. Black is willing to do this work). Because of the large shelf area and the previous puerulus monitoring work which has been done in both Barbuda (Peacock, 1973) and Antigua (Bannerol et al, 1991), it was proposed that these islands be selected as one of the sites for the CFRAMP puerulus monitoring program. The FD agreed to this but stated that lobster size - frequency work had priority over puerulus monitoring.

Barbuda

March 9, 1995
On a day trip, accompanied by Ms. D. Black, a meeting was held with John Mussington, a former employee of the FD, who provided useful perspectives on the changing nature of the lobster fishery. Divers starting using SCUBA about 1985 when lobster catch levels declined in free diving depths. All lobsters are landed whole and live so that divers use only nooses -there is no spearing. The use of traps has reportedly increased significantly in the past five years. Suggested measures for improving the fishery included an education program for fishermen about lobster biology and enforcement of regulations concerning the taking of berried females and juvenile "chicken" lobsters. An informal interview of fishermen at Codrington Wharf, the main landing site, yielded valuable

insights into their fishing activities e.g. soak times, no baiting of traps, average catch rates. An inspection of the traps provided details of materials and construction.

Barbados

4-5 April, 1995
Fisheries Division, Min. of Agriculture, Food and Fisheries
Steven Willoughby, Chief Fisheries Officer, Sandra Prescod, Fishery Biologist, Greg Franklin, Data Collector, Antoinette Marshall, Data Entry Operator,

A study was commissioned to examine the lobster fishery of Barbados including lobster imports for the period December 1990 to December 1991 (Mitchell, 92). Lobsters are caught off the east coast primarily by free-diving and secondarily by SCUBA, and off the west coast primarily by fish pots (Mitchell, in press). The study found the spotted spiny lobster *(P. guttatns)* to be the most prevalent species taken in the free-diving east coast fishery and the larger Caribbean spiny lobster *(P. argjis)* the dominant species taken in the west coast pot fishery (Mitchell, in press). The Chief Fisheries Officer, Mr. Willoughby, is interested in assessing the status of the lobster population in Barbados in an effort to determine if this fishery should be pursued on a commercial basis.

The data collection system was discussed and it was found that data on lobsters are not always collected and any lobster landing collected are recorded in the "other" category. Site visits were made to Martins Bay, Consett Bay and Tent's Bay. Lobsters caught locally are sold either live or frozen to restaurants at BdosSlO.00-15.00/lb. At Martins Bay, a lobster diver, stated that lobsters are targeted at night by approximately 10 divers from that area. This activity occurs in calm weather when visibility is good. Catches vary, however, landings of 10-30 lbs / diver *x* night"[1] are not uncommon.

Very little information could be obtained on the conch fishery and efforts to interview conch fishers were unsuccessful. However, it appears that conch are harvested primarily for the shells, which are used for artwork in the tourist industry, and are primarily a by-catch fishery for divers. Mr. Willoughby stated that the King Helmet, *Cassis tuberosa,* is also fished for its shell.

5 April, 1995
Dr. Hazen Oxenford, Lecturer, MAREMP

Barbados participated in a three month lobster post-larval monitoring program. This program, a GCFI initiative, involved other Caribbean Islands. The results of this preliminary study found that lobsters (P. *argus* and *P. guttatus)* settle in Barbados. Subsequent examinations among algal beds and seagrass found no evidence of post settlement larvae. The study, suggested that this may be due to a lack of adequate habitats for these larvae. In this regard, the CFRAMP biologist promised to send information on juvenile habitat enhancements, also known as condominiums. Dr. Oxenford proposed Barbados as a site for the CFRAMP post-larval monitoring program, and offered her assistance in this endeavor. However, as the complementary landings data are unavailable, correlating settlement with landings would not be possible. Dr. Oxenford suggested that correlations could be made with landings from islands west of Barbados, such as St. Lucia.

Belize
May 29, 1995
Fisheries Department, Ministry of Agriculture
Mr. Vincent Gillett, Fisheries Administrator; Mr. Alfonso Avilez, Assistant Fisheries Officer

The CFRAMP biologist was asked to comment on a proposed Spiny lobster maturity study to be conducted in Belize. The CFRAMP biologist found the objectives and work plan of the proposal to be sound, however, raised some concerns about the logistical aspects of the study. The recommendations of the SPIM report were reviewed and agreed to. These recommendations had come out of informal discussions with the FD during the last six months. In addition, the conch abundance survey which was recommended for CFRAMP support, was developed from a proposal presented to CFRAMP by the FD. Mr. Gillett stated the need for a technician to assist in the biological data collection and spiny lobster post-larval monitoring program.

The CFRAMP biologist mentioned the inclusion of lobster and conch in the biological data collection training undertaken by the St. Vincent RAU. Mention was also made of Dr. Raul Cruz's visit to Belize. Dr. Cruz, a lobster biologist, visited Belize to assist in the development of a proposal for spiny lobster post-larval monitoring in the CARICOM countries (i.e. Antigua/Barbuda, Belize, Jamaica, St. Lucia). Possible sites for monitoring in Belize was suggested and three sites were selected for Dr. Cruz to visit. These sites were Gallows Point reef, Turneffe Atoll and Ambergris Cay.

Dominica

March 17-18,20, 1995.
Fisheries Division, Ministry of Agriculture, Trade, Industry and Tourism,
Ms. G. Augustus, Senior Fisheries Officer; Mr. H. Guiste, Fisheries Officer

The objectives of the lobster / conch RAU were outlined to the FD and discussion ensued about the fisheries for these resources in Dominica. There are about 50 landing sites around the island and 15 data collectors who concentrate their efforts at the most important sites. Draft fisheries regulations have been drawn up since 1987 but have not yet been passed into law. The development of the tourist industry began in the 1980's and so directed fishing for lobster and conch began only 5 - 8 years ago. A visit was made to Portsmouth on the NW coast which is the main site for conch fishing. The data collector there was interviewed and confirmed that there are only a handful of conch fishermen now. A fisher who free dives for conch part-time recounted that a normal diving day yields 50 - 150 conch; they are all landed whole. Buyers come from Roseau to purchase conch. The FD questioned whether CFRAMP could produce an experimental design for a conch survey to assess abundance. They would contribute divers and boats to conduct the study. It was agreed that this proposal should be examined in more detail.

Visits were made to two sites on the east coast where lobster fishing takes place. At Marigot, the data collector indicated that most of the fishers were part-time. They used mainly traps for lobsters but there is a limited market so there is little directed effort. At Calabishie, the data collector introduced CFRAMP staff to several lobster fishers who provided details about their lobster fishing with traps. Trap loss is reported to be high due to strong currents. Some diving for the guinea chick

lobster, *Panulirus guttatus* occurs in shallower depths. The FD asked for the assistance of CFRAMP in designing a study to assess the lobster population. This issue will be addressed further under recommended assessment activities.

Grenada

28-29 March
Fisheries Division, Ministry of Trade, Industry, Energy and Production
Paul Phillips, Chief Fisheries Officer (Ag); Crafton Issacs, Fisheries Biologist; Moran Mitchell, Fisheries Officer.

The status of the lobster and conch resource and the number of fishers involved in these fisheries are largely unknown. However, due to its high value (ECS4.00/ whole conch, ECS9.00/ Ib lobster) the FD is interested an assessment of these fishery. Lobsters are fished in the south, north, and east coast of Grenada and off Cariacou, in the Grenadines. They are harvested by divers (SCUBA or free diving) using wire loops and with trammel nets in the north and possibly Cariacou. The Fisheries Division is in the process of banning the use of these nets for lobster fishing. The current data collection system collects export data as a license must be obtained from the FD before exporting. Some catch and effort data are collected on the northern landing sites in Grenada, however, in the southern landing sites (i.e. Calliste and Woburn) and Cariacou, catch and effort data are not collected. It is assumed that although a large percentage of lobsters landed are exported, local sales are increasing.

Site visits were made to Sauteurs and Levera, in the north, Granville in the east and Calliste and Woburn in the south. In Sauteurs, the RAU biologist was able to talk to some fishers who use trammel nets, these fishers were discouraged at the FD's policy to ban the use of nets. Divers, interviewed at this and other sites, appear to practice unsafe diving (i.e. extended bottom times, multiple dive, short surface intervals) and cases of "bent" divers have been reported. The FD is currently looking at ways to regulate the SCUBA fishery. To this end, the Government embarked on a training program for divers, however, the program was poorly attended. Enforcement of the regulations is a problem and the FD is of the opinion that lobster fishing occurs during the closed season; however, undersized lobsters are generally not targeted, and berried lobsters are kept penned in the sea until the larvae are released.

Conch are harvested by divers, generally during the lobster closed season. Discussions with the FD and the fishers indicate that most of the harvesting is done by SCUBA divers, in depths of 60-80 feet. Most of the conch are harvested in the south (i.e. Calliste, Woburn) as well as the Grenadines (Cariacou). Divers claim that catches in Cariacou are far greater than catches off the Grenada coastline. In the south, divers land the live conch, where it can be penned until a market is available. Examinations of conch shells on these landing sites indicate that many of the landed conch are juveniles (yearlings, 2 year old and 3 year old). Fishers generally agreed that the larger (i.e. adult) conch are landed in the north and in the Grenadines.

Jamaica

March 6-7, 1995
Fisheries Division, Ministry of Agriculture,
Mr. A. Kong, Fisheries Director; Ms. S. Grant, Fisheries Officer; Mr. S. Smikle, Fisheries Officer; Mr. C. Jennings, Master fisherman

The members of the CFRAMP team were introduced by Milton Haughton and an outline of the CFRAMP project and its activities were presented. The project ends in December 1998 and the objective is to leave an infrastructure and plans in place to enable each participating country to continue on with fisheries assessment and management activities at the termination of the project. Mr. Kong stated that there was a need to define realistic and practical programs for implementation; he does not want to commit to plans which he does not have the resources to conduct. CFRAMP team members provided input to the discussion from their areas of responsibility.

Mr. Smikle outlined the development of fishery management plans for both lobster and conch and discussed the problems involved in their implementation. A new policy has reportedly been adopted whereby there is a moratorium on the issuance of any new conch licenses to fishing companies. These licenses have been allocated on an historical basis and there is presently a limit of nine companies permitted to fish these resources. FAO has been approached for assistance with revising the current Fishing Industry Act (1975) with respect to developing legislation for the conch fishery. CFRAMP has reduced funds for the lobster /conch RAU due to recent budget cuts in Canada. This will require the establishment of priorities for the RAU activities in each country to maximize the benefit from this sub-project. The ICOD sponsored project to assess the lobster resources on Pedro Bank was started in 1989 but had many problems and was never completed. An assessment of this initial data set (seven months disjunct data collection) should be made before deciding on further lobster assessment activities. The FD requested CFRAMP's assistance in completing the data analysis and in providing recommendations to either continue with the project or to re-direct its focus. It was estimated that 60 -70 % of total lobster landings come from Pedro Bank but the present data collection system does not include catch and effort data from the artisanal fishery. Carapace length is the only existing measure of minimum legal size of lobsters and yet many lobsters are landed tails only, particularly by industrial vessels. It was suggested that a morphometric study be conducted to develop appropriate equivalent measures for tail size and weight to facilitate more accurate reporting as well as enforcement. A puerulus monitoring program was discussed and the logistics of operating such a program on the south coast versus at Pedro Bank were compared. Some puerulus settlement work has already been done on the north coast and the possibility of continuing there was also mentioned. Mr. Kong stated that a conch management plan was in place and that log book forms had been produced for conch boats and for processors. He agreed that the FD needs to follow up on this program to check on compliance as a priority activity and to ensure that the landings data are accurate in relation to the interim quota. CFRAMP will support the completion of the conch data analysis from the project conducted by graduate student Alex Tewfik. His work is considered to contain much useful information which can be used in the conch stock assessment of Pedro Bank. It was recognized by the FD that regular observer trips at sea would be the best means of validating conch statistics. The FD was encouraged to use the industrial producers for data collection as much as possible.

Fisheries staff (above); Mr. K. Aiken, Zoology, UWI; Dr. J. Woodley, Centre for Marine Sciences, UWI; Mr. H. Webb, South Coast Conservation Foundation

Milton Haughton, after introductory remarks, stated that CFRAMP hoped to implement some of the programs discussed within six months. Ms. S. Auil-Marshalleck outlined the goals and objectives of the lobster/conch RAU which was just starting its work. It was stated that CFRAMP would look seriously at co-management possibilities but would not be planning a region-wide model as programs would need to be country specific. Mr. Kong emphasized that fishing activity was not the only factor which impacted on fishery resources, but that environmental degradation and impacts were also important. Mr. Aiken briefly outlined the involvement of UWI in fishery projects over the years and noted that this knowledge and expertise could be incorporated into defined fishery assessment activities within the CFRAMP program. Dr. Woodley briefly outlined the Coral Reef Initiative program, an international program to enhance our understanding of coral reef systems. The first meeting of this group is to be held in Jamaica in early April and part of it focus will be on co-management.

Centre for Marine Sciences, Zoology Dept., University of the West Indies, Mona, Dr. I. Goodbody, Mr. K. Aiken, Dr. J. Woodley, Dr. D. Steele

CFRAMP stated that due to budget cuts the program would like to use other resources to assist with lobster/conch assessments. With regard to conch, Dr. Goodbody is the CITES authority in Jamaica. CITES' role is to: 1) approve a conch management plan and 2) certify conch export shipments (to countries who are CITES signatories) with the required CITES documents. Pending the results of a conch survey recently carried out on Pedro Bank, an interim quota of 1,500 mt of conch has been set. Dr. R. Appeldoom, Marine Sciences, University of Puerto Rico is analyzing the survey data and is expected to produce a report with preliminary recommendations for the Pedro Bank fishery shortly. It was suggested that a puerulus monitoring program for spiny lobsters might be started as one of the assessment activities using an NGO such as UWI to conduct the program. Dr. Steele briefly recounted his experience with puerulus monitoring on the north and south coasts and indicated that, should a decision be taken to start monitoring as an assessment activity then, this could be a suitable activity for a graduate student project. He expressed concern about establishing a monitoring program without an adequate data collection program in place.

Canadian High Commission, Kingston Mr. M, Kam, High Commissioner

During this courtesy call, the progress of the CFRAMP project was outlined by Milton Haughton.

General discussion ensued regarding different fishery assessment activities around the island and the need for a large-scale public education scheme to increase awareness and understanding of fisheries management was recognized.

Meeting with conch and lobster producers - Mr. R. Moo Yong (Miles Franklin), Ms. M. Wong (Grace Kennedy), Mr. P. Evelyn, Ms. P. Francis (B & D Trawling)

There was general agreement that lobster landings were down last year. About 10 % of landings were rejected by buyers because they were: berried females, undersize, speared, etc. Lobster

production on Pedro Bank was estimated at 10,000 lbs of whole, live lobsters taken by divers every three days. During the open season, live lobster is selling for J $ 120.00 / lb. Most tails landed are exported by the major fish producers but there are believed to be unquantified amounts of lobster being sold abroad which are not recorded. There are only two industrial lobster vessels operating at present. An estimate of artisanal conch production from Pedro Ban!; was given of 10,000 Ibs of conch meats from 6 days diving by a boat. There was a further estimate that 15 % of total conch landings come from the artisanal fishery. Claims were made that conch divers were tampering with lobster traps resulting in loss of catch and damage to traps. In previous seasons, industrial lobster vessels could average 3,000 Ibs of tails per month per vessel. Artisanal lobster production is thought to have increased significantly in the past year or two. This has been accompanied by an increase in the number of artisanal lobster divers (using hookah and SCUBA).

Site Visit to Grace Kennedy Fish Processing Plant, Kingston
Ms. P. A. Hutchinson, Processing Manager; Ms, M. Wong, Marine Products Manager

A dockside inspection of an industrial vessel chartered by the company to fish for conch on Pedro Bank was made. It landed approx. 60,000 Ibs of conch meats after a 12 day trip. A conducted tour of the processing plant was made and the five different levels of cleaning of the conch meats were demonstrated. Approximately 80 % of the meats, which are frozen in 1 Kg. bags, are sold to Martinique and Guadeloupe. The meats are removed from the shell at sea but are landed whole. This provides an opportunity for biological sampling of the landings including the determination of sex. The company appears quite willing to cooperate with the FD in such a sampling program.

Ministry of Agriculture, Head Office, Kingston, Ms. J. Rousseau, USAid, Mr. E. Guise , Advisor, Ministry of Agriculture, Charles Reed, Ministry of Agriculture

This meeting was held to discuss a proposal to set out a large array of casitas (lobster habitats) on the south coast of Jamaica to harvest lobsters on an industrial scale. USAID has been approached to fund this project and wished to discuss the technical aspects with CFRAMP staff. After lengthy discussion, a consensus was reached that there was a need for a preliminary baseline study before proceeding with the full scale proposal as there were too many unknowns.

Montserrat

March 21-22, 1995
Fisheries Division, Ministry of Agriculture, Trade, Lands and Housing. Mr. J. Jeffers, Fisheries Assistant, Ms. Carmen Turlonge, Fisheries Clerk, Mr. R. Roach, Mr. A. Wade, Data Collectors.

A CFRAMP data collection program is in place with data collectors on the conch and lobster landing sites. These sites are at Plymouth in the west and Carrs Bay in the North. Both fisheries are very small but valuable fisheries. Fishers get approximately EC$10.00/lb lobster and EC $3.00/lbs conch. Local catches are do not meet local demand and lobsters have to be imported.
An area of 8,400 m2 on the west coast, north of Plymouth is to be declared a protected area with no commercial fishing and with limited recreational fishing activity. This area also houses an artificial reef. The Fisheries Division is interested in stocking this area with berried females (lobster) and egg masses (conch). Information on stock enhancement, reproductive biology and recruitment, will be

sent to the FD in an effort to have them obtain an appreciation for these processes. Regulations for the lobster and conch fisheries are currently in draft form, these regulations have been harmonized with the other OECS countries.

A site visit was made to the landing site at Plymouth and an interview was held with a conch diver, Mr. Charles Twitt. Less than ten divers target the conch and Mr. Twitt described their diving practices. Divers use one tank, their bottoms times vary and they have been known to stay about 30 minutes. Depths also vary but divers do not dive much below 18 m (60 ft). These divers usually dive when they have a confirmed market for the catches or when they need extra money.

A site visit was made to Carrs Bay on the 22 March. Carrs Bay is Montserrat's second largest fishing beach; pots and nets are the main gear types used. The fishers interviewed confirmed that lobster is a by-catch in fish pots and an occasional by-catch of the net fishery. The fishers also suggest that two types of lobsters are caught in the traps, possibly *P. argus* and *P. guttatus,* but this was not confirmed. Fishers also reported increased landings of lobsters in the latter part of the year.

St. Kitts and Nevis

March 13 - 14, 1995
St. Kitts Fisheries Division, Ministry of Agriculture, Lands, Housing and Development,
Mr. J. Simmonds, Senior Fisheries Officer; Mr. R. Wilkins, Fisheries Officer

A courtesy call was made to the Permanent Secretary Mr. V. Warner to outline the purpose of the CFRAMP mission. He expressed his interest in the lobster/conch assessment activities and wished the project success. The present data collection system in St. Kitts was discussed with the FD and it was revealed that there are three data collectors - two for catch/effort and one for biological data. The Basseterre fish market is sampled daily except Sundays. Other main landing sites are visited regularly. In addition to fisheries programs, the FD also works with the SE Peninsula Association (which is a government agency), on a reef monitoring program and a marine park project. In order to use limited staff resources efficiently, it was agreed that the biological data collection should be linked with the catch/effort data whenever possible. Mr. Simmonds would like to have all the data collectors capable of collecting both types of data. A general discussion ensued about the lobster fishery and Mr. Simmonds requested information on lobster condominiums for use in areas of habitat degradation. It was agreed that an information package on lobster habitats could be put together by CFRAMP and distributed to interested parties. The FD requested assistance with the analysis of a lobster data set generated during a project with Dr. M. Goodwin in 1985-87. CFRAMP agreed to facilitate the transfer of the data to an appropriate format for analysis as well as to provide assistance with the analysis possibly through the OECS Fisheries desk. A site visit was made to Dieppe Bay, which is a major landing site for lobsters and interviews were held with two lobster trap fishers. One fisher appeared willing to assist with biological sampling of lobsters working with Mr. Wilkins.

Nevis

Mr. A. Barrett, Fisheries Assistant

A courtesy call was made to the Permanent Secretary Mr. E. Liburd upon arrival in Nevis. This was followed by a tour of the Fisheries Complex where a lobster diver was interviewed about the diving fishery. Most lobsters are brought to the Complex and exported live; many are kept in cars before being delivered for shipment. A small number of tails are frozen. The FD wants to establish the Complex as a base for biological sampling of lobsters; this was endorsed by CFRAMP. SCUBA diving for conch has apparently declined sharply since the imposition of the CITES regulations. There are no conch regulations presently in place. The concept of using a lip thickness measure to assess sexual maturity was introduced. This is considered more reliable than using the flared lip only but it still needs to be refined. The FD thought that this would take a substantial effort to introduce. A visit to Jessups, a former major conch landing site, revealed that only two out of 10 boats were still diving for conch. Fishers apparently take samba, mature and sub-adult conchs in this fishery. As conchs are cleaned at sea, fishers would have to be accompanied to validate this statement.

St. Lucia

March 15 - 16, 1995
Fisheries Division, Ministry of Agriculture, Lands, Fisheries and Forestry, Mr. Keith Nichols, Fisheries Biologist; Mr. Phillip Matty, Extension Officer; Ms. J.
Compton, Biologist; Ms. F. Nassis, Data Analyst; Mr. J. Lawrence, Manager of Fisheries Complex

The FD is well staffed and supported to carry out its mandate. There are nine cooperatives on the island which provide goods and services to the island's fishers. The FD uses the CFRAMP LRS system for licensing and all fishers must have an ID card. The data collection system has seen in place for over 15 years. Customs and marine police work with the FD to enforce the regulations. The complex will only buy legal lobsters which come mostly from licensed fishermen. Data collectors at the complex can conduct biological sampling. Local demand exceeds supply so that lobsters are also imported. The FD would like to know the stock size and level of recruitment. They have the staff to conduct a puerulus monitoring program. A site visit was made to Praslin on the east coast and a productive discussion was held with two lobster trap fishers who use woven bamboo traps specifically for lobsters. Although there is a closed season in effect, the FD would like to conduct biological sampling at sea to validate the reproductive period or to amend the closed season if it was deemed necessary. The conch fishery is based at the northern end of the island. Site visits were made to Esperance and Gros Islet, two of the main conch landing sites. Conchs are required to be landed whole thus facilitating enforcement of regulations. Inspection of the conch mounds indicated that virtually of the conch were mature. Some samba conchs were also seen. Interviews with conch divers indicated that safe diving practices were not being followed. The FD has planned a workshop to address the issue of diving safety for fishers. Licensing specifically for conch diving is planned in the coming months. The FD can control the conch fishery by limiting exports by quota if it is considered necessary. This could help meet local demand. The FD does not envisage significant financial costs in implementing the various recommended assessment activities and is

prepared to conduct these assessments without drawing on the limited lobster/ conch RAU funds available.

St. Vincent and the Grenadines

March 23-27, 1995
Fisheries Division, Ministry of Agriculture, Industry and Labour
Mr. Kerwyn Morris, Chief Fisheries Officer; Ms. Cheryl Jardine, Data Entry Operator; Ms Jennifer Cruickshank, Extension Officer

Mr. K. Morris stated that Mr. Raymond Ryan, Fisheries Research Officer, currently studying in Barbados, is the fisheries personnel responsible for all CFRAMP sponsored activities. In this regard, Mr. Morris urged the RAU biologist to get in touch with Mr. Ryan concerning lobster/conch assessment needs in St. Vincent and the Grenadines. The fisheries is governed by the Fisheries Ac: of 1986, the supporting regulations were passed in 1987. These regulations set size and weight limits and season closures for lobster and conch. All landed conch must possess a flared lip; and landing of berried, headless and moulting lobsters are prohibited. There is also a restriction on the use of impaling devices for capturing lobsters. These regulations have been harmonized with the other OECS countries. Scientific advice for the regulations were obtained from the OECS Fisheries Divisions as well as from regional scientists, Dr. Carl Berg and Dr. Melvin Goodwin. With the passage of time, Mr. Morris questioned if the regulations currently in place were still appropriate for the management of these species. Specifically, Mr. Morris questioned the advantages of a closed season for lobsters. Enforcement of these regulations remains a problem and offenses take years to be heard in court. As a result, berried and undersized lobsters continue to be landed. The Fisheries Division intends to use their extension program to promote compliance with the regulations. However, at this time, there is only one extension officer in office, all others (seven) are receiving training abroad.

The primarily fishery, in terms of landings and value for St. Vincent and the Grenadines is the pelagic fishery. The focus of the FD is to manage this fishery and exploit their EEZ. However, lobsters and conch make up valuable fisheries for the people of the Grenadines. Fishers receive approximately EC $10.00/lbs for live lobster and 3.00-3.50/lbs for conch. However, the status of, and number of fishers involved in the fisheries are unknown. Anecdotal information suggests that the resource is being depleted and divers have been diving deeper to maintain catches. Information from the divers revealed that fishing occurs primarily off Union Island and Mustique and the majority of the landings are exported, primarily to the French islands. An tax of $1.00 is charged on every pound of exported lobster and S0.50/ Ib of exported conch. All lobster exports are inspected by the Fisheries Division to ensure that they meet the legal requirements, conch exports although not inspected, must be accompanied by a CITES certificate. However, some conch catch destined for export are sold directly to French trading vessels at sea and are not recorded by the Government.

The data collection system obtains information on lobster and conch exports, however, with the data collector stationed in Bequia, information on effort and catch per unit of effort is collected for Bequia, but largely lacking from the other islands. The FD will be obtaining two seven (7) meter boats and intends to use them to commence data collection activities in other Grenadine islands.

Site visits were made to Bequia (24/3) and Mustique (24/3) and interviews with divers and an exporter were conducted. In the Grenadines, the fishers focus more on lobster than conch fishing. Divers use stainless steel wire loops to capture lobster and would carry 10 loops (i.e. ten lobsters) per dive. Improper dive practices such as repetitive diving (3 tanks / day), short surface intervals (10-20 minutes), and extended bottom times (20-30 minutes at 90-100 ft) frequently occur. Divers claim to dive as deep as 120 ft, when targeting lobster and as deep as 100 ft when targeting conch. As a result of these diving habits, many divers have experience the bends. The Government of St. Vincent and the Grenadines has organized dive training sessions for these fishers, however, the divers mention that following the dive tables and associated rules would yield decreased catches.
March 27.

Meeting with Mr. Peter Murray, Data Manager, OECS Fisheries Unit

Mr. Murray was able to present the RAU with papers of work done on lobster and conch in St. Lucia and St. Kitts. The CFRAMP biologist in turn promised to send papers, the Unit does not have, on studies relating to lobster and conch assessment and management in the OECS region.
Mr. Murray suggested that St. Lucia has produced preliminary papers on the status of the lobster fishery and at this point may be able to conduct a more detailed analysis of the fishery. He also suggested that it may be useful to rate the lobster and conch fisheries in each participating countries (i.e. predominant fishery, directed fishery but not predominant, primarily a by-catch fishery etc) for use as a guide when planning assessment activities in each country.

Trinidad and Tobago

30 March - 3 April
Fisheries Division, Ministry of Agriculture, Land and Marine Resources
Sita Kuruvilla, Fisheries Officer, Christine Chan-a-Shing, Fisheries Officer, David Ramjohn, Data Collection Supervisor, Vincent Maharaj, Field Assistant

Very little has been documented on the lobster fishery of Trinidad and the FD is interested in collecting information on this fishery (i.e. landings, species caught, fishing practices, high/low seasons, marketing and distribution). Site trips were made to fishing beaches on the north (Manzanilla Beach, Ortoire Bay) and East coast (Maracas, Las Cuevas, Blanchisseuse) of Trinidad. Discussions with fishers suggest that on the east coast the majority of lobsters are caught by divers (SCUBA and free diving), diving primarily on an opportunistic basis (i.e. when the sea is calm, and when a market is available). At the visit to Las Cuevas, the RAU biologist had an opportunity to talk to three divers. Interviews with these fishers revealed that they dive frequently, leaving in the early morning to dive and returning at midday. They do multiple dive per trip using 2-5 tanks with very little surface intervals between dives. Examination of the catch revealed two species of lobsters being landed *(Panulirus argus* and *P. guttatus)* all female *P. gutiatus* were berried. The divers are of the opinion that two other types of lobster may be landed, however, this was not confirmed during the visit. The divers landed 100 Ibs of lobster and revealed that landings of this amount are common. On the north coast, lobsters are a by-catch of the trap fishery. Lobster catches in traps increase during the latter part of the year. During this period, landings of 500 lbs/week are not unusual. The present data collection system does not include the collection of catch and effort for

lobsters as this is not an important fishery and on some of the lobster landing sites (Ortoire, Las Cuevas) no data collectors are present.
No conch, *Strombus* sp, fishery exists, however, a small fishery for the crown conch, *Melongena sp,* in the estuarine areas of the west coast exists. These conch are picked by hand from the muddy substrate, during low tides.

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Discussions with the FD revealed that the lobster fishery is primarily a by-catch of the pot fishery. Although catches by divers (SCUBA and free divers) also occur. A few fishers also set 45 gallon drums, smashed, with holes on the bottom and sides, to target lobsters. The data collection system was discussed. Two data collectors are currently collecting catch and effort information from the south west landing sites. Tobago will be hiring an additional three CFRAMP sponsored data collectors to assist in the catch and effort and biological data collection program. The FD is also attempting to collect information from fish processors.

The conch fishery, *Strombus sp.* was an important fishery for Tobago in the 1960's and 1970's. The fishery is now considered overexploited. Currently conch is primarily a by-catch of divers targeting finfish. Although divers will target conch on an opportunistic basis, that is, if they get an order to do so, or if the sea is calm and clear. Discussions with the FD and fishers revealed that fewer than five divers regularly target conch. Divers currently receive TTSlO.OO/single conch meat. The FD believes that pockets of conch can still be found around Tobago. Buccoo Reef, a restricted fishing area, for example, houses many conch. The coralline structure of Tobago's coast should provide suitable habitats for lobsters and conch.

Site visits were made to Buccoo Beach, Pigeon Pt. and Castara. Discussion with the fishers found that lobsters are sold locally to restaurant and hotels or sold in Trinidad. Fishers receive TT$20.00-25.00/lbs of lobster. Lobsters are sold either live or tailed. Landings of lobsters from pots increase in the latter part of the year at which time some pot fishers will target the resource. A local processor claims to receive a steady supply of lobsters (from 20-100 lobsters/day) during this time. Divers fishing from Castara describe targeting two species of lobsters, possibly *P. argus* and *P. guttatus,* however, this was not confirmed during the visit. The FD would like to conduct exploratory fishing activities in an effort to identify areas where lobsters reside, however, they lack the resources to do so. A preliminary assessment of lobster fishing grounds can be obtained through interviews with fishers who target the resource.

APPENDIX II- Notes on the biology and fisheries of the queen conch, Strombus gigas

The queen conch is one of the seven strombid (true conch) species of the Western Atlantic. It's general distribution extends from the Bermuda and southern Florida throughout the Caribbean and into coastal South America but south of the Orinoco river in eastern Venezuela. The queen conch are found in clean waters, most commonly associated with sandflats, supporting seagrasses and algal species where conch derive both food (algae and detritus) and shelter. Older conch may be found on coral rubble, gravel, and mud substrates away from seagrass beds. They have been found in depth ranges from shallow subtidal to 76 m, however, seldom found below 30 m.
At the time of sexual maturity, conch cease growing in length and produce the flared shell-lip characteristic. This begins to occur shortly after three years of age. Tissue growth continues at this time, although at a reduced rate, and subsequent shell growth continues as a progressive thickening of the lip. It requires 5-10 months from onset of lip flaring for the conch to be sexually mature. In Belize, no ripe gonads were found until lip thickness reached a minimum of 4 mm.

Reproduction occurs by internal fertilization, under the protection of the flared lip, with the male mounting the female. Males possess a verge (penis) and the females a genital groove. Reproduction has been reported for most of the year, with peaks between April and September. Spawning occurs several weeks after copulation with the females producing 8 to 25 egg masses of 300,000 eggs, with as many as 750,000.

Eggs hatch in approximately 5 days and two to five weeks later the larvae settle on suitable substrate and begin their benthic life. Juvenile conch spend much of their first year as substrate infauna, feeding epibenthically at night. They remain in the shallow intertidal areas of the seagrass beds.

Conch can live upwards of twenty years. At this time considerable erosion has led to a decrease in the shell length and thickness, and very old conch are often found to be shorter and flatter than younger adults.

Detailed information on the life history of the conch can be found in the literature at the CPU and will not be reported on here. This report presents a summary of information on the biology and fisheries of conch including information on the status of the stock, assessments of stock, stock enhancement, and areas of concern. In particular, cases that apply to the participating CARICOM countries are documented.

Stock Status

The queen conch is second only to the spiny lobster in export value in the Caribbean region. Landings have been estimated on the order of 4000 mt with a potential value of US$40,000,000.00 (Appeldoorn, I994b). The table presented below was obtained from participants at a workshop on queen conch fisheries in 1991 in Caracas, Venezuela.

Table 1. Status of Stocks (taken from Appeldoorn 1994b).

Country	Stock Status
Venezuela	Overfished
Colombia	Some areas probably Overfished
Belize	May be overfished
Mexico	Overfished
Jamaica	Present harvest rates probably not sustainable
Cuba	Stable; probably fully exploited but not utilized well
Turks and Caicos	Stable; possibly somewhat overfished
Bahamas	Overfished only in localized areas
Puerto Rico	Overfished
U.S. Virgin Islands	Overfished overall; stable on St. Croix
Dominica	Overfished
Martinique	Overfished inshore, conch are plentiful in deepwater
St. Lucia	Not fully exploited
Grenada	Growth overfished

Assessment of Stock

Although some assessment studies have been done on conch populations in the region. In many cases the information on the species is limited to levels of catch in various countries.

The standard approaches to stock and recruitment studies, such as the Surplus Productions, Ricker and Beverton and Holt models have been used for assessing conch stocks (eg. Martinique, Puerto Rico, Florida) . However, determination of cohorts or year classes can not be done using shell length alone, lip thickness must be used for adults. Appeldoorn (1992) showed a sharp decrease in the rate of growth in weight at maturity, and suggested that predictions of adult weight based on juvenile growth rate would be significantly overestimated. This also implies that there would be little gain in yield-per-recruit by letting conch live beyond onset of sexual maturity (Appeidoorn, 1992). Therefore yield-per-recruit should not be the only consideration in management decisions; this could lead to recruitment over-fishing (Appeldoorn, 1992).

Resource surveys have been used for providing a preliminary view of the biomass and size-structure of conch populations. This approach coupled with fishery statistics allow one to analyze the abundance of the population. Abundance surveys have been carried out in Belize, Pedro Bank-Jamaica, St. Kitts, & St. Lucia.

Growth

Estimates of mean shell lengths (tip of spire to end of siphonal canal) are: 69-115 mm for yearlings, 125-185 mm for two year olds, and 155-224 mm for three year olds. Mean length of adult conch is 210 mm, with a maximum length of 300 mm. Spatial variations in the growth and morphology of queen conch have been documented, and are thought to be related to environmental conditions

(Appeldoorn, I994a).

Assessment of growth and age are made difficult due to the transition in mode of growth that occurs at the onset of sexual maturity. This transition effectively divides the life history of the queen conch in two distinct stages (Appeldoorn, 1988). To date most estimates of growth and natural mortality rate have been made for juveniles, where easily measured changes in size facilitate the use of various aging techniques (Appeldoorn, 1988). Tag-release experiments for conch have also been used for estimates of growth.

Studies aimed at determining growth has been carried out for the US Virgin Islands, Turks and Caicos, Cuba, Belize, Bahamas and Los Roques, Venezuela, comparison between these areas showed growth to be markedly variable, both in rate of growth and in time to, and size at, maturation (Appeldoorn, 1990).

The growth values estimated for Belize were (Strasdine, 1984):

LOCATION	**L_{oo} (mm)**	**K (yr^{-1})**
Boca Chica, Belize	268.0	0.233
Tres Cocos, Belize	206.9	0.389
Water Caye, Belize	269.3	0.329

Attempts to age adults have been done on the basis of lip thickness, however, this analysis has its limitations and it is not advised that growth functions be applied to areas of markedly different characteristics. Also, as the conch gets older, erosion and abrasion of the lip begins to occur and growth predictors for these older adults may be less accurate. This is true as well for deep-sea populations, such as the Pedro Bank population, that have older and slower growing conch.

Mortality

Appeldoorn (1987) estimated the rate of fishing mortality in the La Parguera population to be F = 1.14 year-^{1} and total mortality to be Z= 1.66. Raither et al (1994) estimated natural mortality for the conch population in Martinique as M-0.433 with the F-value of 0.6 and total mortality at 1.278

Stock Enhancement

Release of hatchery reared juveniles have frequently been suggested as a means of replenishing depleted stocks. Although hatchery rearing techniques are well established, survivorship of hatchery-reared conch in the field tends to be low (Stoner et al 1994). Stoner et al (1994) suggested that success of stock enhancement depends upon: (1) developing hatchery stocks with sufficient vigor and adaptations to survive in the field, and (2) releasing the seed stock in optimal habitats.

It has been shown that transplanting conch to seemingly similar habitats results in varying rates of growth and survivorship (Stoner & Sandt 1992). Although the fife history of the queen conch is

well known, the mechanisms of distribution in the field is poorly known and it is difficult to predict where stock enhancement with the species is likely to be successful (Stoner et al, 1994).

Based on previous results and experiences, Stoner et al (1994), concluded:

1) Natural distribution of juvenile queen conch is probably mediated more by dynamic processes such as water circulation, production of foods, and predation rates than by the more easily measured, static features of the habitat such as macrophyte standing crop, sediment grain size and depth.

2) Early juvenile conch (<6-12 months old) probably have habitat requirements different from older juveniles (1-3 years old); therefore stock enhancement programs planning to outplant early juveniles must accommodate ontogenetic shifts in habitat.

3) Highest probability of success in stock enhancement will probably occur in areas of historical significance as nurseries,

4) If historical nurseries are not now or are altered, then small-scale transplants should be made to test potential enhancement sites.

5) Unless releases are to be conducted on a trial and error basis, the stock enhancement manager must have a very thorough understanding of the habitat requirements of the subject species and the ecology of potential enhancement sites.

Information Gaps:

Appeldoorn (1994b) has identified a number of current issues affecting the assessment and management of conch populations in the region. The areas of concern are listed below;

i) The need for resource surveys, particularly in deep waters, thus allowing for a full assessment of stock status. Coupled with this is the need for adequate statistics for analyzing the abundance of contagiously distributed organisms. Therefore obtaining accurate results without excessive sampling effort needed.

ii) A second area of concern is that of habitat destruction. There is little information that chronicles habitat loss and its effect on conch population. The importance of key habitats in the life cycle of the conch is now being appreciated, especially in regard to the larval settlement and juvenile nursery grounds.

ii) A third area of concerns the effect of fishing on recruitment. To answer this requires a knowledge of stock-recruitment relationships, the source of recruiting larvae, and location of key spawning habitats. Similarly, the significance of high adult density in maintaining reproductive potential and the influence of existing conch may have on subsequent recruitment and survival, either through habitat maintenance or social interaction.

Appeldoorn (1994b) recommends that management strategies for the resource be conservative, given the sparse amount of specific data available.

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