

Current Status and Assessments of the Fisheries for Spiny Lobster and Conch in the CARICOM Region

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ABSTRACT

The CARICOM Fisheries Resource Assessment and Management Program (CFRAMP) undertook a mission to assess the lobster and conch fisheries in the CARICOM region in March/April 1995. The second author (CFRAMP biologist) visited all eleven of the participating countries except Guyana. These countries were: Antigua and Barbuda, Barbados, Belize, Dominica, Grenada, Jamaica, Montserrat, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, and Trinidad and Tobago. The first author accompanied the biologist to five of these 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 which was comprised of the following elements: 1) the acquisition and analysis of fishery statistical data 2) the acquisition and analysis of biological data 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 and the use of lobster "condominiums" to monitor juvenile spiny lobsters 5) resource abundance surveys for conch. A concise overview of the fisheries for spiny lobster and conch in each country is provided as well as an assessment of the relative importance of these fisheries and a summary of the most recent landings figures by country.

INTRODUCTION

The fisheries for spiny lobster and conch have considerable economic importance to most 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 and the existing strength of the local and export markets. 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 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.

The spiny lobster and conch Resource Assessment Unit (RAU) of the CARICOM Fisheries Resource Assessment and Management Program (CFRAMP) was established in Belize in late November 1994. During the period March 6 - April 4, 1995, the second author (CFRAMP biologist of this RAU) visited all of the participating CARICOM countries to consult with the Fisheries Divisions as well as non-governmental organizations in some countries. The first author (CFRAMP consultant) accompanied the second author 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 and 3) evaluate the fishery management objectives and requirements for these fisheries. The information presented in this paper is extracted from the Subproject Initiation Mission (SPIM) Report prepared by the authors for CFRAMP (Luckhurst and Marshalleck, 1995).

EVALUATION OF CURRENT STATUS OF FISHERIES IN EACH COUNTRY

In each participating country, the evaluation procedure included an initial determination of the relative importance of these two fisheries in each country. This was accomplished by interviewing key members of the Fisheries Division in each country and by examining their fishery statistics. Visits to principal landing sites, fishers' cooperatives and interviews with fishers provided first hand information about the conduct of the fisheries in each country. Table 1 presents the most recent landings figures available for both lobster and conch for each country which was visited.

Based on a detailed evaluation of the information obtained, the following list indicates the relative level of importance of the lobster and conch fisheries to each country:

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Table 1. Approximate landings of lobster and conch by country. 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	214.5 mt	2,000 - 3,000 mt (all exported)
St. Kitts/Nevis	8 mt 30 mt (Goodwin <i>et al.</i> , 1986)	16 mt (landings have been reduced due to inability to export to French Islands)
St. Lucia	n/a	13 mt
St. Vincent/ The Grenadines	25 mt	37 mt
Trinidad/Tobago	n/a	n/a

Lobster

- 1) predominant and directed fishery - Belize, Jamaica, Barbuda
- 2) small directed fishery year round or only seasonally directed - Antigua, St. Kitts, Nevis, St. Lucia
- 3) primarily a by-catch fishery with few fishers targeting the resource -

Dominica

- 4) only a by-catch fishery - Montserrat

Conch

- 1) predominant and directed fishery - Belize, Jamaica
- 2) directed fishery but not predominant - Antigua, St. Kitts, St. Lucia
- 3) directed fishery with only a few fishers involved - Barbuda, Dominica,

Nevis

OVERVIEW OF FISHERIES BY COUNTRY

The brief overview of the fisheries in each country presented in this section is based on the information obtained by the authors during their mission. The countries visited on this mission are listed in alphabetical order.

Antigua and Barbuda

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 (EC \$12.00 /lb). It is estimated that 50-60 % of the lobsters landed are exported. The Fisheries Department inspects lobster exports which are shipped whole and live. The French islands are the primary destination. Berried females and undersized lobsters are frequently landed but only go into the local market. The Fisheries Department believes the lobster stock is not presently overexploited.

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. 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).

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 80 % or more of the landings are exported, primarily to the French islands. An export tax of EC\$ 1.10/ Kg (\$0.50/ lb) is levied on all lobsters. They are inspected and weighed before shipment thus

providing very accurate records. The tax thus collected 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 Barbudans. The Fisheries Department revealed that they are considering the possibility of the closure of the Lagoon to lobster harvesting.

The conch fishery is very limited and consists mainly of free diving for conch but only for local consumption.

Barbados

The lobster fishery in Barbados is highly seasonal (June - October). Lobsters are taken off the east coast primarily by free-diving with some fishers using SCUBA. The spotted spiny lobster (*Panulirus guttatus*) is the dominant species in this harvest. Along the west coast, lobsters (mainly *P. argus*) are harvested primarily by fish pots (Mitchell, 1992). The smoothtail spiny lobster (*P. laevicauda*) is the second most abundant species in the catches on both coasts. Mitchell (1992) reports that Barbados imports approximately 26 mt of lobsters per year from Belize (tails and meat) and Grenada and Carriacou (whole lobsters). Much of the lobster landings are not recorded and any landings data are placed in the "other" category.

The conch fishery is a small one, taken as incidental by-catch by spear fishermen. The conch are taken primarily for the shells which are used for artwork and sold in the tourist industry.

Belize

The lobster fishery is the most valuable fishery in Belize. In 1994, lobster contributed approximately 55% (US\$7.3 million) of the total value of exported seafood products from Belize. The export trade in lobsters from Belize started around 1920 (Gordon, 1981). This fishery is considered a commercial rather than an artisanal fishery as there are about 500 vessels and 2,000 - 3,000 fishers involved. The resource is harvested both by free divers and by wooden lobster traps. Fishers also use various shelters (*i.e.* tires, boards, oil drums) to aggregate the lobsters. Fishing occurs along the reef crest and the back reef area in depths of 1.5 - 10 m depth. The three adjacent atolls are also fished but little trapping occurs in the deep water off the fore reef. In the past 10 years catches have fluctuated with an increasingly pronounced dip approximately every three years. The value of the fishery has, however increased due to a rise in price on the world market. Most of the landings are handled by fishermen's cooperatives who are responsible for the processing and marketing of the product. Lobsters are sold either tailed or cooked whole. The majority of lobsters are exported, however, with tourism increasing in Belize, local market demand has been rising. Landings statistics have been collected for at least 20 years but effort has been collected only on an ad hoc basis. The current data collection program does collect effort data on the lobster fishery.

Conch is the second most valuable fishery in Belize. In 1994, conch comprised about 9% (US\$1.2 million) of the total value of exported seafood products. Conchs are 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 1960. By the 1970's, Belize was one of the largest producers of conch with exports of over 454,545 Kg (1 million pounds) in 1972. Landings decreased in the 1980's and the fishery was considered overexploited. Current conch landings fluctuate between 90,909 - 204,545 Kg (200,000 - 450,000 lbs) per year. Much of the conch is exported but local sales are increasing. Most of the conch is landed at the fishing cooperatives, where it is processed and marketed. As with lobsters, landings statistics have been collected for at least 20 years but there has been no systematic effort data collected. The current data collection program collects both catch and effort data.

Dominica

The majority of lobsters landed are taken with traps but there is apparently no directed fishery. The local market is said to be limited. Some diving for the spotted spiny lobster, *Panulirus guttatus* occurs on the east coast (Calabashie). 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 pelagic species starting in January. Catch and effort data for lobsters appears not to be consistently recorded.

The conch fishery appears to be very limited with only a handful of fishers participating. One of the remaining conch fishers indicated 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 done only 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.

Grenada

Lobsters are caught by divers (SCUBA and free divers) using loops and by fishers using trammel nets. Most of the catch is taken on the south coast but some

lobsters are also caught on the north and east coasts as well. Lobsters taken in the Grenadines are principally from Carriacou. Divers reportedly follow unsafe diving practices and some have experienced the bends. Lobsters are either sold locally or are exported. Processors are required to have an export licence from the Fisheries Department and export figures are thus collected. Local landings figures are, however, not collected. In 1993, the value of lobster exports was placed at EC\$373,000 which was comprised of approximately 11,295 Kg (24,848 lbs) of whole and tailed lobsters. The French islands are the principal export destination but some lobsters also go to the USA, Trinidad and Barbados. Catch and effort data are not collected from landing sites on the south coast and in the Grenadines.

Conch are harvested mainly in the Grenadines and on the south shelf of Grenada by divers using SCUBA. Most of the landings are not recorded. Many divers harvest conch during the lobster closed season (May 1 - August 31). The majority of conch landings go into the local market but some conch is exported. In 1993, the Fisheries Division reported that 6,127 Kg (13,479 lbs) worth EC\$112,000 was exported. Large numbers of juveniles (yearlings to 3 years old) were found when conch shell mounds were examined on the south coast.

Jamaica

It is estimated that 60 - 70 % of lobster landings come from Pedro Bank but at present 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. Fishery statistical data on the industrial lobster landings are considered inadequate. It is thought that artisanal production of lobsters has increased considerably but that the present data collection system may be significantly underestimating landings. It is speculated that 10 - 20 % of total landings may be going to hotels and restaurants with increased 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. Contraventions 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 Fisheries Department grants a limited number of licences for industrial conch fishing; presently, nine companies have been granted licences. 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. Approximately 80 % of conch

landings are exported to the French islands (Martinique, Guadeloupe). 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 not systematically collected. The Fisheries Department is planning to implement a data collection system involving the use of logbooks and observers on industrial vessels. In addition, the examination of purchase logs from processing plants and the placement of data collectors on key fishing beaches is planned.

Montserrat

Lobsters are not a targeted species and are taken principally by traps, and to a lesser extent, by divers. They are fished on the island shelf and are landed at two main landing sites, Plymouth on the west coast and Carrs Bay on the north coast. Fishers report increased landings in traps during the latter part of the year. It is clear from recent recorded catches, 38 Kg (83 lbs) in 1994 and 33 Kg (73 lbs) in 1993, that lobster landings are not significant, even though these figures are probably underestimates. Fishers believe that two different species of lobster, with differing mean sizes, are being landed. No specimens were available to confirm this report. Regulations for this fishery are in draft form and are to be harmonized with existing OECS regulations.

Conch are harvested by approximately eight divers, either free diving or using SCUBA. Conch are also a by-catch of divers with spearguns harvesting finfish. Most diving is done to fulfill orders; conchs are landed principally at Plymouth and are sold for EC\$6.60 / Kg (\$3.00 / lb). Recorded catches in 1994 and 1993 were 302 Kg (664 lbs) and 422 Kg (928 lbs) respectively. Effort data are not yet collected. As with lobsters, regulations are in draft form and are intended to be harmonized with the OECS countries.

St. Kitts and Nevis

St. Kitts — The Fisheries Department 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 20 fathoms depth on top of the shelf out to 80 fathoms on the shelf edge. Traps are hauled by hand from locally built wooden boats with outboard engines which work from 20 to a maximum of 35 traps per boat. Less than 10 fishermen dive for lobsters. St. Kitts recently adopted the OECS fisheries regulations for lobsters and it is believed that this will increase their effectiveness in managing the stock. About 50 % of the lobster landings go to hotels while the other half is exported. Lobster trap fishermen at Dieppe Bay report no clear trend of declining abundance over the past 8 - 10 years. The Fisheries Department is concerned about habitat degradation of juvenile lobster habitat as a result of foreshore development along the S.E. Peninsula.

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 appear to represent a significant liability to fishers. There are no conch regulations in place at present.

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. About one-third of the lobsters are taken in traps set as deep as 45 m (150 ft). 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 EC\$22.00-26.40 /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 EC\$0.33 /Kg (\$0.15 /lb) export tax and every shipment is certified by the Fisheries Department. There is a high incidence of landing undersized lobsters but they are 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 Fisheries Department feels that the present data collection system captures most of the landings data adequately. Nevis adopted the OECS fisheries regulations for lobsters recently.

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 lbs) per year were exported to the French islands. At present, about 4,545 Kg (10,000 lbs) 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 were no regulations in place for conch until the OECS harmonized regulations were adopted earlier this year.

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 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 Fisheries Department 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 lobsters and mostly from licenced fishermen. Basic biological sampling (size, sex, reproductive condition) is conducted by the Fisheries Department at the Complex during the early part of the season. The Fisheries Department 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 Fisheries Department 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 Fisheries Department must certify all shipments. Martinique has strict control over the importation of conch from St. Lucia. Conch meats are also sold to the Fisheries Complex and to the local market in Gros Islet. 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 meat weight. Based on a preliminary analysis , the Fisheries Department does not think that the northern conch population is presently overharvested. There is no commercial harvesting of the southern population at this time but some free diving at subsistence level reportedly takes place.

St. Vincent and the Grenadines

The most important fishery in terms of landings and value is the fishery for pelagic species but fishing for lobsters in the Grenadines (*i.e.* Mustique, Union Island, Bequia, Petit St. Vincent, Tobago Keys and Palm Island) is an important economic activity. Lobsters are harvested by SCUBA divers using stainless steel wire nooses; they are kept alive in crawls until they are sold for export. Most of the catch is sent to the French Islands. A tariff of EC\$2.20 /Kg (EC\$1.00 /lb) is imposed on all lobster exports. The Fisheries Department inspects all exported

lobsters to ensure that they conform to the regulations. Landings data are collected from the export forms and from a data collector in Bequia who also captures effort data. The Fisheries Department is planning to commence the collection of catch and effort data on Mustique where a major lobster fishing camp exists. There are reports of decreased landings and declining abundance in shallow water. As a consequence, fishers reportedly dive as deep as 36 m (120 ft) to catch lobsters. Unsafe diving practices are apparently widespread and many divers have reportedly experienced the bends. Landings of 31,965 Kg (70,324 lbs) were reported for 1994.

Conch is harvested by divers who fish for lobsters but this is done primarily during the lobster closed season. Divers report that the conch harvesting depth range (18 - 30 m /60 - 100 ft) is shallower than for lobsters. The catch is either sold locally or exported. Some of the conchs destined for export are sold to trading vessels at sea and do not go through any landing sites. Conch exported 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. As with lobsters, catch data can be obtained from export forms and from the Bequia data collector who also collects effort data. The Fisheries Division intends to commence effort data collection in Mustique as well. Reported conch landings in 1994 were 36,956 Kg (81,304 lbs).

Trinidad and Tobago

Trinidad — Little information is available about the lobster fishery in Trinidad. Much of the information reported here was gathered for the first time during the visit of the second author. It was determined that 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 (e.g. Ortoire Bay) and fishers have noted increased landings in the latter part of the year. Although no landings data have been collected, 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 there are two other species of lobsters commonly found in the landings.

There does not appear to be any fishery for conch, *Strombus* spp. ; however, a small fishery for the crown conch, *Melongena* sp. exists in the estuarine areas of the west coast. These conch are picked up from the muddy substrate during low tides.

Tobago — In common with Trinidad, some of the information documented in this paper was obtained for the first time during the visit of the second author. Much of the lobster landings are taken as a by-catch of the trap fishery with increases in landings being reported in the latter part of the year. A few fishers will set traps to target lobsters during this period. A limited number of fishers set

smashed oil drums to target lobsters but this practice is apparently decreasing. Lobsters are also caught as a by-catch by divers, both SCUBA and free; some of these divers may target lobsters. The lobsters are sold locally in Tobago or Trinidad and it is unclear if any are exported. Landings data are lacking but descriptions of the lobsters suggest that two species are being landed (*P. argus* and *P. guttatus*). This could not be confirmed because no specimens were examined.

An established conch fishery existed in the 1960's - 70's but the Fisheries Department believes that the resource was overfished. Currently, conch are landed as a by-catch by divers who target finfish. Very few fishers target conch but it appears that they will do so if given an order by a purchaser. No conch landings data are collected.

STRATEGIES FOR ASSESSMENT

The elements of the assessment strategy developed during the conduct of the mission are outlined below. This provided the framework within which individual country assessments were made. The five elements are as follows:

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 addressed in the assessment process.

2. Biological Data

The acquisition of biological data from exploited stocks can allow for more refined assessments of the fisheries for these populations. This can 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 seasonality 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.

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 is collected.

3. Spiny Lobster Post - Larval Monitoring

This element in the assessment strategy was concerned only with spiny lobster. The possibility of establishing puerulus monitoring programs in selected countries throughout the region has been proposed. Successful monitoring programs have been in place in several different parts of the Caribbean region (Cuba, Florida, Bermuda) 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 (Cruz 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. 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.

4. Monitoring of Juvenile Spiny Lobsters

The use of lobster "condominiums" on an experimental basis is the last element of the lobster assessment strategy. The use of annual abundances of juveniles (14 - 50 mm CL) caught per artificial shelter (concrete blocks) has been shown to be a useful tool to study recruitment to the nursery grounds and to

predict catches one year in advance (Cruz et al., 1995). It is recommended that Fisheries Departments and CFRAMP 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. This program will be linked with the puerulus monitoring program through spatial coupling of these structures. Data from puerulus collectors can be compared with data obtained from "condominiums" and ultimately landings.

5. Resource Abundance Survey

This is the last element in the conch assessment strategy. 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 Fisheries Departments 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.

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, Barbuda 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 the export market. The Jamaican figure for total lobster production in 1994 was estimated at 214.5 mt, just under one-third the total for Belize. 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 (Moe, 1991) 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 overfished. 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 had the second highest conch landings at 149 mt (Table 1). 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. Attendant problems 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. 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 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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