

WESTERN CENTRAL ATLANTIC FISHERY COMMISSION (WECAFC)

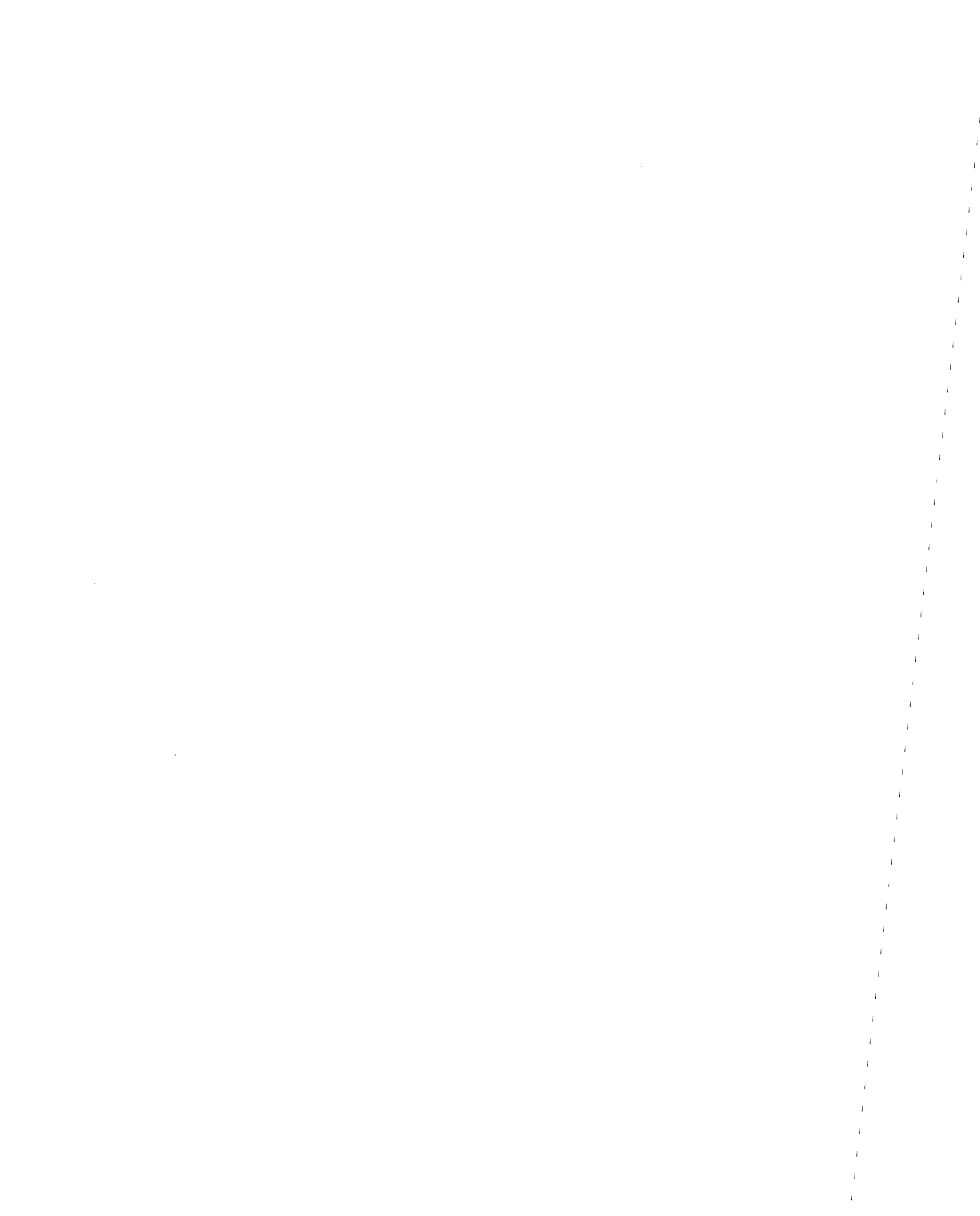
Report of the second joint meeting of the

WORKING PARTY ON ASSESSMENT OF FISH RESOURCES and the WORKING PARTY ON STOCK ASSESSMENT OF SHRIMP AND LOBSTER RESOURCES

Mexico City, Mexico, 26-29 November 1979



FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS



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PREPARATION OF THIS REPORT

This is the final version of the report as approved by the Joint Meeting of the WECAFC Working Party on Assessment of Fish Resources and Working Party on Stock Assessment of Shrimp and Lobster Resources.

Distribution

Participants in the meeting
Members of the Commission
Other interested nations and
international organizations
FAO Fisheries Department
Fishery Officers in FAO Regional
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ABSTRACT

The final formal report of the WECAFC Working Parties on Assessment of Fish Resources and on Stock Assessment of Shrimp and Lobster Resources, held in Mexico City, Mexico, 26-29 November 1979 is presented. Major topics included revisions of earlier resource assessments and evaluations of shrimp resources of Colombia, lobster resources of Northeast Brazilian coast and consideration of a review of Cuban finfish resources.

Among the recommendations of the meeting were:

1. that the WECAF Project hold training courses in statistics and assessment for Spanish-speaking countries of the region,
2. nomination of National Correspondents, and support to intersessional work programmes,
3. organization of a workshop on spiny lobster management.

Annexes include several national reports, and detailed tables of data presented to and analysed at the meeting.

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1. OPENING OF THE JOINT MEETING

The working groups met in Mexico City, Mexico from 26 to 29 November 1979, thanks to the kind invitation of the Government of Mexico. Scientific workers of the member countries and of FAO took part in the deliberations (Appendix 1).

During the opening of the meeting, Dr. J. Carranza, the Director of the National Institute of Fisheries of Mexico welcomed the participants on behalf of Lic. F. Rafful, Director of the Department of Fisheries. Dr. Carranza emphasized the importance of this meeting in relation to the fisheries development plan in Mexico and to the future fisheries of the WECAFC region. Dr. J.F. Caddy of FAO, the Technical Secretary of the working groups, defined the objectives of the groups, the procedures that were to be followed during the meeting and the kind of results that we hoped to obtain.

2. ELECTION OF A CHAIRMAN

Dr. D. Fuentes from Mexico was elected Chairman of the joint meeting.

3. ADOPTION OF THE AGENDA

The participants approved the programme which is given under Appendix 2.

4. RAPORTEURS

Separate Rapporteurs were nominated for the two main sub-groups.

5. EXAMINATION OF THE CONCLUSIONS AND RECOMMENDATIONS OF THE FIRST JOINT MEETING OF THE WORKING GROUPS AND SUBSEQUENT PROGRESS

During the first meeting held in Cartagena, Colombia, in November 1977 various recommendations were approved by the participants of the working groups on the evaluation of fish resources, and evaluation of lobster and shrimp resources, and during the discussions in the plenary session of the two groups. To facilitate the work of the present meeting the recommendations of the first meeting were reviewed under the following headings:

5.1 Statistics

5.1.1 Statisticians

The participants were informed that a fishery statistician was transferred by FAO to the WECAF Project at the end of 1977 to help member countries in their work to improve fishery statistics.

5.1.2 Extension of the geographical boundaries of WECAFC and division of the zone into statistical areas.

The second meeting of WECAFC which was held in Panama in April 1978 endorsed the recommendations of the working groups on the evaluation of resources and on statistics. WECAFC transmitted to COFIL¹ the request that an extension of its area should be considered in the annual meeting.

5.1.3 Collection and submission of catch and effort statistics

The statistician of the WECAF project with headquarters in Panama has been revising the forms used in collection of statistics on the fisheries for shrimps in the region Guianas-Brazil with the objective of proposing improvements in them, in order to obtain the best information available and to facilitate evaluation of this resource. It was suggested that the design of these forms should be similar to that used in the Eastern Central Atlantic for

¹/ Committee on Fisheries

similar studies. The statistician has taken into account in his work programme the recommendations of the working groups relative to the units of effort most suitable for the fisheries on shrimps and lobster, using the common names suggested by FAO, for submission of statistical data etc. Such recommendations will be used to update the statistical systems in the Bahamas, Nicaragua, Panama, Jamaica, Venezuela, Saint Lucia and Brazil.

Important advances have been recorded in the field of fishery statistics in Mexico (Appendix 3) and Saint Lucia. Both countries have started programmes to include the collection of fisheries statistics. Other countries, amongst them, Jamaica, have the necessary plans of action developed to improve their statistics.

The problem of utilizing log books as opposed to port interviews for fisheries effort collection was debated at length. The participants agreed that the use of log books would not be useful for the artisanal fisheries where the small size of landings and the high frequency of illiteracy amongst the fishermen appeared to be the major obstacles for their use. Also the group was agreed on the dangers of receiving false information in the cases where the filling out of log records was made compulsory by legislation. With respect to the industrial fisheries, however, there is no clear advantage with respect to the use of log books or of port interviews. This seems to depend greatly on the circumstances in each case. Furthermore, it was emphasized that the quantity of information needed to be obtained from a given fishery depends greatly on the importance that that fishery holds for the country in question. In view of the importance of the programmes for the collection of fishery statistics from the member countries, mention was made of the resolutions passed by the last session of WECAF Commission in April 1978, referring to the collection and submission of information on the catches from foreign vessels in national waters, the recreational fishery, and classification of small fishing boats (Appendix 4) which differ from the generally accepted international standards.

5.1.4 Determination of a better unit of fishing effort for shrimp fisheries

The group was informed of the investigations being carried out in the United States toward determining the relationship between the amount of shrimp captured and size of the boat; also on the characteristics of the fishing gear used. Mention was made of the possibility of using in some of these fisheries information relatively more simple to obtain, such as the number of boats, and the mean fishing power instead of just the number of boats in use.

5.1.5 A central data bank for fisheries surveys

The participants were informed that in accord with the recommendations of the Working Group for the evaluation of fish stocks, information coming from exploratory cruises made by the United States and by the UNDP/FAO project on the development of fisheries of the Caribbean, have been incorporated in a computerized system which allows users an easy access to this information. This study was carried out thanks to the collaboration between the National Marine Fisheries Service, FAO and the WECAF Project. The information covers the period 1950-1977 and includes 33 000 stations and approximately 35 different types of fishing gear. A small information booklet has been prepared explaining the information contained on these files and the procedures to be followed in obtaining this information.

5.1.6 Statistical bulletin of WECAF

At the last meeting of the WECAF a document was presented which covers the existing catch statistics for the member countries. It was hoped to improve this information in future meetings.

5.2 Training

The participants expressed the feeling that in weighing the earlier activities of the WECAF project (training in statistics for the English speaking countries) and by SELA (Seminar on resource evaluation) there was a great need to implement the recommendations of

the last meeting of the working groups on the training in resource evaluation and orderly planning of fisheries development. It was felt necessary to look for resources of funding for these courses. The possibility was also mentioned of utilizing more effectively the funds which already exist in the countries of the region.

5.3 Manuals for the Evaluation of Short-lived Species (Shrimps and Cephalopods)

The participants were informed of the activities of FAO in updating a series of manuals on resource evaluation. It was mentioned that a manual on shrimp fisheries was now being completed.

5.4 Ichthyoplankton Surveys

The participants were informed that the recommendation of the last meeting on this matter was transmitted to IOCARIBE and will be included in their future work programme. Also, the meeting was informed of the surveys being carried out by United States and Mexico jointly in 1977-1978 in the Gulf of Mexico. It was evident from the discussion that followed that, after weighing the usefulness of this type of study, and the problems which it gives rise to, it should be given a relatively low priority in the region in the near future.

5.5 Other Matters

In relation to experimental fishing on the underutilized species in the region the participants were informed of the surveys of the United States using gillnets to fish king/Spanish horse mackerel. They are also planning to use purse seines for this purpose. In Mexico, almadrabas (tuna traps) are widely used in the commercial fisheries mainly for migrating pelagic fish. While no great advances have been recorded in the fishery for sharks, it was mentioned that Honduras, Nicaragua and Trinidad/Tobago were considered promoting this type of fishery.

6. SUBSEQUENT REVISION OF EVALUATIONS CARRIED OUT SINCE THE FIRST JOINT MEETING

6.1 General Revision

The evaluations carried out during the Cartagena meeting in 1977 were reviewed to see if any changes had occurred subsequently which could affect the conclusions obtained on that occasion. Summaries of these evaluations are presented in Appendix 5. In relation to the fisheries for shrimps in the north of the Gulf of Mexico, the United States and Mexico have increased the information available since Cartagena. Information referring to the Mexican fisheries of Campeche and Contoy have also been provided. A new evaluation was also made at the April 1979 meeting of the WECAF Working Group for the Guianas-Brazil shrimp fisheries on the fisheries in the Guianas-Brazil region with results somewhat different from those obtained in Cartagena. New information also exists on the Colombian shrimp fisheries.

In general it was observed in Cartagena that almost all the fisheries for shrimps were at or around the point of maximum sustainable yield (MSY). The information available on the fisheries for spiny lobsters was of lower quality due to an incomplete series of the data points needed to carry out the evaluation.

6.2 Meeting of the Working Group to Evaluate the Shrimp Fisheries of Guianas-Brazil

At the initiative of the WECAF Project a meeting of scientists was held from those countries taking part in the shrimp fisheries in the region between Venezuela and Brazil (Appendix 6). The meeting was held in Panama City, Panama, in April 1979 and had, as its objectives, the estimation of the level of exploitation, and the determination of the most suitable method of investigating the resource.

Because the necessary data were not available, it was not possible to estimate the MSY for all of the shrimp fisheries in the region; however, the results indicated that the fishery is at or near the level of maximum sustainable yield and the number of shrimping

vessels now in operation is about the maximum that the resource can support. Also it was observed with the exception of the fleet that operates in the more extreme areas of distribution of the resource (Brazil and Venezuela) that indices of abundance for the other fleets have suffered marked reductions since 1969. The group considered that very good reasons existed for the coastal states to adopt common schemes for management, including common regulations. Improvements in the statistics for the shrimp fisheries and the promotion of shrimp marking experiments should be given emphasis in future programmes of investigation.

A number of activities have been carried out since the last meeting of the group in relation to the international cooperative programme for shrimp stocks. These activities included joint surveys by NMFS and the WECAP Project of the artisanal fisheries of Guyana, Surinam, French Guiana and Brazil to determine areas of fishing for juvenile shrimps and a preparatory meeting was held in Belem (Brazil) to determine the basis for this international programme.

The participants in the meeting requested the United States National Marine Fisheries Service (NMFS) to prepare a provisional programme to be submitted for the consideration of the countries participating in the tagging programme. Also they requested the WECAP Project to dedicate funds to finance the training of personnel in the region in tagging procedures at the Galveston Laboratory of the NMFS. From the results of the meeting in Belem and from the visits made to the countries in question it was evident that Brazil is intending to start tagging operations in its own waters in 1981. The participants were concerned that it would be impossible for other countries to start tagging operations at the same time as Brazil, and pointed out the necessity of increasing the national capabilities and international coordination of activities which will ensure the success of the shrimp tagging programme.

6.3 New evaluations

Two subgroups, one on crustacean resources, the other on marine fish resources, were formed to review new data that were not considered at the 1977 meeting. Results of these analyses are presented in Appendices VII and VIII.

7. SHARED RESOURCES

Tagging studies on shrimp and biochemical, genetic and oceanographic studies on spiny lobster are seeking to identify situations where more than one country shares the same stock.

7.1 Shrimp

Since 1978, Mexico and the U.S.A. have undertaken a joint programme for shrimp tagging and recapture in the western Gulf of Mexico, under the MEXUS-GULF Project, in order to determine migration patterns, growth and mortality rates, and, eventually, a stock assessment. The results have been successful. More than 180 000 shrimp have been released and recapture data are now being analysed. Transboundary migrations of shrimp across the Texas-Tamaulipas border have been demonstrated, and their importance to management is being evaluated.

The possibility of shared shrimp stocks between Colombia and Venezuela was considered at this meeting, but could not be evaluated because of the lack of species composition data for the Gulf of Venezuela fishery. The northeastern Colombia fishery lands over 90 percent *P. notialis*, but information on the percentage of this species in the Gulf of Venezuela fishery, which also lands *P. subtilis* and *P. brasiliensis*, was unavailable at the meeting. This problem should be considered as soon as data can be made available.

7.2 Lobster

There is much recorded evidence of migration of spiny lobsters in the WECAPC area indicating that an appreciation of the interchange and sharing of lobster stocks is vital to proper evaluation and the management of this valuable resource. Some of the important areas with shared resources of lobster include Mexico, Belize, Nicaragua and Honduras.

One of the most important methods of understanding the extent of sharing of resources is the organization of cooperative tagging programmes. These tagging studies will also supply data on growth and mortality. There will probably also be latitudinal differences in parameter estimates, which may influence stock assessments.

Where high rates of interchange can be proven, greater efforts to control fishing effort by fishery management measures may be necessary. This is particularly important where adjoining national areas have great variations in levels of fishing effort.

In connexion with the proper understanding of shared lobster stocks, it is considered important that a meeting be convened in the near future to discuss biological and management data from WECAFC countries with lobster stocks. This meeting may be incorporated with the GCFI (Gulf and Caribbean Fisheries Institute) meeting scheduled for November 1980 in Costa Rica. However, it is suggested that the special one-day spiny lobster biology meeting be extended for at least two extra days. The subgroup suggested that a source of funding could be sought possibly from FAO or the WECAF project.

7.3 Marine Fish

It was recognized that the natural distribution or migratory behaviour of some fish resources in the WECAF area apparently permit the exploitation of these stocks by more than one coastal state or island, and these stocks should be properly identified.

With the exception of a few bilateral studies (e.g. the Mexican-U.S. joint tagging programme for scombrids) there appears to be little work currently underway to define stock units of marine fish in the WECAFC region. Although many species (e.g. reef fish) are undoubtedly local, and can be effectively managed separately, for some other stocks (especially pelagics), it seems likely that stock units extend through the national waters of more than one country. Correct identification of stock units is essential to calculate computations of biomass, MSY, and the parameters of the stock.

Initially, it is necessary to compile detailed statistics on catch by volume, area and size and species composition. These data could then be compiled and analysed by the states concerned. In the long term morphological, serological and/or tagging studies could be conducted jointly by states in order to describe the stocks and determine their degree of mixing.

The resources that are probably being shared include the mackerels (most countries in WECAF area) and demersal fishes off the Guianas. Other stocks off Yucatan, Central America and in the Gulf of Mexico area are also probably shared.

It is recommended that all member countries bring to the next meeting data on the four species of the genus Scomberomorus in the WECAFC region, specifically the catches and their size composition, broken down by periods of the year and sections of the coast in the amount of detail possible according to national statistics.

8. STATISTICAL DATA NEEDS

8.1 Shrimp

Continual improvements in statistical data for stock assessment of shrimp are being realized in the WECAFC region. The objective of the Stock Assessment Working Group is to provide the data necessary for assessment of each shrimp stock and for management of the fisheries.

The statistical data needs for shrimp fisheries have been discussed extensively in the 1977 Cartagena report; this report, and the report of the 1979 Working Group on Shrimp Fisheries in Guianas-Brazil. The latter report identifies the data needed for production model and analytical model assessment.

Priorities for collection of these data as considered by the subgroup, are as follows:

8.1.1 Production model

A. Catch

- (1) Total catch
- (2) Catch by species
- (3) Catch by area

B. CPUE

- (1) Catch per day fished

C. Effort

- (1) Number of boats
- (2) Number of fishing days
- (3) Characteristics of different fishing fleets

D. Stock definition and range

8.1.2 Analytical model

A. Growth by sexes

- (1) Seasonal growth

B. Mortality by sexes

- (1) Natural mortality
- (2) Fishing mortality

C. Size composition of the catch

8.2 Lobster

Some of the more vital statistical needs listed in approximate order of importance include the following:

- (1) Better fishing effort data
- (2) Improved size frequency data on an annual basis
- (3) Improved separation of species, i.e., identification of species in landings.

Specifically, improved fishing effort data could include the following:

- (a) Catch per trap calibrated for soak time
- (b) Duration of trips (as days absent from port)
- (c) Numbers of traps
- (d) Size and type of traps
- (e) Effort for gear other than traps (e.g., diving days)

The data requirement above will greatly contribute to the assessment of lobster stocks in the WECAFC area. These data should be submitted on a regular basis.

Attempts should also be made to carefully demarcate the location of fishing areas as well as the estimation of the numbers of vessels.

8.3 Marine Fish

A. Artisanal fisheries: Statistics on the artisanal fisheries are the most difficult to collect because of the varied gear types and many landing sites. Despite this, the group recommends that greater effort be expended to improve the quality of the data collected.

B. Industrial fisheries: Most of the industrial fisheries in the region (pelagic and demersal) take place in countries which already have systems for collection of statistical data. It is essential that this information reach the working group on a regular basis. It was considered that an improvement of information on composition and magnitude of the by-catch of the shrimp fishery needs to be made. It is recommended that contributions on this subject be presented to the next meeting of the working group.

9. INTERSESSIONAL WORK PROGRAMME FOR 1980-82

9.1 Shrimp

Future stock assessment work for shrimp should concentrate on providing estimates of growth and mortality parameters for use in analytical models. Tagging studies will provide these data as well as giving direct evidence of migrations. Of equal importance is the improvement of effort data for use in production models. Where possible, catch data should be supplied by species. This will provide data to determine if long-term changes in species composition have occurred and to calculate production models for each species separately. The work programme also suggests that historical size data be examined for changes in size composition.

The calculation of available habitat for shrimp, both inshore habitat that may be used as nursery areas by juveniles, and offshore habitat that is used by adults, offers a fishery-independent method of assessment. Where other assessment data are lacking or unobtainable, this method may be used to gain an idea of relative production potential of different areas. As part of the Guianas-Brazil shrimp tagging project, a survey of estuaries and associated artisanal fisheries was made in November 1979. For other parts of the Commission region estimates of hectares of offshore habitat by depth zone have been already computed from nautical charts. It is suggested that similar calculations be made for other areas.

The collection of rainfall and/or river discharge data appears to be the first necessary step in examining the effect of environmental factors on annual shrimp production. It is very likely that any management of shrimp fisheries for maximum sustainable yield will need to take into account annual fluctuations in available yield caused by environmental factors.

9.2 Lobster

There are several areas of interest that are in need of attention, all of which are directly related to proper assessment and management of lobster fisheries. Perhaps the most important factor for lobster management is the proper identification of stocks, i.e., the discovery of the source of recruitment for various national stocks. There is presently a small programme of biochemical investigation of the genetic differences between lobster stocks from various areas in the WECAFC region. This programme is being carried out at Nova University, Fort Lauderdale, Florida, U.S.A. under the direction of Dr. Robert Menzies who has already presented some very interesting preliminary analyses of this work.

Interseasonal Work Programme - Shrimp

Task	Region	Responsibility
1. Shrimp tagging	Guianas-Brazil	Brazil - tagging French Guiana - tagging U.S.A. (NMFS) - training WECAF Project - coordination Coastal countries - statistics and tag recovery
	Mexico-U.S.A.	INP-NMFS
2. Collect data on composition of catches, 1980	NE Colombia Gulf of Venezuela	INDERENA, Cartagena CIP, Cumana
3. Compile historical data for 1970-1979 on species composition of catches	All fisheries WECAFC	National correspondents
4. Compute areas of shrimp habitat A. Inshore estuaries B. Offshore areas by 10 m depth interval	All fisheries WECAFC	National correspondents
5. Compile historical data for 1970-1979 on size composition of catches	All fisheries WECAFC	National correspondents
6. Improve effort data for shrimp fisheries to provide annual measures of days at sea	All fisheries WECAFC	National correspondents
7. Provide data on rainfall or river discharge data for the period 1970-1979	All fisheries WECAFC	National correspondents

This has been a joint programme in that samples have been contributed by a number of countries and the results are of importance to all. It is considered that this work can be done most efficiently and economically by having samples analysed by a central group and the results discussed and utilized by WECAFC. Support of this work by partial funding needs to be considered.

Another vital aspect of the assessment work is the use of annual size composition data. This has generally not been forthcoming in data presented at WECAFC meetings or if so only in limited form. Although it is recognized that the collection of these size data will need the addition of manpower, its importance in the eventual derivation of mortality and growth estimates for lobster stocks is emphasized.

The 1977 WECAFC meeting in Cartagena concluded that considerable improvement was needed in the effort data and this was actually one of the recommendations. This improvement has not taken place and, therefore, this recommendation is again included with the following specific requirements: data are needed for catch per day, numbers of traps per boat, average soaking time, trip duration and size and kind of traps.

Migration studies are also needed in those regions which may have shared lobster stocks, and the significance of cooperative tagging studies by those countries in assessing and managing their lobster fishery cannot be overemphasized.

All the above tasks and requirements for intersessional work are listed in the following table:

Intersessional Work Programme - Lobster

Task	Region	Responsibility
1. Stock identification by biochemical and genetic means	WECAFC Region	Ongoing programme in U.S.A. (Additional funding needed)
2. Collect annual data on size composition of lobster catch	WECAFC Region	National correspondents
3. Improvements in effort data: collect data for 1980 or 1981 on: (1) catch/day (2) number of traps/boat (3) average soaking time (4) trip duration (5) size and kind of traps (6) effort by other types of gear such as diving (days diving)	WECAFC Region	National correspondents
4. Tagging for migration studies	WECAFC Region	Cooperative studies between countries as required

The crustacean subgroup considered specific data submitted for the Colombia shrimp fishery and for the Brazilian spiny lobster fishery, and undertook some analyses of the data. These analyses are reported in the working party reports (Appendixes 7 and 8).

9.3 Marine Fish

During the period of intersessional work, the marine fish working group recommends that member countries of WECAFC be invited to participate in the following activities:

A. The work on tagging of mackerels in the Atlantic, Caribbean and Gulf of Mexico that needs to be continued. It is particularly important to seek the participation of Cuba in relation to the joint tagging programme now underway between the United States and Mexico.

B. A workshop to be organized under the direction of experts in the field, to review and update the techniques and methodologies of sampling and analysis of biological data.

10. OTHER MATTERS

10.1 Extent of Fishing Areas

The need for some estimates of the area of the fishing grounds by broad ecologically relevant subdivisions was stressed by the meeting that will be useful to future working groups in moving from biomass/unit area data to estimate total biomass. Although no final decision was made on the best stratification to be used, the technical secretary was requested to look into the question of the most appropriate and readily available depth zones to be used in such an overall scheme for the WECAFC region, to estimate the surface area in each zone, and to prepare charts for each of the national zones (using the provisional designation of unit areas recommended by the statistical subcommittee of WECAFC). These

Intersessional Programme of Work - Marine Fish

Task	Region	Responsibility
1. Compilation of artisanal fisheries statistics	WECAFC	WECAF project and responsible national office
2. Analysis of artisanal statistics using the methods followed by Munro	St. Lucia and Granada	WECAF project and fishery officials of Saint Lucia and Granada
	Other countries	WECAF project and national fisheries officers
3. Compile historical information on landings and size frequency of the four species of <u>Scomberomorus</u> (on a monthly or annual basis)	WECAFC	Responsible national offices
4. Compilation of information on size frequency and age composition of the Spanish mackerel	Gulf of Mexico and Caribbean	INP - Mexico NMFS - U.S.A. CIP - Cuba
5. Compilation of information on the size frequencies, ages, and selectivity of gear for <u>Epinephelus morio</u>	Campeche Bank	INP - Mexico CIP - Cuba NMFS - U.S.A.
6. Shrimp by-catch project	WECAFC	Guyana - information derived from IDRC study (responsible national offices)
7. Information on growth of <u>Microperca undulatus</u>	Northern Gulf of Mexico	NMFS - U.S.A.
8. Direct estimation of natural mortality rates from other than estimates of K	WECAFC	Responsible national offices
9. Description of method used by Mexico in obtaining estimates of natural mortality	Mexico	INP - Mexico

charts would then be sent to the national offices of the coastal countries of WECAFC, with a request that they outline on the charts, to the best of their knowledge, the extent of various resources, e.g.

- (a) Shrimp nursery areas
- (b) Reefs
- (c) Shrimp fishing areas
- (d) Other trawlable bottom
- (e) Untrawlable bottom

An example of such a tabulation is presented in Table A, note being made that a somewhat different depth stratification may be necessary for reefs and islands than for the continental shelves. Availability of suitable charts may be a problem, however.

Table A

Suggested Format for Summarizing Areas of Fishing Zones

Country and zone	0 - 50 m				50 - 100 m	100 - 200 m	200 m
	Reef area	Shrimp bottom	Other trawlable bottom	Non-trawlable bottom	etc.	etc.	etc.
	area in ha	etc.	etc.	etc.			

10.2 Estimates of Potential Yields of Reef Fish

In the Cartagena meeting, great use was made of the estimate by Munro of a production of 40 kg/ha for the island areas. A preliminary analysis of the Cuban document suggests that a figure of around 10 kg/ha is more appropriate here, and note should be made that in addition, the species composition differed considerably from Jamaican waters whether this reflects solely zoogeographical difference, or differences in degree of exploitation, is not clear.

10.3 Marine Turtles

The concern in the region for turtle management can only be realized through international cooperation, especially in the collection and analysis of biological and catch data.

The group brings this need to the attention of the Commission; in particular, note was made that IOCARIBE is planning a symposium on turtles in San José, Costa Rica at the end of this year. In addition, there is a symposium being held in the United States on this subject at the present time. The group will be interested to follow the results of these meetings and reiterates the importance felt by other groups in the rational management of this valuable resource.

10.4 National correspondents

The need for WECAFC to have national correspondents responsible for carrying out the tasks identified by the working parties on fish and crustaceans was identified in the Cartagena meeting, but no action was taken on this recommendation, which is therefore re-emphasized by this meeting. Discussion emphasized the different roles of national correspondents and members of the WECAFC working parties. This latter individual should be chosen at the discretion of the national institute of fisheries as the worker best able to discuss the analyses presented. The national correspondents should be those individuals most familiar with the statistics of the country which will be needed for assessment work. The technical secretary is requested to write to the departments of fisheries of the countries of the WECAFC region requesting nomination of national correspondents.

11. RECOMMENDATIONS

11.1 Statistics

Considerable advances have been made in the region in the collection of statistics, and their application in the evaluation of resources. At the same time, it is recognized that several countries have been delayed in their attempts to improve their statistical system by the lack of manpower for collecting information on catches and effort and for this reason it is recommended that the WECAF Project together with the countries concerned, redouble their efforts to initiate or speed up the training of personnel charged with collecting and processing of statistics from the artisanal fisheries of the WECAFC area.

11.2 Training

It was recognized that one of the principal limitations on the quantity and quality of information available on the fisheries of the WECAFC region is the inadequate number of individuals trained in the collection of fisheries statistics and resource evaluation. This state of affairs was the reason for WECAFC at its April 1979 meeting, making a recommendation to improve this situation. However, limited funds have so far only allowed a training course in fisheries statistics for English speaking countries. The group therefore recommends that in the next intersessional period, two training courses be held, one in statistics for Spanish speaking countries; the other on resource evaluation for member countries of the region.

The group urged FAO to intensify activities leading to the identification of those countries which could host such meetings, the funds to finance them, and the most convenient dates for holding them.

11.3 Revision of national fisheries evaluation

The group noted with satisfaction the considerable quantity of valuable information contained in the Cuban report on resources. Since this report was the result of a joint initiative between FAO and the Government of Cuba, the group recommended that FAO intensify its collaborative efforts with other countries of the WECAFC region to encourage the preparation of similar resource documents to that prepared by Cuba.

11.4 Support for the Intersessional Programme of Work

With the objective of facilitating the execution of the activities of the working groups on fish and crustaceans during the next intersessional period, the participants recommended to the member countries of WECAFC to support, in the most effective manner possible, the programme of intersessional work contained in the body of the report.

11.5 Workshop on Spiny Lobsters

It is recommended that the WECAF project organize and carry out a two-day workshop on management of spiny lobster. The workshop could take place in San José, Costa Rica, at the same time as the 23rd Annual Meeting of the Gulf and Caribbean Fisheries Institute in November 1980, to review the available information on the biology and fishery of spiny lobsters. This meeting should invite the fisheries administrators and scientists of those countries of the WECAFC region who have lobster fisheries, and who might benefit from the most recent technical information and discussions on the problems of management and regional cooperation with respect to lobsters. The WECAF project should provide the funds to organize, finance and carry out this workshop.

11.6 Organization of this and future Meetings of the Working Group

The success of meetings of the group depends not only on those responsible for organizing the meeting, but also all of the participants. It is recommended that in future, those individuals nominated as national correspondents make an effort to reply more rapidly to communications from both the Technical Secretary, the regional project in Panama, and those other countries involved in the working group and intersessional activities, in order to facilitate adequate planning of future activities of the groups.

APPENDIX 1

List of Participants

Albert Jones
Southeast Fisheries Center
75 Virginia Beach Drive
Miami, Florida
33149 U.S.A.

William G. Clark
College of Fisheries
University of Washington
Seattle, Washington
98195 U.S.A.

Pierre Charlier
Proyecto WECAF
Apartado 6-4392, El Dorado
Panama, R.P.

Reuben Charles
Principal Fisheries Officer
Ministry of Agriculture
Fisheries Division
P.O. Box 1001
Georgetown, Guyana

Ignacio Galnares
Depto. de Pesca
Dirección Gral. de Planeación,
Informática y Estadística
Alvaro Obregón No. 269
Mexico 7, D.F.

Luis Villegas
Evaluación de Recursos
Proyecto WECAF
Apartado Postal 6-4392
El Dorado, Panama

Nelson Ehrhardt
Proyecto México/FAO
Alvaro Obregón 286
Mexico 7, D.F.

Dilio Fuentes C. (Chairman, Joint Working Groups)
Subdirector
Instituto Nacional de Pesca
Alvaro Obregón 269
Mexico 7, D.F.

Ernesto Ramirez
Instituto Nacional de Pesca
Alvaro Obregón No. 269
Mexico 7, D.F.

Karl A. Aiken
Fisheries Officer
Fisheries Division
Ministry of Agriculture
P.O. Box 470
Kingston, G.P.O.
Jamaica, West Indies

David Mendizabal Y.O.
Instituto Nacional de Pesca
Depto. de Pesca
Av. Alvaro Obregón No. 269-10 piso
Mexico 7, D.F.

John F. Caddy (Technical Secretary)
Senior Fisheries Resources Officer
FAO, Rome

Carlos E. Rubio Gomez
Instituto de Desarrollo de los Recursos
Naturales Renovables - INDERENA
Subgerencia, Pesca Colombia
Apartado Aereo 2459 - Cartagena

APPENDIX 2

Agenda

Second Joint Meeting -- Mexico City, 26--29 November 1979

Item

1. Opening of the joint meeting
2. Election of a Chairman
3. Adoption of the Agenda
4. Rapporteurs
5. Examination of the conclusions and recommendations of the first joint meeting of the Working Groups, and subsequent progress
6. Subsequent revisions of evaluations carried out in the first joint meeting
 - 6.1 General revision
 - 6.2 Meeting of the Working Group to evaluate the shrimp fisheries of Guianas-Brazil
 - 6.3 New evaluations since the Cartagena meeting
7. Shared resources
8. Statistical data needs
9. Intersessional work programme for 1980-82
10. Other matters
11. Recommendations
12. Approval of the report

APPENDIX 3

Statistical Information on the Mexican Fisheries Sector

During the last few years, the fisheries sector has shown a speed of development superior to all other sectors of the economy. This is particularly important since overcoming the obstacles which lie in the path of catching, processing and marketing in this sector, will allow an accelerated development, above all when one considers the large potential of resources, both in marine and fresh waters. The diagnosis, evaluation and planning in this sector require systematic information as a basis for programming and development.

It should be noted that the systems of collecting fisheries data are still in process of development, which is the reason why the existing figures represent only a part of the whole. There are a number of lines of evidence that support this contention, of which we give the following examples. The figures for annual catches up until 1977 referred to those landings recorded by the existing local fisheries offices in the country, but a survey carried out in 1978 for the Department of Fisheries showed that there were as many as 775 fish landing sites, both on the sea coast, and along the shores of inland bodies of water, whose production was not registered in the normal monitoring of catches. Also, a high proportion of landings was marketed and consumed locally in sites where, even if there was a fisheries office in the locality, for various reasons, they did not enter the statistics. As a result of the above investigation, it is estimated that approximately 80 000 tons are landed which do not reach the official statistics. It is worth noting that these statistics are compiled by the Directorate of Planning, Information and Statistics of the Department of Statistics, based on report from the 149 administrative offices, of which 81 are on the Pacific coast, 48 on the Gulf and Caribbean, and 20 in the interior.

The Department of Fisheries uses two classes of statistics on the fisheries sector: the first based on the fresh whole weight of fish at the time of capture; the second is the landed weight in port, without considering the losses incurred at sea. (For many species a certain amount of processing of the catch occurs before it reaches the port of landing.)

It is useful to warn that often the statistics do not strictly correspond to "landings" until somewhat later, since included under "landings" are species in a great variety of forms, such as shrimp, dried or in a powdered form, sharkfins, bones, tails, etc.

The statistics on fresh whole weight refer uniquely to the volume, and are calculated following the criteria used by FAO, applying conversion factors to all registered species. These factors were revised by the Directorate of the National Institute of Fisheries and in 1977 were used as a base to elaborate the statistical presentation for the years 1973-1977; 1973 was the earliest year for which the necessary records were available for this calculation.

This mode of presentation of statistics is used for several reasons: principally, as a base for international comparisons; to be able to calculate the fishing pressure being exerted in a given fishery; to allow quantities to be added using a common unit of measurement, independent of the different regional forms in which a product occurs (e.g., whole frozen shrimp, fresh headless, dried, powdered, etc.), and to allow us to evaluate the total production of a given species, taking into account the means used by the fisheries authority to regulate its fishery. With respect to this, the most notable example is the oyster, a species for which the most advisable policy is to determine a conversion between shelled forms and the product without shell.

With respect to the statistics on exploitation in terms of the landed weight, it is important to note that several concepts have not remained constant over the years, because since 1973, the separate recording of fish oil and meal in fish landings was abandoned, in favour of recording the primary material that went into its elaboration: industrial anchoveta and sardine, unprocessed fish and by-catch, among others.

The figures presented in the statistics fundamentally refer to the fishery with commercial gear, including catches made in inland and marine fisheries with authorized fishing permits by national vessels. With the reservations mentioned with respect to coverage, they include both the industrial and artisanal fisheries, and exclude sports catches, catches for research purposes and fish caught for self-consumption.

With respect to the figures on vessels, these originate from the National Registry of Fisheries, which has an administrative system now being revised to allow it to carry out simultaneously its informational objectives, since at the moment it covers only one part of its potential scope, which does not, at present permit it to carry out its objectives in a permanent and opportune fashion. At the present time, 28 555 separate vessels have been recorded at the national level, of which 3 298 are greater than 10 tons. With respect to their geographical distribution, of the total of larger vessels, 1 784 occurred on the Pacific coast, and the 1 514 remaining on the Gulf of Mexico and Caribbean. The total of smaller vessels is divided into 13 941 on the Pacific coast, 10 861 on the Gulf of Mexico and Caribbean and 455 from inland waters.

APPENDIX 4

Agreement Reached at the Last Session of WECAFC (April 1978)
on Catches and the Classification of Small Vessels

1. Collection and forwarding of information on catches

Due to the growing importance of foreign vessels operating in zones of national jurisdiction, either under licence or lease, the Commission considered it necessary for countries to collect and transmit information to FAO under three headings (paragraph 14 of the report):

- (a) Catches landed in national ports (by national or leased vessels)
- (b) Catches landed in foreign ports (by national or leased vessels)
- (c) Catches landed in national ports by foreign vessels

2. Collection and forwarding of information on sports and recreational catches (paragraph 15 of the report).

Due to the importance of this category in the WECAFC region, it is suggested that information on sports and recreational catches be published in the ordinary statistical publications of FAO.

3. Classification of small vessels

Countries should classify small boats of less than 5 tons according to their length, rather than by tonnage, indicating the horse power if they are motorised.

APPENDIX 5

Status of Evaluation of Stocks Summary of Results of 1977 Working Parties

(A) FISH

Key: MSY = maximum sustainable yield

COUNTRY & SUB-ZONE	SPECIES	METHOD	EVALUATION	COMMENTS
Mexico Campeche Bank	Red Grouper (<u>Epinephelus</u> <u>morio</u>)	? Y/R	MSY = 13 000 (INP) MSY = 35 000 (Klima)	
Mexico	Spanish Mackerel (<u>Scomber-</u> <u>morus</u> sp.)	? Y/R	MSY = 10 000 (INP) MSY = 5 000 (Klima)	
Gulf of Mexico & Southeast U.S. coast	Demersal fish	$Z\bar{E}/2$	As in Klima	Based on biomass estimates from trawl surveys
Caribbean Islands	All neritic species Demersal species	Exponential catch-effort model	MSY = 40 kg/ha of shelf area Demersal MSY about 1/4 of total neritic potential, or 10 kg/ha (Klima)	Based on Munro's assessment of Jamaican Fisheries W.G. Considered 1/4 a conserva- tive estimate of demersal potential
Continental shelf of Central & South America	All neritic species	$Z\bar{E}/2$; also by analogy with Jamaican estimates	Mostly as in Klima	W.G. found large differences between methods for Colombia and Venezuela

APPENDIX 5 (Cont.)

(B) SHRIMP

COUNTRY & SUB-ZONE	SPECIES	METHOD	EVALUATION	COMMENTS
Northern Gulf of Mexico				
(a) Tampico fishery	<u>P. aztecus</u>			No given conclusions
(b) Campeche fishery	<u>P. duorarum</u>	Exponential U.S. + Mexican data	MSY = 22 900 - 24 900	Slightly underexploited Fully exploited
(c) Contoy fishery	<u>Sicyonia brevirostris</u> <u>P. brasiliensis</u>	Exponential U.S. data	MSY = 1 600 t $f_{MSY} = 100\ 000\ h$	Fishery changed from almost all <u>P. brasiliensis</u> in 1960s to mostly <u>S. brevirostris</u> after 1974. (Fleet size at or beyond f_{MSY} level)
Nicaraguan fishery		Exponential	MSY = 3 800 t $f_{MSY} = 9\ 500\ days$	Close to MSY
Colombian N.E.		Exponential	MSY > 750 t $f_{MSY} > 5\ 000\ days$	Slightly underexploited
S.W.			MSY = 1 000 t $f_{MSY} = 7\ 500\ days$	Fully exploited
Gulf of Venezuela	<u>P. schmitti</u> (white shrimp) <u>P. subtilis</u> <u>P. brasiliensis</u> <u>P. notialis</u> (brown shrimp)	Exponential	MSY = 500 t $f_{MSY} = 8\ 000\ days$ MSY = 3 000 t $f_{MSY} > 40\ 000\ days$	At or beyond MSY Close to MSY for brown shrimp
East of Isla de Margarita		Exponential	MSY = 500 t $f_{MSY} = 9\ 000\ days$	
Contoy fishery	<u>P. brasiliensis</u> <u>P. schmitti</u> <u>P. subtilis</u> <u>P. notialis</u>		MSY = 1 600 t $f_{MSY} = 100\ 000\ h$	Close to MSY

APPENDIX 5 (Cont.)

(C) LOBSTERS

COUNTRY & SUB-ZONE	SPECIES	METHOD	EVALUATION	COMMENTS
Bahamas	Spiny Lobster	Biomass inventory	Little Bahama Bank (1976) 321 lb/mile ² Great Bahama Bank 50 lb/mile ²	Potential productivity of whole Bahamas = 6 800 t?
Florida	Spiny Lobster	Exponential	MSY $\approx$ 1 900 t f_{MSY} = 160 000 traps	Historical yield 2 000 - 3 000 t Poor fit to exponential model
Puerto Rico and U.S. Virgin Islands	Spiny Lobster	Schaefer	MSY $\approx$ 234 t f_{MSY} $\approx$ 6 500 nasas	Catch close to MSY in Puerto Rico
Puerto Rico and U.S. Virgin Islands	Spiny Lobster	$C_{max} = 0.5 MB_0$	Puerto Rico MSY $\approx$ 277 t Virgin Islands MSY $\approx$ 143 t	Near MSY
Venezuela	Spiny Lobster	?	Cobo de Barany <u>et al.</u> (1972)	f_{MSY} exceeded
Brazil	Spiny and Smooth-tail Lobsters	Production model?	MSY $\approx$ 8 800 t $f_{MSY} = 18.8 \times 10^6$ trap days	Considerably overexploited

APPENDIX 6

Results of the Meeting of the Working Party on the Shrimp Fisheries off the Guianas-Brazil

1. General

A Working Group to assess the state of exploitation of the shrimp fisheries off Guianas-Brazil, determine suitable management measures and define research needs and priorities was convened in 1979 by the WECAF Project in Panama City, Panama, in April.

Representatives from seven countries fishing in the region participated in the meeting, and nineteen documents covering various aspects of the agenda were considered.

2. Summarized Results

2.1 Stock evaluation

Although abundance indexes for Venezuelan and Brazilian fleets operating in the extreme areas of the region have not shown any decreasing trend, fleets fishing in the central part (Guyana, Suriname and French Guiana) have experienced marked reductions in their c.p.u.e.s. Decreasing values have been recorded from 1969 onwards.

The analysis of catch and effort data, covering practically all fleets operating in the zone between the Orinoco and Amazon Rivers, during the period 1960-78, suggests that the fishery is now fully exploited and the number of shrimpers presently in operation is near the estimated maximum the resource could support.

2.2 Management

The Working Party agreed that there are reasons for adoption of a common management scheme by coastal countries concerned. The Party recommended that such countries consider the adoption of common management measures and regulations to protect small shrimps (limited fishing in nursery grounds) and control the amount of fishing effort (fixed number and type or boats licensed to fish).

2.3 Research needs and programmes

The Working Group agreed that there are two subjects that need to be covered in priority in any future research programme:

- fishery statistics
- shrimp tagging

2.3.1 Fishery statistics

The meeting was compelled to do a rather crude analysis of catch and effort statistics due to inadequate information available on species compositions, artisanal catches and fishing grounds.

To correct this situation the Working Party recommended to improve data collection and reporting as to have an uniform and consistent set of data. It also recommended to establish a common reporting system.

The Party requested that the WECAF Project assess the suitability of the ongoing statistical programmes carried out by the countries participating in the fishery and propose improvements to be made to such programmes to satisfy requirements arising from the adoption of a common reporting system. Results of such study need to be submitted for consideration to the WECAFC Working Parties on Stock Assessment of Shrimp and Lobster Resources and Fishery Statistics.

As regards the distribution of statistical information to permit users from various countries participating in the fishery to have easy and timely access to it, the Party considered that only a central data bank (under a regional and unbiased body) could opportunely provide the information required. The Working Party requested that the WECAF Project convene a group to develop a proposal to establish a Central Data Processing System and estimate the cost of implementing such system. Results of the study will be considered at the next meeting of the WECAFC Working Party on Fishery Statistics.

2.3.2 International cooperative tagging programme

It was considered that a tagging programme will provide much of the missing information on growth rates, mortalities and species distribution to be used in a better assessment of the state of exploitation of the resource.

The Working Party recommended that countries participating in the fishery carry out a cooperative tagging programme. Such programme could be done with the assistance and coordination of a regional body such as the WECAF Commission or WECAF Project.

The Party also requested that the WECAF Project establish (before October 1979) a small working group to prepare a proposal and a plan for this tagging programme.

In order to obtain the best results from this tagging programme a short survey of nursery grounds and artisanal fisheries in the area needs to be made. The Party obtained the assistance of the Southeast Fisheries Center of Miami (U.S.A.) to perform the survey. In this respect it also suggested that the WECAF Project could collaborate in this work.

Provisional commitments to participate in the programme were obtained from Brazil, French Guiana and the U.S.A. French Guiana will start offshore tagging in late 1980 and Brazil's participation is proposed for 1981. The U.S.A. can provide expertise in shrimp tagging, training for tagging operators and processing of recovery data.

2.4 Report on shrimp fisheries of Guyana and Suriname

Guyana and Suriname were not represented at the meeting and information available to the Party only partially covered 1977-78.

3. Reporting

A preliminary report was distributed to participants at the end of the meeting.

A more elaborate draft version was circulated for comments at the end of August. The corrected version together with documents submitted will be included in the "Proceedings of the Meeting".

APPENDIX 7

Crustacean Sub-group Report

The sub-group on crustaceans reviewed new data on crustacean stocks and summarized existing and new information for inclusion in this report.

New data presented at this meeting included:

- (a) The report of the WECAF Working Group on the Guianas-Brazil Shrimp Fishery, which included an assessment of the stocks;
- (b) The results of stock assessment of five species of shrimp in the U.S. Gulf of Mexico (P. aztecus, P. setiferus, P. duorarum, H. robustus, and S. brevirostris);
- (c) The results of stock assessments of shrimp on the shelf of Cuba;
- (d) Data on two Colombian shrimp fisheries;
- (e) The results of fishery surveys for spiny lobsters in Jamaica;
- (f) The results of stock assessment for spiny lobsters in U.S.A. (Florida, Puerto Rico and U.S. Virgin Islands).
- (g) A report on the spiny lobster fishery of northeastern Brazil, which included an assessment of the stocks;
- (h) Data on the spiny lobster fishery in Nicaragua.

These reports and data indicate that a considerable number of new assessments of crustacean stocks in the WECAFC region have been made since the last meeting and existing assessments are being updated (Table 1).

Assessments based on production models continue to be the most used, because catch and effort data are more readily available than other kinds of information. Efforts are being made to improve the data and analyses through such means as more precise measures of fishing effort, information on species composition of the catch, measures of fishing power of different vessel types in order to standardize effort, calculating directed (to species) fishing effort, and inclusion of the effects of environmental variables in production models. These techniques follow many of the recommendations made at the 1977 Cartagena meeting.

Stock assessments using production models are generally the first kinds of fishery assessments to be made, and provide administrators with information on the potential yield of a stock and the associated level of effort. It should be noted that the production models fitted to most of the shrimp stocks are flat-topped and indicate that nearly the same yield can be obtained over a rather wide range of fishing effort.

Analytical models have been applied to crustacean stocks in the WECAFC region by Mexico and the U.S.A. The tagging work proposed for the Guianas-Brazil fishery would also provide data to use in analytical models. While the results of current studies are preliminary, these methods promise to provide additional useful information to administrators. For example, the effect of harvesting small shrimp, and the effect of changes in fishing effort on yield can be examined through the use of analytical models.

The crustacean sub-group reviewed the results of stock assessments that were submitted to the meeting and that were available in previous reports.

These results were summarized in Tables 1 and 2, which report on the conclusions of production and analytical models and the estimates of parameters made.

Table 1

State of Evaluation of Crustacean Stocks
Summary of Results of 1979 Working Parties

SHRIMP

COUNTRY & SUB-ZONE	SPECIES	METHOD	EVALUATION	COMMENTS
Campeche fishery	<u>P. duorarum</u>	Exponential Model Mexican data	MSY 26 400 t f_{MSY} 10 000 days	Slightly underexploited
Colombia N.E.	<u>P. notialis</u>	Evolution of catches	MSY $\approx$ 750 t f_{MSY} $\approx$ 5 000 days	Probably overexploited
Colombia S.W.	<u>P. schmitti</u> <u>P. brasiliensis</u>	Exponential Model	MSY $\approx$ 1 000 t f_{MSY} $\approx$ 7 000 days	Fully exploited
Guianas- Brazil fishery	<u>P. brasiliensis</u> <u>P. schmitti</u> <u>P. subtilis</u> <u>P. notialis</u>	Catch versus total number of vessels	Potential Yield $\approx$ 15 000-20 000 t	Production model not applied because of multispecies nature of fishery and lack of catch and effort data by species. Close to full exploitation
Cuba (sub-zone A)	<u>P. notialis</u> <u>P. schmitti</u>	Production Model	MSY $\approx$ 6 000 t	Fully exploited

Table 1 (Cont.)

LOBSTER

COUNTRY & SUB-ZONE	SPECIES	METHOD	EVALUATION	COMMENTS
Bahamas	Spiny Lobster <u>P. argus</u>	Biomass inventory	Little Bahama Bank (1976) 321 lb/mile ² Great Bahama Bank 50 lb/mile ²	Potential productivity of whole Bahamas = 6 800 t ?
U.S.A./Florida	<u>P. argus</u>	Exponential Production Model	MSY = 7.3×10^6 lb (3 311 t)	Beverton and Holt and bioeconomic model also applied. Fully exploited
Puerto Rico and U.S. Virgin Islands	<u>P. argus</u>	Biomass inventory	MSY = 0.83×10^6 lb (376 t)	Catch and effort data not suitable for production model. Fully exploited
Brazil	<u>P. argus</u> + <u>P. laevis</u>	Production Model	MSY = 8 800 t $f_{MSY} = 18.8 \times 10^6$ trap days	Considerably overexploited
Jamaica (Island shelf)	<u>P. argus</u>	Sample survey	(Recent annual yield) 200-220 t	Probably exceeding MSY

KEY:

MSY = maximum sustainable yield

Table 2

Available Data and Parameter Values for Stock by Country, Sub-zone (where Applicable) and Species

Note: For production models just show dates when data are available, and list data separately.
For the rest, insert parameter value where available, indicating dates (where applicable)
and references by footnote.

CRUSTACEA

Country	Sub-zone	Species	Production models				Analytical models											Biomass estimates	
			Catch data for 19 to 19	Effort data for 19 to 19	Years in fishery $\bar{t}$	Model fitted ? (N/X)	Growth		Mortality						Model fitted ? (N/X)	B_0	B		
							L_∞ M_∞	K	Z	M	F	M/K	E	l_c t_c				$\bar{I}$ $\bar{t}$	
LOBSTER U.S.A.	Florida	<u>P. argus</u>		1965 -78	1	MSY = 3311 t	190 mm 4.7 kg	.16 -.25	1.15 -1.51	.40 -.83	.32 -1.11	1.6 5.2	.28 -.73	75mm	78 - 93 mm				
Brazil	Northeast Coast	<u>P. argus</u>		1965 -78	1	MSY = 8800 t	195 mm	.19	.28 -.39	.29	.3	1.53	.51 1978	78.4	107 - 125 mm				
SHRIMP Mexico	Campeche	Mostly <u>P. duorarum</u>		1956 -74	1	MSY = 24 900 t	211 mm 80.6 g		.64	.47	.17	-	.13	115 mm 4 mon	141 mm 7 mon				
		<u>P. setiferus</u>							.96 -1.08	.32	.24 -.76							Klima and Beningo 1968	
		<u>P. setiferus</u>							.65 -.90	.16 -.48	.40 -.48							Klima 1974	
		<u>P. artecus</u>							.48	.21	.29							Klima 1969	
		<u>P. duorarum</u>							.88 -1.08	.08 -.4	.64 -.92							Berry 1967	
		<u>P. duorarum</u>							.44 -.72	.32 -.44	.12 -.23							Costello and Allen 1968	
								.40 -.48	.04 -.08	.36							Berry 1969		

SHRIMP

Evaluation of Colombian shrimp resources

Evaluation of Colombian shrimp resources were carried out in two areas: one to the northwest and the other to the southwest of the Atlantic coast. Both fisheries correspond to units of population considered as independent. In the southwestern region the catches are predominantly pink shrimp (*P. duorarum*) and white shrimp (*P. schmitti*). In the northwest area, catches consist of pink shrimp, pink spotted shrimp (*P. brasiliensis*) and white shrimp. In both areas, the pink shrimp has been predominant; in the last few years representing 96.9 percent of the catch in the northwest, and 94.4 percent in the southwest. The white shrimp has made up 1.6 percent and 5.6 percent in the two areas respectively. Pink spotted shrimp made up 1.5 percent of the catch in the northwest stock. Information on 1977 and 1978 landings has been added to that presented on catch and effort at the Cartagena meeting in 1977, as well as partial information from the 1979 fishery.

Northeast zone

In Table 3 and Figure 1 the information used in the analyses is presented. A production model was not considered to be appropriate for the fishery because despite the lack of a significant decline in abundance with increasing effort, there has been a notable decline in catches although the effort has remained relatively constant during the last two years. Because of this, estimation of the MSY and the corresponding effort level at MSY would be quite inappropriate. However, an analysis of the historical evolution of the production in this area permits one to conclude that probably the fishery is now taking place at an intensity greater than that corresponding to the MSY level. Although the preliminary statistics for 1979 indicate an increase in catch per unit effort, it seems likely that the observed fluctuations are more related to an environmental effect, than to an effect of exploitation. On the other hand, we do not have sufficient evidence to establish the effect on the resource of the fishery in the Gulf of Venezuela. However, the fishery in the Gulf of Venezuela is mainly concentrated on the white shrimp, which represents a small fraction of the catches off Northeast Colombia. In general it is suggested from the limited information available, that an average catch of about 750 tons and a fishing effort of around 4 500 days absent from port could represent the maximum expectation for returns from this resource.

Southwest zone

The information available for this area is presented in Table 4 and Figure 2. Inclusion of information on CPUE and fishing effort for 1977 and 1978 shows a better definition of the rate of decline in abundance with effort. Analysis of the present state of the fishery using the exponential model establishes that the MSY will be of the order of 1 000 tons with a fishing effort of 7 000 days absent from port.

Conclusion

The results for both zones are in agreement with those reached during the Cartagena meeting in 1977. It was necessary to group the information on production of all species since the statistics on fishing effort are not reported by species. Since there are differences in the reproductive potential of the species in question, it is possible that the combined MSY from the fishery could vary if analysed separately by species.

In the report of the 1977 Cartagena meeting, information was presented on the size of landed shrimp. The information was grouped for all species captured in both areas. It is important to note that the species being considered reach different maximum sizes. In Table 5 separate estimates are given of the mean lengths for the two most important species. These were calculated using a weighting for captures according to size. It is felt that the reduction in mean size of the pink shrimp in both fishing areas is due to the inclusion of smaller individuals in the commercial production. With the information available at this meeting, it was not possible to make conclusions on the historical changes in

Table 3

Shrimp Fishery on the N.E. Caribbean Coast of Colombia: All Species Combined

Year	Total catch (whole shrimp) (t)	Effort (number days at sea)	CPUE (kg/days at sea)
1972	623.0	3 463	180.0
1973	492.8	2 942	167.5
1974	665.6	3 875	171.8
1975	655.5	4 323	151.6
1976	1 038.4	4 249	157.0
1977	815.6	5 117	159.4
1978	518.1	4 089	126.7
1979	(499.9)	(2 677)	(186.7)

Table 4

Shrimp Fishery on the S.W. Caribbean Coast of Colombia: All Species Combined

Year	Total catch (whole shrimp) (t)	Effort (number days at sea)	CPUE (kg/days at sea)
1972	1 109.6	7 260	152.8
1973	1 042.8	5 569	187.2
1974	1 003.0	7 738	129.6
1975	992.5	7 713	128.6
1976	853.8	6 592	129.5
1977	930.2	7 940	117.2
1978	973.9	9 291	104.8
1979	(666.8)	(5 842)	(114.1)

(Data for 1979 only included the fishery up to September)

Table 5

Mean Annual Size of the Shrimps (*P. duorarum* and *P. schmitti*) from
Catches on the Colombian Caribbean Coast in 1977 and 1978
(mm)

	Pink (<i>P. duorarum</i>)		White (<i>P. schmitti</i>)	
	1977	1978	1977	1978
S.W.	131.31	124.58	150.48	150.40
N.E.	123.43	119.42	144.35	146.13

the sizes of individuals of different species whether it is because of exploitation or because of the method of operation of the fleets in the two areas.

LOBSTER

Production model analysis for Brazilian rock lobster stocks

Data from the commercial lobster fishery in the northeast of Brazil were available up to and including 1977. Total effort in that year was 28.62 million trap days, which is considered greater than necessary to harvest the maximum sustainable yield. The 1977 data were included in a revised calculation of MSY both for the total area and for the two sub-areas separately (Figures 3 and 4):

<u>Area</u>	<u>MSY</u>	<u>f_{MSY}</u>
All Northeast Brazil	8.8×10^3 t	18.8×10^6 traps/day
Northeast Brazil (south of Cabo San Roque)	2.0×10^3 t	5.2×10^6 traps/day
Northeast Brazil (north of Cabo San Roque)	7.3×10^3 t	14.6×10^6 traps/day

The estimates calculated for the sub-areas separately were slightly higher than when the data for the two sub-areas were combined. The separate estimates indicated that over-exploitation is most serious in the area of the western northeast coast north of Cabo San Roque (6°S), where 1977 effort was 50 percent more than that necessary to harvest the available yield.

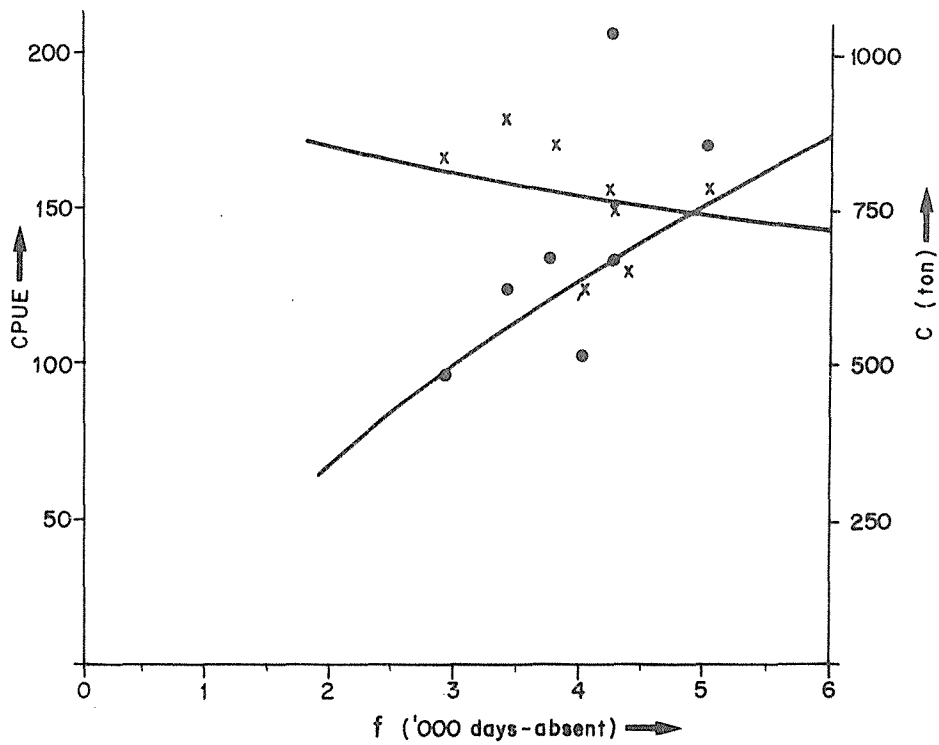


Figure 1. Relationship between total effort and the CPUE (crosses) and the corresponding yield curve (circles) for all shrimp species on the N.E. Colombian Atlantic coast

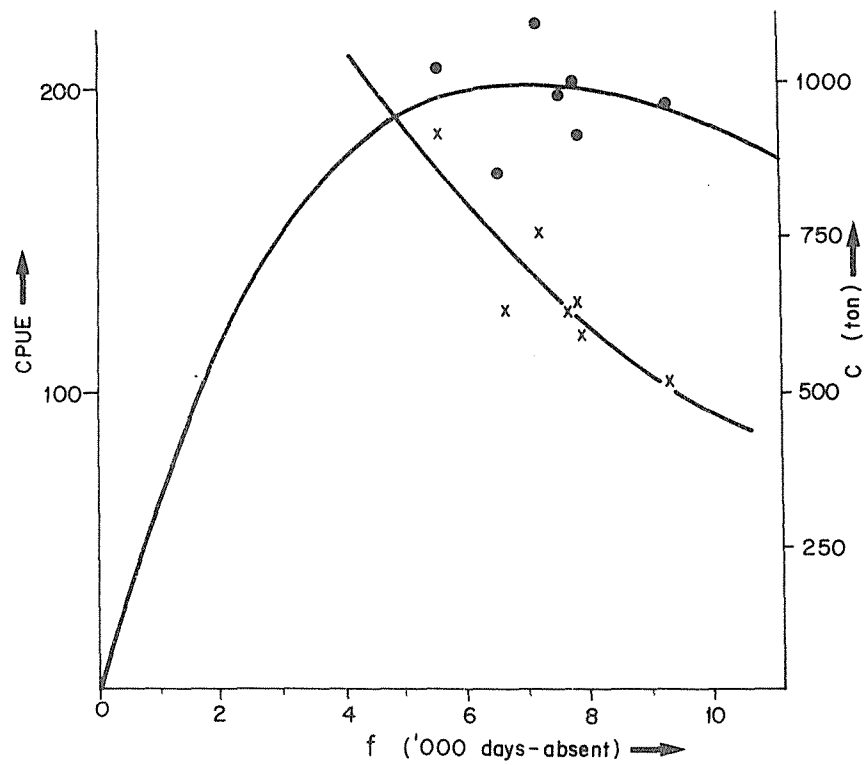


Figure 2. Relationship between total effort and CPUE (crosses) and the corresponding yield (circles), for all species of shrimp combined on the S.W. Colombian Atlantic coast

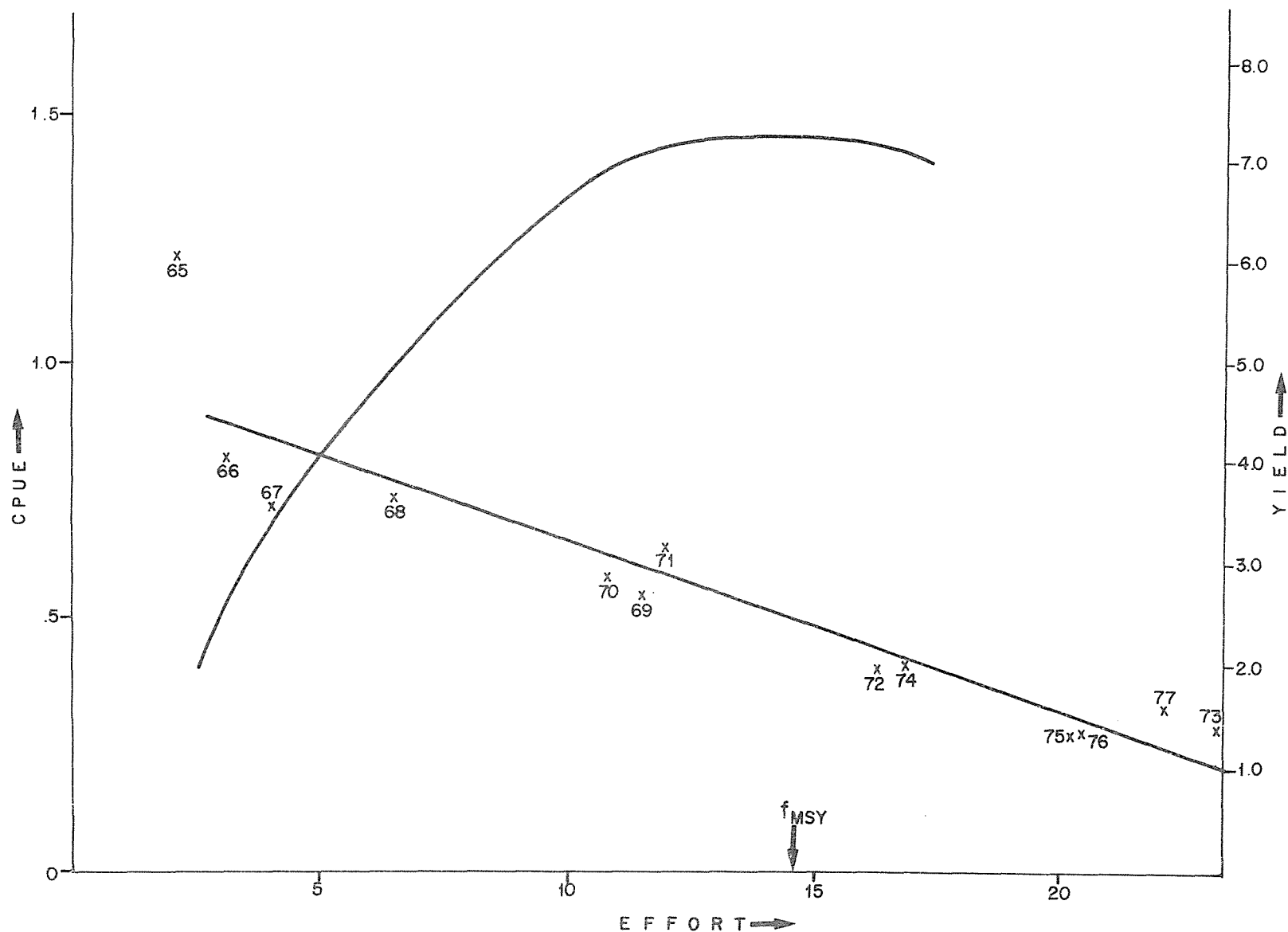


Figure 3. relationship between CPUE (catch/trap/day) and effort (number of traps fished/per year $\times 10^{-4}$) for spiny lobster (both species combined) off the western N.E. coast of Brazil (north of Cabo San Roque)

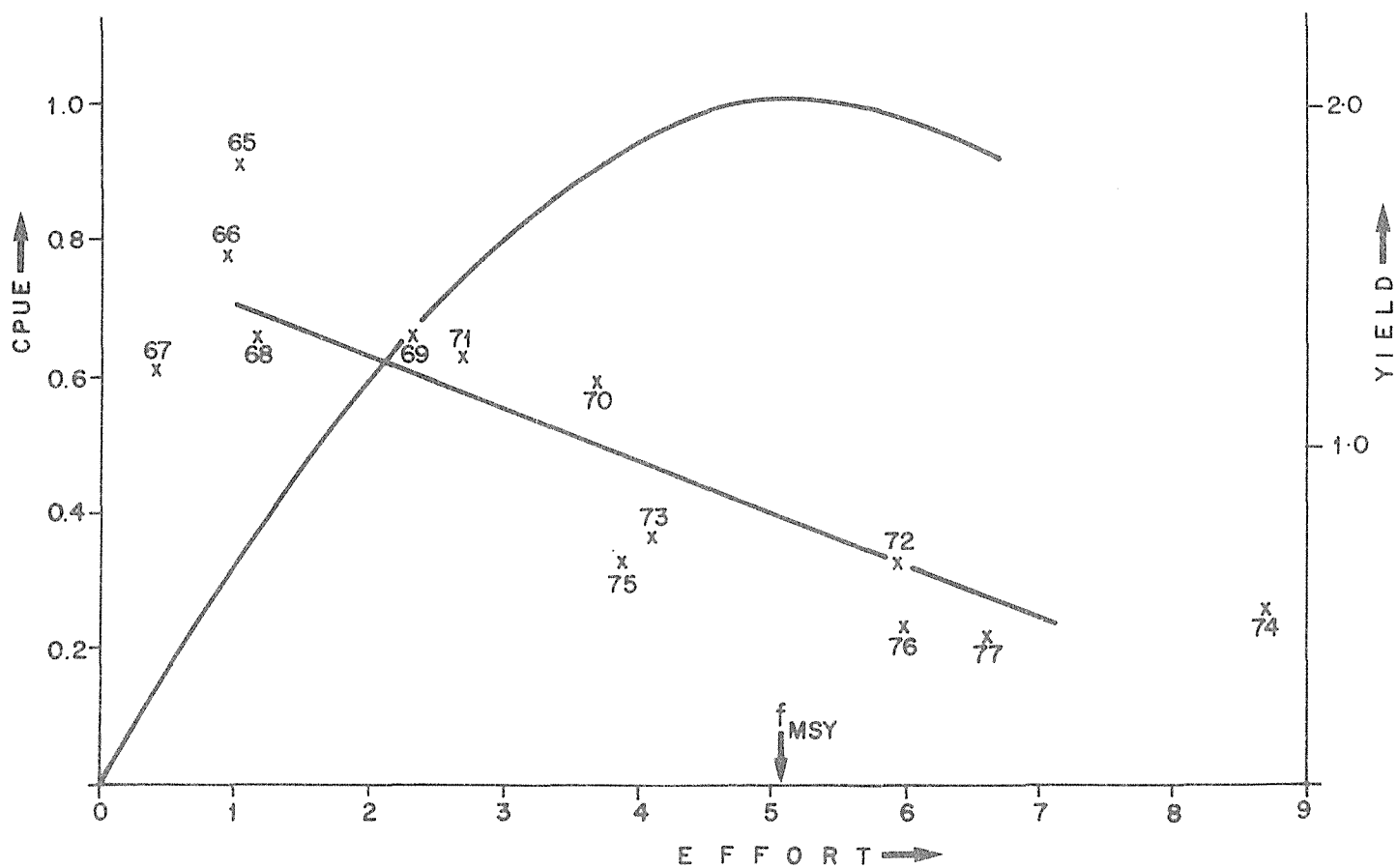


Figure 4. Relationship between CPUE (catch/trap/day) and effort (number of traps fished per year $\times 10^{-6}$) for rock lobster (both species combined) off the N.E. coast of Brazil (south of Cabo San Roque)

APPENDIX 8

Marine Fish Subgroup Report

The meeting received reports of recent assessments done in the United States of America, Mexico and Cuba. The basic data on which the assessments were based, including estimates of population parameters, are given in Table 1, while the results of the assessments are summarized in Table 2.

United States of America

Several new assessments were done for stocks in the U.S. fishery zone in the course of implementing extended jurisdiction. In most cases, however, there were no new data and therefore not sufficient basis for straightforward assessments, so some quantities (e.g., natural mortality rates or recreational catches) had to be more or less guessed in order to arrive at estimates of potential yield and present level of exploitation.

For the stock of croaker (Microponias undulatus) in the northern Gulf of Mexico, it was possible to estimate natural and fishing mortality rates and perform an analytic assessment (albeit in two versions, because of uncertainty as to the growth schedule).

Attempts to estimate the MSY of the entire groundfish (Sciaenid) assemblage and the reef fish assemblage in the northern and eastern Gulf of Mexico by means of surplus production models produced poor fits.

At present only the menhaden (Brevoortia spp.) stocks in the U.S. zone are well known as regards population parameters. The groundfish stocks in the Gulf of Mexico are monitored by regular trawl surveys. Research on the most important outstanding questions is in progress.

Mexico

Mexico has greatly increased its activities in fishery research as part of the country's ambitious fishery development plan, but for the most part the results are not yet available in the form of completed assessments.

The meeting received a paper on Spanish mackerel (Scomberomorus maculatus) and a summary of a paper in press dealing with the red grouper (Epinephelus morio) on Campeche Bank. Both described analytic assessments in which the rate of total mortality was estimated from age compositions of the catches and the natural mortality was estimated by reference to other life history parameters, so that the current fishing mortality rate could be obtained by subtraction. The procedure used to estimate the natural mortality rate is fairly complicated and not well known, so the group decided to consider it in detail at the next meeting (see recommendation below).

In the case of the red grouper, there was some doubt that the total mortality rate estimated from the age composition of the catch was accurate, since the fish are caught on hooks that are highly selective for a certain size range. Moreover, the fish appear to segregate by size to some extent, so the unweighted sum of catch samples from different grounds may not accurately represent the true size distribution of the stock.

Cuba

The thorough discussion of fishery statistics at the Cartagena meeting in 1977 showed that Cuba had by far the most detailed and complete statistics in the region, so in preparation for the present meeting FAO asked the Centro de Investigaciones Pesqueras in Havana to combine its data and assessments in the form of a comprehensive review of the fishery resources around Cuba and their state of exploitation. The result was an outstanding study whose methods and results show how much can be done even in the generally difficult circumstances presented by the fisheries of the WECAFC region. The group greatly appreciated this contribution and greatly regretted that due to travel difficulties, no one from Cuba was present at the meeting to discuss it.

Nearly all the Cuban assessments of fish stocks were analytic. The total mortality rate was estimated from age or size composition and the natural mortality rate M values estimated from the growth rate using the average M/K ratio for perciforms and the state of exploitation derived from yield-per-recruit computation. In conjunction with the detailed Cuban catch statistics, this procedure provided estimates of maximum sustainable yield, and stock size as well. The only criticism levelled at this procedure is with respect to the heavy reliance placed on estimates from other areas and related species (especially the use of $M/K = 1.7$ for perciforms). An attempt to upgrade assessments in the region will depend to a large extent on the availability of independent estimates of parameter values for growth and mortality for the main commercial fish species. Table 1 compiles estimated values from the literature for those species for which information was presented at the meeting. To a large extent, these values should be regarded as rather tentative also, and where possible, new estimates made for each local fishery rather than adopting these values as standards.

Most of the fisheries in the WECAFC region are mixed gear, mixed species artisanal fisheries in which the catches are fairly stable and consist of small quantities of many species. Fisheries of this sort normally cannot be appraised well by the standard methods, and attempts to do so require large amounts of detailed catch and effort data. The Cuban method, on the other hand, is less liable to multi-species problems, and it in fact requires the stable catch levels that stymie some procedures based on series of catch-per-effort data. It is thus ideally suited to the region. At a minimum, it can provide a rough estimate of the state of exploitation on the basis of one careful field investigation of the age composition and growth schedule of a stock, with no data whatsoever on fishing effort (aside from the knowledge that catch and effort have been fairly stable for several years beforehand).

The weakness in the procedure is the manner in which the natural mortality rate M had to be estimated in most cases, i.e., on the basis of the observed growth rate K and the mean value of the ratio M/K for some taxonomic group including the species in question. This ratio does in fact vary much less than either its numerator or its denominator, but values for individual species can differ from the group mean by a factor of two or three, and an error of this size in the estimate of M will usually produce an even larger error in the final results of the assessment. The value of M/K of 1.7 for perciforms in Beverton and Holt's paper for example, comes from three separate estimates only, two of which were for temperate region freshwater species.

Given the attractiveness of the Cuban method in all other respects, the meeting recognized as an important task the development of alternative procedures for calculating M from other life history parameters and decided to consider the problem in detail at the next session. Specifically, the meeting

Recommended that its members should ponder and research the problem of deducing the value of M from other life history parameters and report their findings to the next session. In particular a Mexican scientist should present an account of the procedure referred to in the Mexican papers and how it has been applied in Mexican assessments.

It should be noted that while the common belief is that the ages of individual fish usually cannot be determined in tropical areas, by now a large number of species have been successfully aged in Mexico, Jamaica and Cuba, so age determination should not be an obstacle to widespread application of analytic techniques in the WECAFC region. On the other hand, it was reported that rings are very indistinct in some species off Guyana, so this approach may not be feasible universally, particularly in the southern parts of the region.

Needs for Fisheries Statistics

1. Artisanal fisheries. Statistics on the artisanal fisheries are the most difficult to collect because of the varied gear types and many landing sites. Despite this, the group recommends that greater effort be expended to improve the quality of the data collected.

2. Industrial fisheries. Most of the industrial fisheries in the region (pelagic and demersal) take place in countries which already have systems for collection of statistical data. It is essential that this information reach the working group on a regular basis. It was considered that an improvement of information on by-catch of other species in the shrimp fishery needs to be made. It is recommended that contributions on this subject be made to the next meeting of the working group.

During the period of intersessional work, the marine fish working group recommends that member countries of WECAFC be invited to agree to the following points:

1. That the work on tagging of scombrids in the Atlantic, Caribbean and Gulf of Mexico be continued. It is particularly important to seek the participation of Cuba in relation to the joint tagging programme now underway between the United States and Mexico.

2. That a workshop be organized under the direction of experts in the field, to review and update the techniques and methodologies of sampling and analysis of biological data.

Table 1

Available Data and Parameter Values for Stocks by Country, Sub-zone (where applicable) and Species

Note: For production models just show dates when data are available, and list data separately.
For the rest, insert parameter value where available, indicating dates (where applicable)
and references by footnote

MARINE FISH

Country	Sub-zone	Species	Production models				Analytical models											Biomass estimates	
			Catch data for 19 to 19	Effort data for 19 to 19	Years in fishery t_f	Model fitted ? ($\sqrt{K}$)	Growth		Mortality			M/K	E	$\frac{L_c}{(cm)} \frac{t_c}{(yr)}$	$\frac{\bar{L}}{(cm)} \frac{\bar{t}}{(yr)}$	Model fitted ? ($\sqrt{K}$)	B_0	B	
							L_∞ (cm) H_∞ (kg)	K	Z	M	F								
Mexico		<i>Scomberomorus maculatus</i>		1973-1976		X	58.3	6.48 (?)	0.90	0.69	0.21	1.07	0.14	35 1.7	42		36x10 ³ t		
Cuba		<i>Scomberomorus maculatus</i>				X	102.6 11.41	0.16	0.72	0.41	0.31			53	57.2	✓			
U.S.A.	Gulf of Mexico	<i>Scomberomorus maculatus</i>				X	55.8 1.82	0.47	1.0	0.5- 0.8	0.2- 0.5			1.2					
Cuba	Gulf of Mexico	<i>Scomberomorus cavalla</i>				X	141.2 44.5	0.14	2.53 (?)	0.36	2.17			2.4	44	✓			
U.S.A.		<i>Scomberomorus cavalla</i>				MSY= 16 700 t	100.9 9.41	0.21	0.31	(0.4)	0.31	(0.2)		1-1.5					
Cuba		<i>Scomberomorus regalis</i>				X	171	-	0.75	0.33	0.42			1.8	41	✓			
Cuba		<i>Ocyurus chrysurus</i>				X	79-86 7.1-8.9	0.07	1.0	-	-			19-24 2.6-3.8	22-25	✓			
Cuba		<i>Epinephelus striatus</i>					92.8 12.87	0.105	0.55	0.18	0.37	(1.7)	0.285	35.8					
Mexico		<i>Epinephelus morio</i>		1972-1976		X	80.24	0.159	0.48	0.33	0.15	2.08	0.12	35 3.0	50		138x10 ³ t		
Cuba		<i>Haemulon album</i>				X	62.13 0.56	0.196	1.0	0.33	0.67	(1.7)	0.42	19 -					
Cuba		<i>H. aurolingatum</i>					37.63 1.03	0.138	2.7	0.13	2.57	(1.7)	0.95	13 -					
Cuba		<i>H. bonariense</i>					45.71 1.826	0.183	1.4- 2.3	0.31	1.09- 1.99	(1.7)	0.59- 0.78	19-21					
Cuba		<i>H. sciurus</i>					49.73 1.377	0.189	1.7- 2.3	0.32	1.38- 1.98	(1.7)	0.66- 0.78	17- 20					
Cuba		<i>Lutjanus analis</i>					80.8 7.81	0.12	0.87	0.20	0.67	(1.7)	0.45	26					
U.S.A.		<i>Micropogonias undulatus</i>					55.2	0.1- 0.38	1.1- 2.5	0.3	0.8- 1.85	0.35- 3.0		10		✓	300 000 t (1975)		

() = assumed value

Table 2

Status of Evaluation of Stocks (Marine Fish)

Country and sub-zone	Species	Method	Evaluation	Comments
Cuba (shelf)	Biajaiba (<i>Lutjanus synagris</i>)	Y/R Schaefer	MSY = 5 000 t Near full exploitation	Gulf of Batabano
Cuba (shelf)	Roncos (<i>Haemulon</i> spp.)	Y/R	MSY = 2 500 t Near full exploitation	M/K taken as mean for percoids; assessment rough
Cuba (shelf)	Pargo criollo (<i>Lutjanus analis</i>)	Y/R	MSY = 1 500 t Near full exploitation	M/K taken as mean for percoids
Cuba (shelf)	<i>Scomberomorus</i> spp.	Y/R	MSY = 3 500 t	Nearly all parameter values calculated by analogy
Cuba (shelf)	Clupeids	Primary production	MSY = 9 000 - 13 000 t	Based on empirical relationship between primary production and yields elsewhere
Cuba (slope)	Pargo del alto (<i>Lutjanus vivanus</i>)	MB/2	MSY = 2 000 t	Underexploited
Cuba (shelf)	Rabirrubia (<i>Ocyurus chrysurus</i>)	Y/R	MSY = 1 600 t	Value of M/K taken as mean for percoids
Cuba (shelf)	Cherna criolla (<i>Epinephelus striatus</i>)	Y/R	MSY = 800 t	Value of M/K taken as mean for percoids
Cuba (shelf)	Cubera and caballerote (<i>Lutjanus griseus</i> , <i>L. cyanoptera</i>)	Y/R	Fully exploited or overexploited	Parameters estimated for cubera only and applied to both species
Mexico (Campeche Bank)	Red grouper		MSY = Mexico 11 800 t Cuba 4 600 t	Total biomass 138×10^3 t
Mexico	Spanish mackerel		MSY = 10 000 t	Total biomass 36×10^3 t

APPENDIX 9

National Report: Marine Fisheries in Guyana

INTRODUCTION

Marine fishery activities in Guyana involve the relatively large industrial shrimp fishery operation and the scattered and diverse undertakings of the large artisanal fishery.

THE INDUSTRIAL FISHERY (SHRIMP)

There are at present 164 shrimp trawlers operating in Guyana's waters. These trawlers exploit Penaeus schmitti, P. aztecus subtilis, P. duorarum notialis and P. brasiliensis which are landed and processed by three shrimp processing plants along the Demerara River.

Heavy incidental catches of the sea-bob (Xiphopenaeus kroyeri) occur in some areas and there are indications that the scarlet prawn (Plesiopenaeus edwardsianus) exist in significant concentrations.

Table 1 shows the annual landings in Guyana and the average annual catch per vessel for the four most important species. Commencing from 1977, all catches were made off Guyana in contrast to the earlier years when vessels ranged freely between Guyana and Brazil. More than 50 percent of shrimp tail catches during 1976 to 1978 have been brown shrimp.

It is mandatory in Guyana that each shrimp trawler lands 2 t of fish (shrimp bycatch) per trip. In addition there are two converted shrimp trawlers that trawl for fish. Trawlers accounted for 4 138 000 lb (2 069 t) of fish in 1978. Bagamary (Macrodon ancyclostodon) 39 percent, croaker (Micropogonias furnieri) 22 percent and sea trout 9 percent were the principal species.

Table 1

Landings of Shrimp Tails by Vessels Based in Guyana^{1/}

Year	Shrimp tails (1 000 lbs)	Number of vessels	Average catch (lb/vessel)
1968	9 161	143	64 000
1969	10 469	152	69 000
1970	11 877	175	68 000
1971	11 380	181	63 000
1972	11 576	185	63 000
1973	15 443	214	72 000
1974	12 160	232	52 000
1975	9 241	231	40 000
1976	6 980	215	32 000
1977	8 122	176	46 000
1978	7 445	165	45 000

^{1/} The catch of 13 Cuban vessels is excluded

THE ARTISANAL FISHERY

Four types of vessels using five different types of gear make up this fishery. Vessels are typically flat bottom (dory) shaped to facilitate easy movement over the mud foreshore in moving to and from the ocean.

Vessels less than 30 ft in length total 684 and use longlines, fyke nets and beach seines. Fifty percent of the vessels are powered by sail and the remainder by outboard motor (6 to 9 hp).

There are gillnetters which are 25 to 35 ft in length, equipped with small ice boxes and make three-day fishing trips with inboard engines.

Larger gillnetters 45 to 50 ft with inboard engines and 5 t ice boxes make longer trips. Table 2 gives the estimated artisanal fish production for 1978. The nearshore white belly shrimp (*Palaemon schmitti*) is heavily fished by the artisanal fishermen but data on that species have never been recorded.

Table 2
Artisanal Fish Production, 1978

Class	Number of boats	Average catch per boat per year (lb)	Total ('000 lb)
Vessels less than 30 ft using longlines, fyke nets and beach seines	684	24 000	16 416
25 to 35 ft gillnetters	233	44 000	10 252
Large gillnetters plus 2 snapper handliners	95	84 000	7 980
			34 648

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