

The Status of the Conch Fishery on the Shelf and Banks off the South Coast of Jamaica

R. MAHON¹, G. A. KONG², and K. A. AIKEN³

¹*Pelagic and Reef Fishes Resource Assessment Unit, CFRAMP, Kingstown, St. Vincent and the Grenadines*

²*Fisheries Division, Ministry of Agriculture, Marcus Garvey Drive, Kingston, Jamaica*

³*Department of Zoology, University of the West Indies, Mona, Jamaica*

ABSTRACT

There has been a recent rapid expansion in the fishery for conch on the south coast and banks south of Jamaica. This expansion appears to be primarily due to the entry into the fishery of several commercial scale vessels, in the 22-28 m size range with about 20 divers using SCUBA and hooka gear. Preliminary estimates suggest that landings of conch meats in 1990 were in the vicinity of 2,100 metric tons. Government of Jamaica records indicate that about 800 and 1,200 metric tons of processed conch were exported in 1990 and 1991.

The landings appear to be coming primarily from Pedro Bank. Preliminary estimates of the potential sustainable yield of conch from Pedro Bank, based on estimates from other areas of the Caribbean, are 600-800 metric tons per year. Therefore, it is likely that continued harvesting at current rates will rapidly lead to severe overexploitation. Rough estimates suggest that the fishery will reduce the resource past the levels required for MSY within the next two to three years. Various measures to reduce fishing effort have been employed in other Caribbean countries. These were discussed by the industry and agreement was reached on the introduction of meat weight limits, a closed season, and a freeze on new licenses, until a more accurate assessment can be completed. The industry also identified a number of other areas requiring management attention.

INTRODUCTION

Conch fisheries throughout the Caribbean have experienced extreme overexploitation (Brownell and Stevely, 1981; Berg and Olsen, 1991). This has usually manifested itself as a dramatic reduction in catch, and has sometimes required closure of the fishery (Munoz *et al.*, 1987; Hunt, 1987; Moore, 1992).

In Jamaica, conch have been exploited for decades on the south shelf and the offshore banks to the south, by small-scale fishermen. In the early 1980s, production in the conch fishery appears to have increased due to the establishment or enhancement of collector systems on the cays and at landing sites by exporters. In the late 1980s conch production appears to have increased substantially due to the introduction of commercial-scale conch fishing, primarily on Pedro Bank, using vessels in the 22 to 28 m size range with 20 to 40 SCUBA and hooka divers per vessel.

The apparent rapid increase in conch production from Pedro Bank resulted in the expression of concern by those involved in conch fishing and exporting, that the rate of exploitation of conch from the South Shelf and banks in general, and from Pedro Bank in particular, may exceed the potential yield of conch. Given the history of overexploitation of conch throughout the Caribbean, the Fisheries Division of Jamaica, the University of the West Indies, and the CARICOM Fishery Resource Assessment and Management Program undertook to: (1) Conduct a preliminary evaluation of the status of the fishery; and (2) Develop management options for consideration by the conch fishing industry and by the Minister of Agriculture, including an evaluation of assessment requirements for the conch resource in the area.

The preliminary assessment of the fishery (Mahon *et al.*, 1992), was reviewed at two meetings by participants in the conch fishery of Jamaica (Aiken and Mahon, 1992). The meetings resulted in a consensus on appropriate actions for management which were then drafted into a preliminary management plan.

THE CONCH FISHERY

The information on which this paper is based was acquired by accessing records of the Fisheries Division, and Statistical Planning Unit, Government of Jamaica, and by interviewing several commercial and small-scale fishermen, and processors. The meetings with the industry served as a further source of information as drafts of the preliminary assessment and fishery management plan were reviewed.

The Primary Sector

Most of the conch currently exported from Jamaica appears to be harvested from Pedro Bank (Figure 1). However, conch are also occasionally taken from other banks such as Formigas Bank, and the Morant Bank, and from the South Shelf. The relative amounts of conch coming from these areas are not known. Formigas Bank is considered to be relatively productive, Morant Bank is considered to be too deep for safe diving, and the South Shelf is considered to be either unproductive or overfished.

The conch fishery is pursued by three groups of fishermen. Small-scale fishermen resident on the Pedro Cays free-dive in the vicinity of the cays to depths of 15 m. They take their catch ashore to clean it for sale to collector boats. Small-scale fishermen who go out from fishing beaches on Jamaica often dive with SCUBA, in the vicinity of the cays to depths of about 25 m — they may also dive on the South Shelf — and may sell their catch to collector boats, or bring it back to the fishing beach where it is sold to buyers for export. Commercial-scale fishermen operate from vessels 22 to 28 m in length, with about twenty divers using SCUBA and hooka gear, operating all over the Pedro Bank, to depths of about 25 m. The conch are cleaned on the bottom and taken

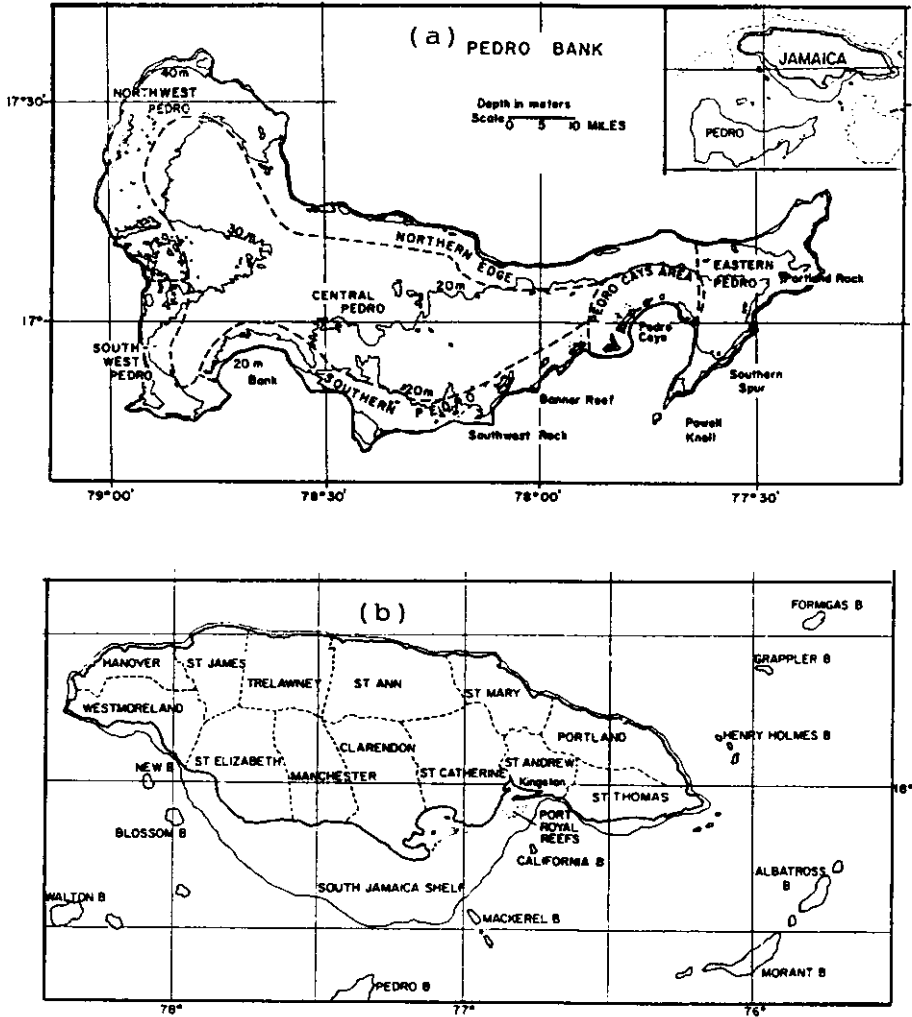


Figure 1. (a) Offshore banks in the area of Jamaica; (b) The south shelf; (c) Pedro Bank (Munro, 1983).

to the main vessel where they are either frozen or iced. The commercial vessels currently licensed to fish conch in Jamaica are described in Table 1. Details of many of these vessels remain to be acquired.

Processors/Exporters

There are about six companies currently processing/exporting conch from Jamaica.

B and D Trawling (1 Port Royal St., Kingston, Mr. Bunny Francis, Proprietor): operates three commercial scale vessels, usually on Pedro Bank.

Grace Kennedy, Ltd. (Harbour St., Kingston) operates two commercial scale vessels.

Mr. Sydney Francis: Operates one commercial vessel (Table 1), and one collector boat which purchases conch from Pedro Bank.

Mr. Percy Lambert (Rocky Point, Clarendon): Purchases from small-scale fishermen at Rocky Point and on Pedro Bank.

Miles Franklyn: (???) operates three boats from Kingston (?) and White House, sometimes landing the catch in Montego Bay (?).

Letts: (???) purchases conch from small scale fishermen on (???) beaches

Marine Products (???) purchases conch from small scale fishermen on (???) beaches.

Annual exports (kg) in the category 'other crustaceans and molluscs', believed to be primarily conch appear to have increased dramatically between 1986 and 1990 (Figure 2, Table 2). These data were acquired from the External Trade reports published annually by the Statistical Planning Unit. Figure 2 also shows lobster exports, which have levelled since 1986. This suggests that there may be a relationship between the declining lobster exports and increased conch exportation.

Estimated Landings

There are no firm estimates of the landings of conch from the areas discussed above. Two approaches were taken to estimating the landings. The first approach was to ask major participants to provide information on the landings which their enterprise accounted for in 1990 and 1991 (Table 3). These estimates were discussed at a meeting with the conch industry in August, 1992. The total estimated landings at this point are in the vicinity of 2,100 mt/yr.

The second approach was to work backwards from the export figures. At the conch meeting, participants noted that there were various levels of product loss due to processing for export and agreed that on average there would be about 40% loss in processing. It was also observed that about 70% of conch landed in Jamaica was exported. On the basis of the recorded values of 800 and 1,200 mt of conch exported in 1990 and 1991 respectively, and the above

Table 1. Vessels licensed to fish conch in Jamaica.

Vessel	Length (m)	Description	Company	Base	Notes
El Indio	23		B & D Trawling Ltd.	B & D Trawling, Kingston	
Cachita	23		B & D Trawling Ltd.	B & D Trawling, Kingston	
La Coca	?		B & D Trawling Ltd.	Nicaragua	
Mefal	25	Leased from Capt. Andy Goll. Two	Sydney Francis	Kingston Fisheries Complex	
Adventure		20,000 lb freezers, 30-40 divers, SCUBA & hooka			
Iquazi	26	Freezers	Miles Franklin Comm. Ltd.	Whitehouse, Westmoreland	Relocated to Miami in 1992
Hope	23	Freezers	Miles Franklin Comm. Ltd.	Whitehouse, Westmoreland	Relocated to Miami in 1992
Dream Girl	23	Freezers	Miles Franklin Comm. Ltd.	Whitehouse, Westmoreland	
Water Spirit			Grace Kennedy Co. Ltd.	Kingston Fisheries Complex	
Kalpha			Grace Kennedy Co. Ltd.	Kingston Fisheries Complex	

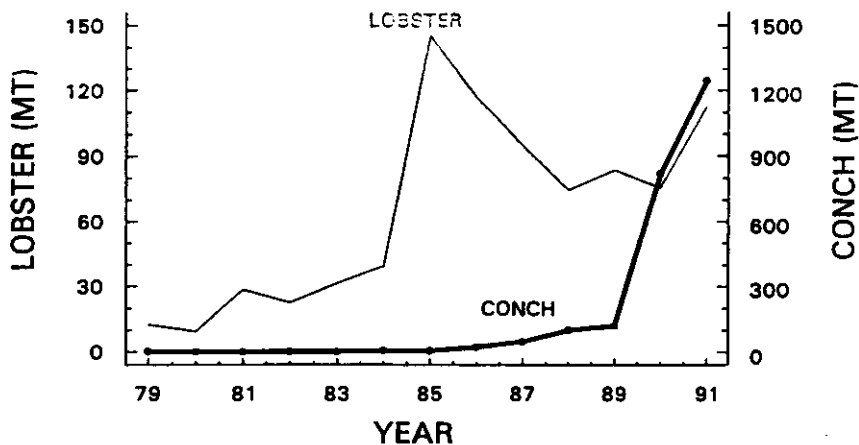


Figure 2. Exports of conch and lobster from Jamaica, 1979-1991.

Table 2. Exports (kg) of lobster and other crustaceans and molluscs (crus/moll) assumed to be primarily conch, from Jamaica, 1979-1990.

Year	Crus/Moll		Total
	Frozen	Not frozen	
1979	1,355	0	1,355
1980	0	0	0
1981	0	0	0
1982	0	0	0
1983	317	0	317
1984	5,658	0	5,658
1985	4,914	0	4,914
1986	22,124	0	22,124
1987	35,107	11,773	46,880
1988	91,992	9,453	101,445
1989	119,969	250	120,219
1990	649,752	171,632	821,384
1991	1,246,717	-	1,246,717

Table 3. Estimated landings of conch in Jamaica accounted for by the fishing or processing operations of various participants in the conch fishing industry.

Participant	Type	Landings (mt)		Notes
		1990	1991	
Grace Kennedy Ltd.	Commercial	600	600	Estimated at industry meeting, relative to landings by B & D Trawling.
B & D Trawling Co. Ltd.	Commercial	800	800	Based on 3 boats landing about 80,000 lbs/month each for 7-8 months/year.
Sydney Francis	Commercial	0	250	Based on 1 boat landing about 80,000 lbs/month for 7-8 Small-scale months/year. Figures for collector boat to be provided.
Miles Franklin Commodities Ltd.	Commercial	500	500	Based on 2 boats landing about 80,000 lbs/month each 7-8 months/year.
Percy Lambert	Small-scale	110	110	Based on an estimate of about 20,000 lbs/month
Lett	Small-scale	?	?	No contact with participant
Marine Products	Small-scale	?	?	No contact with participant
Total		2,010	2,260	

percentages, the estimated total landing for 1990 and 1991 respectively would be about 1,900 and 2,850 mt of cleaned meats.

The two estimates of landings are very close for 1991 but the 50% increase in exports in 1991 is not reflected in the fishing industry's estimates of its own production. However, the figures indicate that 2,000 mt would be a minimum estimate of conch landings in Jamaica.

POTENTIAL YIELD OF CONCH FROM PEDRO BANK

The potential yield of conch from the fishing grounds described above is unknown. In this paper, the focus will be on the potential yield from Pedro Bank. There are several approaches to estimating potential yield of a fishery resource. All of these require data which do not exist for the Pedro Bank fishery, and which could not easily be acquired in an appropriate time frame. The application of these approaches will be discussed below under assessment requirements, with a view to determining the best approach for longer-term assessment of the conch resource. Potential yield on Pedro Bank was roughly estimated using estimates from other areas in the Caribbean (Table 4). These are quite variable, ranging from 0.033-0.263 mt/km². The upper value is considerably higher than all the rest, and subsequent work indicates that the mortality rate which was used in the estimate was probably too high. Table 4 suggests that a value of about 0.100 mt/km², would be about average for the Caribbean.

The extent to which these estimates can be extrapolated to Pedro Bank will depend of the similarity between Pedro Bank and these areas as regards the amount and quality of conch habitat; namely, the relative amounts of sand, seagrass, reef, etc., in the various areas shown above, as compared to the amounts on Pedro Bank. The best available information on the distribution of habitats on Pedro Bank is provided by Dolan (1972). Unfortunately, there is no documentation on which to base a rapid comparison of habitats between the various areas.

The average depth of Pedro Bank (about 25 meters, Munro, 1983) is probably greater than that in the areas used for comparison. The major effect of this may be to limit suitable nursery/juvenile habitats, which tend to be in shallow areas. If nursery/juvenile habitat is limiting, recruitment to the Pedro Bank stock may be lower than to the other areas, and MSY may be lower than in those areas. In this case, the fishery may be harvesting biomass which have accumulated over many years, but which does not replenish itself as rapidly as other areas with higher rates of recruitment.

The total area of Pedro Bank is 8,040 km², with the distribution of depths as follows (Munro, 1983):

Table 4. Estimates of maximum sustainable yield of queen conch (MSY) from various areas in the Caribbean.

Location	MSY (mt/km ²)	Method	Reference
Great Bahama Bank	0.054-0.093	Biomass survey and Cadima's formula	Smith & van Neiroop (1984)
	0.033	Revised above estimate to correct for bias	Appeldoorn (1992)
Little Bahama Bank	0.152-0.263	Biomass survey and Cadima's formula	Smith & van Neiroop (1984)
	0.101	Revised above estimate to correct for bias	Appeldoorn (1992)
Caicos Bank	0.116	Surplus production model	Berg & Olsen (1991)
St. Thomas/St. John USVI	0.101	Yield/recruit and recruitment	Wood & Olsen (1983)
	0.057	Revision of above estimate	Appeldoorn (1992)
St. Croix, USVI	0.079	Yield/recruit and recruitment	Wood & Olsen (1983)
	0.057	Revision of above estimate	Appeldoorn (1992)
Puerto Rico, west coast	0.057	Gulland-Fox surplus production model	Appeldoorn (1992)

Table 5. Estimates of density of queen conch in various areas of the Caribbean.

Location	No./km ²	Exploitation	Reference
Great Bahama Bank	2,850	Low	Smith & van Neiroop (1984)
Little Bahama Bank	2,079	Low	Smith & van Neiroop (1984)
St. Thomas, USVI	970	High	Wood & Olsen (1983)
	1,225		Friedlander <i>et al.</i> (1983)
St. Croix, USVI	760	High	Wood & Olsen (1983)
St. John, USVI	1,264	High	Friedlander <i>et al.</i> (1992)
Puerto Rico, S. Coast	811	High	Torres (1987)
Florida Keys	1,157	High	Berg <i>et al.</i> 1992a
	- 14		
Bermuda 1, previously very high	52	Low ¹	Berg <i>et al.</i> 1992b

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Depth range (m)	0-10	10-20	20-30	30-40	40-50
Area (km ²)	171	2,219	3,700	1,742	206
Percent of total	2.1	27.6	46.1	21.7	2.6

If the entire bank is harvestable the rough estimate of potential yield is about 800 mt/yr. However, if the bank is harvestable only down to depths of 30 m, the estimated yield is about 600 mt/yr. The estimated landings exceed the estimated potential yield by a factor of three or four. In considering the implications of this observation, several points must be born in mind:

- All sources of landings have not been accounted for, therefore, landings may be higher than shown in Table 3.

- Further to the above point, foreign fishing, and sales to foreign vessels are reported to occur, but to an unknown extent. These have not been included in the estimates of landings.

- All the conch landed does not come from Pedro Bank, and the proportion coming from other areas is unknown. Maximum sustainable yield from these other areas has not been estimated. However, indications are that most of the landings are from Pedro Bank.

Despite the uncertainty associated with the estimates presented above, it appears likely that if the current level of fishing effort is sustained, the conch resource on Pedro Bank will be overexploited. The scenario which is usually associated with the overexploitation of a fishery resource is that catch rates (catch per diver per day) decline steadily as the resource is depleted until they reach a point where fishing is no longer profitable, or until the resource fails to reproduce successfully, and becomes 'commercially extinct'.

The rate at which the resource will be depleted when the rate of exploitation exceeds the rate of production depends on the initial abundance (standing stock) of the resource. There are no surveys of abundance of conch in Jamaican waters which can be used to estimate initial abundance. However, there is information on the density of conch from other areas in the Caribbean. The available data indicate that conch density is considerably higher in lightly fished areas - the Great and Little Bahama Banks - than in heavily fished areas (Table 5). If we consider Pedro Bank to have been lightly fished prior to 1990, and apply an average density for the Bahama Banks (2,465 individuals/km²) to the area of Pedro Bank shallower than 40 meters, the estimated standing stock is about twenty million individuals. Conch processors report that there are, on average, 3 cleaned conch meats/lb, in the catch from Pedro Bank. Therefore, the estimated total weight of meats on Pedro Bank before 1990 would be about 3,000 mt.

Clearly, at the current rate of fishing (2,100 mt/yr) it would take only one to two years to remove most of the standing biomass. It is also necessary to consider the rate of production of the resource. This has already been estimated in the vicinity of 600-800 mt/year. Such production levels would be expected at

intermediate levels of stock biomass. Therefore, even considering both standing stock and production together, it is unlikely that the resource could sustain the current fishery for more than a few years.

Given that there have already been almost three years of fishing, one would expect that the industry would already have noted significant depletion in some areas and reduced catch rates. There are several reasons why the rough estimates of standing stock and production above could be in error, but given the information from other areas of the Caribbean, it is unlikely that they would be in error by more than a factor of two. Even if both these values were double our estimates, the resource could not sustain the current levels of harvest for more than two to three years longer, and would currently be in the vicinity of the level of abundance at which MSY would be expected (*i. e.*, half the original biomass).

It must also be born in mind that as the abundance of conch goes down, the catch rates will also decline. This will slow the depletion process, and will reduce profitability.

MANAGEMENT CONSIDERATIONS

Management Options

A variety of management measures have been used in various areas of the Caribbean in attempts to prevent overexploitation of conch. These are summarised in Table 6 and discussed below. Shell size and flared lip regulations are only useful when conch are landed in the shell. This is never the case for the commercial fishery in Jamaica, and the extent to which it occurs in the small-scale fishery is unknown. At any rate, conch from Pedro Bank would never be landed in Jamaica in the shell. Therefore, meat weight limits would be most appropriate for Jamaica. These could be spot checked on the dock and in processing plants. The appropriate limit should be determined by a study of size at maturity for the stock in question.

Although the flared lip, taken as an indicator of maturity, is not useful as a regulatory measure, fishermen could still use it as an indicator, and avoid harvesting individuals without a flared lip.

Closed seasons have been used to protect conch during the period of reproduction. The appropriate period should be based on a study of the reproductive season for the stock in question. However, other studies indicate that the conch reproductive season is more or less the same throughout the Caribbean (Appeldoorn *et al.* 1987, Stoner *et al.* 1992):

Venezuela	early July - mid November
St. John, USVI	late April - late November
Turks and Caicos	February/March - November/December
Puerto Ricomid	March - mid November
St. Kitts & Nevis	mid May -mid November

Table 6. Summary of management measures which have been used for queen conch in various Caribbean countries.

Location	Shell size limit	Meat wt limit	Flared lip	Closed season	Closed area	Ban on SCUBA	Catch quotas	Limited entry	Ban on fishing	Reference
Bahamas	X		X							
Belize	>18 cm	84 g process	X	July-Sept.		X	X	X		
Bermuda									X	
Bonaire	>20 cm			X	X					
Cuba				X			780 mt			1978-1982
Florida										X
French Antilles						X				
Turks & Caicos	>18 cm		X			X				
Venezuela									X	
Puerto Rico										
OECS islands		224 g cleaned	X			X				
St. Thomas/John, USVI										
St. Croix, USVI										5 yr. 1988-
Jamaica (Proposed)										5 yr. 1988-

Florida	late May - September
Jamaica	pre-July -late November

A closed season somewhere during the period from April to November could be considered for conch in Jamaica. A closed season would be relatively easy to enforce if it were island wide. However, foreign fishing and sales to foreign vessels would have to be strictly controlled.

Closed areas are generally used to eliminate fishing in areas where there are abundant small individuals; that is, known nursery areas. Two individuals interviewed indicated that there were specific areas on Pedro Bank where extremely high densities of juvenile conch had been seen. Closing such areas to fishing might be appropriate if large numbers of juvenile conch were being landed. This is not currently the case, but might become so as stocks of adults become depleted. Enforcement of closed areas on Pedro Bank would be difficult.

In view of the depths at which the fishery is being conducted, any ban on SCUBA or hooka would essentially eliminate the commercial fishery.

A total allowable catch could be considered for the entire fishery. However, Jamaica currently lacks the capability to monitor catches sufficiently closely to close the fishery when the quota has been reached. Furthermore, this would probably result in a race for the quota.

Limited entry by licensing will ultimately be required for sustainable harvest of conch from the area under consideration. If licensing were to be possible, individual vessel or company quotas could be considered and would result in more orderly harvesting and would minimize overcapitalization. However, Jamaica cannot monitor and control such quotas at present.

Conflicts Between Commercial and Small-scale Fishing

There is a potential for conflicts between the newly established commercial fleet and the small-scale fishermen. The latter fish primarily by free-diving in areas shallower than 20 m, and near to the Pedro Cays. There have been some observations by small-scale fishermen relating to depletion of conch in these areas. Spatial separation of the two fleets could be achieved by zoning. For example a zone in the general areas shown as 'Pedro Cays Area' and 'Eastern Pedro' for small-scale fishermen might be appropriate.

If zoning is considered to be an appropriate approach, then potential yield can be estimated separately for the two zones and the management measures used in each zone can be geared to the type of fishery.

Foreign Fishing

Owing to its location, Pedro Bank is accessible to fishing and carrier vessels from the Central and South American mainland. Illegal fishing for, and over the

side sales of lobster are known to be common. The extent to which this is the case for conch is not known. Industry representatives considered the incidence of illegal fishing to be relatively low. Nonetheless, it will be very difficult to gain the cooperation of the Jamaican participants in managing the conch fishery on Pedro Bank until they are confident that there is no significant amount of foreign fishing or sales to foreign vessels.

The Jamaica Defence Force Coast Guard has recommended the establishment of a security post on one of the Pedro Cays. It also recommends that the network of communication among fishing vessels and the coast guard be formalised and enhanced in order to effectively increase the enforcement presence in the area of Pedro Bank.

Assessment Requirements

The approach to resource assessment which will adequately address the long-term management needs for conch in Jamaica will depend on the management measures which are considered feasible. In any case, there will be the need for accurate data on catch, catch location, and fishing effort. Further assessment activities are medium to long-term undertakings which are described in the revised version of the preliminary assessment (Mahon *et al.*, 1992).

Data on catch and fishing effort are essential for an assessment of the resource, and for monitoring the status of resource and its response to fishery management. A trip reporting form is essential for commercial vessels. It will be necessary to conduct random spot checks on vessels as they land to ensure that the forms are being completed accurately.

In order to acquire information on landings by the small-scale fishermen, processors should be required to report their purchases monthly.

The abundance of juvenile and harvestable conch on Pedro Bank should be determined by a diving transect survey, such as has been carried out in other areas (Wood and Olsen, 1983; Smith and van Neirop, 1984; Berg *et al.*, 1992a; Berg *et al.*, 1992b). This survey should take into account the seasonal variation in availability of conch.

The breeding season of conch on Pedro Bank should be determined in order to define the most appropriate closed season. This could be done by sampling on commercial vessels, but it would require the cooperation of the operators in bringing uncleaned meats on board.

Growth and size at maturity of conch on Pedro Bank should be determined in order to set the appropriate minimum size for maintenance of spawning stock biomass, and to provide advice on optimisation of yield per recruit. This study could also be carried out from commercial vessels, but would require additional sampling of small conch.

The above analyses will also require information on the size distribution of conch in the commercial catch. This information can be gathered at landing points by a sampler.

Industry Consultation

Representatives from the conch fishing industry and interested parties (*e.g.*, Coast Guard, Marine Police) participated in two meetings to address the urgent need for management identified in the preliminary assessment (Aiken *et al.*, 1992). Participants updated the information on the conch fishery, and agreed that a plan for management should be drafted identifying the key issues and the recommended short-term and medium to long-term action in a format similar to that provided by Mahon (1991). Three management measures were identified as indicated in the action summary which follows.

Management Action Summary

Short-term action

- Limit further entry into the fishery, and set limits on the numbers of divers which can be deployed by vessels of various sizes (diver limits to be established in consultation with the industry).
- Regulate the minimum size of conch to 84 g per processed meat, and determine corresponding values for cleaned meats and intermediate stages of processing.
- Introduce a closed season of three months during the peak spawning period, to be determined with reference to studies on conch elsewhere in the Caribbean.
- Explore measures required to minimise conflicts among commercial and small-scale fishermen, for example, establishment of an exclusive zone for small-scale fishermen in the vicinity of the Pedro Cays.
- Implement mechanisms for the collection of data on conch landings and effort by introducing a mandatory trip reporting form for commercial vessels. Reporting areas should be established in consultation with the industry. A minimum area breakdown for reporting should be by individual bank, or island shelf.
- Establish a security post on one of the Pedro Cays to maintain a surveillance and enforcement presence as a deterrent to illegal foreign fishing.
- Formalise the current communication network among Coast Guard and commercial fishermen.

Medium and Long-term action

- Undertake a survey of the abundance, size distribution, and reproductive status of the resource on Pedro Bank, and if possible on other offshore banks.
- Evaluate the breeding season of conch on Pedro Bank in order to define the most appropriate closed season.

- Examine the growth and size of maturity of conch on Pedro Bank with the aim of determining the appropriate minimum size for maintenance of spawning stock biomass.
- Explore the feasibility of enhancing conch production on Pedro bank, and in other areas, by seeding with hatchery reared individuals.
- Revise penalties for illegal fishing, including; confiscation and forfeiture of vessels, and a fine of US\$1,000.00 (one thousand) per foot (0.3 m) of vessel length (LOA).

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