CARICOM Fishery Research Document No. 14

LARGE PELAGICS, REEF AND DEEP SLOPE FISHES ASSESSMENT SUBPROJECT SPECIFICATION WORKSHOP

18-26 JANUARY, 1994
BASSETERRE, ST. KITTS/NEVIS

FINAL REPORT

CARICOM Fisheries Resource Assessment and Management Program
Tyrell Street, St. Vincent and the Grenadines
June, 1994

TABLE OF CONTENTS

List of Acronyms

CAC	Consulting and Audit Canada
CANARI	Caribbean Natural Resource Institute
CARISEC	CARICOM Secretariat
CEA	Canadian Executing Agency
CFCL	Canadian Fisheries Consultants Ltd
CFMU	CARICOM Fisheries Management Unit
CFRAMP	CARICOM Fisheries Resource Assessment and Management Program
CFTDI	Caribbean Fisheries Training and Development Institute
CIDA	Canadian International Development Agency
CTAP	Canada Training Awards Project
GCAA	Government Consulting and Audit Agency
ICCAT	International Commission for the Conservation of Atlantic Tuna
ICOD	International Centre for Ocean Development
IMA	Institute of Marine Affairs
LRS	Licensing and Registration Software
MAREMP	Marine Resource Environmental Assessment and Management Program
MTI	Maritime Training Institute
NMFS	National Marine Fisheries Service (U.S.A.)
PRC	Program Review Committee
RAU	Resource Assessment Unit
SCMA	Standing Committee of Minister of Agriculture
SPIM	Subproject Inception Mission
SSW	Subproject Specification Workshop
TC	Technical Committee
TIP	Trip Interview Program (Data collection software package)
UWI	University of the West Indies

ACKNOWLEDGEMENTS

The Workshop on which this final report is based could not have been staged without the assistance of a number of people. We wish to especially thank the Government of St. Kitts/Nevis for hosting the Workshop, and to record our appreciation for the critical logistical support and hospitality of Mr. J. Simmonds and Mr. R. Wilkins of St. Kitts, for the hospitality of the Minister of Agriculture of St. Kitts/Nevis, the Hon. Hugh Heyliger, as well as the support and participation of the Permanent Secretary of the Ministry of Agriculture of St. Kitts, Mr. V. Warner. Much appreciation is also extended to Mr. A. Barrett of Nevis for his considerable hospitality to participants. We also wish to thank the manager and staff of the Fort Thomas Hotel, Basseterre for accomodatory arrangements. CFRAMP especially wishes to express its gratitude to ICLARM fisheries expert Dr. D. Pauly, whose presence at the Workshop greatly contributed to maintaining the technical standards of the proceedings. We thank for their various contributions also, Dr. S. Heileman, IMA, Dr. H. Oxenford and Dr. W. Hunte of MAREMP, Ms. D. Phillip, Mr. G. Alleng, Mrs. S. Auil-Marshalleck, Mr. P. Murray, OECS Fisheries Unit, Mr. M. Rolon and Dr. G. Garcia-Molinari of CFMC. The reviewers of this final report are thanked for comments made on the draft. The vital operational inputs of the SVG RAU support staff, Mrs. Y. Murray, Mrs. D. Sergeant and Mr. D. Gopaul, preparatory to, during, and following the Workshop, are gratefully acknowledged. We also wish to express our appreciation for significant contributions to various aspects of preliminary preparation for the Workshop, by former Canadian Chief Scientist, Dr. Robin Mahon. Special thanks are due to Mrs. D. Sergeant (SVG-RAU) who collated the final draft of this report.

CHAPTER 1

1.0 EXECUTIVE SUMMARY

1.1 Introduction

The Large Pelagic, Reef and Deep Slope Fishes Assessment Subprojects Specification Workshop was held in St. Kitts/Nevis from 18-26th January, 1994. At this Workshop, proposals for assessment activities, consultants' reports, and background papers, were presented to the participating countries. The following is a brief account of the proposals presented at the Workshop. The recommendations of Workshop participants are also summarised for each proposed activity.

Participation in ICCAT

The International Commission for Conservation of Atlantic Tunas (ICCAT) coordinates assessment and management of several large pelagic stocks which occur in CARICOM waters. ICCAT also maintains a comprehensive database on Atlantic fishery statistics for these stocks. Through participation in ICCAT, CFRAMP participating countries would obtain regularly updated information on the status of several large pelagic stocks and would have ready access to the ICCAT database which would provide details on foreign fleet activities in the Caribbean area.

CFRAMP proposed participation in ICCAT for a trial period. Specifically, it was proposed that CFRAMP participate in the annual ICCAT Working Group Sessions and the annual meeting of ICCAT's Standing Committee on Research and Statistics (SCRS) which take place in Madrid during the last week of October and the first week of November respectively each year. In addition, CFRAMP indicated that there would be a need to participate in one other inter-sessional scientific meeting, if considered to be relevant and useful to large pelagic resource assessment in the region.

This activity was **approved** by the Workshop without modification.

This activity began in FY 1992/93 and will end in FY 1998/99. The budget for this work is $70,330 CDN.

Migration Patterns of Small Tuna and Tuna-Like Species in Caribbean Waters

The objective of this study is to determine the limits of stock distribution, stock structure and migration patterns of several commercially exploited stocks of small tuna and tuna-like species. This is usually best achieved through tagging experiments. CFRAMP proposed a tagging study of the four commercially important stocks of dolphinfish (*Coryphaena hippurus*), wahoo (*Acanthocybium solandri*), king mackerel (*Scomberomorus cavalla*) and blackfin tuna (*Thunnus atlanticus*). Two options for tag and release activities were recommended: (1) artisanal boat hire and (2) recreational tagging tournaments.

Due to budget constraints, tag and release activities were proposed for only three CARICOM EEZs in the eastern Caribbean. CFRAMP noted that option 2 could be implemented only if sponsors could be obtained. On the other hand, concern was raised regarding the unpredictability of catch

rates under option 1, and this would have to be reviewed prior to implementation of this option. The workshop discussed the choice of tag and release locations, as well as the need to incorporate information from previous relevant studies in developing null hypotheses. Generally, selected tag and release locations noted in the proposal were accepted as appropriate.

This activity was **approved** by the Workshop with the following modification: under option 1, Guyana is to be selected as the southernmost Exclusive Economic Zone (EEZ), instead of Trinidad and Tobago.

This activity is scheduled to begin during FY 1995/96 and to end during FY 1997/98. The budgets for implementation of options 1 and 2 are $48,060 CDN and $117,785 CDN respectively.

Determination of Migration Patterns and Stock Structure of the Atlantic Billfishes and Large Tunas

The objective of this study is to collaborate with staff of the ICCAT Billfish Tagging Program to obtain more information on stock structure and the migration patterns of the large tunas and billfishes in the Caribbean. This information is usually derived from tagging experiments.

To date, the ICCAT Billfish Tagging Program has requested the use of the Fisheries Division vessels of Grenada and St. Vincent and the Grenadines for tagging activities. CFRAMP proposed to fund up to five tagging trips per year, with at least an equal number of trips to be funded by the ICCAT Billfish Tagging Program.

This activity was **approved** by the Workshop without modification.

This activity is scheduled to begin in FY 1994/95 and to end in FY 1996/97. The budget for this work is $7,950 CDN.

Proposal on Habitat Mapping

This proposal arose from discussions resulting from the working paper on potential yields of reef and deep slope fishes (SSW/WP/17). The result of these discussions was an agreement that it was important to have accurate estimates of what the productive areas for coral reef fish were, through habitat mapping. It was suggested that CFRAMP utilize GIS (Geographic Information Software) for this purpose. As a result of the agreed importance of this matter, a sub-committee met during the Workshop to discuss details and suggested the following. Firstly, that all types of substrates needed to be mapped in the EEZ covering the shelf and bank areas. This would be done by contour ranges from 0-50m, 50-100m and 100-200m. Soft and hard bottoms would also be mapped.

The output or product would be for the short term, the area of productive substrate in square km and for the long term, maps. The output could take the form of spreadsheets with country-specific information on productive substrate areas obtained through networking and through

interaction with the IUCN (International Union for The Conservation of Nature) GIS-based 10-year project to create descriptions of all coralline areas of the world.

Associated with this work is a related proposal for further work on the mapping of areas affected by ciguatera (see following section).

This proposal was **approved** by the Workshop. Although there was no original budget brought to the Workshop, savings from other proposals which were not approved (for example, studies of hermaphroditic fishes) could provide the estimated $20,000 CDN required for this purpose.

Expansion of Study to Map Areas Affected By Ciguatera

During the Workshop, CFRAMP presented the results of a pilot study which investigated the occurrence of ciguatera in Montserrat and Nevis.

These and other countries affected by ciguatera expressed a desire to have more work done on ciguatera. Participants proposed that work on mapping of ciguatoxic areas be extended to all countries affected, and be conducted in conjunction with recommended work on habitat mapping. It was accepted that the information could be mostly derived from interviews with local fishers.

The Workshop **approved** this activity should there be available funds.

Reef Fish Natural Mortality and Dispersal

The objectives of this activity are to provide estimates of natural mortality (input required for stock assessment purposes) and to provide estimates of dispersal of adult fish from a central protected site. The latter objective was considered important, given the view that marine reserves can act as "reservoirs" of adult fish which can enhance fisheries immediately adjacent to the reserve. The site of the activity was proposed to be the Bellairs Institute in Barbados. That location was viewed as desirable, given its small boat facilities, links with UWI, and proximity to protected reefs. The field work and related analyses would be undertaken as a part of the requirements for an M.Phil. degree, with co-supervision by a CFRAMP staff member.

The technical approach to the work was considered sound by Workshop participants. The site for this activity, however, was questioned, with some supporting the idea that the work should be done at the Hol Chan Marine Reserve in Belize, where many of the same amenities are available to researchers and fish densities are thought to be higher. Others supported the reef area off Bellairs, Barbados as set out in the proposal. Generally the better site would be Bellairs with its proximity to the RAU, and to suitable scientific expertise. As a result of discussion from the floor, the priorities of the work were reversed, with the dispersal component receiving higher priority than the investigation of natural mortality. That change in emphasis does not affect the workplan, however.

This activity was **approved** by the Workshop. The budget for the work is $24,574 CDN, and the work is to occur in FY 1995/96. It is assumed that the graduate student undertaking the field program would receive a CFRAMP fellowship.

Hook Selectivity for Deep Slope Fish

The objective of this activity is to describe how samples from the commercial hook and line fisheries reflect the size composition of the population at large. The investigation is to occur in the Windwards (probably the Grenadines of St. Vincent) in the first year of operation (FY 1994/95) and focus on the Leewards in the second year of the operation.

CFRAMP staff showed Workshop participants results of a similar study in the Pacific, noting that the results were somewhat inconclusive. The consensus from participants was agreement that the field investigation carried a risk of failure, but improved experimental design might minimize such risks.

Participants noted, however, that many of the outputs foreseen from this activity may be forthcoming from the modified proposals for biological data collection in Jamaica (see below), or from recently developed approaches for comparison of commercial catch rates obtained from different gear. Thus, the field component of this activity was **deferred** by the Workshop, pending the results of the other investigations.

The budget for this activity was $31,580 CDN.

Biological Data Collection in Participating Countries

This is the largest and most broad-ranging activity planned by the RAU. The intent of the work is to collect sufficient data on commercially valuable fish populations throughout the region to permit stock assessments on key species identified at the Workshop. The duration of the period of data collection is two years, starting in FY 1994/95. The method through which the data are to be collected is by the establishment of a network of biological data collectors in participating countries.

In general, the proposals for biological data collection originated from CFRAMP. However, Trinidad and Tobago submitted their own proposal which integrated the CFRAMP initiatives into that country's already-impressive capabilities for biological data collection. There were, however, some outstanding questions regarding that proposal which would need to be addressed during bilateral discussions between CFRAMP and Trinidad and Tobago. The Jamaica initiatives planned by the Program were extensively revised during the Workshop. The technical merits of all proposals were judged adequate by the participants.

CFRAMP maintained a flexible position in meeting country-specific requirements for data collection, including requests for additional resources and changes in species for which data were to be collected. The Program reserved the right, however, to review the individual country's request

for resources to ensure that the regional perspective of the Program is maintained.

The Biological Data Collection activity was **approved** by the Workshop. The budget for the activity is $648,494

Regional Age and Growth Laboratory

The objective of this activity is to provide age and growth information on commercially significant fish species in the region, a necessary input to stock assessments. Thus, this activity is closely linked to Biological Data Collection described previously. The general approach suggested was to augment existing capability to conduct age and growth studies using the resources of the Institute of Marine Affairs, Trinidad and Tobago. The lifespan of the lab under CFRAMP funding was for three years, and was seen fulfilling the needs of not only this Subproject, but also the Coastal Pelagics and Flyingfish Subprojects, as well as the Shrimp and Groundfish RAU, should those activities identify a need for age and growth studies.

The Workshop viewed the proposal as being technically sound, and endorsed the concept of a regional laboratory providing this capability for participating countries. However, the fate of the lab once CFRAMP funding ended was raised as a concern, since participating countries anticipated a need for such work even after CFRAMP funding was complete.

This activity was **approved** by the Workshop. The budget is $102,742.00 CDN.

Histological Studies of Hermaphroditic Species

As part of the plan for Biological Data Collection in participating countries, data collectors are to make visual assessments of both the sex and stage of maturity of fish. Such data are necessary to assess whether the exploited population contains an unacceptably high proportion of immature fish. A further activity was proposed to deal with those species which could not be assessed in the field. The activity entailed the collection of gonads, with subsequent histological examination in the laboratory. The emphasis was on four species of hermaphroditic or suspected hermaphroditic fish. The Institute of Marine Affairs was suggested as the centre for the histological studies.

The laboratory component of this study was **not approved** by the Workshop. The main objection was the cost of obtaining such data for four species of fish only. In addition, the species identified in the proposal were not always viewed as being of high commercial importance. It was noted that much of the required information on maturity would be obtained in the field rather than in the laboratory.

The budget for this activity was $62,208.00 CDN.

CHAPTER 2

2.0 PREFACE

During 18th-26th January, 1994 the Large Pelagics, Reef and Deep Slope Fishes Assessment Subproject Specification Workshop, organized by the Pelagic and Reef Fishes Resource Assessment Unit (RAU) was held at the Fort Thomas Hotel in Basseterre, St. Kitts/Nevis. It was one of the milestone events of the CFRAMP timetable and was a necessary step in the development of resource assessment plans for participating countries. The Workshop was hosted by the Government of St. Kitts/Nevis. The opening ceremony, attended by a wide range of invitees, took place on Tuesday, 18th January, and was chaired by Mr. Joseph Simmonds, Senior Fisheries Officer (see also Appendix 5). All twelve CFRAMP participating countries were represented at the Workshop. In addition there were some specially invited observer countries and organizations (see Appendix 1). Representatives from the following countries and organizations were in attendance at the opening:

Antigua/Barbuda
Barbados
Belize
British Virgin Islands
Grenada
Guyana
Jamaica
Montserrat
St. Kitts
Nevis
St. Lucia
St. Vincent & the Grenadines
Trinidad & Tobago
ICLARM, Philippines
Caribbean Fisheries Management Council, (CFMC), Puerto Rico
OECS Fisheries Unit
UWI, MAREMP, Barbados
IMA, Trinidad & Tobago

It should be mentioned that the French Overseas Departments of Martinique and Guadeloupe, as well as Haiti, were invited but were unable to attend. Also unable to attend was the representative from the Bahamas.

This report documents Workshop activities, opening ceremony presentations, as well as Country and Working Group Reports. Also, the results of the discussions which resulted from the presentation of the technical papers are incorporated into the summaries or précis of each paper. It should be noted that the précis of the technical papers provided, contain a summary of each paper as well as the essence of the discussions on each paper, and necessarily do not include the full text of these papers. A number of the proposals were circulated several months prior to the Workshop in order that participating countries could have an opportunity to review these particular documents in advance of the Workshop. (For a complete listing of all Workshop Documents, see Appendix 3). Attendees were supplied on arrival with copies of those working documents that were not previously circulated.

CHAPTER 3

3.0 THE LARGE PELAGIC, REEF AND DEEP SLOPE FISHES ASSESSMENT WORKSHOP

In order to properly understand the reasons for staging the Workshop, it is necessary to review the objectives of CFRAMP. Briefly, these include the promotion of the management and conservation of fishery resources in the CARICOM region to permit their exploitation on a sustainable basis. The overall objective is to enhance the basic institutional capacity and information base and to manage and develop fisheries in CFRAMP participating countries .

During the CFRAMP Initiation Mission it was noted that there were several major constraints to fishery management and development. These were as follows. There was little information on:

1. stock structure
2. migratory movements
3. the extent of sharing of stocks
4. estimates of potential yields for resources
5. state of exploitation of stocks.

These major deficiencies had therefore to do with assessment-related information on the basic fishery parameters concerning the fishable stocks. In other words, the primary need was for more and detailed information on the status of fish stocks occurring in the waters of participating countries. (This was needed in order for the countries to propose development or management strategies for those resources). One of the consequences of these deficiencies in knowledge concerning the status of the resource, is poor management, leading to possible overexploitation with increased demand and consequent degradation of the resource. All this pointed out the need for proper assessments of the region's fish stocks. The major point to be grasped among these several ones, is that more information was needed on the scalefish resources in order for them to be assessed and managed on a sustainable basis.

The Pelagic and Reef Fishes RAU is responsible for a number of important fishery resources. These include:

1. the large pelagics
2. reef fishes
3. deep slope fishes (snapper/grouper complex)- for convenience these are grouped with reef fishes
4. coastal pelagics (smaller pelagics)
5. flyingfish

Assessment activities for large pelagics, reef fishes and deep slope fishes will commence formally during the 1994/95 fiscal year while assessment activities for coastal pelagics and flyingfish will be initiated after fiscal year 1995/96.

These are the most important fishery resources for many CARICOM countries. Given the shortage of information on these fishes on which to base management decisions, the RAU designed proposals for their assessment, in consultations with participating countries, sub-regional and regional institutions.

Some of these proposals were circulated to participating countries some months before the Workshop. The next stage was for all the proposals to be taken before the countries in a joint Workshop for review and approval. The specifics of the assessment activities once decided on at the Workshop, would form the basis of implementation in the various countries. Fine tuning of the activities would take place as they progress.

In the original CFRAMP management plan there was to have been separate assessment activities for each category of resources: large pelagics, reef and deep slope fishes. Further, there was to have been separate Subproject Specification Workshops for each resource. At each of these, there was to have been descriptions, explanations and discussions of the activities planned by CFRAMP. It became most appropriate to combine the SSWs planned for the three categories of assessment activities. The main reasons for this was because (a) various refinements in the approaches to the Assessment Subprojects indicated that it would be more appropriate to consider all three categories at once and (b) staffing limitations at the Fisheries Divisions meant that the same staff members would attend all three Workshops.

Given the cooperative efforts to design, develop and harmonize detailed proposals for national sampling and data collection programs involving length-frequency and other biological data the Workshop would:

1. review the recent developments in fisheries assessments in each participating country since the original Initiation Mission;

2. review with countries the theoretical background or conceptual framework behind the Assessment Subproject activities for the large pelagic, reef and deep slope fishes;

3. review the preliminary estimates of potential yield for the various categories of resources;

4. review and discuss the details of the various proposals for the assessment of large pelagic, reef and deep slope fishes;

5. discuss up-to-date information on fishery assessment techniques;

6. review and discuss the results of consultants' reports and special studies on subjects related to fishery assessment in the CARICOM region;

7. review and discuss the budgetary provisions for the Assessment Subprojects; and

8. decide on the most appropriate scale and sequence of implementation of assessment activities for the participating countries, given budgetary and personnel constraints.

The sequence of activities that took place during the Workshop is recorded in Appendix 2.

Regarding plans for follow-up activities after the Workshop, it was stated that the plan was for the proceedings to be published as a CARICOM fisheries document and for this to be circulated to participating countries. Also, it was intended that CFRAMP staff would visit the countries after the Workshop to refine the proposals and assist countries to initiate their implementation.

CHAPTER 4

4.0 PRÉCIS OF TECHNICAL PAPERS

This section is intended to provide summaries of the technical papers presented at the Workshop and which were reviewed and discussed with participants. Incorporated into the précis of each paper are the significant comments from discussions which were noted by the rapporteur for each session. Each précis is intended to provide a summary of the agreements arrived at by participants. The full text of all Workshop documents was provided to all participants.

The papers for which précis are supplied are:

1. selected overview paper (SSW/WP/03)

2. background papers and reports (SSW/WP/16 -25)

3. research proposals (SSW/WP/26-35)

4. methodological papers (SSW/WP/36-39).

Also presented is the summary of a paper presented at the Workshop by specially invited fisheries expert Dr. Daniel Pauly of ICLARM, Philippines. This paper was presented at the start of the Workshop as it provided a suitable introductory environment for participants and set the stage for later presentations and discussions.

4.1 SELECTED OVERVIEW PAPER

4.1.1 Resource Assessment and Fishery Advisory Outputs (SSW/WP/03)

The overall goal of CFRAMP is to promote the management and conservation of fisheries resources in CARICOM Member States in order to permit their exploitation on a sustainable basis. In this regard, the various limiting factors which affect the attainment of the goals need to be addressed. The limitations were identified in the paper as being information on the stock migration, stock structure, potential yield and also non-biological factors such as inadequately developed institutional capability. Data were presented which implied that there were substantial differences between current and recent yields and potential yields from the reef and slope fishes from CARICOM countries, which were related to overexploitation and in a few cases underexploitation. The value of the difference was noted as being quite substantial. Perhaps the major point was that this indicated the urgent need for proper management advice.

The paper showed how the assessment activities of the Pelagic and Reef Fishes RAU were related to the generation of resource management advice. There was said to be three modes of operation of the RAU which essentially were (a) implementation of specific fishery assessment activities collaborating with national fisheries departments, (b) promotion and facilitation of fishery assessment activities at the national level and (c) liaison with institutions and projects inside and external to CARICOM doing similar work in order to facilitate technology transfer. The steps

leading up to the generation of useful fisheries management advice were described and these were (a) data collection, (b) data analyses (c) production of outputs and advice. These were followed by another step which was the execution of management action. CFRAMP proposes to collect a great variety of different types of data including catch, effort, length, age and maturity. These data could be analysed by a variety of fisheries assessment and analytical models such as yield per recruit, production models and catch curve analysis. These analyses will provide information on trends in mean size of individuals, sustainable yield, optimal harvesting rate and abundance, on which fisheries management advice could be based.

A major point was that the core activity of all the assessment activities is the collection of fisheries data in participating countries. Stock status as well as current and optimal harvesting levels are to be assessed by the collection of length data in particular. The activities proposed for the various resource groups, and how these related to the production of management advice were set out. For the large pelagics collaboration with and participation in ICCAT was proposed as well as length-based approaches. For reef fishes a study of the natural mortality and dispersal is planned as knowledge of these parameters are vital in order to generate some of the assessment models that are used for their management. For deep slope fishes, the selectivity study of hook and line gear would assist in assessing how commercial fishery samples reflect the size composition of the population. The RAU was described as being involved in a number of other activities which are of relevance to assessment and fisheries management including collaborative work on such areas as spawning aggregations, mesh size as a management tool, mapping of ciguatoxic areas in Montserrat and Nevis, reviewing the importance of coastal areas as fish nurseries, the St. Lucia wahoo fishery and the Antigua reef fishery.

In conclusion, it was pointed out that data from landings were but one part of the larger fisheries management perspective. For there to be produced acceptable and comprehensive outputs which captures the complexity of the fishery, such landings information must be combined with economic and social information. The CFRAMP philosophy on fisheries management being developed, suggests that a central process to generating fisheries management information is the analysis of biological data, along with advice from other sectors of the industry as to what is best for the fisheries. These assessment activities would provide the raw data the analyses of which would guide the formulation of appropriate management actions for implementation by CARICOM countries.

4.2 BACKGROUND PAPERS AND CONSULTANT REPORTS

4.2.1 Conceptual Framework for Assessment of Reef and Deep Slope Fisheries (SSW/WP/16)

The reef and deep slope fishes (along with the pelagics) constitute the major scalefish resources of CARICOM countries and contribute to the relative diversity of their fisheries. The paper reviewed the types of assessment models that could be used by CFRAMP in its examination of reef and deep slope (snapper/grouper) fishery resources. It also examined the theoretical background for the assessment activities planned by CFRAMP for reef and slope fishes.

Fisheries assessment techniques and models all depend on data from the fisheries, and thus, the core of assessment activities by CFRAMP will be collection of fishery data in participating countries through the Biological Data Collection proposal. Various other types of related data will also be available from the Data and Information Systems Subproject. The paper reviewed the types of data available from all sources which could be used for assessment purposes. It was shown that the fitting of data to assessment models and the interpretation of the assessment results, was the second of four broad steps in the overall process of fish stock assessment, the others being first, data collection, thirdly, selection of management procedures from a suite of alternatives and fourthly, the implementing of the chosen management measures.

The two main assessment model classes, holistic and analytical or dynamic pool models were examined giving details of examples of models from both categories. One model from the holistic class presented was the surplus production model (SPM) which uses simple catch and effort data as input and finds the relationship of stock size to fishing mortality rate. An important and relevant variation of the SPM examined was the spatial model of Munro & Thompson which uses catch and effort data for assessment of stock status, but which data are gathered in one year in different fishing grounds of a country, which have discrete stocks. This model was thought to have some potential for use in the CARICOM countries with reef fishes. Other models reviewed included the yield per recruit model from the analytical class, which considers the fate of a cohort or year class once it is recruited to the fishery. Estimates of the yield from the given class can then be calculated based on knowledge of growth rates, gear selection and mortality. The spawning stock biomass per recruit (SSPBR) model was examined and was shown to be able to evaluate the effects of varying the fishing mortality and age at first capture on the spawning potential of the stock. This model was described as being of considerable use to CFRAMP as it was capable of providing information on recruitment overfishing to the fisheries manager.

Other types of assessment analyses mentioned included determination of size and age at maturity, which is important with regard to status of the fishery as it applied to recruitment overfishing and hence to the sustainability of the stock and of fishing on that stock. Also mentioned were length-based analyses of mortality or length-converted catch curve analyses, which could provide information on the mortality rates of a fish stock. This was shown to be a standard method of estimating fishing mortality rate. Age-based assessment analyses based on the use of otoliths and other hard parts were said to be of considerable value in corroborating the parameter estimates from length-based methods. It should be noted these age-based methods were not examined in detail as the collection of hard parts and the uses to which they may be put were themselves the subject of other technical presentations in the workshop (SSW/WP/34, and SSW/WP/38).

The review concluded by noting that, given the limitations of data collection systems in CARICOM countries, that all relevant assessment models such as those examined, be utilized and the results compared. CFRAMP was said to be choosing length-based analyses with supporting ageing information for its assessment activities. It was therefore suggested that as data collection systems improved and expanded their capability, that the more complex and demanding models be considered for use by CFRAMP to monitor, assess as well as to verify deductions made using the simpler assessment models.

In the discussion it was pointed out that in assessment by length-based methods, especially for larger, long-lived species, the estimation of mortality and the use of surplus production models, depended on equilibrium in the population structure. This equilibrium could take 5 or even more years to be established. The importance of the assumption of constant recruitment and the sensitivity of length-converted catch curves to violations of this especially with respect to short-lived species, was noted. The importance of distinguishing between shared and independent stocks needed to be taken into account. Finally, the point was made that given the expected high contrast in the effort levels in the Lesser Antilles, it might be most appropriate to use the countries as individual data points in a single surplus production model.

4.2.2 Potential Yield Estimates for Reef Fisheries: A Review of Approaches and their Limitations with Reference to the Caribbean (SSW/WP/17)

This background paper reviewed the various approaches for the estimation of fish yield, using examples from tropical reef fisheries, with special reference to the Caribbean region. An interpretation of the potential yield of reef fish communities in the Caribbean, along with some measures of uncertainty was presented. It was important to recognise such variability, as there is often a tendency to give a single figure for potential yield, with no indication of the imprecision that applies to those values. For selected Caribbean countries, plots of actual landings in relation to potential fish yield were provided illustrating how fisheries could be better managed to produce optimum yield.

The apparently large difference in potential yield between the Caribbean and Pacific was considered largely artefactual, and probably related to the size of the study area. Based on the review, a range (1.7 -2.3 t/km^2/yr) of potential yields possible from reef fisheries on coralline shelves of the Caribbean was suggested. Recent landings of reef fisheries within the region were typically considerably less than the potential yield, indicating that with proper management, a significant increase in landings could be realised.

This background paper generated considerable discussion. It was noted that the generation of maximum yield might not be a desirable goal, depending on countries' objectives. For example, large, visible predators are an important part of the tourist attraction of many reefs, but would likely be removed on a reef that is approaching its potential maximum yield. Anthropogenic impacts on reefs were also discussed, with the conclusion that they have serious impacts on the potential fish production.

Participants agreed that the wide gap between actual and potential landings probably presented a lack of knowledge of the extent of true reef habitat within the EEZs of the countries. They concluded that to provide a better picture of potential yield, it would be necessary to map the extent of reef habitat on a quantitative basis. Participants concluded that such work was of high priority, and a working group was formed with the mandate to review the needs for spatial information in the context of resource assessment. The working group was to consider means of refining measurements of reef area, and habitat and resource mapping. The main conclusions of the working group are noted below:

Data Requirements:

a. Exclusive Economic Zone (EEZ) Area (known for most participating countries)

b. Shelf and Bank Area
by isobaths, 0.50 m, 51-100 m and 101-200 m (in 10 m intervals)

extent of soft bottom
- mud and silt
- sand
- sea grass beds

extent of hard bottom
- live coral
- other
- degraded coral
- volcanic rock

The working group agreed that the above data would be required as area in km^2 immediately, with a view to producing, over the longer term, habitat maps. The information should be acquired by collation of existing information (ie. use of published and unpublished British Admiralty data), leading to the production of country-specific spreadsheets of habitat data. The working group noted that there would be a need for the people conducting the proposed work to liaise with other organisations whose activities may complement the initiative. For example, it was noted that a IUCN GIS-based project of 10 years' duration had recently been initiated, with the intent to describe all coralline areas throughout the world. Clearly, the CFRAMP initiative would benefit from linkages with such projects. Finally, it was noted that some countries had expressed an interest in a follow up study to the ciguatera pilot study the results of which were reported in poster form at the Workshop. The proposed habitat mapping study could include a component addressing that need, once the requirement was better defined.

4.2.3 An Overview of CFRAMP Approaches to Assessment of Large Pelagic Fish Stocks (SSW/WP/18)

Assessment analyses provide important information on stocks and their potential for rational exploitation. In principle, stocks of large pelagic fishes could be assessed using standard methods such as yield-per-recruit and surplus production analyses. However, the analyses must take into account the wide geographic distribution and migratory habits of these species. These characteristics also have important implications for management since the resource may be shared among country marine areas in various ways. Special approaches to assessment would therefore be needed.

CFRAMP participating countries would need to collaborate to gather the necessary biological information for accurate assessment of the stocks of large pelagic stocks. In addition, the biological and assessment data would help countries determine the nature of collaboration required to achieve coordinated international management of these shared stocks.

The International Commission for the Conservation of Atlantic Tunas (ICCAT) is responsible for coordinating research, assessment and management of the Atlantic tuna and tuna-like species. Since many of these species occur in CARICOM EEZs and are commercially important, CFRAMP proposed to participate in selected ICCAT activities. By this means, CFRAMP would cover the assessment of several large tuna and billfish species. CFRAMP's Data and Information Systems and Licensing and Registration Systems Subprojects would yield national catch and effort data for monitoring health of local fisheries, given all available information on stocks. In addition, after catch and effort data have been collected for at least eight years, these data could be incorporated into ICCAT surplus production analyses. Examination of national size frequency and other biological data would help to determine whether fish availability and movements within CARICOM EELS are random, related to seasonal changes, associated with the growth and development of the fish, or are influenced by other factors.

For large pelagic species not currently completely assessed by ICCAT such as the small tunas, CFRAMP would need to establish its own database of regional fishery statistics and biological data. CFRAMP proposed to collect catch and effort data, as well as data on size, age and maturity for the most commercially important species. In addition, CFRAMP would begin to investigate migration patterns of these species to enable coordination of assessment analyses and regional stock management. Using these data, CFRAMP would apply length-based methods of assessment.

Regarding this background paper, comments and queries raised were directed at specific activities planned by CFRAMP. These comments and queries, together with RAU responses, have therefore been incorporated under those sections dealing with proposals for specific pelagic activities (see section 4.3).

4.2.4 Potential Yield of Large Tuna and Billfish resources in CARICOM Marine Areas: A Preliminary Estimation (SSW/WP/19)

Using available ICCAT estimates of Maximum Sustainable Yield (MSY) or approximations of these, preliminary estimates of the potential yields of large tuna and billfish resources within CARICOM marine areas were obtained. The estimation procedure assumed uniform distribution of each stock, and was based on the ratio of country marine area to total stock distribution area. The theoretical estimates were then compared to actual country yields to assess the status of local pelagic fisheries. Results were also compared to similar estimates reported by Marcille (1985). In addition, the effects of environmental factors on tuna and billfish abundance were reviewed to try to determine how the 'true' estimates of yield might differ from the theoretical estimates.

In general, the data imply that environmental conditions in southern Caribbean areas are more favourable for concentrating tunas and billfishes than those present in northern areas. In particular, the existence of the Venezuela-Guyana continental shelf, as well as annual upwelling and significant river discharges off the north and northeast coasts of South America, could lead to the formation of fronts which would tend to increase tuna and billfish yields in the southern Caribbean. In addition, in southern areas, depth of thermocline and oxycline would tend to limit the vertical range available to certain species, making them more accessible to surface gear. These conclusions are further supported by the fact that current yields in southern CARICOM EEZs are higher than the theoretical estimates. Similarly, the current low yields obtained in northern CARICOM EEZs may be due to the lack of favourable conditions for tuna aggregation in this part of the Caribbean. Evidence for the effects of islands, current systems, species composition of the secondary biota and bottom topography, on tuna and billfish abundance were also discussed.

Participants supported the theoretical approach applied for potential yield estimation. It was noted that the initial approximations of area and assumption of homogeneity could be refined by including more detailed data on the environmental and biological processes as such information becomes available. It was also noted that additional environmental data have recently been published and that copies of the relevant publications would be sent to CFRAMP. CFRAMP was informed of the availability of additional environmental data on sediment discharge from the Amazon and Orinoco rivers, which could be sent to the Program.

It was pointed out that differences in gears used in each country may account for the observed differences in EEZ yields rather than resource availability. CFRAMP shared this opinion, and further noted that it is possible that in northern areas, the fish may be present at comparatively greater water depths.

The authors will proceed to incorporate any available new data and pursue publication of the material in the primary literature.

4.2.5 Size Selection of Fish by the Mesh of Fish Traps (SSW/WP/20)

Mesh size is an important factor determining catch rates and the size at which fish are recruited to fish traps. Mesh size also appears to affect the species composition in fish traps, probably through size selectivity. As a consequence of size selectivity, an increase in mesh size in areas of high fishing mortality typically results in a substantial short-term reduction in catch per trap. several other factors also affect catch rates, and the fish size and species composition in traps. These include soak time, trap design, trap size, and species body shape.

Given the variety of growth rates of reef fish commonly taken in fish traps in the Caribbean, no single mesh size would optimize the yield from the entire range of exploited species. Similarly, given the variety of maturity schedules of reef fish, a mesh size which protects the larger species from recruitment overfishing may catch few fish of the smaller species. Conversely, a mesh size which protects the smaller species from recruitment overfishing may result in severe overexploitation of larger species. Managers should therefore first determine the type of fishery catch which they

consider to be appropriate. If large numbers of small fish are required for local consumption, minimum mesh size may be set smaller than if large high-quality fish are required for export, or than if conservation of biodiversity for tourism is a management goal. It is recommended that, where national fishery management plans do not already do so, they should explicitly state the goals of management of trap fisheries for reef fish, and should include a statement of the trade-offs which can be expected from pursuing the stated goal.

Based on studies to date, it appears that mesh sizes currently in use in most Caribbean countries are too small, and that a minimum mesh size of about 1.5"-2" would be required to optimize yields for local consumption. Comparative fishing experiments indicate that an increase in minimum mesh size would result in significant short-term losses to fishers. However, no studies have examined the time which would be required for catches to return to the levels prevailing before the mesh size increase, nor the time which it would subsequently take for fishers to recover the losses incurred during the transition period. The report recommended that such an analysis be carried out for an hypothetical assemblage of 10-15 reef fish species using available information on growth, mortality and selectivity, to provide managers with an estimate of the impacts which mesh size regulation could have on fishers. Preliminary data suggest that the fishing power of traps decreases with increased mesh size. This could reduce the theoretical long-term benefits expected from a mesh size increase. Fishing power information should be incorporated into the analysis of catch rate recovery time recommended above. The report recommended that a field study be carried out in an area with moderately exploited fish stocks to determine the relative fishing power of identical traps with different mesh sizes.

4.2.6 The Role of Information on Maturity and Fecundity in the Provision of Management Advice (SSW/WP/21)

The report outlined the need for the incorporation of reproductive studies into CFRAMP stock assessment activities. It noted that one of the possible objectives of fisheries management is to prevent overfishing. Two possible types of overfishing are usually recognized: growth and recruitment overfishing. Growth overfishing occurs when fish are caught before they have completed their rapid early growth thereby losing yield. Recruitment overfishing, which is the more critical type of overfishing, refer to the situation in which there are not enough mature fish left to replenish the stock which then declines resulting in a collapse of the fishery. Based on the average size of fish in some populations, it is suspected that both growth and recruitment overfishing are occurring. Information on reproduction could guide fisheries management decisions to prevent overfishing either directly or through their use as input parameters in stock assessment models. Some stock assessment models, such as Egg Per Recruit (EPR) and Spawning Stock Biomass Per Recruit (SSBPR) models, have been developed which incorporate more detailed information on reproduction such as weight-specific fecundity, weight/length-at-maturity, size-specific sex ratios, and (for hermaphroditic species) size and age at sexual transition.

4.2.7 Size-at-maturity

Size-at-maturity, usually the size at which 50% of the population is sexually mature (L_{m50}), would be obtained from data on the percentage of mature fish in each length class. L_{m50} can be used to help prevent recruitment overfishing by setting minimum fish size limitations based on its value.

The effects of minimum fish size limitations on yield and spawning potential could be predicted by converting L_{m50} to T_{m50} (age-at-maturity) and using $T_{m50} = T_c$ (where T_c is the age-at-first-capture or the age at which 50% of the fish are retained by the gear) in Yield Per Recruit (YPR) and SSBPR analyses respectively.

Spawning seasons could be identified from monthly data on gonad maturity and the location of the spawning grounds could be identified from the geographic sources of the samples. Knowledge of the peak spawning season could be used in management either to optimize catches, if through some aspect of their reproductive behaviour the fish are easier to catch at this time, or to protect the fish if they are vulnerable to overexploitation at this time. It was noted that information on spawning seasons would also be useful in assigning birthdates in age determination. Information on age and growth is used in all stock assessment models with the exception of surplus production models which use data on catch and effort. The paper also reviewed the value of data on fecundity, sex ratio and spawning potential in determining recruitment overfishing.

4.2.8 The Role of Drifting Objects in Pelagic Fisheries in the Southeastern Caribbean (SSW/WP/22)

The role of naturally-occurring drifting objects in fisheries for pelagic species in the southeastern Caribbean was investigated by conducting a questionnaire survey of two hundred and fifty-three fishers, fifty from each of St. Lucia, Barbados, Grenada, Tobago and fifty-three from St. Vincent. The study shows that drifting objects play an important role in large pelagic fisheries in the southeastern Caribbean by attracting fish and thereby increasing their catchability. This effect is seasonal, being greatest between January and March in all islands, but having a more extended seasonal duration in Grenada and Tobago. The effect is most marked in water which is green or brown in colour. Fish associate with both natural and anthropogenic drifting objects, with no apparent preference within or between these groups. Fishers actively seek and fish around drifting objects. Fishers from St. Lucia, Barbados, Grenada and Tobago target flyingfish by deploying drifting FADs which they construct of naturally-occurring material. However, none of the fisheries deployed or used drifting FADs to target large pelagics.

The information acquired in this study implied that the deployment of anchored FADs succeeded in increasing catch rates of large pelagics, and also implied that the potential might exist for developing fisheries for large pelagics by deploying drifting FADs.

The workshop generally discussed the importance of documenting traditional knowledge of fisheries. In particular, participants noted that fishers usually possessed a great deal of valuable knowledge on the seasonality of fisheries, fish movement patterns and some biological information.

4.2.9 Review of the Role of Coastal Habitats as Nursery Areas for Coral Reef Fishes (SSW/WP/23)

The report noted that the function of mangrove systems and associated seagrass as nursery for commercially important fish species still remains unclear and even though these systems have been implicated as nurseries, this phenomenon has not been well studied in either the Caribbean or the Indo-Pacific. There is ample circumstantial evidence which suggests that some of the function and attributes of these coastal systems such as their high productivity and structural complexity are conducive to a nursery function. Certainly for invertebrates such as penaeid shrimp, the dependence of juvenile stages on mangrove and seagrass systems has been adequately proven. But this dependence or obligatory residency of invertebrates cannot be extrapolated to coral reef fish.

There is a lack of quantitative data to adequately substantiate the generalizations that have been made concerning this function for these areas. It is apparent from the literature that the nursery function may be site specific, dependent on such physical factors as hydrology and geographical setting or turbidity and depth. The review also noted the need to determine whether the mangrove systems function on their own as nurseries or in tandem with associated seagrass beds.

The environment degradation of coastal habitats is expected to negatively impact offshore fisheries and there is an urgent need to reverse the continued deterioration and loss of these ecosystems. This expectation of a negative impact is as a result of the interactions which exist between systems. These linkages are multifaceted and may vary in strength, but they are present and include both chemical and physical interactions. It is therefore logical to assume that any perturbation within one system, would be directly or indirectly translated to any associated area. There are several examples where this has occurred and has led to declines in offshore fish yields. Some of the activities that have been responsible for these declines range from the overexploitation of natural resources to other non-sustainable activities such as the conversion to agriculture and hydrological interferences within coastal habitats.

In spite of these examples, there is still the need to empirically demonstrate the relationships between systems particularly how they affect fish community characteristics, as has been shown for penaeid shrimp populations. The results of this exercise could be used to provide a useful basis for studying changes in offshore fish populations, that would occur as a result of the deterioration of these coastal systems.

4.2.10 A Review of the Occurrence of Fish Spawning Aggregations in the Caribbean and the Implications for Fisheries Management (SSW/WP/24).

Spawning aggregations have been noted in the Caribbean for decades. Fishers have traditionally fished these aggregations, in some cases causing their elimination. The review examined the occurrence of these aggregations, focussing primarily on demersal fish within the Caribbean, to demonstrate the effects of fishing on the aggregations and to discuss the implications for management.

Approximately seven Caribbean families are known to have species which form aggregations. The review suggests that large-sized species appear to migrate long distances. It is speculated that this allows the eggs and larvae to drift into deeper waters away from predation found in the inshore adult habitats. The smaller-sized species usually migrate shorter distances. Spawning for these species usually involves a rapid upward dash which may function to distribute the gametes out of the reach of benthic predators.

Intense fishing, it was suggested, results in the removal of the mature and larger-sized classes from the stock. Such an occurrence on a hermaphroditic stock may stimulate a sexual transition that could alter the reproductive potential of the population. Additionally, the removal of the reproductive adults from the stock could decrease future yields by reducing recruitment. Reports of decreased catches from aggregations, and the elimination of certain aggregations that were intensely fished, were said to be common in the Caribbean.

Management of a fishery was thought to involve the identification of all spawning aggregations within the region, the collection of relevant fisheries and environmental data and the introduction of measures aimed at controlling fish catch and effort. It was suggested that the identification of aggregating stocks should include the collection of information on the species that aggregate to spawn, including spawning locations and times. Such information could be obtained from local fishermen. Fisheries data that could be collected was said to include information on catch, effort, growth and mortality. This information could be used to assess the state of exploitation on a stock and could equip managers with information for adjusting fishing effort or size at capture. The collection of environmental data such as temperature, tides, currents, weather and lunar periodicity was said to be necessary in order to understand the occurrence of spawning aggregations and the importance of these factors in facilitating recruitment and larval survival. It was suggested that, as many fisheries divisions did not have the resources to carry out the necessary oceanographic studies, they were advised to collaborate with agencies and individuals involved in collecting and analyzing such information within the region.

Permanent and seasonal closures, limited entry, and in the case of a severely depleted fishery, a total harvest ban, were identified as some of the measures that could be used to control fishing effort in a fishery. Other measures used to control effort directed at specific, usually smaller individuals within a stock are gear and size restrictions. Measures used to control catch are bag limits and catch quotas. These measures may be considered for the management of fishing on spawning aggregations.

The social implications of managing a fishery should be taken into account before implementing a fishery management plan. Issues to be considered would include the inclusion of fishers in the management of a fishery and the availability of alternate work for fishers who may be displaced from the fishery.

In the discussion it was noted that the role of catchability was not specifically identified in the paper and importantly, during aggregations catchability increased by a large factor. This effect confounds normal models such as yield per recruit since they assume that catchability remains constant throughout. The potential impact of size regulations for hermaphroditic species was mentioned and it was concluded that there are no appropriate management measures for aggregating species and hermaphroditic species are even more difficult. It was also pointed out that most of the management problems are associated with K-selected species. Flyingfish, anchovies and many semelparous species are r-selected and could possibly withstand higher exploitation pressure.

4.2.11 Study to Determine Areas of Ciguatoxicity in Montserrat and Nevis (SSW/WP/25)

A pilot study was conducted to determine the feasibility of interviewing fishermen for gathering and documenting information on fishing areas and species affected by ciguatera poisoning. The islands of Montserrat and Nevis were selected as the pilot study area because of the known presence of ciguatera, their small geographic area and the shared fishing ground on Redonda Bank. An interview questionnaire was prepared to acquire information on areas and species affected by ciguatera. Seasonal differences in ciguatera occurrence, as well as the relationship between size of fish and ciguatoxicity were also investigated. Since ecologic disturbances, whether man-made or natural, are known to create or enhance the ciguatera effect, these data were also gathered. In Montserrat, thirty interviews with local fishers were conducted at the landing sites of Plymouth, Carr's bay and Kinsale. In Nevis, forty-five interviews were conducted with local fishers from all over the island. In addition, a boat trip was conducted in each island to fix the positions or coordinates (latitudes and longitudes) of fishing areas using a GPS (Global Positioning System). At the time of the workshop, a final report of the pilot study had not been completed. Hence, a verbal report of preliminary results and poster display were given at the workshop.

The fishing areas noted to be most commonly associated with ciguatoxic species were Redonda Bank, Havers Shoal, Barnes Ghaut and Bush. Several species were identified as potentially ciguatoxic, with the most important being barracuda and a number of species of cavalli, snapper and grouper. In general, the risk of catching ciguatoxic fish was believed to increase around the period of the full moon and during the spawning season. From the data gathered, it was not possible to determine whether size of fish was a critical factor influencing the occurrence of ciguatera.

Participants enquired about CFRAMP's intentions to do further work on ciguatera, including whether additional studies would be conducted in other areas in the Caribbean. CFRAMP noted that the pilot study was not originally included in the RAU's plans, but was undertaken as a result of concerns expressed by fisheries officers in affected islands. When the final report is completed, the success of the study would be assessed at that time in determining any future work undertaken.

However, if the ultimate aim of the research is to determine the loss in yield due to ciguatera, then CFRAMP recommended that future work attempt to quantify proportions of the fish populations that are toxic. CFRAMP advised that it may not be possible to obtain such quantitative data from interviews with fishers, and suggested more direct monitoring of fish discarded due to fear of ciguatera. Also, if an appropriate ciguatera test kit becomes available, this could be used to directly test the landed catch.

It was noted that the detailed results from the study were needed in spite of initial problems with the survey questionnaire. It was further noted that it would be very useful to examine hospital records in any additional studies on ciguatera. The suggestion was made to expand the study to include all the Leeward islands affected, as this would yield valuable information for fishery expansion planning in those islands.

It was noted that it was unfortunate that Antigua fishers were not included in the pilot study as Antigua has the highest incidence of ciguatera poisoning in the region. The Workshop was informed that Fisheries Division staff in Antigua already advise local fishers to avoid fishing on Redonda Bank because it is a known area for ciguatoxic fish.

The question was raised whether further studies on ciguatera would include measuring levels of ciguatoxicity in fish. In response, CFRAMP noted that individuals varied greatly in their sensitivity to the toxin or toxins involved, and that existing test kits are capable of detecting only the presence or absence of the toxin.

The Workshop proposed that consideration be given to the work on mapping of ciguatoxic areas being extended to all countries affected, and ideally to be conducted in conjunction with recommended work on habitat mapping. It was accepted that the information could be mostly derived from interviews with local fishers.

4.2.12 ICCAT Data Analyses

As a result of recent participation in ICCAT activities, CFRAMP has been able to gain access to the ICCAT database. To date, CFRAMP has examined the ICCAT Task II catch and effort data in those sea areas which include the Exclusive Economic Zones (EEZs) of CFRAMP participating countries. It should be noted that ICCAT Task II catch and effort statistics report catch and effort by gears and time-area strata. The analyses of these data included examination of, species composition of the catch, pattern of fishing effort by large commercial foreign fleets operating in Caribbean and adjacent waters, seasonal and annual trends in species abundance. The majority of ICCAT data are reported in 5° squares and hence this was the smallest unit of sea area used in the analyses. For the Caribbean region, the ICCAT 5° squares are identified by their lower right hand corner coordinates of latitude and longitude. To date, only the analyses specific to those four 5° squares within and adjacent to Guyana's EEZ {see figure 1; coordinates given as (5°N, 55°W), (5°N, 60°W), (10°N, 55°W), and (10°N, 60°W)} have been compiled, and hence only these results were presented at the Workshop.

For the four identified squares, results could be summarised briefly as follows. During the period 1955 to 1990, the major foreign fleets which operated in these waters belonged to Japan, Venezuela, USA, Taiwan, Korea and Cuba. Generally, the most important species of the longline catch were yellowfin tuna, albacore and bigeye tuna. However, for the US longline fleet, the catch comprised mostly yellowfin tuna and swordfish. In comparison, purse seine and baitboat catches consisted principally of allophone tuna and skipjack tuna. The catch per unit of effort (CPUE) was used as an index of species abundance. Preliminary plots of CPUE vs year show large fluctuations for a number of species and may simply reflect fluctuations in effort. Similar results were obtained for plots of CPUE vs month. Further analyses are therefore needed before firm conclusions could be drawn regarding annual and seasonal trends in species abundance.

This presentation was well received, and participants noted their eagerness to have the analyses completed and documented. In view of this interest, CFRAMP noted that this task would be given high priority for completion in the near future.

It was asked whether CFRAMP intended developing an appropriate software package that could be used by individual countries for examination of the ICCAT data. In response, RAU staff noted that manipulation of the raw ICCAT data, to produce smaller datasets which could be used for analysis, is a very time-consuming task. RAU staff did not recommend individual countries undertake this task and emphasised that the CFRAMP generated datasets should adequately serve any further analytical needs that individual countries may have. It was further noted that any additional required data manipulations should be easily handled by available analytical packages since the CFRAMP generated datasets are available both in spreadsheet and database format. RAU staff assured participants that they would be willing to show interested persons the methods used for transforming the raw ICCAT data.

The question was raised whether the pattern of foreign fleet fishing effort was sufficiently stable to allow an accurate investigation of seasonal patterns in CPUE. In response, RAU staff noted this was the reason why further examination of the data was necessary before drawing any conclusions about seasonal and annual trends observed in the initial analyses.

It was suggested that the RAU attempt to include data reported for 1° squares, since it would help to make the analyses more complete. RAU staff accepted this suggestion. (Note that a working paper was not prepared on ICCAT Data Analyses).

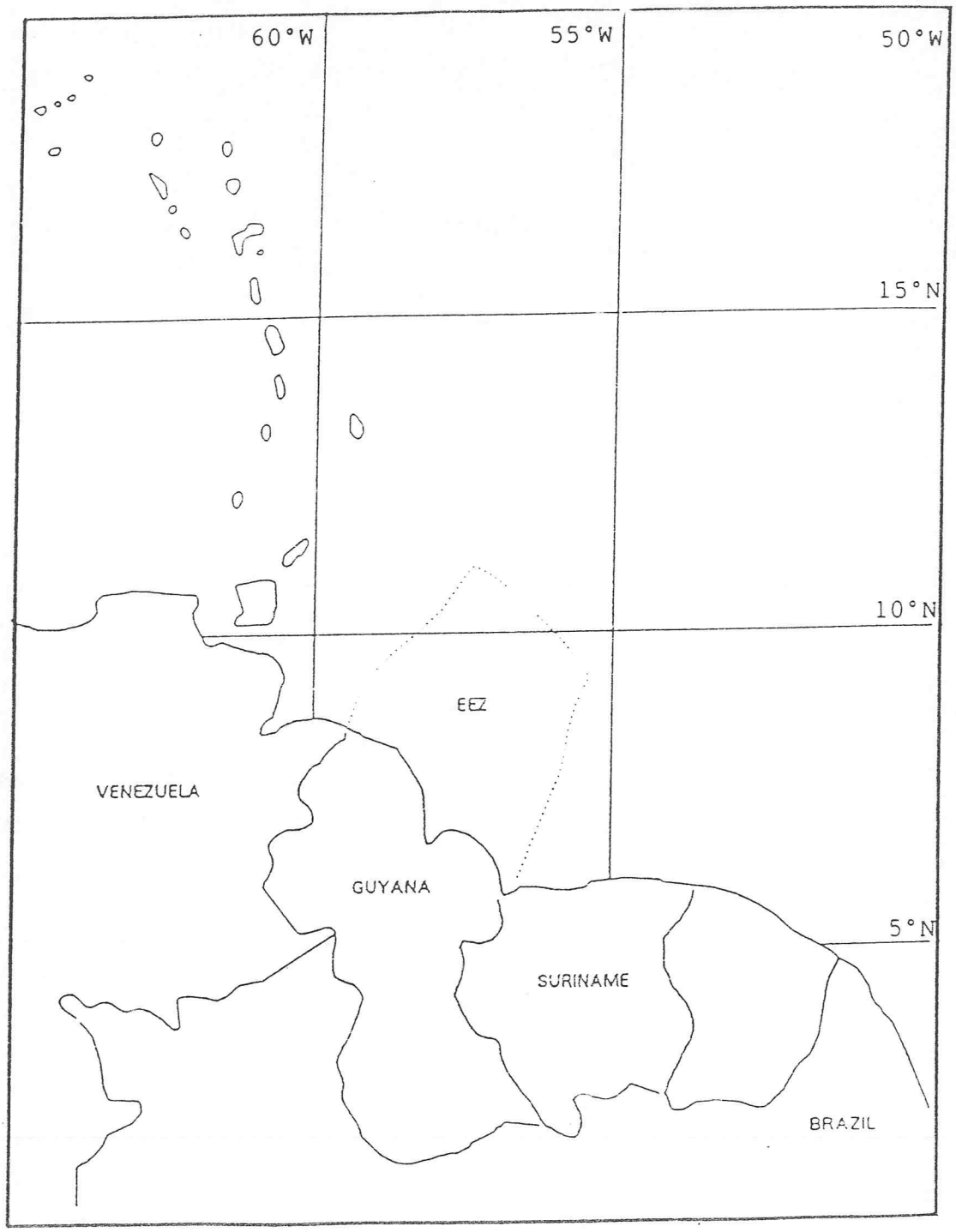


Figure 1. Map of Guyana's EEZ and adjacent sea areas.

4.3 RESEARCH PROPOSALS

4.3.1 Dispersal and Natural Mortality of Reef Fish (SSW/WP/28)

The proposed field study on Dispersal and Natural Mortality of Reef Fish has two objectives. The primary objective is to determine natural mortality for several reef fish species. The second is to determine the rate of dispersal from an area closed to fishing. The rationale for the first objective is that rates of natural mortality are input data necessary for stock assessments. CFRAMP demonstrated the implications of not knowing the rate of mortality using dolphinfish as an example. The need for knowledge of rates of dispersal are based in the increasing interest in establishing marine reserves as a fisheries management tool. One frequently-cited benefit of such reserves is that they contribute, through export of adult fish, to the fishing opportunities in adjacent areas. However, the extent of that benefit remains unquantified.

The proposed work would be conducted in a fringing reef environment located in the Barbados Marine Reserve, off the west coast of Barbados and adjacent to the Bellairs Research Institute. Both aspects of the study would be addressed through a mark-recapture study which would form part of a proposed M.Phil. investigation based in the University of the West Indies.

This activity was **approved** by the Workshop participants, with the qualification that the dispersal component should be emphasised over the natural mortality component. It was suggested that this study may make a unique contribution to our understanding of the importance of marine reserves, whereas the natural mortality component, while useful, is limited in scope. The estimate of natural mortality may be applicable to the study site only and several other estimates of natural mortality of reef fishes are available from other areas. A further suggestion was to conduct the work at the Hol Chan Marine Reserve, Belize. The species assemblage in Belize differs from that found in Barbados, and includes typically larger, more highly-valued species. However, it may not be as representative of the regional fish fauna as a whole. The decision regarding site of study was deferred pending further examination by CFRAMP.[1]

The budget for the work is $24,574 CDN, and the work will occur in FY 1995/96.

[1] Subsequent to the SSW, some further suggestions on experimental design were received by CFRAMP from Ms. Ana Ratikin, who had recently completed a closely-related study in Barbados. She suggested selecting reefs at either the northern of southern margin of the Barbados Marine Reserve. Given the new focus of this work to emphasise dispersion rather than natural mortality, this suggestion seems very appropriate.

Ms. Ratikin also advised against the use of parrotfish for the tagging work, because of the problem of exfoliation of scales in traps. Such fish may then become prone to additional mortality and bias the results. Based on her experience, she suggested the study focus on butterflyfish, surgeonfish and grunts.

Finally, she commented on the seasonality of the trap fishery in Barbados, noting that there would likely be much reduced effort during the pelagic fishing season. Such seasonality would affect the interpretation of the results of the dispersion study when fish move outside the Reserve boundaries.

4.3.2 Hook and Line Selectivity (SSW/WP/29)

The rationale for this study is based on the observations that hook and line fisheries for deep slope resources (snappers and groupers) are important to several participating countries, and that selectivity information is a critical input in the stock assessment process. The degree to which commercial fishery samples reflect the exploited population is related to both availability of fish (affected by factors such as season, migrations, feeding patterns, etc.) and to the selectivity patterns of the fishing gear. The proposed study will focus on the latter question, with particular emphasis on hook and line fisheries. Comparatively little information is available on the selectivity of hook and line fisheries, worldwide.

The proposed approach is to employ the research vessel *Black Jack*, provided courtesy of the Fisheries Division of the Government of St. Vincent and the Grenadines. Based on consultations with the Division, an experimental design was developed which included fishing hooks of various sizes suspended from buoys (see working paper for full details). The study would focus on deep slope resources occurring around the Grenadines Bank during the first field season, then switch to a Leeward Island location during the second field season. Apart from information on hook selectivity, the study would provide ancillary information on size and age at maturity, species composition, sex ratio, and other biological characteristics.

CFRAMP staff indicated how past studies have led to inconclusive results. Review of the experimental design by Workshop participants led to the conclusion that the protocol was sound, but could have included features such as a broader range of hook sizes. The importance of controlling bait size and type was also noted. Workshop participants concluded that the activity has some risk associated with it: there is a possibility that CFRAMP may expend funds but not achieve the planned outcome. However, revised proposals prepared by Jamaica which intend to obtain measures of total biomass of demersal fish populations on selected oceanic banks would obtain hook and line selectivity information as well. A further option would be to estimate selection from commercial sample data forthcoming from the network of data collectors proposed under the Biological Data Collection activity in participating countries (Working Paper 33). It might be necessary to provide incentives to commercial fishers to use different hook sizes. It would also be necessary to carefully design data collection forms to ensure that information of location of capture is available, since the analytical methods assume that the length frequency data are obtained from the same stock. An option to ensure this information is obtained would be to place observers on board commercial fishing vessels. The offers of involvement of Fisheries Divisions could be used to supplement the information from the commercial fishery, perhaps by employing hook sizes which are not used by fishers.

In light of concerns over the likelihood of success, the proposed activity involving the controlled experimental approach for determining hook selectivity were subsumed under part of the revised Jamaican proposal. The stock assessments done during the first year of data collection would provide important information on the sensitivity of management advice to assumptions made regarding selection on a species by species basis, thus facilitating a more cost-effective allocation of resources.

4.3.3 Participation in ICCAT (SSW/WP/30)

The International Commission for Conservation of Atlantic Tunas (ICCAT) coordinates assessment and management of several large pelagic stocks which occur throughout the Atlantic Ocean including CARICOM waters. ICCAT also maintains a comprehensive statistical database for these stocks. A CARICOM delegation, comprising officials of CFRAMP and the OECS Fisheries Unit, attended the 1991 annual ICCAT Standing Committee on Research and Statistics (SCRS) and Commission Meetings, to determine the potential of CFRAMP participation in ICCAT. The report of that mission (Mahon and Murray, 1992), recommended that CFRAMP participate in ICCAT as an observer for a trial period to determine the benefits to be gained. As an observer at ICCAT, CFRAMP would not have voting rights but could participate freely in all ICCAT meetings for an annual fee of US$1,000. This proposal was therefore developed as a result of recommendations made by Mahon and Murray (1992).

Through participation in ICCAT activities, CFRAMP participating countries would obtain regularly updated information on the status of the stocks of several large pelagic species: yellowfin tuna (*Thunnus albacares*), bigeye tuna (*T. obesus*), skipjack tuna (*Katsuwonus pelamis*), Atlantic sailfish (*Istiophorus albicans*), blue marlin (*Makaira nigricans*), white marlin (*Tetrapturus albidus*), and swordfish (*Xiphias gladius*). This would obviate the need for CFRAMP to conduct separate assessments of these stocks which would require a significant input of time and funds. Participation in ICCAT would ensure CFRAMP input into data analyses and interpretations of these in determining management recommendations. In addition, CFRAMP participating countries would have ready access to the ICCAT database which would provide details on foreign fleet activities in the Caribbean area. Information on catch composition, catch rates and seasonal effects could also be derived for the Caribbean area. The ICCAT data would also be valuable in providing a preliminary evaluation of the potential for development and expansion of local pelagic fisheries. Participation in ICCAT would also expose CFRAMP participating countries to new developments in assessment methodology and fishing technology, and would indirectly also help to build closer working relations with neighbouring territories. By permitting CFRAMP to represent all its participating countries, this would save individual countries the expense of either separate observer or membership fees.

CFRAMP proposed participation in the annual ICCAT Working Group Sessions and in the annual ICCAT SCRS Meeting which take place in Madrid during the last week of October and the first week of November respectively each year . In addition, CFRAMP indicated that there might be a need to participate in one other inter-sessional scientific meeting, if considered to be relevant and useful to large pelagic resource assessment in the region. The choice of Working Group sessions and Inter-Sessional meetings attended would be priorised according to the recommendations of Mahon and Murray (1992): listed in order of priority, these would be the Working Groups responsible for Western Atlantic Tropical Tunas (WATT), Small Tunas, Tropical Tunas, Billfishes and Swordfish. In preparation for Working Group meetings, CFRAMP would usually submit one or more working documents on research relevant to the subject of the meetings. In preparation for the annual meeting,

CFRAMP, with input from fisheries officers, would have to submit a written annual CFRAMP report on the status of the region's pelagic fisheries. In addition, fisheries officers would need to review all annual meeting and workshop reports, as well as respond to ICCAT requests usually for pelagic fishery statistics.

Regarding this proposal, some participants questioned ICCAT's efficiency at enforcing stock management measures. In response, RAU staff noted that successful implementation of fish stock management is a worldwide problem and is not peculiar to ICCAT. CFRAMP participation in ICCAT would be directed towards technical activities and determining stock health. Hence, problems at the management level within ICCAT would not prevent the expected gain to be derived from the proposed CFRAMP participation in ICCAT activities.

It was asked whether current ICCAT assessments indicated potential for fishery expansion. In response, CFRAMP staff noted that ICCAT analyses implied that several stocks were close to or at their levels of maximum sustainable yield. Only in some cases would there appear to be some potential for expansion. However, current ICCAT assessments rely on certain stock assumptions which are only now in the process of being verified. Hence, the assessments are continually being updated as new data become available and assessment methodology is refined.

Some participants also queried whether participation in ICCAT was necessary to facilitate acquisition of the relevant ICCAT reports and ICCAT database. In response, it was noted that these were not normally readily available to CARICOM countries. Furthermore, ICCAT deals with requests for data and information from its member countries prior to handling similar requests from non-member parties. In consequence, CARICOM countries might not receive data and information at a timely rate which would be useful. CFRAMP's Canadian Data Manager noted, however, that ICCAT reports and Statistical Bulletins may be found in libraries of several international fishery research institutes and laboratories.

The value of ICCAT membership was also discussed. Unlike observers, members of ICCAT are allowed to vote on ICCAT issues which include enforcement of management regulations. CFRAMP staff noted that current ICCAT regulations permits only individual countries to become members; organisations could not be accepted for membership. Participants agreed that there would be a need to assess the political benefits to be gained from ICCAT membership, and suggested that this could be dealt with by CFRAMP's PRC.

This activity was **approved** by the Workshop without modification.

CFRAMP participation in ICCAT began in FY 1992/93 and would end in FY 1998/99. The budget for this work is $70,330 CDN.

Reference

Mahon, R. and P. Murray. 1992. Mission to Explore the Potential for CFRAMP Participation in the Activities of the International Commission for the Conservation of Atlantic Tunas (ICCAT) (November 4-12, 1991) CARICOM Fish. Res. Doc. No. 2:13pp.

4.3.4 Determination of Migration Patterns and Stock Structure of the Atlantic Billfishes and Large Tunas (SSW/WP/31)

In 1988, the ICCAT Program for Enhanced Research for Billfish initiated the ICCAT Billfish Tagging Program, to expand billfish tagging activities in the Atlantic Ocean to obtain more detailed information on stock structure and migration patterns of the billfishes and large tunas. This information is required to refine current ICCAT assessments and for effective coordination of international management of these shared stocks. To date, the ICCAT Billfish Tagging Program data provide only a partial analysis of overall fish movements. For example, for the Caribbean area, only fish movements into Caribbean waters have been investigated. In consequence, workers of the ICCAT Billfish Tagging Program are eager to collaborate with CFRAMP staff in order to increase tagging activities within Caribbean waters. By this means, CFRAMP would be able to analyse movement patterns of the large tunas and billfishes within the region at a comparatively low cost. Furthermore, these data would help CFRAMP participating countries to better determine the significance of ICCAT assessment analyses for the region's fisheries. Collaboration with the ICCAT program would also allow CFRAMP participating countries access to the database maintained by the ICCAT Program for Enhanced Research for Billfish, which contains major Atlantic fishery statistics, as well as biological and tagging data. Other benefits would include access to the Program's reports, training of regional scientists in conducting internationally coordinated field activities and tagging, and enhancement of CFRAMP's international profile. As a result, a proposal was developed for a CFRAMP-ICCAT joint tagging study on billfishes and large tunas.

CFRAMP would fund up to five day trips per year for a period of three years. An equal number of trips would be funded by the ICCAT Billfish Tagging Program. Fisheries Division vessels equipped with longline gear would be employed for all field trips. To minimise field operation costs, field trips would be conducted during December to June when targeted species would usually be most abundant. Both ICCAT and Billfish Foundation dart tags would be used, and these, together with tagging equipment and data recording cards, would be supplied by the ICCAT Billfish Tagging Program. The ICCAT Program would also be responsible for advertisement of the project and payment of rewards for recapture information.

Fisheries officers in participating countries would be responsible for in-country preparations for this activity, including the collection of live bait prior to field trips. They might also be required to participate in field trips. In addition, fisheries officers would need to review CFRAMP reports, as well as reports and other documentation received from the ICCAT Program for Enhanced Research for Billfish.

When this proposal was first mentioned during the presentation of background paper SSW/WP/18, there was concern about the success of tagging studies. It was suggested that CFRAMP should concentrate effort and funds on the smaller large pelagics such as king mackerel, rather than on the large tunas and billfishes which are already studied by ICCAT and other international agencies. In response, RAU staff noted that only a small sum of money would be allocated to this activity, and that several other important benefits would be derived in addition to acquisition of tagging data. Furthermore, more funds and effort would be put into a tagging study of the smaller large pelagics. Following a detailed presentation of the proposal, the above query was not raised again.

Concern was voiced about the difficulty of catching, tagging and successfully releasing large fish in a condition that would ensure survival. In response, RAU staff noted that this was a valid concern and it is always a risk associated with tagging. Tagging experiments always have to accommodate for some loss due to post-tagging mortality.

This activity was **approved** by the Workshop without modification.

This activity is scheduled to begin in FY 1994/95 and to end in FY 1996/97. The budget for this work is $7,950 CDN.

4.3.5 Preliminary Determination of Migration Patterns of Small Tuna and Tuna-Like Species in Caribbean Waters (SSW/WP/32)

The objective of this study is to determine the limits of stock distribution, stock structure and migration patterns of several commercially exploited stocks of small tuna and tuna-like species. This information is needed for accurate and complete assessment of these stocks which are distributed over more than one EEZ and show migratory behaviour. Information on patterns of movement and the extent of interchange among fisheries is also required for coordination of regional management. Acquisition of the above information is usually best achieved through tagging experiments. Tagging experiments also facilitate estimation of size at release and at recapture which can then be used to provide estimates of growth rates. CFRAMP proposed a tagging study of the following four commercially important stocks: dolphinfish (*Coryphaena hippurus*), wahoo (*Acanthocybium solandri*), king mackerel (*Scomberomorus cavalla*) and blackfin tuna (*Thunnus atlanticus*). Two options for tag and release activities were recommended: (1) artisanal boat hire and (2) recreational tagging tournaments.

Regardless of the option chosen, the tag to be used would be either an internal anchor tag or a miniaturised version of The Billfish Foundation (TBF) dart tag. The TBF tag is normally inserted into the dorsal muscle of the fish using an applicator and wooden pole similar to that used for tagging large billfishes and tunas. Use of the TBF tag would obviate the need to bring fish aboard vessel for tagging. This tag would not be suitable for use on king mackerel owing to observed high shedding rates. Use of the internal anchor tag would require placing fish within a tagging cradle on board the

vessel. The disk of the anchor tag would then be inserted manually through a small incision made in the anterior abdomen of the fish. Assuming a tag recovery rate of seven percent, a minimum of 143 fish should be tagged per species per site per year.

Due to budget constraints, tag and release activities were proposed for only three CARICOM EEZs in the eastern Caribbean. EEZs proposed for tag release activities under option 1 were St. Vincent and the Grenadines, St. Lucia and either Barbados or Grenada. EEZs proposed for tag release activities under option 2 were Trinidad and Tobago, Grenada or Barbados and St. Lucia. Option 2 would be implemented only if tournament and lottery prize sponsors could be obtained. Due to the more technical procedure required for tagging king mackerel with internal anchor tags, this species might have to be omitted from the study under option 2.

Under option 1, artisanal boats would be hired to conduct ten day trips per selected EEZ each year for three years. Fisheries officers would be responsible for in-country arrangements for vessel charter, and their participation in field trips would be desirable. A local fisher would be needed to accompany CFRAMP and/or Fisheries Division staff on each tagging trip. Under option 2, nine three-day tagging tournaments are planned, one per island per year for three years. Fisheries officers would be responsible for finalising in-country arrangements with sponsors and tournament committees, and for monitoring in-country tournament preparations. Fisheries Division representation at tournaments would be desirable.

When this proposal was first mentioned during the presentation of background paper SSW/WP/18, two participants voiced concern about the success of tagging studies. These individuals thought that mitochondrial DNA analyses or morphometric analyses should be considered instead, as these methods would yield results in a shorter time, generate much more data and be more cost-effective. In response, RAU staff noted that the results of DNA and morphometric analyses were often inconclusive whereas recaptured tagged fish provided unmistakable evidence of individual fish movements, even though tag returns could be low. In addition, a beneficial aspect of the tagging study is that it would involve fishers directly. After presentation of background paper SSW/WP/18, one of the participants also noted that sport fishers would participate voluntarily in tagging programs, and enquired whether CFRAMP's planned approach considered the use of sport fishers. In response, the RAU noted that one of the options proposed relies heavily on involvement by sport fishers. Following detailed presentation of the proposal, the above queries were not raised again.

The Workshop discussed the choice of tag and release locations. It was asked whether Jamaica's EEZ had been considered for tag and release activities under option 2. In response, RAU staff noted that, due to budget constraints, only three EEZs had been selected in what is considered to be the core area of stock distribution. In addition, it is possible that stocks in Jamaican waters are different from those in the eastern Caribbean: tag recovery data from the study would help to determine if this is true and would be valuable information for both Jamaica and Belize.

Representatives from Guyana noted that the Guyana Fisheries Division has a good working relationship with several local fishers, and requested that Guyana's EEZ be selected as the southern most EEZ under option 1. Participants agreed to the change suggested by the Guyana representatives.

The questioned was raised whether the proposed study would use information on migration hypotheses already put forward by previous workers. This concern was supported by a number of other participants who suggested that tag release locations should be selected so that they could test distribution patterns and migration routes already proposed in the literature. In response, RAU staff noted that only the Oxenford hypothesis for dolphinfish migration had been considered to date, and in this case, further work may be necessary to gain wider acceptance of the hypothesis proposed. However, RAU staff assured participants that all available information would be considered in developing null hypotheses for studying the four stocks concerned. To this end, the MAREMP representative noted the relevance of some previous work done on wahoo.

There was concern regarding the unpredictability of catch rates under option 1. In response, RAU staff noted that this was a valid concern. Discussions with local fishers in St. Vincent revealed that catch rates could vary from 0 to 300 kg or more per day. To maximise the potential catch, therefore, tagging trips would be scheduled during known periods of peak species abundance.

A few participants were concerned that option 2 would not make sufficient use of fishery officers and local fishers. In response, RAU staff noted that, on the contrary, both options would require extensive input from both fishery officers and local fishers. This is because the tag recovery aspect of the study would rely heavily on the cooperation and support of both fishery officers and local fishers. Fishery officers would be responsible for ensuring that posters advertising the experiment be properly displayed and that local fishers understand the importance of reporting recovered tags. This might mean holding or attending local meetings of the fishers, and giving regular talks, demonstrations and reminders of the importance of the study and of reporting recapture information. The study would not succeed unless it has the full cooperation and support of the local fishers who would play a major role in recapturing tagged fish. In addition, under option 2, it is hoped that fishery officers in the selected countries would assist with the arrangements and running of tournaments.

This activity was **approved** by the Workshop with the following modification: under option 1, Guyana's EEZ would be selected as the southernmost EEZ.

This activity is scheduled to begin during FY 1995/96 and to end during FY 1997/98. The budgets for implementation of options 1 and 2 are $117,785 CDN and $48,060 CDN respectively.

4.3.6 Biological Data Collection in Participating Countries (SSW/WP/33)

The objective of assessing the status and potential of large pelagic, reef and slope fishes in the EEZs of participating countries would be addressed by establishing a system of biological data collectors. It is important to note that this system would be in addition to the ongoing catch and effort data collection systems being established by the Data and Information Systems Subproject. In fact, the two systems of data collection are to be integrated into one data collection system covering biological and catch and effort data. In most cases the same individuals are to be utilised for both biological and catch and effort data. The data would be collected by data collectors who would be specially engaged for that purpose for a period of up to two years. The data collectors would collect primarily length data, but also other biological data such as weights, maturities, and hard parts for ageing (see SSW WP 34 and 35).

This activity would be the core or umbrella activity to which the other resource assessment activities would provide input. The overall Biological Data Collection activity for reef and pelagic fishes would be coordinated by the Pelagic and Reef Fishes Resource Assessment Unit in collaboration with the Data Managers/Analysts. However, in each country the activities would be carried out by the data collector under the supervision of the individual designated by the Fisheries Officer in each country. The terms of employment for the data collectors would be country-specific and follow the model of the CFRAMP catch-effort data collectors. The biological data would be compiled, entered into a computer and analysed in each country, with assistance from staff. In addition, both ICLARM and FAO have offered to assist with data analyses. Subsequent compilation and analysis at the regional level would be the responsibility of the RAU, in collaboration with the Data Managers/Analysts at the CFMU.

The details of data collection activities in each country were developed at the SSW, by consensus among participating countries. The details of the sampling arrangements depended on the country's priorities, and on the need for a rational distribution of sampling among the countries to provide adequate coverage of the major fisheries.

Data collection efforts would focus on about 16 reef fish species, 5 deep-slope fish species and 12 large pelagic species. The species to be sampled for assessment were determined on the basis of a questionnaire survey which the fisheries officers of participating countries completed, examination of available data on landings, and further refinement at the Workshop. The data collection plans are summarised by country in Table 1.

Table 1 - Overview of biological data collection by country. (Codes: L -full sampling of length frequencies; I -less intense sampling of length frequencies; M -sampling of maturity stages; A- sampling of hard parts.)

SPECIES / COUNTRY	LARGE PELAGICS												DEMERSAL																							
													REEF																SLOPE									
	DOL	WAH	YFT	KGM	BLF	CRE	SAI	SKJ	SSM	ALB	BET	SHA	RHN	MSN	SPA	GSN	ASN	YSN	LSQ	QTR	FGR	DOC	LSN	DSN	BBS	BLS	NGR	CON	QSN	SSN	YGR	RSN	VSN			
ANTIGUA & BARBUDA													LMA	L	LMA	I	I	I	L	I	LMA	L						I	LMA	LMA	I	I	I			
BARBADOS	L	LMA	LM	LM	LMA	I	I	LM					I	I	I		I	I			I				L				LMA	LMA	I	L	L			
BELIZE												L	LMA	LMA		L	LM	LM		LMA				L			L		I	I	I	I	I			
DOMINICA	I	I	L	L	I	I	I	I					LMA						LMA		L	LMA						L	I	I	I	I	I			
GRENADA	L	L	L	L	L	I	LM	LM					IA																IA							
GUYANA	L	L	L	L		L			LM			LM		L									L									L	I			
JAMAICA PELAGIC	L	LM	LM	LM	LMA	L	L	L																												
JAMAICA OFFSHORE	L	LM	LM	LM	LMA	L	L	L					L	L	L	L	L	L	L	L	L	L							L	L	L	L	L			
MONTSERRAT	I	I			I	I	I	I						I		I	I	I		LMA	I	LMA								L						
ST. KITTS/NEVIS	L	L	I	LMA	L	LMA							L															LMA	LMA							
ST. LUCIA	L	LMA	L	L	L								L	L	L	L	I	L	I	L	I	I			L			L	LMA	I	L	I				
ST. VINCENT	L	L	LM	I	LMA			L					L	I				I		I							L	L	I	I	I	I	I			
GRENADINES													L	LMA	LMA	LM	L	LM	LMA	LMA	LMA	LMA							L	L	L	L	L			
TRINIDAD & TOBAGO	L	L	L	LMA		LMA	L		LMA	L	L	LMA											L	LMA								L	L			

Key to Species Codes:

DOL/CORYHI	dolphin	*Coryphaena hippurus*
WAH/SCOMSO	wahoo	*Acanthocybium solandri*
YFT/SCOMAB	yellowfin tuna	*Thunnus albacares*
KGM/SCOMCA	kingfish	*Scomberomorus cavalla*
BLF/SCOMAT	blackfin tuna	*Thunnus atlanticus*
CRE/CARAHI	crevalle jack	*Caranx hippos*
SAI/ISTIPL	sailfish	*Istiophorus albicans*
SKJ/SCOMPE	skipjack tuna	*Katsuwonus pelamis*
SSM/SCOMMA	Spanish mackerel	*Scomberomorus maculatus*
BET/SCOMOB	bigeye tuna	*Thunnus obesus*
ALB/SCOMAA	albacore	*Thunnus alalunga*
SHA/SQUA	Shark Species (Belize - lemon shark; other - 5 species)	
QSN/LUTJOC	queen snapper	*Etelis oculatus*
SSN/LUTJVI	silk snapper	*Lutjanus vivanus*
YGR/SERRVE	yellowfin grouper	*Mycteroperca venenosa*
RSN/LUTJCA	southern red snapper	*Lutjanus purpureus*
VSN/LUTJAU	vermilion snapper	*Rhomboplites aurorubens*

RHN/SERRG	red hind	*Epinephelus guttatus*
MSN/LUTJMA	mahogany snapper	*Lutjanus mahogoni*
SPA/SCARVI	stoplight parrotfish	*Sparisoma viride*
GSN/LUTJG	grey snapper	*Lutjanus griseus*
ASN/LUTJAN	mutton snapper	*Lutjanus analis*
YSN/LUTJCH	yellowtail snapper	*Ocyurus chrysurus*
LSQ/HOLOA	longjaw squirrelfish	*Holocentrus ascensionis*
QTR/BALIVE	queen triggerfish	*Balistes vetula*
FGR/POMAF	French grunt	*Haemulon flavolineatum*
DOC/ACANC	doctorfish	*Acanthurus chirurgus*
LSN/LUTJSY	lane snapper	*Lutjanus synagris*
DSN/LUTJJO	dog tooth snapper	*Lutjanus jocu*
BBS/HOLOJ	blackbar soldierfish	*Myripristis jacobus*
BLS/LUTJBU	blackfin snapper	*Lutjanus buccanella*
NGR/SERRS	Nassau grouper	*Epinephelus striatus*
CON/SERRF	coney	*Epinephelus fulvus*

3rd Revision Aug. '94

In countries where additional staff would be required, Fisheries Divisions, in consultation with CFRAMP, would begin to hire staff and make preliminary arrangements for sampling to begin summer 1994. Sampling Programs would be expected to begin in July and August 1994, and continue for two years. A staff member[2] from the RAU would visit each country for up to two weeks when the sampling activities are to be initiated. During this visit, assistance would be provided with establishing sampling, data recording and reporting procedures. Thereafter, the staff member would visit for up to one week at intervals of four months to review progress and assist with preliminary compilation and analyses of data.

Ongoing monitoring of sampling relative to targets would be monitored by the collaborating officer in the Fisheries Division of the participating country. A fortnightly reporting form would be used to communicate progress in sampling to the RAU.

An Interim Workshop is scheduled for about 14 months after the start of data collection. Participants would bring their first year of data to this workshop where training would be provided in the use of assessment software, and preliminary analyses of the data would be carried out. There would also be an opportunity to refine sampling during the second year. ICLARM and FAO have indicated their willingness to participate in the interim workshop to provide assistance in training on, and use of, the FiSAT and other assessment software packages.

The two-year data collection period would produce substantial amounts of data and information which would require extensive analysis. Therefore, a period of 18 months is scheduled for analysis and reporting following the period of data collection. During this period, some follow-up activities would be conducted using the uncommitted funds.

A final workshop would then be held to review the progress of data analyses and advice would be provided on the basis of these analyses. The final workshop, and advice would review the various activities, note problem areas, draw general conclusions on the basis of the entire suite of activities, provide advice, and identify future directions for fishery assessment activities.

Workshop participants gave much time and effort to the discussion of this proposal. The Workshop generally **accepted the recommendations of CFRAMP for biological data collection with modifications to countries' species sampling list**. Jamaica and Trinidad and Tobago generated their own proposals prior to the Workshop. Summaries of these country proposals, as well as revisions to the main proposal are given below. In general, the revised plans fit well into the regional context of the biological data collection program, with a couple of exceptions noted below.

[2] A Consultant is to assist with the initiation of data collection through the training of data collectors.

4.3.7 Belize and Jamaica

Belize finfish fisheries are perhaps unique in the region, since they are generally considered underexploited. The Belize Division of Fisheries added lemon sharks (*Negapion brevirostris*), Nassau grouper (*Epinephelus striatus*) and the dog snapper (*Lutjanus jocu*) to the list of species originally suggested by the RAU (Table 1 of SSW/WP/33). The Belize Division of Fisheries also recognised that since much of the fisheries on snappers and groupers focus on spawning aggregations, there would be a need to better document spawning seasons and spawning aggregation sites. A one-month long contract was suggested to provide these data. The Belize Division of Fisheries also identified concerns pertaining the large and growing proportion of fish landed as filleted product. Hence species identification would be a problem.

The RAU staff developed country specific proposals for Jamaica, but these were considerably revised during the course of the Workshop. The work recommended for Jamaica would involve the evaluation of biomass of demersal fish occurring on selected offshore banks. The rationale for this is that there has been extensive research on inshore fisheries resources over the past several decades, and there is a pressing need to evaluate offshore resources at present since those resources are currently being exploited by several countries besides Jamaica. A second part of the planned Jamaica work would entail examination of existing data and information on large pelagic fish resources occurring in the Jamaican EEZ, to obtain a description of the present fisheries and to determine their potential for development. It is planned to retain a consultant to conduct the Jamaican pelagic fisheries study (See Working Group Report).

4.3.8 Trinidad and Tobago

The Trinidad and Tobago country specific activities focus on the trap and handline fisheries for snappers and groupers caught by both the artisanal and industrial fisheries, and the trolling and longline fishery for the highly migratory large pelagics and the more locally occurring dolphinfish, wahoo and kingfish. More complete details on the work planned in Trinidad and Tobago are given in Appendix B of the SSW Working Paper 33. Participants expressed concern that the proposal from Trinidad and Tobago includes a component of age and growth work, noting that there is an apparent overlap with the Regional Age and Growth Lab to be established under CFRAMP auspices at the Institute of Marine Affairs (see SSW WP 34 for details). There is also a planned expenditure on flyingfish which was not considered acceptable under the current Subproject, since there would be a separate Subproject pertaining to flyingfish planned in the future. RAU staff are to follow up with the Trinidad and Tobago Fisheries Division to resolve these discrepancies.

The plan for CFRAMP activities in Guyana was revised to reflect landings of catch from Surinamese waters. The monitoring and estimation of discards, particularly of finfish in the shrimp fishery, would need to be established. Finally there would be a need for training in identification of fish species from Guyana waters and it was proposed that such training could be received through the Fisheries Division in Trinidad and Tobago.

4.3.9 Leeward Islands

The species list proposed by CFRAMP for Dominica was modified by decreasing sampling for yellowfin tuna and enhancing sampling for coney. Most biological sampling would take place at cooperatives. Dominica requested an additional officer level position to monitor data quality control.

4.3.10 Windward Islands and Barbados

Working Group members from the Windwards Islands and Barbados revised their species list as well, noting that there were some species where landings were felt to be inadequate to permit full biological sampling. Some species identification problems were also noted, in particular with red snapper and doctorfish. It was noted that in some circumstances, the data collectors might be required to go to sea. In general, they expressed optimism that the loss of funding for the biological data collectors after the planned two year period would be offset by the transfer of expertise to Fisheries Division personnel. Several requests for additional personnel, and revisions of budget amounts were received.

4.3.11 Summary of Changes in Biological Data Collection

Regarding changes to the proposals for Biological Data Collection, the principal ones related to: selection of species to be studied, intensity of sampling effort, human resources required and proposal restructuring. Several species for different countries were changed as a result of discussions during the Workshop. These changes related mainly to the number of species that could be properly sampled given human resource limitations, and possible previous coverage elsewhere. The most significant changes were made to the proposal for data collection in Jamaica where there was a major revision to the original proposal. Details of the changes for each participating country are set out in the Working Group Reports.

It should be noted that the Trinidad & Tobago proposal mentioned flyingfish and age and growth. Although mention of these activities will not be expunged from the text of the final report, it should be pointed out that flyingfish work will not be dealt with until FY 1995/96 at the earliest.

4.3.12 General Remarks on Biological Data Collection

The problem of species identification was identified by several participants. The urgency for CFRAMP to proceed with plans for species identification guides was reiterated on several occasions. It was noted that the retention of the capacity in biological data collection would require that participating countries find the means to transfer the expertise to their permanent staff. Participants agreed that there is an important role to be played by CFRAMP's Community Participation and Education Subproject in building awareness and familiarity among fishers for the aims and needs of data collection programs.

4.3.13 Provision of Age Determination Data (SSW/WP/34)

As described in detail in Working Paper 33, Biological Data Collection in Participating Countries, CFRAMP intends to provide most of its stock assessment advice using length-based approaches. However, such approaches often still require supporting data from examination of hard parts of fish, including otoliths, scales, fin rays and the like. Examination of hard parts for age determinations would be required, since use of length-based approaches on their own could sometimes yield many possible solutions, which are sometimes quite divergent. Information on age-at-length from hard parts would allow informed choices to be made among such solutions. In some instances, length-based approaches might be completely inappropriate, thus making the collection of age data obligatory. In light of the obvious importance of age data, the RAU proposed to provide such data for selected species of reef, slope and pelagic fish. In doing so, the RAU envisaged the creation of a regional laboratory for the provision of such data, which could be employed by all member states.

The strategy of CFRAMP has been to strengthen existing capabilities within the region rather than to develop its own. In that light, the RAU approached the Institute of Marine Affairs in Trinidad to augment its already-impressive capability in age and growth studies, through collaboration with CFRAMP in establishing a regional age and growth laboratory. It was proposed to refer to the regional laboratory as CARIFAL (CARICOM/Caribbean Fish Age Laboratory).

The first activity solicited the views of participating countries on species which are of local significance to their fisheries. The RAU accomplished this by circulating a questionnaire, in which respondents were requested to rank the top ten species, by landed weight, in the categories of a) reef and slope, b) large pelagic, and c) coastal pelagic. Where the RAU was aware of published or in progress studies which had already been completed, the RAU elected not to duplicate such work. The provisional list was reviewed in depth at the Workshop. In summary, 12 species in 28 locations were selected for inclusion in the mandate of CARIFAL.

Concerns raised during the workshop included apparent duplication with the Trinidad and Tobago Fisheries Division proposal, and whether Fisheries Division staff in other countries could receive training in age determination methods at the regional laboratory. Regarding the latter concern, RAU staff noted that short-term attachments were available in CFRAMP, but reminded participants that age determination studies were time and labour-intensive, and fisheries officers might prefer to have the regional laboratory conduct the technical work. Participants were also apprised of an alternative approach for age and growth studies called the phi-prime technique, which allows generation of growth parameters for a given species when such parameters are available for related taxa. It was concluded that this approach might have utility for 4-5 species of interest to CFRAMP. After revision of the species list, this proposed activity **was approved** by workshop participants.

The budget for this proposal is $102,742 CDN and work would commence in FY 1994/95.

4.3.14 Incorporation of Studies on Reproductive Biology into the Stock Assessment Activities of CFRAMP (SSW/WP/35)

There are two main goals in optimising harvest from exploited populations: one is to maximise yield and the other is to maximise the reproductive potential of the stock to ensure its long-term sustainability. Yield optimisation is obtained through standard approaches such as yield per recruit analyses, and will be part of the outputs of CFRAMP's stock assessment activities. The second goal is somewhat more demanding, and necessitates observations of maturity and sex ratio in the landed catch. For some reef species, obtaining maturity data is complicated by the fact that they are hermaphrodites and reliable data on maturity can only be obtained through histological study in a properly equipped laboratory, rather than through field observations which is the usual procedure.

The approach to obtaining the required data was again to build on existing expertise in the Region. The Institute of Marine Affairs again had much of the expertise and hardware required to conduct the work. The IMA and CFRAMP jointly prepared a proposal aimed at obtaining the following data:

time of peak spawning
sizes at maturity
size-related sex ratios
life history strategies (ie. gonochorism or hermaphroditism)
sizes of sexual transition of the hermaphrodites

It was planned to obtain such data through a combination of the biological data collection network described in Working Paper 33, and enhancing the histological capabilities at the Institute of Marine Affairs.

After discussion, participants noted that field observations of maturity and sex would provide the necessary input data to address possible recruitment overfishing for most species. The additional species for which histology observations would be required included red hind, stoplight parrotfish, doctorfish and yellowedge grouper. The first two species were considered high priority species in the fisheries officers' replies to CFRAMP's questionnaire which preceded the Workshop. Notwithstanding this, Workshop participants felt the incremental gain in knowledge provided by this study did not warrant the cost, especially in light of other currently unfunded options identified during the Workshop (for example, the habitat mapping study was identified as a high priority unfunded activity). This proposal, therefore, was **not supported**. The budget for this activity was CND$62,208 CDN.

4.4 BUDGETING AND SCHEDULING

4.4.1 Budget for Assessment Subproject (SSW/WP/26).

The budget for the Assessment Subproject activities was produced for all those activities which were requested by participating countries and developed by CFRAMP. The budget was broken out for assessment work for the three fisheries resources: large pelagics, reef and deep slope fishes.

In summary, the budget was structured so that the first three to four years were to have the bulk of the expenditures for the field activities. The general start-up date would be 1994/95. The budget was presented in the form of a number of tables organized into the headings, (1) field operations, (2) communications, (3) reporting, (4) travel, (5) remunerations, and (6) annual totals.

The spread of activities shown was from FY 1992/93 to FY 1998/99. Also, generally, the bulk of the activities were grouped to begin in FY 1994/95 or FY1995/96.

The budget for tagging studies to assess large pelagic stock identification was divided into two activities. The first was participation in ICCAT tagging work and the second was one of two options for tagging of local pelagics. The option presented showed the costs related to the more costly of the two. It was pointed out to the Workshop that if the second option, that of using recreational tournaments for tagging was chosen, then a probable saving of approximately $70,000.00 CDN would be achieved.

4.4.2 Biological Data Collection (SSW/WP/33)

The budget for biological data collection in participating countries that was presented and following discussions by participants was amended. The major expense was remunerations at almost $500,000.00 CDN spread over four fiscal years. The budgets for activities in Trinidad & Tobago and Jamaica were separately presented. The discussions produced significant changes to the budget for Jamaica.

Lengthy discussions took place on a group basis on all aspects of the budget, due to its importance. An overall summary is shown in table 2. The major changes were for Jamaica with a large reduction in the original budget down to a revised estimate of $86,970.00 CDN. The amendments were in summary as follows. (Only those activities amended are addressed). Under histological studies of hermaphroditic species, the laboratory component of this study was not approved on the basis of the relatively high costs of data for only four species and its relatively low priority. The budget for this activity was $62,208.00 CDN and this has therefore been removed.

Under the hook selectivity for deep slope fish activity, participants noted that many of the outputs would be forthcoming from the modified Jamaica proposal for biological data collection and possibly from other sources. As a result of this, this proposal was not approved by the Workshop. The budget of $31,580.00 CDN has been removed.

Habitat mapping was seen as an important new activity that arose from the presentation on potential yields (SSW/WP/17). The result of discussions was an agreement to have accurate estimates of the productive areas for coral reef fish through this mapping, possibly using GIS. The proposal for habitat mapping was approved by the Workshop. Although there was no original budget brought to the Workshop, savings from other proposals which were not approved, could provide the funds to initiate the work.

Several countries expressed the wish to have additional work done on ciguatoxic area mapping on being presented with the results of the pilot study. This pilot study mapped ciguatoxic areas around Montserrat and Nevis. The expansion of ciguatera mapping was approved by the Workshop should there be available funds. The approximate estimated budget was $10,000.00 CDN.

Table 2 - Budget summary in Canadian dollars, by activity.

Activities Proposed by CFRAMP	Cost	Status
Biological Data Collection latitude to discuss costs with countries bilaterally	648,494.00*	Discussed, Agreed that CFRAMP has
Biological Data Collection - Trinidad & Tobago some other questions, total expected to decrease.	111,100.00	Discussed (flyingfish work to be deleted,
Biological Data Collection - Jamaica	86 ,970.00*	Discussed.
Age and Growth Studies reviewed, consensus assumed.	102,742.00	Discussed, slightly reduced workload
Histology of Hermaphrodites given cost.	0.00	Not approved, merit of work dubious
Hook and Line Selectivity under Jamaica proposal.	0.00	Replaced by similar project subsumed
Tagging - ICCAT	7,950.00	Discussion, consensus assumed.
Tagging - Local	117,785.00	Artisanal option assumed.
Reef fish Dispersal and Nat. Mortality dispersal first, then Consensus achieved.	24,574.00	Objectives of study were reversed:
ICCAT Participation	70,330.00	Consensus was reached on participation.
Activities Identified During Workshop		
Habitat mapping and approach tabled by WG. Tentative budget shown.	20,000.00	Consensus reached on need for study
Expansion of Ciguatera Study Montserrat. Tentative budget shown.	10, 000.00	Need expressed by Antigua and Barbuda,
Total	1,199,945.00*	

* These values were altered after the Workshop as a result of changes recommended during follow-up consultations with fisheries officers.

Working Group Reports were also revised to incorporate the recommended changes.

4.4.3 Scheduling for assessment activities (SSW/WP/27)

The scheduling of all assessment activities was presented in a format set out for the period FY 1993/94 to FY 1998/99. The document showed that stock assessment activities would be the major ones occupying the Pelagic and Reef Fishes RAU. The data presented showed that there was overcommittment by all the RAU staff to varying extents. In general, the key table presented showed that the majority of the assessment activities would begin in FY1994/95. Activities for Trinidad & Tobago and Jamaica had been set back from this general start-up date to prevent a bunching up of all the starts. The main reason for this concern was the limited staff resources at the RAU. For Trinidad & Tobago and Jamaica, start-up was FY1995/96 and 1996/97 respectively in the original presentation.

Following discussions with participants, the following changes were agreed upon. Assessment activities would begin in Jamaica in FY 1994/95 with a short (six-month) consultant's study of data on pelagic resources. In Jamaica, there would be a separate study of the deep slope resources on selected oceanic banks which would begin in FY 1995/96 and continue into the next fiscal year for a total of two years. For Trinidad and Tobago, biological data collection would begin in FY 1995/96 as originally set out. Note that the length of biological data collection in any one country would not exceed two years. Because the start-up year could differ, however, the length of the bar in table 3, covers the period from FY1994/95 to FY1996/97.

It was noted that availability of CFRAMP personnel could be a problem, in the future. It was suggested that this potential problem would be reduced with the hiring of new biologists at the RAU in the summer of 1994. The revised information for the scheduling of all assessment activities is shown in Table 3. The major features to note would be the omission of the selectivity study, the reversal of the goals of the study now known as the dispersal/mortality study and the removal of the maturity (hermaphroditic fishes) study.

Table 3 REVISED SCHEDULING OF ASSESSMENT SUBPROJECT ACTIVITIES

	PROJECTS	FY92/93	FY93/94	FY94/95	FY95/96	FY96/97	FY97/98
1	ICCAT Participation						
2	Biological Data Collection						
	Jamaica - pelagic						
	Jamaica - deep slope						
	Trinidad						
	All other countries						
3	Dispersal/Mortality						
4	Age and Growth						
5	Local Tagging						
6	ICCAT Tagging						

4.5 METHODOLOGICAL PAPERS

4.5.1 Data Collection for Length Based Stock Assessment (SSW/WP/36)

The paper noted that typically fishermen's catches can form a biased sample of the fish population, giving fisheries data collection its own character. The choice of the amount of data to be collected is dependent on: (a) how valuable the catch is; (b) how costly data collection is; (c) the value of the collected data to the assessment; and (d) the type of assessment method to be used.

It was pointed out that length-based methods of stock assessment utilise data that are simple and relatively cheap to obtain. Assessment results could be in the form of a long-term management advice, short-term management advice, and simple assessment information in the form of rough guides or broad averages.

The factors which should be considered when designing a sampling programme for length-based stock assessment were: aggregation method; length interval; time span of study; and uniformity of sampling frequency.

4.5.2 Errors in the data

It was said that it was usual to think of data errors in terms of bias, variance, and silly mistakes. The person designing the data collection must find ways of reducing these error sources as far as possible or, at least, to some level that would be considered acceptable.

The most sensible approach to reducing bias was said to have a series of sampling strata such that it was simple to arrange random sampling within each stratum. It may be necessary to consider the bias as unknown and probably not removable, while ensuring its consistency from year to year; thus enabling it to be calibrated from other information sources. Such data could still be useful for assessment if the biases were consistent over the time series. The best approach for reducing variance would be to split the population into a number of more homogeneous strata; variation within these strata could then be reduced and the overall estimate made by combining the results of each stratum. Mistakes could include unmeasured, mis-measured, unrecorded, or misrecorded data.

Carefully designing the sampling system and the use of available checking and procedures, such as cross-checking with other data, checking the range of values, and checking average levels of particular variables, were said to go a long way towards reducing mistakes. It was noted that the human side of the data collection process is extremely important. Sampling or treatment biases could include: samples which are too small or too infrequent; systematic errors in length measurements, or non-random selection of the fish being measured; and errors in the method for grouping length measurements. It was said to be more advantageous to have larger samples in which the modes in the distribution, if any, would thus be clearer. The smallest practical length interval should be used; these could be aggregated later as necessary. It was suggested that the

length-frequency analysis should be performed with a suite of alternative groupings, including groupings of the time period represented by each sample.

The paper noted the need to consider all aspects of the sampling programme, thus avoiding ill-defined situations which could lead to biased sampling related to the definition of the population, nature of the sampling procedures, and randomness of unit selection. The design should ensure that the basic assumptions of the methods of analysis could be met by the data set to be collected. There should be, at least, a harmonization of methodologies used in each CFRAMP participating country such that the same types of length information are collected. It was suggested that participating countries use fork length for fish species with obviously forked tails, or total lengths. Carapace lengths should be used for crustaceans, and lip thickness for conch.

A number of general and specific guidelines were given for designing a sampling scheme to ensure that any error would be at an "acceptable" level within well-defined objectives. The data collection programme was said to be dynamic and hence, at regular intervals in the overall programme the sampling design should be reviewed.

In the discussion, questions arose as to the dynamic approach to data collection and this approach was the one recommended. The interests of the data end-users, quality control in data entry, as well as proper training and high motivation of data collectors, were considered as factors affecting data collection systems. Levels of remuneration, legislation and use of marketing facilities were other factors which were said to affect the success of fishery data collection systems.

4.5.3 Field and Laboratory Methods for the Determination of Maturity of Fishes (SSW/WP/37)

The ability of a fish stock to withstand perturbation due to fishing and natural causes is a function of its life history parameters: reproduction, growth and mortality. Fisheries managers should therefore be familiar with basic life history knowledge which would guide them in developing suitable strategies for the management of the resources. The paper outlined several methods for determining maturity of fishes, both in the field and in the laboratory.

Two field methods of determining maturity were discussed. One method involved the use of descriptions of the external features of the gonads to assign them to one of several maturity stages. It was suggested that for ease of use in the field and because of the difficulty in distinguishing some stages, the number of maturity stages be reduced to four or five by combining two or more stages into one. Convenient stages to use could be immature, developing, ripe, spawning and spent.

The second field method involved was the use of the Gonadosomatic Index (G.S.I., which is the weight of the gonad as a percentage of the body weight). G.S.I. could be used as a measure maturity and a time series of mean monthly G.S.I. would show the mean reproductive condition

of the fish stock throughout the year from which it would be possible to determine peaks in reproductive activity. The G.S.I. method was considered to be the more reliable of the two field methods for determining spawning seasons as it relies on quantitative measurements.

Three laboratory methods for determining maturity of fishes were discussed: the use of keys describing the appearance of stained histological preparations of gonads of various maturity stages, egg diameter frequency distributions and the use of image analyses systems (IAS). These methods look at the fate of the reproductive products during gametogenesis. The oocyte diameter frequency distribution method would have the advantage of requiring less equipment, chemicals and training of personnel than histological methods. One disadvantage of the egg measurement method would be that it could not be used for determining maturity of males or for detecting transitional gonads of hermaphroditic species. Histological methods would be the only reliable means of determining sex and maturity of hermaphrodites. In addition, making egg diameter measurements would be very time consuming. IAS could be used to determine maturity of fish ovaries. IAS would have the advantage of speed and would not require the use of noxious chemicals associated with histology or with the egg diameter technique. However, IAS would require expensive equipment and specially trained personnel.

4.5.4 Guidelines for the Collection and Storage of Hard Parts of Fish in the Field (SSW/WP/38)

As discussed in SSW/WP/34, biological data collectors in participating countries would be asked to collect hard parts of fish as part of the initiative to provide age and growth information. A brief document was prepared describing the location of the hard parts to be sampled, techniques for their removal, and methods for preservation. The paper was intended as a resource document for both fisheries officers and data collectors.

Based on information obtained during CFRAMP's pilot studies, several recommendations were made which should minimise the cost of this project. For example, it was noted that for some species, it could be possible to use other hard parts in place of the traditional otoliths. Techniques were also discussed which would minimise physical damage to the fish, an important consideration for large, highly-valued species. Such approaches, which would lead to trust between fishers/vendors and data collectors, were viewed as very important for the success of the data collection program.

In response to questions from participants, RAU staff noted that it was very important that all members of the RAU became proficient[3] at techniques for hard part removal, prior to holding planned instructional sessions with data collectors.

[3] A Consultant is being contacted to assist with training of data collectors and with training of RAU staff as appropriate.

4.5.5 Management of Biological Data (SSW/WP/39)

This paper was presented as a broad overview of some of the concepts of data management and essentially shared CFRAMP's developing philosophy on the subject. Data management was said to begin with data collection. In particular, it was said to be the collection of accurate observations from a catch in the field. Further to that point, it was also said to involve effective training and adequate monitoring of data collectors in the field, as this was the primary source of ensuring accuracy of data. A major point was that for an optimal data management system, data collectors would first need an understanding of the eventual use to which the data they collect are put, as well as the mastery of biological skills needed for the job.

Careful storage of original data forms and computerisation of data possibly entered into spreadsheets, was said to allow for data entry, data processing and analysis, reporting and graphics. On the other hand, national data collection schemes would probably require a variety of relational database systems to accommodate the complexity and flexibility required. Training of data entry operators would allow for improvement of data sets by data correction as errors are spotted. Security of data was recommended in the form of rigorous data backup and separate data storage away from the data entry site. Data reports were products of the data management system. These data reports were defined for the purposes of the paper as outputs that were the result of arithmetic calculations required at intervals and which were amenable to a high degree of automation. Other outputs requiring model application, interpretation and/or intellectual creativity were described as data analyses.

The paper then examined fishery statistics and such aspects as the application of raising factors. Length frequencies and the required forms were also examined as to their suitability for jobs with a specific level of precision. Higher levels of precision were preferred over others. The matter of biological observations on fishes was also examined and such aspects as length-weight relationships. Data management software used by CFRAMP, in particular, the FoxPro application TIP (Trip Interview Application) was said to be appropriate for most countries in CFRAMP. It was described as being designed for entry and compilation of catch/effort, length frequency and individual fish observation data. One minor negative aspect of TIP was that it was somewhat more complex than strictly necessary for use in the Caribbean, but was still the best for the purposes at the present time. The paper concluded by pointing out the need for training in data management practices and the use of database applications for the production of standardised reports and output datasets. It also noted that CFRAMP, with the assistance of the OECS Fisheries Unit, was developing arrangements for the provision of in-country training in all aspects of field data collection.

This paper also presented a number of data collection forms useful to CFRAMP participating countries which were accepted without change.

4.6 INVITATIONAL PAPER

4.6.1 An Approach forMinimizing the Costs of Obtaining the Growth Curves Required for Fish Stock Assessments in the Caribbean[4]

Age and growth studies in the Caribbean and elsewhere in the tropics are usually conducted to estimate the parameters ($L\infty$, K, t_o) of the von Bertalanffy Growth Function (VBGF), as required by various analytic stock assessment models (Beverton and Holt's yield per recruit model and its variants, Jones' length cohort analysis and its variants, etc.)

Usually, a single set of growth parameters per (single-species) stock (or population) is considered sufficient, because:

- growth parameters appear to vary among years far less than fishing mortality, the parameter of interest for most fisheries investigations; and
- the scarcity of data and personnel in the region would in any case make periodic re-estimation of growth parameters impossible.

Growth parameters estimates exist and are documented in FishBase (Pauly and Froese 1991) for many species (>100) in the greater Caribbean area, and particularly for most of the fish species considered of prime importance in the CARICOM area (Table 4).

Hence it was suggested that the most effective approach for accelerating fish stock assessments in the area would be to:

1) find a way to make VBGF parameters estimates pertaining to a given site or stock (or a number of sites or stocks) apply to the site or stock one is interested in (henceforthwith "critical site" or "critical stock");

2) estimate age and growth from hard parts (e.g., otoliths) only in important species that have never been studied in terms of growth. (i.e., for which no size-at-age data are available from which growth parameters could be straightforward and reliably estimated.)

Item (2) is obvious, and should in any case become part of the terms of reference of the CFRAMP-sponsored Fish Aging Laboratory which may be set up at the IMA, Trinidad and Tobago.

Item (1) was the topic of this paper.

[4] Summary of a lecture presented by Daniel Pauly (ICLARM) at the CARICOM Fisheries Resources Assessment and Management Program -Subproject Specification Workshop, St. Kitts, January 18-26, 1994.

Evidence was presented which shows that for fish, there exists a strong inverse relationship between the parameters K and $L\infty$ of the VBGF, expressed by the relationship

$$Ø' = \log10\ K + 2\ \log10\ L\infty \quad ...1)$$

with Ø' showing very little variability among stocks of the same species. In addition, data were presented showing that Ø' is normally distributed within a species.

Hence, it was shown that given an estimate of Ø' from any stock of a given species, and an estimate of $L\infty$ for a critical stock of the same species, the value of K in the critical stock could be estimated from

$$\log K_{crit} = Ø' - 2 \log L\infty_{crit} \quad ...2)$$

Moreover, when several $L\infty$, K pairs are available from various stock, the mean or median Ø'(Õ') could be calculated, and K_{crit} estimated by inserting Ø' into equation (2)[5].

This estimate of K_{crit}, would not only be compatible with the estimate of $L\infty$ for the stock concerned, but also embody all the aging work that went into the value of Ø', often a considerable accumulation of material and intellectual inputs.

Estimating $L\infty$ for a critical stock was shown to be straightforward, being done either:

- from length-frequency data, using the Wetherall method as incorporated in the complete ELEFAN or FiSAT, its successor (to be launched in early 1994 by FAO and ICLARM);
- from a series of locally sampled maximum sizes, using extreme value theory (also incorporated as an easy-to-use routine of FiSAT); or
- a single value of maximum size, from a report, a taxonomic account, or field observations.

The paper indicated the availability of growth parameter estimates for a large number of species for the CARICOM area. Hence, the approach was proposed to use these growth parameters estimates to obtain critical values of K, given critical estimates of $L\infty$. In this way, fish stock assessments in the region would be considerably accelerated.

The software programs required for this approach (FishBase, FiSAT, AUXIM) are available, or soon would be available to all researchers in the CARICOM area.

---

[5] A new software program called AUXIM has recently been developed at ICLARM which facilitates estimation of Ø' and the identification of outliers; this program is available from the author.

The author indicated his readiness to make this approach known to researchers in the area, either through one, or several presentations in the region, or through a short course that could be arranged, by CFRAMP for the purpose.

Reference

Pauly, D. and R. Froese. 1991. FishBase: Assembling Information of fish. NAGA, the ICLARM Quarterly, October 1991: 10-11.

Table 4. Some species of interest of CARICOM countries and the numbers of corresponding growth curves available through FishBase (Pauly and Froese, 1991).

Reef and Slope		**Growth Curves**
queen snapper	*Etelis oculatus*	0
red hind	*Epinephelus guttatus*	1-LF; 1-OS
mutton snapper	*Lutjanus analis*	6-OS
silk snapper	*Lutjanus vivanus*	1
stoplight parrotfish	*Sparisoma viride*	0
mahogany snapper	*Lutjanus mahogoni*	0
longjaw squirrelfish	*Holocentrus ascensionis*	1-TR
yellow snapper	*Ocyurus chrysurus*	1-LF: 4-OS; 2-OR
rock hind	*Epinephelus adscensionis*	0
queen triggerfish	*Balistes vetula*	1-LF; 1-TR; 1-OS;1
doctorfish	*Acanthurus chirurgus*	1-TR
white grunt	*Haemulon plumieri*	2-LF; 1-OS; 1
coney	*Epinephelus fulvus*	1-LF
ocean surgeon	*Acanthurus bahianus*	1-TR
blackfin snapper	*Lutjanus buccanella*	2-LF; 1
Nassau grouper	*Epinephelus striatus*	2-TR; 1-OS; 1
margate	*Haemulon album*	1-LF;1-OS
French	*Haemulon flavolinealum*	0
redtail parrotfish	*Sparisoma chrysopterum*	1-TR
hogfish	*Lachnolaimus maximus*	0
striped grunt	*Haemulon striatum*	0
tomtate grunt	*Haemulon aurolineatum*	1-OS
porkfish	*Anisotremus virginicus*	0
striped parrotfish	*Scarus iserti*	0
dog snapper	*Lutjanus jocu*	0
black grouper	*Mycteroperca bonaci*	1-OS
porgy	*Calamus penna*	0
yellowmouth grouper	*Mycteroperca interstitialis*	0
smallmouth grunt	*Haemulon chrysargyreum*	0
blue parrotfish	*Scarus vetula*	1-TR
red grouper	*Epinephelus morio*	1-OS
black grunt	*Haemulon bonariense*	0
redspotted goatfish	*Pseudupeneus maculatus*	2-OS
angelfish	*Pomacanthus paru*	1-TR

Reef and Slope		**Growth Curves**
smooth trunkfish	*Lactophrys triqueter*	0
tiger grouper	*Mycteroperca tigris*	0
saucereye porgy	*Calamus calamus*	0
Large Pelagics		
wahoo	*Acanthocybium solandri*	1-LF
blackfin tuna	*Thunnus atlanticus*	2
crevalle jack	*Caranx hippos*	0
cero mackerel	*Scomberomorus regalis*	1-LF
albacore	*Thunnus alalunga*	5-OS; 2-TR; 1-OR;10
Serra mackerel	*Scomberomorus brasiliensis*	1-LF
marlin	*Makaira nigricans*	1-OS; 1
Atlantic bonito	*Sarda sarda*	6
little tuna	*Euthynnus alletteratus*	4
tiger shark	*Galeocerdo cuvieri*	3-OR
scalloped hammerhead	*Sphyrna lewini*	1-OR
blacktip shark	*Carcharhinus limbatus*	4-OR
Coastal Pelagics		
ballyhoo	*Hemiramphus brasilienis*	1
skipjack tuna	*Katsuwonus pelamis*	10-LF; 4-OS; 2-TR; 32
scad	*Selar crumenophthalmus*	7-LF; 5-OS
scaled sardine	*Harengula jaguana*	0
round scad	*Decapterus punctatus*	1-LR; 1-OS
yellow jack	*Caranx bartholomaei*	0
jack	*Caranx ruber*	1-LF; 1-OR
rainbow runner	*Elagatis bipinnulata*	1-LF
great barracuda	*Sphyraena barracuda*	3
bar jack	*Caranx ruber*	0
sprat	*Harengula humeralis*	0
nurse shark	*Ginglymostoma cirratum*	0
black jack	*Caranx lugubris*	1-OS; 1
amberjack	*Seriola dumerili*	1
thread herring	*Opisthonema oglinum*	0
horse-eye jack	*Caranx latus*	0
"anchovy"	*Sardinella brasiliensis*	0

Numbers without codes are entries where the data type is blank.

Growth curves based on:
LF - length frequency
OS - otolith/scale data
OR - other annual rings
TR - tagging recapture data

CHAPTER 5

5.0 WORKING GROUP REPORTS

This section includes the summaries of detailed discussions held by participating countries regarding biological data collection. As a preliminary step, a two page questionnaire was circulated to participating countries during late 1993, (see Appendix D of Working Paper No. 33). The intention was for countries to review and examine the forms and more importantly, to indicate on the forms the following:

1. description of existing biological data collection procedures

2. timing and location of samples.

During the meeting of the Working Groups, an additional guide used for discussions was an appendix to the Workshop document on Biological Data Collection in participating countries (SSW/WP/33), appendix C - Outline of report to be prepared by Working Groups (See also Appendix 4 - of the present report). Additional points which were addressed as a result of this guide included:

1. potential special problems in national biological data collection
2. levels of discards (if any).
3. data collector workloads
4. identification of landing sites
5. integration of biological data collection with existing catch and effort data collection system.
6. data handling
7. quality control.

The general discussions therefore produced reports which were done with a view to implementing a data collection program for biological data properly customised to suit each country. During the period 24th to 25th January, participating countries met in working groups to discuss the technical details and the practical difficulties of designing and implementing such a data collection program for biological information. The working groups were as follows:

<u>Working Group 1</u>
Grenada
St. Vincent & the Grenadines
Barbados
St. Lucia.

<u>Working Group 2</u>
Antigua/Barbuda
St. Kitts
Nevis
Montserrat
Dominica

Working Group 3	Working Group 4
Guyana	Belize
Trinidad & Tobago	Jamaica

Each of these working group discussions was chaired/coordinated by a CFRAMP staff member. At the Workshop, countries decided to report on the results of their discussions both collectively as Working Groups and also individually by participating country. It should be noted that these conclusions on national biological data collection programs represent the customised plans of a two-year biological data collection program commencing in FY 1994/95.

5.1 REPORT OF WORKING GROUP 1

Working Group Members: **Paul Phillip**
Justin Rennie
Raymond Ryan
Stephen Willoughby
Sarah George
Feria Narcisse
Peter Murray
Susan Singh-Renton

Establishing the Background/History for Data Collection

The Biological Sampling Questionnaires were reviewed. Amendments and additions were made to the forms and completed questionnaires were submitted to CFRAMP.

Preliminaries to Data Collection

1. Species Assignments were reviewed. Alterations included the following:

   a) Grenada - Crevalle jack is not a targeted species and thus it would be difficult to achieve the required sampling size for intensive sampling (i.e. L). If necessary, Grenada could also sample for redhind (1, A) and queen snapper (1, A).

   b) St. Vincent - King mackerel is not a consistently targeted species thus it would be difficult to achieve intensive sampling (i.e. L). Skipjack could be sampled at full intensity (L), yellowtail and mahogany snappers, and queen triggerfish at low intensity (1) and redhind, blackfin tuna, and coney could all be sampled at high intensities (L).

c) Barbados - Yellowfin tuna, blackfin tuna, and skipjack tuna, silk and queen snappers could be sampled for maturity (M). Queen and silk snapper and blackfin tuna could also be sampled for age (A). Crevalle jack, sailfish and yellow grouper are not consistently targeted species. It would be difficult to achieve sufficient sampling size for intensive sampling (L). Landings of queen triggerfish, grey snapper and longjaw squirrelfish landings are not sufficiently large to warrant even a low level of sampling. Blackbar squirrelfish could be added as a species for length sampling.

d) St. Lucia - Mutton snapper, longjaw squirrel, and French grunt are not landed in quantities to warrant intensive sampling (i.e. L). Coney and blackbar squirrelfish could be sampled intensively. Crevalle jack, silk and southern red snapper are not highly featured in the catch (they were not on the country list of species).

e) Grenadines - It could be difficult to access the large purchase market being provided for demersals by trading vessels off the Grenadines since the fish are transshipped at sea. It would be necessary to employ a biological data collector for the Grenadines (serving both St. Vincent and Grenada). The existing mobile data collector in St. Vincent could be used to work with this person and thus provide transport. Fish would probably need to be bought from these vessels to facilitate age and maturity data collection.

The Grenadines could also be sampled for redhind, queen snapper, queen triggerfish, red snapper and the silk snapper as these species are sold to hotels in the Grenadines.

Implications of Discarding Practices

In Grenada and St. Vincent, large local vessels generally remove the heads of large pelagics prior to landing. Demersals are mostly landed whole. The effect of this practice should be minimal since sampling would focus on smaller vessels landing their catches on the mainland. In Barbados the same discarding practice occurs; however, this accounts for a substantial quantity of fish landed. This would need to be considered. No significant discarding practices occur in St. Lucia.

Special Problems of National Interest and Workload of Data Collectors (Biological Samplers)

1. General concern was voiced over the recommended sample size (300 individuals per sample site per month). This could be very difficult to acquire for many reef species or to achieve given the large number of species to be sampled per site and gear. For large pelagics it would not likely be a problem if we assume that only one stock is being fished from all sites of any given island.

It was recognised that, for the scarcer species, countries should aim to acquire as large a sample as possible, but it might be worth considering reducing the number of species to be sampled.

2. The point was made that demersal catches taken by a single boat are often obtained from an extensive area over which several stocks may exist. This issue would need to be addressed since it would lead to bias in data analyses and interpretation.

3. When selecting their biological sampler(s) countries should consider that it would be preferable that the person is able to occasionally venture to sea with fishermen to examine the areas fished. In addition this would help to develop rapport with the fishermen.

4. General concern was expressed that the individual(s) concerned with biological sampling could be lost from the system after the CFRAMP project. However, the group noted that if samplers are to work within existing catch/effort data collectors and fisheries officers or, if the catch/effort data collectors do the work themselves, the skills should in fact be sustainable.

5. Most countries felt they would require separate biological samplers (i.e. not add to the workload of existing data collectors) and their systems allowed for the two to work together. Barbados has market personnel collecting weight information at major fish markets, therefore catch/effort data collectors do not service these sites. Biological samplers at these sites would have to work alone or might require an assistant. A similar situation occurs at Kingstown market in St. Vincent. This situation would therefore need to be resolved.

6. Reef fishes are often referred to as "reef/pot fish". Also, data collectors often call a number of small tuna species "bonito". There would also be a need to ascertain whether the fish being called "southern red snapper" is actually *Lutjanus purpureus*. It was felt that many different snapper species are being called by this common name. Concern was expressed that countries might have selected doctorfish, believing it to be the colloquial name for "crevalle jack".

7. Many countries are doing a complete census of landings at sampled sites. This could prove impossible during periods when biological sampling is taking place since the data collector would need to assist the biological sampler. Countries should be certain of the procedures for sub-sampling catch and effort and extrapolating for total catch.

Design of Data Collection (Biological Sampling) System

a) **BARBADOS**

Sample Sites:

Site 1 Oistins: pelagic , reef and slope species

Constraints: speed at which catch is transferred to vendors; no data collector present for collaborative biological sampling. A mobile team of two biological samplers would be preferable.

Permission: none.

Interception: attempt at docks, but may need to go to market vendor.

Site 2 B'town Market: pelagic and slope species

Constraints: same as Oistins.

Permission: photo IDs required from Senior Superintendent of Markets.

Interception: same as Oistins.

Site 3 West coast site (to be selected): Slope and reef species

Constraints: no data collector to assist; speed of sale to public.

Permission: none

Interception: at the boats, but may need to go to the vendors.

b) **GRENADA**

Sample Sites: (species codes explained in Section 4.3, Table 1)

Site 1 Melville St., St. Georges*: YFT SAI RHN QSN
Site 2 Gouyave*: DOL YFT SAI
Site 3 Grenville*: DOL WAH KGN BFT SKJ RHN
Site 4 Victoria: YFT KGN BFT SAI
Site 5 Duquesne: YFT KNG SAI RHN
Site 6 Sauters: BFT RHN
Site 7 Grenada Commercial Fisheries Ltd.: YFT SAI QSN
Site 8 Caribbean Seafoods Ltd.: YFT
* Priority sites

Constraints: accommodation costs would often be required for the sampler to work at west coast sites due to the late arrival of boats. Sampler could use the telephone to keep in touch with relevant markets/cooperatives so as to learn catch levels for any given day. In general, however, landings at Grenville tend to be in the day (10a.m.-3p.m.) whereas Gouyave and Melville St. boats land in the evening.

Permission: none (market facilities are controlled by the Fisheries Div.) except for work with export companies (Sites 7 and 8).

Interception: preferably at boat side or in market before reaching the vendor.

c) ST. LUCIA

Sample Sites:

Site 1 Castries (Fisheries Complex and Bannanes): DOL WAH KGN YFT BFT QTR all Reef and Slope.
Site 2 Dennery: WAH KNG YFT BFT QTR DOL
Site 3 Vieux Fort: WAH KGN YFT DOL BFT QTR QSN, Squirrelfish (not LSQ), SPA.
Site 4 Soufriere: pelagic, reef and slope species (possibly not high intensity).

Constraints: difficulty of one person travelling to all four sites (will generate high travelling costs and be time consuming). Ideally there should be one sampler for Castries and Dennery and another for Vieux Fort and Soufriere. The cost of an additional collector, allowing for maximum sampling, should be weighed against the lower sampling capacity and travel costs of only one collector.

Permission: required to operate within the St. Lucia Fish Marketing Corporation (SLFMC) in Castries. This could be obtained easily by the Fisheries Department. The SLFMC could be used for increasing sample size for pelagics and QSN.

Interception: preferably at boat side, otherwise from vendors or the SLFMC.

d) ST. VINCENT

Sample Sites:

Site 1 Kingstown: all species
Site 2 Barrouallie: DOL WAH
Site 3 Greathead Bay: Reef and Slope
Site 4 Calliaqua: DOL WAH
Site 5 Caribbean Fisheries: YFT (heads discarded at sea)

Constraints: variable catches for reef and slope species. No catch/effort data collector at Kingstown (similar constraint as Barbados).

Permission: by letter is required from the Marketing Corporation for Kingstown and Caribbean Fisheries.

Interception: preferably at the boat side, otherwise from vendors or if fish are intercepted before freezing at Kingstown market. Fish at site 5 is dressed at sea, thus there would be a need for applying a conversion from dressed weight to length for length frequency information.

e) GRENADINES

Species Sampling

Species which could be sampled in the Grenadines include RHN, parrotfish (not sure if it is STP), YTS, Coney, QSN and RSN.

Constraints: landings are sufficiently high to support high intensity sampling. However, interception by trading vessels (up to 60% of demersal landings) would significantly restrict shore-based sampling. Sampling would have to be designed to focus on these vessels to avoid bias. The St. Vincent and Grenada Fisheries Divisions are eager to overcome these problems so as to allow for some biological sampling in the Grenadines. However, it might be difficult to reach full sampling intensity. Options for overcoming this problem were considered.

License conditions could be used to allow for inspection and sampling of the catch on these vessels prior to clearing customs. Results of the recent study MAREMP/CFRAMP trading boat activities should also be reviewed before any final decisions are taken concerning the sampling strategy to deal with this market. In addition, experimental fishing being undertaken by St. Vincent Fisheries Division and the Japanese could be used as a source fish for sampling. If this problem is not overcome, then the degree of overlap with Tobago species should be considered to determine, if necessary, the priority species from the Grenadines.

Clearly there would be a need for a separate biological sampler for the Grenadines.

Implementation of the Data Collection System

Fine Tuning of Sampling Design

Based on the number of issues raised related to country-specific fine-tuning of the sampling frame and manpower constraints at the fisheries departments, it was agreed that this activity should be extended from its existing starting point to the end of May. This would yield a three week period for fine tuning. The rest of the schedule should be shifted accordingly.

With the exception of St. Lucia, staff limitations would warrant the biological samplers being used to investigate fisheries characteristics which would affect the sampling frame. Thus the initiation of data collection (biological sampling) in these countries would commence one month later.

Hiring Data Collectors

It is hoped that the long delays experienced in finalising and initiating the field activities under the previous CFRAMP data collection subprojects would be avoided in the biological data collection activities. The group noted that money would be required no later than the beginning of May. Money might be needed for advertising the biological sampling job(s).

Remuneration

The following summarises recommended changes to figures quoted in SSW/WP/33.

St. Vincent: required amount to be increased by $2,400 CDN/yr ($4,800 CDN for the 2 years) for the mainland sampler so as to enable hiring of someone who could operate as a fisheries assistant and hopefully, who could be retained by the Department after the project. One sampler would be required for the Grenadines at $6,000/yr (a total increase of $16,800 CDN for the project).

Barbados: requested 2 samplers at $14,000 CDN/yr each (a total increase of $32,000 CDN). This salary scale would be adequate for hiring an A Level graduate.

St. Lucia: requested 2 samplers at $5,000 CDN/yr each (a total increase of $8,000 CDN).

Grenada: wages for the collector would need to be increased to $8,000 CDN/yr (total increase of $4,000 CDN) in order to employ a suitable person.

Transportation

The following summarises recommended changes to figures quoted in SSW/WP/33.

St. Vincent and the Grenadines: requested $3,500 CDN/yr (total increase of $4,600 CDN).

Barbados: adequate

Grenada: requested increase to $2,000 CDN/yr for overnight accommodation (total increase of $1,600 CDN).

St. Lucia: assuming 2 samplers, it would be adequate. If one sampler is used, the cost would increase to $3,500 CDN/yr to accommodate island-wide transport.

Data Handling Forms

The following summarises recommended changes to tables in SSW/WP/39.

Basic agreement with Tables 1,2,4, and 5. Recommended that the age column be removed from Table 5 since this would not be determined in the field.

Data Submission to CFRAMP

Data would be submitted to the OECS Fisheries Desk (as directed by the OECS Third Meeting on Fisheries Management and Development) and would then be submitted to CFRAMP. The frequency of data submission would depend on the form in which it is sent. Countries would want to input in their own computers prior to submission.

TIP provides an appropriate mechanism for inputing data and frequently passing on data to OECS and CFRAMP. It was felt that countries have not been given adequate training in the operation of the programme. Countries requested more detailed exposure to this programme and other related programmes such as FiSAT. This could be facilitated by the OECS and/or CFRAMP.

Barbados requested access to the FiSAT programme and assistance in analysing their data as the project progresses.

Countries would need to become involved in their own data analysis. This should form a major component of the Interim Workshop.

Access to Data

Ownership of data would rest with the national governments. For non-participating countries, access should be granted only to scientific/research institutions and they should be required to request of the country, through the CARICOM Secretariat. For data generated by OECS countries, a copy of this request should also be made available to the OECS Secretariat.

Participating countries and regional institutions should be required to request data from the relevant country or countries through the CFRAMP Programme Directorate.

The CFRAMP Directorate should be informed in writing of any bilateral arrangements for the sharing of data between participating countries and non-participating entities.

Quality Control and Monitoring

The reporting form was considered appropriate. The frequency (bi-weekly) was considered too high given the workload of fisheries officers. The group therefore recommended a monthly report.

Other Considerations (availability of freezer space to store gonad samples)

Freezer space for storage of gonad samples is available in St. Vincent and the Grenadines, Grenada and St. Lucia. In Barbados, freezer space is available only if paid for.

5.2 REPORT OF WORKING GROUP 2

Group Members: **Eustace Royer**
Dian Black
Audra Barrett
John Jeffers
Nigel Lawrence
Harold Guiste
Paul Fanning

REPORT OF ANTIGUA AND BARBUDA

Background

In Antigua there are six sampling areas which includes 16 landing sites. Currently there are two data collectors gathering catch and effort data from these areas. In Barbuda there are two major landing sites with several minor sites. There is a part-time data collector in Barbuda collecting catch and effort data. It was proposed that an additional data collector would be hired for Antigua and the data collector in Barbuda wouldd be made full-time. We have collected some length data, and based on this information we have decided on intensive (L,M,A) collection of a subset of the species outlined in Table 1 of SSW/WP/33. Those species not included for intensive sampling would be investigated by the other Leeward Islands and Dominica.

Data Collection

It was agreed that the fork length would be taken but in the event of straight tail species the tail would be manually adjusted to obtain the maximum length. We have agreed on a 0.5 cm interval for species with maximum length of 30 cm and a 1 cm interval for larger species.

The nature of the reef the fishery is such that it would be difficult to determine the weight of individual species within a catch. The fishermen are not always tolerant of the data collectors handling the fish and most often do not have the time for sampling. It would be necessary to purchase fish from the urban areas for the collection of age and maturity data. Purchased fish could be resold to save money. In St. John's it may not be necessary to purchase fish.

Length data would be collected at all landing sites for all species, however, age and maturity data would be restricted to one or two sites for some species. The data would be collected by site sampling for all parameters. However, some data would be collected at the two fish processing plants in St. John's. For those sites where there are a high frequency of landings two data collectors may be assigned to those sites. This would be the case at St. John's on Fridays only. On other days the data collectors would be working alone. In Barbuda biological data would be collected at two landing sites.

Design of the Data Collectors System

The sampling schedule would take the form of the current catch and effort schedule, with special considerations given to the collection of the age and maturity data as necessary. All data collectors would be trained to collect both catch and effort and biological data.

With reference to the list of species given in Table 1 of SSW/WP/33, and we would be collecting intensive length, maturity and age data on red hind, stoplight parrot, French grunt, queen snapper and silk snapper. High intensive length data would also be collected for long jaw squirrel fish, and doctor fish. Less intensive (1) sampling would be done for mutton, and grey vermillion and yellow tail snapper, queen trigger, and coney. Other species may be added to the less intensive list as the workload is analysed on a continual basis.
Those species that Antigua and Barbuda are not collecting data on would be addressed by Dominica, St. Kitts, Nevis and Montserrat.

Implementation

A detailed schedule of activities has not been determined at this time, however the proposed schedule would appear acceptable. It is hoped that length data could be collected with present resources from March, 1994. Funds required to support biological data collection are given in Table 5.

Table 5. Budget (EC$) for Biological Data Collection in Antigua.

Budget	Monthly	Annual
1 full time Data Collector	1,200.00	14,400.00
Gratuity		3,600.00
Transportation	275.00	3,300.00
1 part-time Data Collector	600.00	7,200.00
Transportation	137.50	1,650.00
part time data entry	200.00	2,400.00
Purchase of fish (100)	300.00	3,600.00
shipping	50.00	600.00

Tools

3 scales	400.00
4 dissection kits	150.00
2 measuring boards	100.00
3 measuring tapes	150.00
5 lab coats	250.00
2 tool bags	150.00

Data Handling

The forms presented in SSW/WP/39 were accepted, however there may be some changes. The form for the submission of data to CFRAMP was also accepted. The data would be inputted by the current data inputters, the data collection supervisors, and to a lesser extent the data collector. Reports would be prepared by the data collectors.

Access to Data

Since the Leeward Islands would be collecting data to be used by all these islands collectively it would be ideal for reports and raw data to be sent to the OECS and RAU (biological data) which would be sent out to the individual islands.
Any other information needs could be handled on a bilateral basis.

Monitoring and Quality Control

The data collector would be monitored by the data collection supervisor. The data collectors would be retained periodically. The data collectors would visit Barbuda once monthly.

REPORT OF DOMINICA

Revisions of species sampling list are given in table 6 below. Demersal reef species would be sampled during the pelagic off season except coney which is targeted year round.

Table 6. Overview of Biological Data Collection in Dominica

Species	Length	Age	Maturity
Yellowfin Tuna	1	-	-
Kingfish	L	-	-
Red Hind	L	A	M
Coney	L	A	M
Long Nose Squirrel Fish	L	A	M
French Grunt	L	-	-

The letters indicated in the table above depicts the type and intensity of sampling to be done.

'I' indicates a low intensity of sampling: a total of 300 length samples per species would be measured over a two month period.

'L' indicates intense sampling: 300 samples per species per month per gear type.

'A' indicates collection of hard parts for ageing. Otoliths would be taken as well as length data and 300 hard part samples per species would be required over the year.

'M' indicates collection of maturity data. This would involve only observation of gonads and stages of maturity. Five hundred (500) samples per species would be required over the year.

For practical purposes of length measurement fork length would be used, and in cases where this is not possible, total length would be used. Standard length would not be used as it might cause confusion in the mind of the observer.

Length measurement would be taken to the nearest millimeter. Class intervals of 0.5 cm would be used for fish species with maximum size of less than 30 cm and 1.0 cm for those greater than 30 cm.

Strategy

This exercise as far as possible would be integrated into the existing data collection system and would for the most part utilise existing data collectors. Data would be obtained from about seven landing sites, the locations of which would spread the sampling effort over a wide cross-section of the fishery as possible. The sites chosen would be those where the species to be studied are landed in greatest abundance and hence the acquisition of adequate sample sizes would be assured.

Where possible, fisheries co-operatives would be used to obtain biological data owing to the fact that they might allow more time for sampling and collection of gonads and otoliths.

The existing data collectors on whom more responsibility would be placed, might be granted a small increase in salary as allowed by government. This would serve as an incentive to perform the extra duties.

A Fisheries Supervisory Reconnaissance person to be trained by the Stock Assessment Officer would be absolutely necessary for the proper functioning of this project. The person would function as a Data Quality Control Officer to monitor on site sampling, to collect his/her own samples and to assist the data collector in other work while fish are being measured.

The person would have to travel throughout the island and would have to visit at least one site per week.

Training and upgrading of data collectors once a year would be necessary. They would be trained in the techniques of otolith and gonad sampling. Training would take the form of a one day workshop and transportation and meals would be provided. Persons responsible for data entry and fisheries extension officers would also attend this workshop. The Fisheries Division could prepare measuring equipment once the material is provided.

A monthly report on sampling activities would be sent to the RAU, as well as all collected samples.

The budget presented (Table 7) below was revised to accommodate for above noted changes in the Biological Data Collection Program for Dominica.

Table 7. Dominica Budget for the Biological Data Collection on the Large Pelagic, Reef and Deep Slope Fishes Assessment Subproject (CDN$)

	Details	FY94/95	FY95/96	FY96/97	TOTALS
A	**Field Operations**				
1	Materials and equipment	500.00	1,000.00	500.00	2,000.00
2	Fish Purchase	625.00	1,250.00	625.00	2,500.00
	Field Op. Total	1,125.00	2,250.00	1,125.00	4,500.00
B	**Communications**				
1	Communications	100.00	200.00	100.00	400.00
2	Shipping	300.00	600.00	300.00	1,200.00
	Communications Total	400.00	800.00	400.00	1,600.00
C	**Travel**				
1	Travel	600.00	1,200.00	600.00	2,400.00
2	Transportation (training)	150.00	150.00	150.00	450.00
	Travel Total	750.00	1,350.00	750.00	2,850.00
D	**Remunerations**				
1	Salaries	4,200.00	8,400.00	4,200.00	16,800.00
2	Salary increase	2,730.00	5,460.00	2,730.00	10,920.00
3	Catering	300.00	300.00	300.00	900.00
	Remunerations Total	7,230.00	14,160.00	7,230.00	28,620.00

REPORT OF MONTSERRAT

Plan for Biological Data Collection

The collection of age and growth and length frequency data would be done at the two major landing sites i.e. Carr's Bay and Plymouth.

An additional data collector, along with those already on staff, would be trained in the collection of biological data. The additional data collector would be employed at least 2 weeks prior to the training programme and would be primarily responsible for the collection of biological data. At least one data collector would work on Saturdays. The mobile data collector would spend 2 and 3 days alternate weeks at Carr's Bay and Plymouth.

The interception would be done at the landing sites. The fork length would be used where applicable. In some cases, samples for age and growth would be gathered at points where fish are sold and gutted. Weight of fish would be estimated by eye where actual weight could not be obtained. Revisions to biological data sampling in Montserrat are given in table 8.

Table 8. Overview of Biological Data Collection in Montserrat

Species	Age	Maturity	L	l
Red hind	-	-	L	l
Spotlight parrot	A	-	L	l
Doctorfish	A	M	L	l
Queen triggerfish	A	M	L	l
Longjaw squirrel	-	-	L	-
Silk snapper	-		L	-
French grunt			L	-

The salary quoted in the table 9 is in keeping with the local Government's salary scale.

Table 9. Budget for Biological Data Collection (EC$) in Montserrat

3 scales @	$400 x 3	$1,200.00
Wages and redundancy	$240 x 52 wks. x 2 yrs	$26,880.00
Transportation	$8 x 52 wks x 2 yrs	$832.00
Purchase of fish	x 2 yrs	$600.00
3 Measuring boards	$150 x 3	$450.00
3 Tapes	$15 x 3	$45.00
1 Knife		$20.00
3 Bags	$3 x 7	$225.00
Shipping	x 2 yrs	$800.00
Clipboards	$14 x 3	$42.00

		$31,094.00

The scheduled as outlined in SSW/WP/33 is acceptable. Length frequency would commence in April.

REPORT OF ST. KITTS/NEVIS

Current data collection activity in St. Kitts and Nevis are restricted to gathering catch information. One major landing site on each island is undergoing a census while random sampling is taking place at all of the other sites. Data collection activity is done at a total of twelve sites, six in St. Kitts and six in Nevis.

The proposed species assignment was revised as follows:

We feel that these species are not only important to us but they are caught in sufficient quantities which would allow us to do the length frequency studies and other biological studies. There are seven species namely: dolphinfish (*Coryphaena hippurus*), crevalle jack (*Caranx hippos*), wahoo (*Acanthocybium solandri*), kingfish (*Scomberomorus cavalla*), red hind (*Epinephelus guttatus*), coney (*Epinephelus fulva*) and queen snapper (*Etelis oculatus*).

Coney and queen snapper would be sampled at sites on Nevis, while the remaining five species would be sampled at sites on St. Kitts.

Another data collector would be required by each island to accommodate biological data collection.

Approximately $1250 EC per month would cover the cost of salary for each new data collector (table 10).

All data collectors would be trained to do all aspects of the data collection work. In-country training on the actual recording and collection plus understanding of the use of this data would be necessary.

Table 10. Overview of Biological Data Collection in St. Kitts and Nevis

	Budget (CDN$)			
	FY94/95	FY95/96	FY96/97	TOTAL
Equipment	500.00	1,000.00	500.00	2,000.00
Fish Purchase	250.00	500.00	250.00	1,000.00
Travel	600.00	1,200.00	600.00	2,400.00
Remunerations (2 collectors)	7,500.00	15,000.00	7,500.00	30,000.00

5.3 REPORT OF WORKING GROUP 3

Working Group Members: Reuben Charles
Terrence Phillips
Bores Fabres
Sita Kuruvilla
Sherry Heileman
John Neilson

Establishing the Background/History for Data Collection

Guyana fisheries deals mostly with deep slope species, especially snappers. Due to a species identification problem, the precise species composition of landings is not well understood but is thought to include red snapper and mahogany snapper.
In the grouper category, *Epinephelus sp.* are important. Georgetown is the only site for landing such species. It is also thought that fish caught in Guyanese waters may be landed in Trinidad and Tobago.

Recently, there has been the possibility of joint ventures starting up dealing with pelagic species. There is a second major landing site, Corentyne, but fish landed there might have originated from Surinam.

Trinidad and Tobago submitted an extensive report documenting current patterns in the fishery and existing data collection activities, included here as table 11.

Preliminaries to Data Collection

Trinidad and Tobago would collect biological data on dolphinfish, wahoo, yellowfin tuna, kingfish, crevalle jack, sailfish, red snapper and vermillion snapper in Tobago. In Trinidad, data would be collected on carite, albacore, bigeye tuna, red snapper, vermillion snapper, five species of sharks, yellowfin tuna, kingfish, crevalle jack, lane snapper and dog snapper. Guyana noted that the problems of species identification are very important, and would need to be resolved early. Trinidad and Tobago could assist Guyana to resolve its species identification problems.

Trinidad and Tobago ran a fisheries taxonomy and ichthyology course last year and could provide the material to other interested countries. It was suggested that CFRAMP contact Ken Carpenter to provide project with 12 copies of the FAO Field Guide for Guyana.

Discarding Practices

Impacts on stock assessment of other countries catching a portion of the stock were discussed, as was the option of sampling bycatch of trawlers. Combination of countries landings for stock assessment purposes may be an option. An assessment of the discarding practices could be obtained by sending data collectors to sea to observe the trailer operations.

Type of Length Measurement

It was agreed to measure to the nearest 0.5 cm or 1.0 cm below, for fish of certain size.

Workload

The workload of the data collectors seemed reasonable for the resources available. A caveat was that the actual requirements for biological data collection for Guyana would not be ascertained until the species identification issues were resolved.

Design of the Data Collection System

Landing Sites

Trinidad and Tobago produced a table showing landings by species and sites (see Table 11). For Guyana, the major landing sites are Georgetown (trawlers) and Corentyne (most of the gill net fleet) (also see Table 11). Depending on results of species identification studies, there might be a requirement to get information on landings from gear such as Chinese seine.

Special Constraints to Obtaining Data

In Guyana, the two major landings sites are separated by over 100 miles. Landings are normally made headless (shark) or gutless (snappers, groupers, pelagics). Issues relating to damage to marketability were discussed. No special permits would be required. It was questioned whether it was feasible to place biological data collectors on vessels since the trips tended to be of long duration. In response, it was pointed out that collectors could come back on a different vessel.

Captains should be cooperative about having an observer on board. Guyana noted that some artisanal fishermen would not allow women on the boat.

Proper identification (t-shirts, caps) of data collectors was also noted to be important.

Trinidad and Tobago noted the necessity of purchasing some samples. Sampling of pre-sorted fish at markets was identified as a problem, particularly for the pelagics (kingfish, carite). Working with National Fisheries Company might require letter of verbal authorization. A small room would be available for use by data collectors.

A special constraint in Trinidad and Tobago might be the distance between sites, and the unpredictability of fishing patterns.

The issue of Accidental Death and Dismemberment Insurance was raised, and it was assumed mandatory for all countries.

Where are fish to be intercepted by sampler?

Both countries agreed that sampling would work much better if it occurs at the beach/landing site.

Integration of Biological Data Collection with Catch/Effort Data Collectors.

Basically, the use of multi-person teams were supported by both countries. However, the use of voice activated recorders could be considered.

Coordination of the two programs of data collection would provide obvious benefits, including improved identification of times of landings, maintaining contacts and greater coverage. Guyana noted that two-person teams could be useful, but such teams could also include Fisheries Division personnel.

Implementation of Data Collection System

Is schedule realistic?

Guyana noted that the schedule seemed appropriate. Trinidad and Tobago wanted CFRAMP to provide details of the interim workshop and the type of people for which the workshop was intended.

Remuneration and Hiring

Hiring would be through normal civil service approach in Guyana. Trinidad and Tobago noted that hiring in Trinidad and Tobago could have special problems. In Trinidad and Tobago, data collectors might be considered CFRAMP employees, rather than Fisheries Division employees. It might be possible to recruit new directly from the better schools.

Trinidad and Tobago agreed to train their biological data collectors.

Guyana noted that salaries were under review, but proposed salary seemed adequate at the time of this meeting. For trips to Corentyne, however, there would be a requirement to provide funds for overnight allowances and subsistence of about $200.00 CDN (assumes 3 trips per month).

Trinidad and Tobago positions were reviewed and remunerations seemed adequate.

Other Budget Costs

Field costs in budget table seemed low (FY 1994/95). It was suggested that amounts provided be doubled, providing scope for items such as printing of data forms, purchase of field gear etc.

Transportation Requirements

Guyana requested provision of a motorcycle, with a suitable allocation for fuel. It was noted that Trinidad and Tobago transportation costs were high and these needed to be checked.

Data Handling

CFRAMP data collection forms are to be reviewed by participating countries, in light of existing practices. Data sheets could follow existing practices as long as required data are collected. Suggestion was for CFRAMP to circulate draft data collection forms.

How often and in what form should data be forwarded to CFRAMP?

Countries preferred option of reporting on a monthly basis. Summary sheets could be sent to CFRAMP. It was agreed that the data be provided in an aggregated form.

Access to Data

Policies and procedures regarding access to data should be comparable to catch and effort data. Countries should be able to share data on a standardised basis. General guidelines for age determination data seemed appropriate for the other types of data as well. Final fate of the data -- should be in public domain, possibly on CD-ROM.

Monitoring and Quality Control

Both countries thought that the reporting form could be used on a monthly basis. Size stratified question could be dealt with under comments, and reviewed during quarterly visits of CFRAMP staff.

Other Considerations

Public relations materials could be useful, to introduce programs and to help facilitate collectors' work. The use of pamphlets or other media such as a video were discussed. It was noted that there might be an option of using funds from the Community Participation Subproject thus building desirable cross-linkages with the CFRAMP activities.

LIST OF REFERENCES USED FOR SPECIES IDENTIFICATION AND COMMON/LOCAL NAMES INTERPRETATION

** Allen, G.R. (1985) FAO Species Catalogue Vol. 6. Snappers of the world. an annotated and illustrated catalogue of Lutjanid species known to date. FAO Fish. Synop., (125): 208 p.

** Bohlke, J.E. and C.C.G. Chaplin (1968). Fishes of the Bahamas and adjacent tropical waters.The Academy of Natural Sciences of Philadelphia. Livingstone Publishing Company, Wynnewood, Pa.: 771.

** Castro, J.I. (1993). The sharks of North American waters. (W.L. Moody, Jr. Natural history series: no. 5). Texas A & M University Press, College Station. 180p.

** Cervigon, F. (1966). Los peces marinos de Venezuela (2 tomos). Tomo II. Estacion de investicaciones marinas de Margarita. Fundacion la salle de Ciencas Naturales, Caracas. pp. 449-951.

** Cervigon, F. (1966). Los peces marinos de Venezuala (2 tomos). Tomo I. Estacion de investigaciones marinas de Margarita. Fundacion la salle de Ciencas Naturales, Caracas. pp. 1-436.

** Cervigon, F. et al (1992). Fichas FAO de identification de especies para los fines de la pesca. Guia de campo de las expecies commerciales marinas y de aguas salobres de la costa septentrional de Sur America. Preparado con el financimiento de la Comision de Communidades Europeas Y de NORAD. Roma, FAO.: 513p.

Chaplin, C.C.G. (1972). Fishwatchers guide to west Atlantic coral reefs. Livingstone Publication. Wynnewood, Pennsylvania. 65p.

** Collette, B.B. and C.E. Nauen (1983). FAO Species Catalogue Vol. 2. Scombrids of the world. An annotated and illustrated catalogue of Tunas, Mackerels, Bonitos, and elated species known to date. FAO Fish. Synop., (125). 137 p.

** Compagno, L.J.V. (1984). FAO Species Catalogue. Vol. 4 Sharks of the World. An annotated and illustrated catalogue of shark species known to date. Part 2 - Carcharhiniformes. pp. 251-655.

** Dore, I. and C. Frimodt (1987). An illustrated guide to shrimp of the world. Van Norstrand Reinhold, New York. 229p.

Fischer, W. (ed.) (1979). FAO Species Identification sheets for Fishery purposes. Western Central Atlantic (Fishing Area 31), Vols. I-VII, FAO, Rome.

Greenberg, J & I Greenberg (1986). Guide to Corals and Fishes of Florida, the Bahamas and the Caribbean. Seahawk Press, Miami. 64p.

** Guzman, C.L. (197). Clave tentativa para identificar los Chondrichthyes del orden Squaliformes (Selachii) de Venezuela. Estacion de investigaciones marinas de Margarita. Fundacion la Salle de Ciencas Naturales, Margarita, Venezuala. 79p.

** Hoese, H.D. and R. Moore (1977). Fishes of the Gulf of Mexico, Texas, Louisiana, and adjacent waters. (W.L. Moody, Jr. Natural history series; No. 1) Texas A&M University Press, College Station and London. 327p.

** Holthius, L.B. (1980). FAO Species Catalogue. Vol. 6. Shrimps and Prawns of the world. An annotated catalogue of species of interest to Fisheries. FAO Fish. Synop., (125). 261p.

Humann, P. (1989). Reef Fish Identification, Florida, Caribbean and the Bahamas. New World Publications, Inc. Vaughan Press, Orlando, Florida. 267 p.

** Masatsure, T. and T. Okutani (1983). Crustaceans and mollusks trawled off Suriname and French Guiana. Japan Marine Fishery Resource Research Centre, 354 p.

Michael, S.W. (1993). Reef Sharks and Rays of the World, A Guide to their Identification, Behaviour and Ecology. Sea Challengers, Monterey, CA 106 p.

Miyake, M. and S. Hayasi (1978). Field manual for statistics and sampling of Atlantic tunas and tuna-like fishes. International Commission for the Conservation of Atlantic Tunas, Madrid, Spain. 104 p.

** Nakamura, I. (1985). FAO Species Catalogue. Vol. 5. Billfishes of the world. An annotated and illustrated catalogue of Marlins, Sailfishes, Spearfishes and Swordfishes known to date. FAO Fish Synop., (125). 65 p.

** Nelson, J.S. (1984) Fishes of the World. John Wiley & Sons Inc. 2nd Ed. 523 p.

Randall, J.E. (1983). Caribbean Reef Fishes. T.F.H. Publications, Inc., N.J. 350 p.

Robins, C.R., Ray, G.C. and J. Douglas. (1986). Atlantic Coast Fishes. Peterson Field Guide Series No. 32. Houghton Mifflin Co., Boston. 354. p.

** Roper, C.F.E., M.J. Sweeney and C.E. Nauen (1984). FAO Species Catalogue. Vol. 3. Cephalopods of the World. An annotated and illustrated catalogue of species of interest of fisheries. FAO Fish. Synop., (125). 277 p.

Russo, J.L. (1981). Field guide to fishes commonly taken in longline operations in the western North Atlantic Ocean. NOAA Tech. REPT. NMFS Circ. 435. 51p.

Stokes, F.J. (1984). Divers and Snorkelers Guide to the Fishes and Sea Life of the Caribbean, Florida, Bahamas and Bermuda. Academy of Natural Sciences of Philadelphia Publishers. 160 p.

Took, I.F. (1978). Fishes of the Caribbean Reefs. MacMillan Caribbean. 92 p.

** Uyeno, T., K. Matsuura and E. Fujii (eds.) (1983). Fishes trawled off Suriname and French Guiana. Japan Marine Fishery Resource Research Center. 519 p.

** Walls, J.G. (1975). Fishes of the northern Gulf of Mexico. T.F.H. Publications, Inc. 432 p.

** Whitehead, P.J.P. (1985). FAO Species Catalogue. Vol. 7. Clupeoid fishes of the world. An annotated and illustrated catalogue of the Herrings, Sardines, Pilchards, Sprats, Anchovies and Wolf Herrings. Part 1 - Chirocentridae, Clupeidae and Pristigasteridae. FAO Fish. Synop., (125). pp. 305-579.

** Zaneveld, J.D. (1983). Caribbean fish life. Index to the local and scientific names of the marine fishes and fishlike invertebrates of the Caribbean area (Tropical Western Central Atlantic Ocean). E.J. Brill, Leiden. 163 p.

** References not cited in the CFRAMP listing but available at the Fisheries Division in Trinidad.

Table 11

Species covered by biological data collection programme	LARGE PELAGICS									REEF DEMERSALS			DEEP SLOPE		SHARKS				
	Dolphin	Wahoo	Kingfish	Crevalle Jack	Sailfish	Spanish Mackerel	Yellowfin Tuna	Albacore	Bigeye tuna	Lane Snapper	Dogtooth Snapper	Mahogany Snapper	Red Snapper	Vermilion Snapper	C. porosus	C. limbatus	S. tudes	R. lalandi	S. lewini
	L	L	LMA	LMA	L	LMA	L	L	L	L	LMA		L	L		LMA			
TRINIDAD major landing sites																			
Carenage			LMA																
Chaguaramas			LMA							L				L					
Las Cuevas			LMA																
Blanchisseuse			LMA																
Toco																LMA			
Balandra										L				L					
Ortoire										L				L					
Manzanilla																LMA			
Guayaguaryare						LMA				L				L		LMA			
Moruga			LMA			LMA				L				L		LMA			
Erin						LMA								L					
Icacos						LMA				L				L					
Bonasse						LMA				L				L		LMA			
Fullerton						LMA				L				L					
Carli Bay						LMA													
N.F.C.			LMA				L L	L											
TOBAGO major landing sites																			
Milford							*							L					
Pigeon Point	L						L												
Buccoo	L																		
Grafton																			
Plymouth		L																	
King Peter's Bay																			
Castara	L																		
Parlatuvier		L																	
Charlotteville		L					L												
Speyside		L																	
Granby Bay													L	L					
Lambeau	L						L												
Kilgwyn													L	L					
	L	L	L	L		LM	L			L		L	L					LM	
GUYANA major landing sites																			
Georgetown (IFC)			L	L		LM							L						
Corentyne (66) (IFC			L	L		LM													

* This refers to a general grouping "Tunas" - The form in which data is presently recorded on tuna landings in Tobago

** The list is subject to change pending confirmation of species identification

Table 11 (contd.)

	DOLPHIN	WAHOO	YELLOWFIN TUNA	ALBACORE	BIGEYE TUNA	KING M.	SPAN. M.	CREVALLE	LANE SNAPPER	DOG TOOTH SNAPPER	MAHOGANY SNAPPER	RED SNAPPER	VERMILION SNAPPER	SHARKS (5 SPECIES)
GUYANA	L	L	L			L	LM	L	L	L		L	L	LM
T & T	L	L	L	L	L	LMA*	LMA**	LMA*	L	L		L	L	LMA**
	LARGE PELAGICS											REEF	DEEP SLOPE	

* Otoliths and hard Parts collected for IMA

** Ageing to be performed by the Fisheries Division

5.4 REPORT OF WORKING GROUP 4

Working Group Members: Milton Haughton
Jean-Marc Bergevin
Karl Aiken
Andre Kong
Stephanie Auil-Marshalleck
Antionette Clemetson

REPORT OF BELIZE

Fishing efforts in Belize are focused mainly on the lobster fishery both in terms of value and in terms of effort, with 60% of the total fishermen concentrating their efforts only on lobster. This is followed by the conch fishery, then the trawl shrimp fishery and finally, the finfish fishery, being the least developed.

Foreign exchange generated from the fishing industry in 1992 was in the vicinity of BEL$23 million (US$11.5 million), and is expected to increase slightly for 1993, with a marked increase in total shrimp exported due to a substantial increase in farmed shrimp. Even though the combined foreign exchange generated from trawled and farmed shrimp exceeds that of conch, shrimp would not be classified as the second most important, since for the purposes of this report, we are referring to 'trawled' or 'fished' shrimp only.

There is no doubt that the finfish fishery is underdeveloped in some areas of Belize. However, recommendations to increase the exploitation of this fishery could not be justified without reliable data on the status of the stocks and, the potential yields associated with these stocks.

With the lobster fishery assumed to be moderately exploited to overexploited, and the conch fishery reflecting constant decreases in annual catch, it is crucial that fish stock assessment be conducted in Belize so as to obtain a clearer view of the species and stocks that are exploitable; and to what extent they might be exploited.

WORKPLAN

Considering that a great quantity of work exists on many of the species that Belize had listed as priority (table 12), we have decided to incorporate three species only to those listed in the table proposed by CFRAMP; namely: the lemon sharks under the pelagics section (*Negrapion brevirostis*), the Nassau grouper under the reef section (*Epinephelus striatus)*, and the dog snapper under the slope section (*Lutjanus jocu*). This would leave Belize with a total of nine species for which intensive sampling of length frequencies would be conducted, eight species for which maturity studies would be conducted, and six species for which ageing would be conducted. The existing information on those species which are of special interest to Belize would be requested from ASFA and FISHBASE at ICLARM.

The first activity related to the Biological Data Collection would be the design and

The first activity related to the Biological Data Collection would be the design and implementation of a one (1) month survey by a consultant to be provided by CFRAMP, to determine spawning seasons and spawning aggregation sites in Belize. This activity would be expected to last from 1st - 31st July 1994, after which the length, age, and maturity data collection would begin.

The data collector for Belize would monitor demersal finfish landings at local cooperatives and markets (figure 2 and table 13) with the view of determining the extent to which these landings are from spawning aggregations in Belizean waters, as well as an indication of the proportion of finfish actually taken from spawning aggregations.

Tables 4 and 5 presented in Working Paper 39 (SSW/WP/39) would be used for the collection of length and biological data respectively. Two one week workshops would be scheduled in which it would be expected that Data Entry Operators and their supervisors would be trained to better manage and analyse the data collected.

Maturity stages would be determined using the maturation scales presented as figure 1 in SSW/WP/40. All hard parts extracted would be shipped at regular intervals to the Institute of Marine Affairs (IMA) in Trinidad for further age and growth studies; results of which would be sent back to the country of origin and to other participating countries if requested.

All the Biological Data Collection activities mentioned above would be incorporated into the present catch and effort activities, so that the Catch/Effort Data Collector would assist the Biological Data Collector.

The proposed budget is shown in table 14.

Table 12 - Priority Fish Species List - Belize

Common/Local Name	Scientific Name	Priority Listing
GROUPER, black	*Mycteroperca bonaci*	4
GROUPER, Nassau	*Epinephelus striatus*	1
GRUNT, blue-stroped	*Haemulon sciurus*	14
JACK, crevalle	*Caranx hippos*	5
SNAPPER, dog	*Lutjanus jocu*	2
SNAPPER, grey	*Lutjanus griseus*	11
SNAPPER, lane	*Lutjanus synagris*	12
SNAPPER, mutton	*Lutjanus analis*	8
SNAPPER, red	*Lutjanus campechanus*	3
SNAPPER, reef/schoolmaster	*Lutjanus adodus*	9
SNAPPER, black	*Apsilus dentatus*	7
SNAPPER, yellowtail	*Ocyurus chrysurus*	6
HOGFISH	*Lachnolaimus maximus*	10
STONE BASS	*Gerres cinereus*	13

Table 13 - Codes for landing sites - Belize (See Fig. 2 for position)

(1) Belize City National Cooperative
(2) Belize City Northern Cooperative
(3) Caye Caulker Northern Cooperative
(4) Caribena Cooperative
(5) Dangriga Market
(6) Placentia Cooperative
(7) Punta Gorda Market
(8) Corozal Market

FIG. 2. Map of Belize showing coral reef area and landing sites.

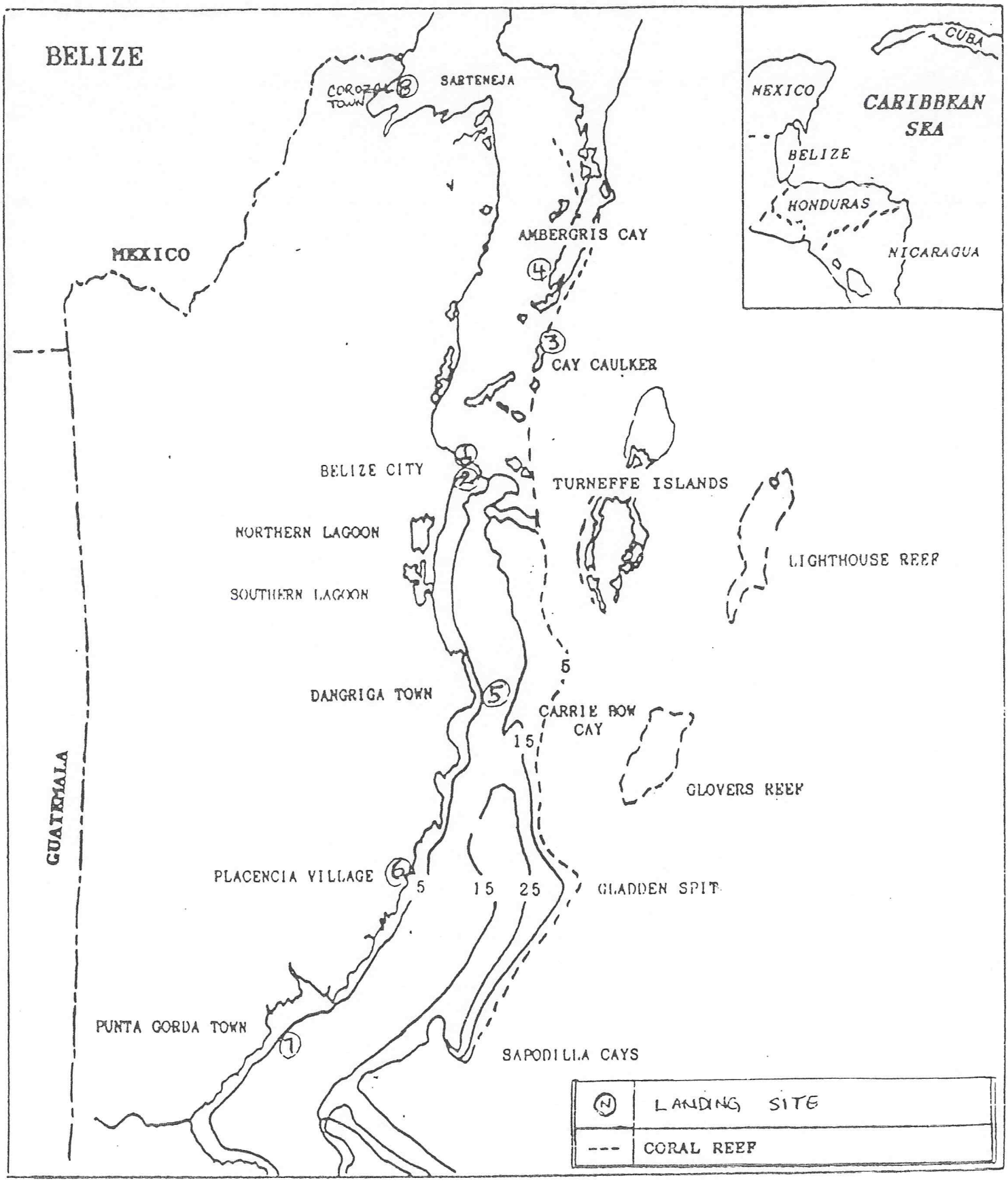


Table 14 BIOLOGICAL DATA COLLECTION IN BELIZE (USD)

		DETAILS	UNIT COST	FY94/95	FY95/96	TOTALS
A	FIELD OPERATIONS					
1	Field expenses			$730.00	$730.00	$1,460.00
2	Fish purchase	300 samples by 2 lbs	$2.50/lb	$750.00	$750.00	$1,500.00
3	Freezer		$1,000	$1,000.00	$0.00	$1,000.00
	Field Op. Total			$2,480.00	$1,480.00	$3,960.00
B	COMMUNICATIONS					
1	Communications			$750.00	$750.00	$1,500.00
2	Shipping			$500.00	$500.00	$1,000.00
	Communications Total			$1,250.00	$1,250.00	$2,500.00
C	REPORTING					
1	Publication				$1,200.00	$1,200.00
	Reporting Total				$1,200.00	$1,200.00
D	TRAVEL					
1	Belize - Dang.	100 by 4/mths by 24		$2,400.00	$2,400.00	$4,800.00
2	Belize - Czl.	20 by 4 monthby 24		$480.00	$480.00	$960.00
3	Belize - S. Pedro	70 by 4/month by 24 months		$1,680.00	$1,680.00	$3,360.00
	Travel Total			$4,560.00	$4,560.00	$9,120.00
E	REMUNERATIONS					
1	Salaries	1100/mth by 12 monthsyr1		$6,600.00		$6,600.00
2	Salary	1210/mth by 12 months yr2			$7,260.00	$7,260.00
3	Accommodation	8ngts/month @30.00 by 24mths		$1,440.00	$1,440.00	$2,880.00
4	Subsistence	16dys/mth by 25.00.mth by 24 mth		$2,400.00	$2,400.00	$4,800.00
	Remunerations Total			$10,440.00	$11,100.00	$21,540.00
F	ANNUAL TOTAL			$18,730.00	$18,390.00	$38,320.00

REPORT OF JAMAICA

Biological Survey of Demersal (deepslope fishes)

Background

There has been extensive research on the traditional Jamaican finfish fisheries over the past three decades. All studies have indicated that these fisheries are over-exploited. The Jamaica Fisheries Division (JFD) therefore would refrain from doing additional research on these resources; instead effort would concentrate on evaluating the extent of total biomass of the demersal fish on selected offshore banks, and also to access all available information on the local stocks of small and large pelagics. It is envisaged that the pelagic fishery resources would be assessed by the consultant through the use of existing data to obtain an estimate of abundance. An assessment of total biomass of the demersal stock would be conducted by the use of the Leslie method which would be the basis for the sustainable development of the fisheries and would also act as a guide to managing the subsequent entry of vessels into the fishery. It is the intention of the Jamaican Fisheries Division to obtain the preliminary data required to determine a first estimate of stock biomass and to develop a draft plan for subsequent development of the fishery.

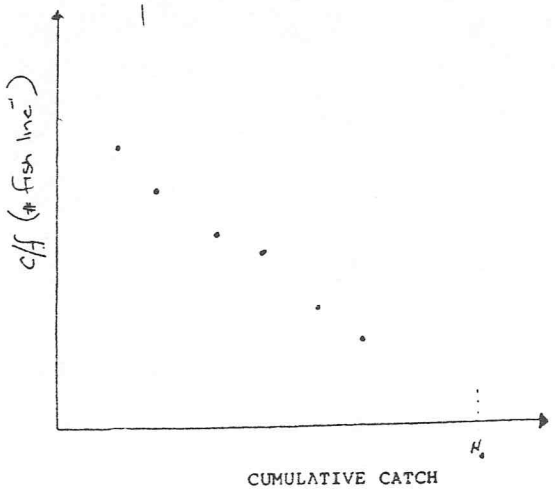
The latter would be conducted through the efforts a consultant who would be sub-contracted and whose terms of reference are presented further in this document.

Work Plan

The basic underlying principle of the Leslie method is the assumed linear relation between catch per unit of effort and cumulative catch. The theory enables an estimation of the theoretical standing biomass in the absence of fishing, by extrapolation. (Figure 3).

The method also assumes (i) homogeneity in standing stock distribution, (ii) the stock is primarily composed of demersal species, (iii) the deployment of a fishing gear with a high catchability coefficient (iv) the gear saturation is relatively small and (v) the absence of extraneous fishing activities during the sample time in the sample site (i.e. no other vessel is fishing within the sample area during the data collection process). Success of the method relies on the ability to rapidly remove a standing stock and hence drastically reduce the effect of natural mortality so that the total mortality closely approximates fishing mortality.

Figure 3 - Application of catch data to the Leslie method



The RV Dolphin would be utilised to conduct intense fishing on a known area for one week on each selected bank. The method of fishing to be deployed should be the use of drop-lines which would most likely comprise a total of 10-12 baited hooks per line (240 lbs strain). However the precise specifications would be refined through subsequent communication with other researchers which have utilised this gear in demersal fishing in other tropical areas.

The periphery of the sampling area would be determined by the use of GPS (Global Positioning system), depth sounder and also flag poles (NB: The size of the sampling site would be determined through further communication). This area should ideally be centrally located on the bank (i.e. the area which is selected should be representative) and also be sufficiently large to minimise variance but must also be large enough to maintain a vigilance. It is therefore proposed that the RV be escorted by the Jamaican Coast Guard whose responsibility would be to ensure that the sample site remains close to other vessels. The research vessel would then proceed to engage in fishing in this confined area.

The average soak time would be relatively short (eg. 30 minutes) after which the lines would be retrieved; the catch per line would then be recorded on the basis of the types and number of each species caught per line (kg) and the total catch per line. Data collected would include depth fished, species composition and biological data which would include the numbers of each species caught and individual weight of each fish caught. Data would be entered on appropriate data sheets as specified in Working Paper SSW/WP/39.

The hooks would then be re-baited and the process repeated. The entire area would be fished in the course of a short time period, (i.e. a day); the process would then be repeated for a period of five fishing days. This process of intensive fishing activity would be conducted on all banks which are to be investigated.

The effects of seasonality, catchability, use of fishing gear, oceanographic conditions and behavioural cues on selected banks would be obtained through communication with local fishing experts which have engaged in previous fishing activities within these areas (e.g. Karl Aiken-Fisheries Biologist and Clinton Jenning-Master Fisherman FD) prior to sampling. Each bank would then be revisited within six months to repeat the sampling based on the interviews with the local experts with regards to seasonality.

Further communication with international fishing experts would also be needed to refine the technological specification of the gear deployment.

Data Analysis

Data on species landings on drop-line would be recorded on spread sheet to obtain a plot of catch per unit of effort (c/f) versus the cumulative catch. Length frequency data would also be entered on appropriate software (e.g. FISAT) for subsequent analysis using traditional methods.

Continuity

The data collected would be used to obtain an estimate of total biomass within the area (assuming the area is uniform) which would serve as a basis for sustainable development of the offshore fishery and which would give further guidance on the optimum level of fishing effort.

With the issuance of short term renewable licenses for fishing, it would be required that a license holder declare catch and effort by the use of log book which would be subject to scrutiny at the discretion of the Fisheries Division. This would enable the Fisheries Division to calculate total annual yield from the various areas.

It would also be the duty of the Fisheries Division to collect biological data as outlined in the CFRAMP proposal SSW/WP/33 via quarterly sampling on the various banks using traps, hook and line and trolling. This gear combination would facilitate the collection of specimens over a wide range of lengths. The data to be collected on these trips would include a species list, length (FL) and weight frequency, stage of maturity, gonadal samples and hard parts for appropriate species. The important species for Jamaica are assumed to be *Lutjanus buccanella, L. vivanus, A. dentatus* (black snapper), but other species of importance may emerge.

Proceeds of the fish sale would be utilised to assist in the maintenance of the RV survey activities and also contribute to the routine maintenance of the vessel.

Habitat Study

It is proposed that a small amount of funds be allocated towards a habitat study of the banks. This would facilitate the estimation of total annual yield based on the collection of catch and effort data from license holders. It is proposed that this small component be executed through collaboration with either the UWI or other interested parties.

It is proposed that the cost of implementing this minor component of the deep fish assessment be allocated between CFRAMP and the Fisheries Division (Table 15). The Fisheries Division has a RV which is fully equipped to conduct fishing in offshore locations and which has been recently rigged with a GPS. The engine was also completely overhauled and hence the vessel is currently in a condition to undertake such research activities as proposed.

Table 15 - Budget for demersal study

Item	**Contribution (CDN$)**		
	FD	CFRAMP	TOTAL
Data Collector[1] (part time)		1,500.00	1,500.00
Per Diem & Sea Time		450.00	450.00
Transportation			
Fuel		30,000.00	30,000.00
Oil		120.00	120.00
Equipment			
Nylon line (240 lbs strain)	1,000.00		1,000.00
Manual Gurdy (8)	1,600.00		1,600.00
Hooks (#9 circular hook)	1,600.00		1,600.00
Swivel	300.00		300.00
Bait	50.00		50.00
Ice		1,600.00	1,600.00
Traps		2,500.00	2,500.00
Accommodation			
Per Diem (6 weeks sampling)	6,000.00		6,000.00
Food (6 weeks sampling)		5,000.00	5,000.00
Habitat Study		5,000.00	5,000.00
Publication			
Reprints Acquisition		100.00	100.00
Report Writing		200.00	200.00
Contingency	975.00	4600.00	5,575.00

Contribution (CDN$)	FD	CFRAMP
	10,725.00	51,070.00

[1] It is required that the data collector possesses at least a first degree in Marine Biology.

PELAGIC RESOURCES ASSESSMENT IN JAMAICA

TERMS OF REFERENCES FOR THE CONSULTANT

Background

This is part of the Biological Data Collection Program for Jamaica, which is designed to examine the large pelagic fish resource in the maritime space of that country. The purpose of the Program is to collect data on large pelagic fishes in order to assess the status of these stocks and to form the basis for the development and management of these resources. The Biological Data Collection Program is an essential part of CFRAMP's efforts to assess the condition of the stocks as stated above. In view of the importance of the study and scheduling commitments, it would be necessary to engage the services of an appropriate consultant.

Duration of Consultancy

This consultancy shall be for a period not exceeding 62 days between 15 October 1994 and 30 April 1995.

Objectives

1. To provide a description of pelagic fisheries and resources of Jamaica.

2. To determine the potential for development of a small-scale versus commercial pelagic fishery.

3. To develop proposals to assess pelagic resource abundance and distribution using fishery dependent and fishery independent data.

4. To develop guidelines for the rational exploitation of pelagic resources.

Workplan

The Consultant will:

1. Conduct a thorough review of existing relevant and useful information on the large pelagic fisheries and resources of Jamaica, including available fishery, biological and environmental information;

2. Provide synopses of fishery and biological information for major commercial pelagic species of interest to Jamaica and relate this information to exploitation of these resources in Jamaican waters;

3. Gather and analyse all existing relevant data, useful for stock assessment purposes;

4. Make an inventory of all known available sources of oceanographic data, and indicate how these data may be relevant to assessment analyses and fishery development planning work;

5. Develop a proposal to examine the distribution and abundance of large pelagic resources in Jamaican waters by scientific survey;

6. Develop a proposal to collect data necessary for stock assessment purposes;

7. Develop a management plan for small-scale and commercial exploitation of pelagic resources, which provides guidelines for short-term, medium-term and long-term measures;

8. Prepare a full written technical report for submission to CFRAMP by 30 April 1995.

Outputs

Deadline dates for delivery of outputs are noted within brackets.

1. Report providing a full up-to-date description of pelagic fisheries and resources of Jamaica, and their potential for exploitation.

2. Report documents results and conclusions of assessment related data analyses.

3. Inventory of sources of oceanographic data, including an appraisal of the usefullness of these data to assessment analyses and fishery development planning.

4. Research proposal to examine distribution and abundance of large pelagic resources in Jamaica.

5. Research proposal to develop data collection program for stock assessment purposes.

6. Guidelines for short-term, medium-term and long-term management measures.

7. A full report incorporating outputs 1 to 6.

Table 16 provides details of the estimated cost of this study.

Item/Activity	FY 1994/95
Communications	2,000.00
Reporting	1,000.00
Travel (subsistence)	5,000.00
Fees (assuming 62 days)	27,900.00
TOTAL	35,900.00

Table 17. Scheduling for demersal resource study in Jamaica

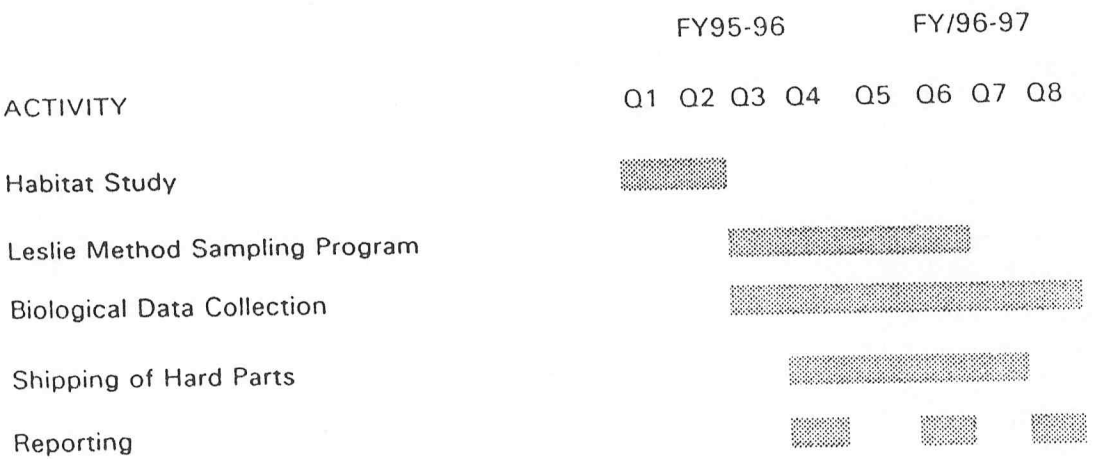
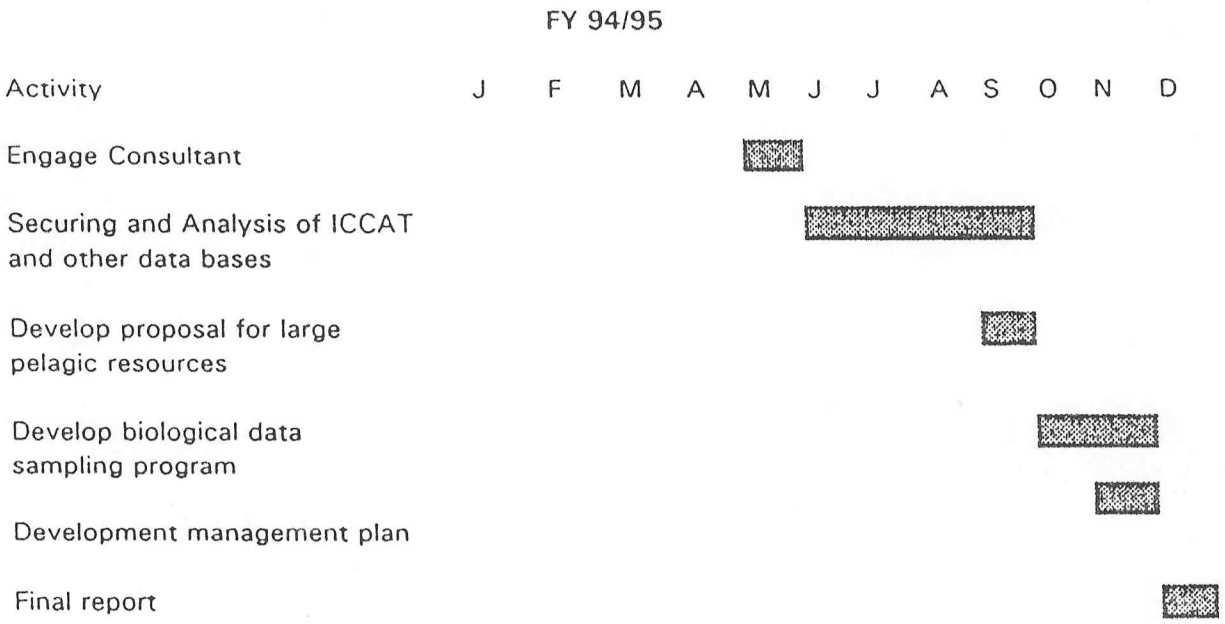


Table 18. Scheduling for pelagic assessment study.



APPENDIX 1

6.0 APPENDICES

Appendix 1

LIST OF PARTICIPANTS
ASSESSMENT SUBPROJECT SPECIFICATION WORKSHOP
18TH - 26TH JANUARY 1994

CFRAMP PARTICIPATING COUNTRIES

Antigua and Barbuda-

Eustace Royer
Chief Fisheries Officer
Fisheries Division
Point Wharf
St John's
Tel 809 462 1372 Fax. 809 462 1372

Dian Black
Fisheries Assistant
Fisheries Division
Point Wharf
St John's
Tel 809 462 1372 Fax. 809 462 1372

Barbados -

Stephen Willoughby
Chief Fisheries Officer
Fisheries Division
Bay Street
St Michael's
Tel. 809 427 8480\ 809 426 3745

Belize -

Noel D. Jacobs
Agriculture/Research Officer
182a East Collef Canal
Belize City
Tel. 501 2 32623 Fax. 501 2 32923

Grenada	-	Paul Phillip Fisheries Biologist Fisheries Division Church Street St George's Tel. 809 4403831\3814 Fax. 809 440 6613
	-	Justin Rennie Data Officer Fisheries Division Church Street St George's Tel. 809 440 3831\3814 Fax. 809 440 6613
Guyana	-	Terrence Phillips Principal Fisheries Officer Ministry of Agriculture Fisheries Department 18 Brickham, Georgetown Tel. 592 2 64398 or 2 61833
	-	Reuben Charles Chief Fisheries Officer Ministry of Agriculture Fisheries Department 18 Brickham, Georgetown Tel. 592 2 64398 or 2 61833
Jamaica	-	Andre Kong Director of Fisheries Fisheries Division Marcus Garvey Drive P.O.Box 470, Kingston 13. Tel. 809 923 8811\2\3 or 923 7571\2 Fax . same as phone
Montserrat	-	John Jeffers Fisheries Assistant Ministry of Agriculture P.O. Box 272 Plymouth Tel. 809 491 3612\2075 Fax 809 491 7897

St Kitts and Nevis -

Joseph Simmonds
Senior Fisheries Officer
Fisheries Division
P.O.Box 39
Basseterre
Tel. 809 465 8045 Fax. 809 465 8045

- Ralph Wilkins
Fisheries Officer
Fisheries Division
P.O.Box 39
Basseterre
Tel. 809 465 8045 Fax. 809 465 8045

- Randolph Walters
Fisherman
30 St. Johnson Ave.
Basseterre
Tel. 809 465 3156

- Audra Barrett
Fisheries Assistant
Ministry of Agriculture
P.O. Box 507
Charlestown
Nevis.
Tel. 809 469 5521

St Lucia -

Sarah George
Fisheries Officer
Department of Fisheries
Ministry of Agriculture
Castries
Tel. 809 452 3853 Fax. 809 452 3853

- Feria Narcisse
Data Entry officer
Dept of Fisheries
Ministry of Agriculture
Castries
Tel. 809 452 3853 Fax. 809 452 3853

St Vincent and the Grenadines	-	Raymond Ryan Fisheries Officer Fisheries Division Ministry of Agriculture, Industry and Labour Kingstown Tel. 809 456 2738 Fax. 809 457 2112
Trinidad and Tobago	-	Boris Fabres Fisheries Division Ministry of Agriculture St Clair Port of Spain Tel. 809 625 4504\4505 Fax. 809 625 4488
	-	Sita Kuruvilla Fisheries Officer Ministry of Agriculture St Clair Port of Spain Tel. 809 625 4504 \4505 Fax. 809 625 4488

OBSERVER COUNTRIES

British Virgin Islands	Anthony Mitchell Fisheries Officer Ministry of Natural Resources and Labour Conservation Fisheries Department Road Town, Tortola Tel. 809 494 5681 Fax. 809 494 2510
Puerto Rico	Miguel A. Rolon Executive Director Caribbean Fishery Management Council 268 Munoz Rivera Ave, Suite 1108 San Juan, Puerto Rico, 00918 Tel. 809 766-5928 Fax. 809 766 -6239
-	Graciela Garcia-Molinari Special Assistant to the Executive Director Caribbean Fishery Management Council 268 Munoz Rivera Ave, Suite 1108, San Juan, Puerto Rico, 00918 Tel. 809 766-5926 Fax. 809 766 -6239

INSTITUTIONS/ORGANISATIONS

IMA	-	Sherry Heileman Senior Research Officer Institute of Marine Affairs Port of Spain, Trinidad Tel. 809 634 4291/4 Fax. 809 634 4433
South Coast Conservation Foundation	-	Antoinette Clemetson Research Associate South Coast Conservation Foundation, 91a Old Hope Road Kingston 6 Tel. 809 978 4050 -1
ICLARM		Daniel Pauly Director, Life Sciences Division International Center for Living Aquatic Resources Management (ICLARM) MC P.O.Box 2631, Makati, Metro, Manila 0718, Phillipines

REGIONAL/SUBREGIONAL INSTITUTIONS/ORGANISATIONS

UWI	Hazel Oxenford Lecturer Bellairs Research Institute MAREMP UWI, Cave Hill Tel. 809 425 1310 Ext 707 Fax. 809 422 0692
	Judith Mendes Lecturer in Fisheries Centre for Marine Sciences Zoology Department U.W.I, Mona, Kingston 7 Tel. 809 927 1609 Fax. 809 927 4117

OECS Fisheries Unit	-	Peter A. Murray Data Management Officer OECS Fisheries Unit P.O.Box 846 Cane Garden Kingstown Tel. 809 457 2979 Fax. 809 456 9243
CARISEC	-	Krishna Gooriesingh Resource Economist Agriculture Development Section Division of Trade and Agriculture CARICOM Secretariat, Georgetown, Guyana Tel. 592 2 52961 Fax 592 2 67816
CONSULTANT	-	Stephanie Auil-Marshalleck Data Analyst Fisheries Division 7 Violet Avenue Kingston 6 Tel. 809 977 1637
CFRAMP	-	Milton Haughton Program Director CFMU P.O.Box 642 Princess Margaret Drive Belize City, Belize C.A. Tel. 501 2 34443 Fax. 501 2 34446
	-	Jean Marc Bergevin Program Director CFMU P.O. Box 642 Princess Margaret Drive Belize City, Belize C.A.
	-	Paul Fanning Data Manager CFMU P.O. Box 642 Princess Margaret Drive Belize City, Belize C.A.

- Karl Aiken
  Chief Scientist
  SVG RAU (CFRAMP)
  Tyrell Street
  Kingstown

- John Neilson
  Biologist
  SVG RAU (CFRAMP)
  Tyrell Street
  Kingstown

- Susan Singh-Renton
  Biologist
  SVG RAU (CFRAMP)
  Tyrell Street
  Kingstown

- Yvette Murray
  Administrative Officer
  SVG RAU (CFRAMP)
  Tyrell Street
  Kingstown

APPENDIX 2

Appendix 2

SUBPROJECT SPECIFICATION WORKSHOP FOR THE LARGE PELAGICS, REEF FISHES AND SLOPE FISHES ASSESSMENT SUBPROJECTS

AGENDA

Tuesday 18th January — **OPENING AND BACKGROUND PAPERS**

08:00 - 09:00	Registration	
09:00 - 10:30	Opening	- Overview of CFRAMP - M. Haughton, Prog. Dir. - CFRAMP Address by Program Directors, CFRAMP Keynote address and opening of Workshop - Gov't of St. Kitts/Nevis Introduction of Participants
10:00 - 10:45	Coffee Break	

Session 1 - Chairman, M. Haughton

10:45 - 11:00	Overview of workshop objectives and schedule
11:00 - 11:45	Resource assessment and fishery management advisory outputs - K. Aiken
11:45 - 12:30	Recent development in strategies and methodologies for tropical fisheries assessments, particularly studies of fish growth - D. Pauly - ICLARM
12:30 - 14:00	Lunch
14:00 - 15:30	Current activities in fish stock assessment in participating countries - Participating countries
15:30 - 15:45	Afternoon Coffee Break
15:45 - 16:30	Current activities in fish stock assessment

Wednesday 19th January — **BACKGROUND PAPERS AND CONSULTANTS REPORT**

Session 2 - Chairman, P. Fanning

09:00 - 09:45	Conceptual framework for reef and deep slope fishery assessment -K. Aiken
09:45 - 10:30	*Regulation of mesh size as a management tool for reef fish fisheries - Bellairs*[3]
10:30 - 10:45	Coffee Break
10:45 - 11:30	Estimated yields of reef and deep slope fishes from EELS of participating countries - J. Neilson
12:30 - 14:00	Lunch

[3] *Items in italics are feature presentation of pilot studies of consultant reports.*

14:00 - 14:45 An Overview of CFRAMP approaches to large pelagic fish stock assessment - S. Singh-Renton
14:45 - 15:30 Potential yields of large tuna and billfish resources in CARICOM marine areas: A preliminary estimation - S. Singh-Renton

15:30 - 15:45 Afternoon Coffee Break
15:45 - 16:30 Natural mortality and dispersal of reef fishes - J. Neilson

Tuesday 20th January **REVIEW OF PROPOSALS**

Session 3 - Chairman, S. Heileman

09:00 - 09:45 Catchability of deep slope resources - J. Neilson
09:45 - 10:30 ICCAT data analyses - S. Singh-Renton
10:30 - 10:45 Coffee Break
10:45 - 11:30 Participation in ICCAT - S. Singh Renton
12:30 - 14:00 Lunch
14:00 - 14:45 Preliminary Determination of Migration Patterns of the Small Tunas and Tuna-like species in Caribbean waters - S. Singh Renton
14:45 - 15:30 Determination of Migration Patterns and Stock Structure of Atlantic Billfishes and Large Tunas - S. Singh Renton
15:30 - 15:45 Afternoon Coffee Break
15:45 - 16:30 *Information from fishers - association of large pelagics with drifting objects - MAREMP*

Friday 21st January **REVIEW OF CONSULTANTS' REPORTS, BIOLOGICAL DATA COLLECTION, AGEING AND MATURITY STUDIES**

Session 4 - Chairman, M. Haughton

09:00 - 09:30 *The importance of coastal habitats as fish nursery areas - K. Aiken*
09:30 - 10:00 *Spawning aggregations in Caribbean reef fishes - S. Auil - Consultant*
10:00 - 10:30 *Information from fishers - Mapping Ciguatera around Montserrat and Nevis - S. Singh Renton*

10:30 - 10:45 Coffee Break
10:45 - 11:45 Overview of Biological Data Collection proposal (general philosophy, species selection, outputs foreseen) J. Neilson
11:45 - 12:30 Outline of plan for Jamaica/species Synopses - K. Aiken
12:30 - 14:00 Lunch
14:00 - 14:30 Outline of plan for Trinidad and Tobago - Trinidad & Tobago Division of Fisheries
14:30 - 15:15 Review of budget for Biological Data Collection - J. Neilson
15:15 - 15:30 Afternoon Coffee Break
15:30 - 15:45 Proposal for age and growth laboratory - S. Heileman and J. Neilson
15:45 - 16:30 *The role of maturity studies in fish stock assessment - S. Heileman - IMA*
16:30 - 17:00 Proposal for maturity studies - IMA/J. Neilson

Saturday 22nd January **SAMPLING CONSIDERATIONS AND FIELD TRIP**

Session 5 - Chairman, D. Pauly

09:00 - 09:30 Overview of biological sampling requirements - K. Aiken
09:30 - 10:15 Sampling design considerations for length frequency data - P. Murray - OECS FU
10:30 - 10:45 Coffee Break
10:45 - 11:15 Observing and sampling maturity stages in fishes - S. Heileman, IMA
11:15 - 11:45 Sampling hard parts of fish for age and growth studies - J. Neilson
11:45 - 12:15 Management of biological data - P. Fanning
12:15 - 13:15 Review of Budgets and Scheduling - K. Aiken
13:15 - 14:00 Lunch
14:00 Field Trip

Sunday 23rd January **OPEN**

Monday 24th January	**DESIGN NATIONAL SAMPLING PROGRAMS**
09:00 (All day)	**Working Group Sessions:**
	Review, customise or harmonise national sampling programs
	Group 1 - Grenada, St. Vincent and the Grenadines St. Lucia and Barbados (Resource persons - S. Singh-Renton and P. Murray)
	Group 2 - Antigua and Barbuda, St. Kitts and Nevis, Montserrat, Dominica. (Resource person - P. Fanning)
	Group 3 - Guyana, Trinidad and Tobago. (Resource persons - J. Neilson and S. Heileman)
	Group 4 - Belize, Jamaica (Resource person - K. Aiken)
	Resource person-at-large: Dr. D. Pauly, ICLARM
Tuesday 25th January	**DESIGN NATIONAL SAMPLING PROGRAMS (CONTINUED)**
09:00 (All day)	Working Groups (cont'd)
Wednesday 26th January	**REVIEW NATIONAL SAMPLING PROGRAMS AND SCHEDULES**
08:00	Session 6 - Chairman, P.A. Murray
09:00 - 10:30	Working Group Reports and Discussion (Group Chairmen)
10:30 - 10:45	Coffee
10:45 - 12:30	Final Working Group Reports and discussion (Group Chairmen)
	Plenary
12:30	**Closing**

APPENDIX 3

Appendix 3 LIST OF DOCUMENTS

	SSW/WP/02
Agenda	SSW/WP/01
List of documents	SSW/WP/02
Resource assessment and fishery management advisory outputs	SSW/WP/03

Current activities in fish stock assessment in participating countries

Antigua and Barbuda	SSW/WP/04
Barbados	SSW/WP/05
Belize	SSW/WP/06
Dominica	SSW/WP/07
Grenada	SSW/WP/08
Guyana	SSW/WP/09
Jamaica	SSW/WP/10
Montserrat	SSW/WP/11
St. Kitts and Nevis	SSW/WP/12
St. Lucia	SSW/WP/13
St. Vincent and the Grenadines	SSW/WP/14
Trinidad and Tobago	SSW/WP/15

Background papers and reports

Conceptual framework for reef and deep slope fishery assessment	SSW/WP/16
Potential yield estimates for reef and slope fisheries: A review of approaches and their limitations with special reference to the Caribbean	SSW/WP/17
Conceptual framework for pelagic fishery assessment	SSW/WP/18
Potential yields of large tuna and billfish resources in CARICOM Marine Areas: A preliminary estimation	SSW/WP/19
Regulation of mesh size as a management tool for reef fish fisheries	SSW/WP/20
The role of maturity studies in fish stock assessment	SSW/WP/21
Information from fishers - association of large pelagics with drifting objects	SSW/WP/22
Review of the role of coastal habitats as nursery areas for coral reef fishes.	SSW/WP/23
A review of the occurrence of fish spawning Aggregations and the implications for fisheries management.	SSW/WP/24
Information from fishers - mapping ciguatera around Montserrat and Nevis	SSW/WP/25

around Montserrat and Nevis	SSW/WP/25

Proposals

Budget for Assessment Subproject activities	SSW/WP/26
Scheduling of Assessment Subproject activities	SSW/WP/27
Natural mortality and dispersal of reef fishes	SSW/WP/28
Selectivity of Hook and Line Gear for Deep Slope Resources	SSW/WP/29
Participation in ICCAT	SSW/WP/30
Tagging of large pelagics Determination of migration patterns and stock structure of the Atlantic Billfishes and Large Tunas	SSW/WP/31
Preliminary determination of migration patterns of the small Tunas and Tuna-like species in Caribbean waters	SSW/WP/32
Biological data collection in participating countries	SSW/WP/33
Provision of Age Determination Data	SSW/WP/34
Maturity studies	SSW/WP/35

Methodology

Data Collection for Length Based Stock Assessment	SSW/WP/36
Observing and sampling maturity stages in fishes	SSW/WP/37
Sampling hard parts of fish for age and growth studies	SSW/WP/38
Management of biological data	SSW/WP/39

APPENDIX 4

Appendix 4

OUTLINE OF REPORT TO BE PREPARED BY WORKING GROUPS

Establishing the Background/History for Data Collection

- ensure that background questionnaires are completed, as much as is possible (see Appendix D for background questionnaires).

Preliminaries to Data Collection

- are proposed species "assignments" acceptable from all countries point of view?

- are there special problems of national interest which have been overlooked in the preliminary plans, and could the data collectors obtain information which could be of use in addressing those special needs?

- describe any known discarding practices, and evaluate implications for biological data collection.

- agree on type of lengths to be collected (fork length recommended unless special case -- all countries must agree!!)

- agree on level of precision of fish lengths (following Gulland and Rosenberg (1992), we recommend 0.5 cm interval for fish smaller than 30 cm, one cm interval for larger fish of the same species.

- is the workload for the data collector reasonable?

Design the Data Collection System

- identify major landing sites to be covered by data collectors, by species (a table would be helpful). Note that country maps are available from the resource persons for most countries.

- identify any special constraints to obtaining length-frequency, age and growth and maturity data. Describe if any special permits or letters of permission required for sampling at ports or market places. If such documentation is required, please describe how to go about obtaining it.

- where are the fish to be intercepted by the sampler? It is important that market practices do not bias the samples. Therefore, it is best if the sampler work at dockside or beachside, rather than at the retail end of a fisheries complex.

- consider now to integrate activities of biological data collector with catch/effort data collector(s), given the assumption that a two-person unit is required for most, if not all, of the sampling activities.

Implementation of the Data Collection System

- is schedule for implementation shown in the Gantt Chart realistic?

- ensure that suggested level of remuneration (see budget table) is appropriate given duties and in keeping with salary scales within country.

- identify and provide costs for transportation, if required, and ensure provided amounts are sufficient.

Data Handling

- forms for recording data -- review recommendations of Paul Fanning.

- how often and in what form should data be forwarded to CFRAMP

Access to Data

- who can access data and what approvals are required?

Monitoring and Quality Control

- review suggested form. How do we ensure that length-stratified sampling is proceeding as planned?

- consider whether requirements for monitoring are sufficient and practical given workload of fisheries officers

Other Considerations

- if maturity data are to be collected in a given country, will the samplers have access to a freezer for storing the samples.

APPENDIX 5

Appendix 5

OPENING REMARKS AND ADDRESSES.

The Workshop was officially opened on Tuesday, 18th January, 1994 with a short ceremony held at the Fort Thomas Hotel, Basseterre. The ceremony was attended by representatives of all the CFRAMP participating countries, and government officials principally from the Ministry of Agriculture, Lands and Development of the Government of St. Kitts and Nevis. Also in attendance were the two CFRAMP Program Directors, representatives of the Ministry of Education, and members of the press. The chairman of the ceremony was Mr. Joseph Simmonds, Chief Fisheries Officer of St. Kitts. In this section are included remarks by the Chairman, and the CARICOM Program Director, Mr. Milton Haughton. The text of the feature address by the main speaker, Mr. Valdemar Warner, Permanent Secretary of the Ministry of Agriculture, Lands and Housing, who also formally opened the Workshop, is provided.

Chairman's Opening Remarks by Mr. Joseph Simmonds, Chief Fisheries Officer, Fisheries Department, Ministry of Agriculture, Lands and Development, St. Kitts.

Mr. Valdemar Warner, Permanent Secretary of the Ministry of Agriculture, Lands, and Development; Mr. Milton Haughton, CARICOM Program Director of CFRAMP; Mr. Jean-Marc Bergevin, Canadian Program Director of CFRAMP; Mr. Karl Aiken, Chief Scientist for CFRAMP; Dr. Keith Archibald, Director of Agriculture; Mr. Joseph Haliday, Chief Education Officer; my colleagues from the St.Kitts and Nevis Fisheries Divisions; Dr. Daniel Pauly, Director, Life Sciences Division, ICLARM, The Philippines; Mr. Miguel Rolon, Executive Director of the Caribbean Fisheries Management Council, Puerto Rico; Graciella Garcia-Molinari, also of CFMC, Puerto Rico; representatives of CARICOM Fisheries Divisions; representative of the University of the West Indies; representative of the Institute of Marine Affairs; representative of the OECS Fisheries Unit; Fishermen; Members of the press; representatives of non-government organisations; other consultants; ladies and gentlemen, Good Morning.

It is an honour and pleasure to be Chairman of these opening proceedings this morning. First, I wish on behalf of the St.Kitts and Nevis Fisheries Divisions to welcome you all, to the CARICOM Fisheries Resource Assessment and Management Program Large Pelagics, Reef and Deep Slope Fishes Assessment Subproject Specification Workshop.

Let me, however, pause for a minute to introduce to you the members of the head table.

Mr. Valdemar Warner, Permanent Secretary in the Ministry of Agriculture, Lands, Housing Development
Mr. Milton Haughton, CARICOM Program Director of CFRAMP
Mr. Jean-Marc Bergevin, Canadian Program Director of CFRAMP
Mr. Karl Aiken, Chief Scientist for CFRAMP

Ladies and gentlemen, we are happy that you have all arrived safely here in this twin island federation of St. Kitts and Nevis, we are happy to have you with us for the next nine days as we sit together to examine the various proposals and reports concerning the assessment and management of some of the most valuable fisheries resources in our waters, and to critically review the details of methodologies, budgets, and other specifications set out by CFRAMP. I wish at this time, to extend a warm Caribbean welcome, and especially a Kittitian welcome to a special invited guest, Fisheries expert Dr. Daniel Pauly, who has journeyed all the way from ICLARM in the Philippines, to be with us during this Assessment Workshop.

During the period between today and the 26th, we also need to consider the importance and implications of the reports submitted by consultants contracted by CFRAMP to review certain significant subject areas, pilot studies and phenomena relating to fisheries assessment. Importantly also, we will sit in Working Groups later in this Assessment Workshop to formulate national sampling programs for the collection of biological information which will form the foundation of the assessment activities.

This Assessment Subproject Specification Workshop is a major milestone event in CFRAMP as it marks the fulfillment of a necessary step leading up to the implementation of assessment and resource work for the very valuable large pelagics, reef and slope fishes in the CARICOM countries.

Ladies and gentlemen, fisheries of the CARICOM represent important economic resources for the future of our countries. As a group of countries, CARICOM will possess in time the capability to manage in a sustainable fashion fisheries resources in their territorial waters. Because of this, we should be committed to the assessment and management of the fishable resources in the CARICOM region and more importantly to the sustainable exploitation of those fisheries resources so that future generations, as well as those of the present, may benefit from them.

I am confident that this Workshop will be an interesting and stimulating one because of the series of presentations and deliberations that are planned over the next nine days. Significantly, however, the success of this Workshop depends on all participants making real inputs towards the development of the design of resource assessment activities. We also have the responsibility together to work together to produce a series of documents that will help us to ensure their proper management for the future.

Before I hand over to the next speaker, I wish to take this opportunity to sincerely thank CFRAMP for their involvement in Fisheries Development in the Region.

I now call upon Mr. Milton Haughton CARICOM Program Director of CFRAMP to deliver his opening remarks. Thank you very much and a very warm welcome again to you all.

Remarks by
Mr. Valdemar Warner, Permanent Secretary
Ministry of Agriculture, Lands, and Housing
at the opening of the
Assessment Sub-Specification Workshop
(January 18-26, 1994)

On behalf of the Government and people of St. Kitts and Nevis, and more specifically of the Ministry of agriculture, the Ministry responsible for Fisheries; I extend a warm welcome to our Caribbean brothers and sisters especially those who are visiting our shores for the first time. I bring greetings from the Honorable Minister who could not be with us this morning, but who extends best wishes for a most successful workshop.

I know that in early December the organisers, and I believe some of the participants were concerned about St. Kitts as the venue for the workshop, but now that you are here, you will I hope realise that St. Kitts and Nevis is "A Land of Beauty - A Country Where Peace Abounds"

In invite you while here to use your leisure time to sample and savour the hospitality of our people, which is second to none in the Caribbean.

Here in the Caribbean we speak about being divided by water, but I invite persons involved in the fishing industry to see the waters of the Caribbean Sea and the Western Atlantic as linking our islands. More specifically, regard it as a common resource base with so much potential for development, and from which so many of our people either earn or make out a livelihood.

Traditionally, agriculture has been at the bottom of the economic spectrum in the Caribbean, with fisheries being accorded lowest priority. This I believe has been due to the uncertainty of the level of harvestable resources. There has therefore been low levels of investment and those involved in the industry have traditionally regarded it as part-time employment left generally to the older and less productive ones of our society. Because of the low level of investment, both in terms of capital and human resources, the returns have been low, making the industry very unattractive.

This low level of investment has in turn led to over exploitation of our inshore resources, resulting in lower catch both in quantity and in size, reduced income to fishing families, and in some cases abandonment of the fishing industry. The rapid expansion of Caribbean Tourism has also led to over-exploitation and near depletion of some of our marine resources, more especially conch and lobsters. Where once conch and lobster fishermen would free dive, now they are using scuba gear in up to sixty to eighty feet of water. There is need to put a regime in place to stop this over-exploitation of these resources.

The irony of the situation is that while our local fisherman suffer, evidence exists of unauthorised and illegal fishing in our exclusive economic zone by foreign vessels from as far away as south east Asia. These foreign vessels, with their advanced levels of technology are not only robbing our people of a livelihood, but are destroying the juvenile marine resources and upsetting the ecological balance of our waters. It has been reported that some of these vessels operate under

license from some Caribbean Governments, but such governments should review their policy if they are unable to monitor these activities.

Evidence also exists of environmental destruction of our waters. Industries have been known to dump dangerous chemicals at sea, and the threat of oil spills is always present with us. Cruise ships also are guilty of dumping the garbage at sea. Not only are some of these materials toxic, but they are non biodegradable and non ingestible by marine life. Agriculture, mainly crop production is also a contributor to marine deterioration; the residue of the very chemicals which are used to increase production and productivity on land are washed into the sea and upset the balance of aquatic life.

I said earlier that there are large untapped resources in our exclusive economic zone. But there is need for a proper assessment of these resources. CFRAMP, we strongly believe, is the vehicle by which a proper assessment of our resources could take place. In St. Kitts and Nevis we have begun a data collection process with financial and technical assistance from CFRAMP. This exercise not only enables us to record reliable data, but provides us with relevant information for the future development of the fisheries subsector.

Once these data have been collected and analysed, fishermen would be assisted in using this information to prepare bankable proposals for presentation to financial institutions to secure funding for capital investment in the industry.

But the harvesting of our resources must be done in a sustainable manner. Fishermen must be educated to use the right gear and equipments so that juvenile fish are not landed; they should be educated not to catch spawning lobsters or take turtles coming ashore to lay, or to take the freshly laid eggs; fishermen must be educated not to land endangered species; in fact they must be educated to respect, and protect the sources of their livelihood.

Along with fishermen education goes the passage and enforcement of laws to protect our fishing industry. If fishermen are properly educated then it is more a question of surveillance rather than enforcement.

I sincerely hope that by the end of the CIDA funded phase of this project, we will see some financial institutions, more willing to provide assistance to the fishing industry, so that those involved may benefit from improved income and a better quality of life for them and their families.

The fishing industry will then be well placed to supply more of the fresh fish required by nationals, and the growing tourist industry, leading to saving of our many valuable foreign exchange. I would wish before I close to commend the Senior Fisheries Officer, the Fisheries Officer, and the other members of staff of the Fisheries Division for the arrangements for this workshop.

I note that you have a very full schedule for the workshop, and I hope your deliberations may bear fruit. I take great pleasure in declaring this workshop open.

OPENING REMARKS BY MR. MILTON HAUGHTON
PROGRAM DIRECTOR, CFRAMP

Mr. Chairman, Distinguished Guests, Ladies and Gentlemen.

It is indeed a pleasure to be with you today and to have the privilege of welcoming you to this important CFRAMP Subproject Specification Workshop, on the assessment of large pelagics, reef and deep-slope fishes of the region. We are indeed grateful to the Government of St. Kitts and Nevis for hosting this meeting in such a beautiful environment. I want to specially thank Mr. Warner and the staff of the Ministry of Agriculture and the Fisheries Division for their kind assistance and support with the logistic arrangements for the meeting.

I want to also use this opportunity to once again thank the Government of Canada for providing most of the funding for the program as well as technical expertise to assist the countries with the management of their fisheries resources.

Mr. Chairman, overall the countries of CARICOM have been experiencing gradual recovery in economic activity over the past few years. This improvement has been attributed to increase agricultural production, growth in tourism and tight macro-economic policies pursued by many of the countries. Despite these positive trends, however, the countries of the region continue to grapple with chronic social and economic problems such as very high unemployment, rising crime, weak export/foreign exchange earnings, rising food import bills, expanding fiscal deficits, dependence upon external funding and crippling external debts. As a consequence of our legacy of colonialism we find ourselves as largely commodity-exporting countries, with severely limited capacities to compete in the world economy and generate the resources we need for growth and development. The countries have all continued to pursue policies to structurally adjust their economies and expand and diversify their productive base.

The signing of the law of the sea convention in Jamaica in 1982 and the practice of coastal states to extend their maritime jurisdiction to include a 200 mile exclusive economic zone, presents the countries of the region with new opportunities for growth and development. The area of marine space under the jurisdiction of each Caricom country is substantially greater than the area of their respective land space. St. Kitts/Nevis for example, has a total land area of 261 sq. km compared to an EEZ of more than 20,000 sq. km., Jamaica has a land area of 11,430 sq. km. and an EEZ of about 274,000 sq. km. and this pattern is the same for the other Caricom countries.

In order for us to take advantage of the opportunities and discharge the responsibilities assumed through the law of the sea convention we need to develop new perspectives and policies and initiate innovative programs in ocean management in the region.

In this regard, as we approach the 21st century, one of the major challenges facing the states of the Caribbean is the development, and management of the living marine resources of the region in a responsible and sustainable manner, for the benefit of our people and the social and economic

development of our countries. The living marine resources in the waters around us represent substantial potential for perpetual income generation, foreign exchange earnings, employment opportunities, and a source of high quality protein to feed present and future generations in the region. As a region we need to develop and utilise our indigenous resources to their full sustainable potential to realise our goal of economic independence and prosperity.

We need to move aggressively to diversify and strengthen the very foundations of our economies, time is not on our side, we can no longer allow the vast potentials of the fishery resources to go untapped or dwindle away through negligence. At this time there are dramatic changes taking place in the world economy that could have serious consequences for our countries if we fail to position ourselves to deal with the new challenges. After 7 years of relentless negotiation the GATT Agreement was finally concluded in mid-December. Only weeks before we watched on television the drama surrounding the passage of NAFTA by the US Congress, the preferential one-way free trade arrangements we have with the US and Canada will soon disappear. We are all very familiar with the developments in the European Community and the disappearance of our once protected preferential markets. At the same time availability and access to external sources of development funding are fast disappearing .

I turn back to fisheries. Within the countries participating in CFRAMP there are approximately 40,000 fishermen, who landed about 74,000 metric tons of fish in 1990. At the same time the countries exported 14,000 mt of fish and imported 23,000 mt. We are not realising the full potential of fisheries sector through under-development in some cases and over-capacity or overfishing in others.

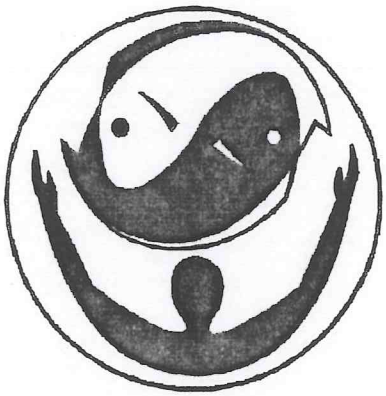
In order to realise the full potential of the fisheries resources of the region in a sustainable manner, we need to promote the concepts of responsible fishing within the context of sustainable fisheries management. We need to develop and implement fisheries management systems at the national and regional levels. We need to improve our knowledge of the biological, ecological and socio-economic aspects of the fisheries. We need to improve the systems for Data Collection analysis and monitoring of the fisheries. We need to integrate fishermen and fishing communities in the fisheries management process. We need to provide training opportunities to the people of the region to acquire the broad range of skills necessary for research and resource management. These are the things that CFRAMP has been, and will continue to work with the countries to achieve. There are also other critical areas that need to be addressed that CFRAMP will not be directly involved in. We need to protect critical habitats and the general environment from degradation. There is also the adoption of appropriate technology, improved processing and marketing, and improved monitoring control and surveillance systems.

At the global level we note that world harvest of fish decreased in 1990 and again in 1991 after almost 40 years of continuous growth. The decrease has taken place as a result of declining catches of marine fishes. The catch in 1991 was 96.95 mill mt. compared to 100.23 mill mt. in 1989. We note too that a significant portion of the decline occur in areas which according to FAO, have been considered as role models for fisheries management. This naturally raises questions about the effectiveness of the strategies that have been used to manage fisheries in the past and cautions us

regarding the wholesale adoption of these approaches to fisheries management in the region. We should not be afraid to be creative and innovative in our search for improved strategies for managing our fisheries, strategies that are compatible with the physical characteristic of the resource and with the socio-economic, cultural, and political realities of our region.

As we continue to consolidate and build the foundation of our fishing industry on the principles of sustainable management and responsible fishing using the best available scientific information, and as we seek to impose regulation and discipline on our own people, we also need to improve our efforts to detect and eliminate or control illegal fishing operators who violate our sovereignty and often operate in a manner which destroys the very foundation of the resource. We also need to discourage the reflagging of vessels in the region where it is done as a means of avoiding compliance with national or international regulations or code of conduct for conservation and management of the fish resource.

Thank you, Mr. Chairman.



APPENDIX 6

Appendix 6

COUNTRY REPORTS

This section contains the presentations made at the Workshop by participating countries on the status of national fish stock assessment activities. The reports were intended to be summaries of the recent assessment activities as well as those currently being undertaken. Each country was also asked to give a report on the possible future plans and goals in assessment. A very brief summary of the principal fishery activities as well as any recent changes (if any) in assessment work was also requested to be incorporated. The maximum total time allowed for each verbal presentation was approximately 10 minutes. The Country Reports were presented on the opening day of the Workshop.

Current activities in fish stock assessment in participating countries

Antigua and Barbuda	SSW/WP/04
Barbados	SSW/WP/05
Belize	SSW/WP/06
Dominica	SSW/WP/07
Grenada	SSW/WP/08
Guyana	SSW/WP/09
Jamaica	SSW/WP/10
Montserrat	SSW/WP/11
St. Kitts and Nevis	SSW/WP/12
St. Lucia	SSW/WP/13
St. Vincent and the Grenadines	SSW/WP/14
Trinidad and Tobago	SSW/WP/15

LPRSF Assessment SSW/WP/04

STATUS OF FISH STOCK ASSESSMENT ACTIVITIES ANTIGUA and BARBUDA

by

Eustace Royer
Chief Fisheries Officer

Antigua/Barbuda has been collecting catch and effort data since 1979 and since 1988, information with respect to effort, as well as length frequency, has also been collected.

The purpose for the collection of catch, effort and length frequency data are principally to observe trends, as evidenced by variations in landing and effort, as well as changes in mean size of the species that form the major portion of the catch. Also, since 1988, information has been collected on carapace length, sex and maturity of *Panulirus argus* (spiny lobster), again, to determine minimum carapace length at which females are observed to be sexually active, as well as variations in the mean size of lobsters being landed.

The foregoing are all quite important as a first step for development of a management plan. With the coming into being of CFRAMP, the Data Collection System has been reviewed; the data collection forms have been revised; two full-time data collectors have been provided and with the assistance of the CFRAMP Data Manager, a new system for a sample survey of catch, effort and predominant species in landings is now in place and is being implemented as of 1 June, 1993.

LPRSF Assessment SSW/WP/05

STATUS OF FISH STOCK ASSESSMENT ACTIVITIES BARBADOS

by

Stephen Willoughby
Fisheries Officer

INTRODUCTION

At present, the Fisheries Division does not presently collect any biological information on the local fisheries. However, catch and effort data are collected from several landing sites around the island. With the new biological data collection program it is hoped that the number of data collection sites will be expanded. Present monthly salary for a fisheries data collector is the equivalent of US$881.74.

The Fisheries Division hopes to have a better estimate of fish production and to be in a better position to collect information that will enable it to make management decisions in order to prevent overexploitation.

LPRSF Assessment SSW/WP/06

STATUS OF FISH STOCK ASSESSMENT ACTIVITIES BELIZE

by

Noel Jacobs
Aquaculture and Research Officer
Belize Fisheries Department
Belize city, Belize

INTRODUCTION

Fishing efforts in Belize are focused mainly on the lobster fishery. This is the most important fishery both in terms of value and in terms of effort, with 80% of fishermen concentrating their efforts only on lobster. This is followed by the conch fishery, then the trawl shrimp fishery and finally, the finfish fishery, being the least developed.

Foreign exchange generated from the fishing industry in 1992 was in the vicinity of twenty three million Belize dollars, converted to Canadian (2 Bel=1 US), and is expected to increase slightly for 1993, with a marked increase in total shrimp exported due to a substantial increase in farmed shrimp. Even though the combined foreign exchange generated from trawled and farmed shrimp exceeds that of conch, shrimp will not be classified as the second most important, since for the purposes of this report, we are referring to 'trawled' or 'fished' shrimp only.

There is no doubt that the finfish fishery is under-developed. However, recommendations to increase the exploitation of this fishery cannot be justified without reliable data on the status of the stocks and the potential yields associated with these stocks.

With the lobster fishery assumed to be moderately to over-exploited and the conch fishery reflecting constant decreases in annual catch, it is crucial that fish stock assessment be conducted in Belize to obtain a clearer view of the species and stocks that are exploitable, and to what extent they may be exploited.

CURRENT ACTIVITIES IN FISH STOCK ASSESSMENT

Presently, the Trip Interview Program (TIP) is being used in Belize. This consist mainly of the weekly collection of catch and effort data from the five major cooperatives and markets throughout the country. Attempts have also been made to collect data on quantities of fish bought by hotels from independent fishermen, but success in this aspect has been minimal simply because hoteliers believe that this information will be used for income tax purposes and are thus reluctant to provide correct data or any data at all.

Annex I illustrates the map of Belize with the landing sites where the data is presently being collected, being namely:

1. Belize National Fishermen Cooperative Society Limited
2. Northern Fishermen Cooperative
3. Caye-Caulker Northern Fishermen Cooperative
4. Caribena Cooperative
5. Dangriga Market
6. Placencia Fisherman Cooperative
7. Punta Gorda Market
8. Corozal Market

In a decreasing rank order of the sites, we have the following sequence: 1,2,5,8,3.6,7 then 4 for all of the species fished except one, that is the queen triggerfish, *Balistes vetula* which, in a decreasing rank order of sites we have: 3,4,1 then 2. The other sites have no information of catch of this Species Priority List for Belize (Table 12).

Generally, the data collected on catch and effort are considered to be of a workable quality, and we should have our first report on the analysis of this data by the end of February. January 31st of this year we will be completing our first year of catch and effort data collection, from which we will only be able to determine trends in seasonal production.

Even though the information collected is considered to be workable, it must be emphasised that a series of problems exists which may lead to a reduction in the validity of the data. These are as follows:

1) There are instances where one boat might have two or three crews working on it, the data on catch that is recorded from this boat is usually recorded by the cooperatives as the catch of one crew and not of several crews, thus this information might be misleading where effort is concerned.

2) There are situations where a particular fisherman might owe a substantial amount of money, knowing that if he makes his submission of catch to the cooperative, deductions will be made from his income to pay for his loan. So he would normally ask a fellow fisherman to make the submission under that fisherman's name to avoid payment to the cooperative. This again will lead to a mis-interpretation of effort, since the catch is being recorded as the result of a one-man effort and not of two. It is important to note that this is a common practice in Belize.

3) There are fishermen who own more than one boat which have different names. The cooperatives in many cases do not record the name of the boat, but rather the name of the fisherman. This leads to the appearance of data from time to time which do not make sense. For example, on a particular date the same fisherman might appear to be conducting fishing activities in two different areas, which we know is not logistically possible considering the distances between sites.

4) There is no reliable way of determining production lost by the illegal export of fishery products to Honduras and Guatemala, which we presume to be of a considerable quantity.

Other current data collection include the Shrimp Trawler Logbook System, which has only recently began. Since the trawlers are operating under Joint-Ventures with the fishing cooperatives by the Fisheries Department, the cooperatives are then responsible for the adequate filling out of the logbook by the shrimp trawler captains. It was also considered that an officer from the Fisheries Department board the trawlers from time to time to supervise the compliance of this requirement. However, due to staff constraints boarding may not be as frequent as they should.

CONSIDERATIONS FOR FUTURE RESEARCH

Short-Term

1) Determine potential of Deep-sea fishing.
2) Stock assessment of the Nassau grouper, dog snapper, red snapper, black grouper and the crevalle jack.
3) Assessment of aquarium fish potential.
4) Proposed joint study with CIQRO of Mexico to determine the negative and positive effects of 'shades' in the lobster fishery, before it is heavily employed in Belize.
5) Detailed assessment of the conch fishery.

Long-Term

1) Stock assessment of the other priority species in Belize (Table 12).
2) Study of natural mortality and dispersal in the Hol-Chan Marine Reserve to determine its success as a source of replenishment to neighbouring exploited areas.

LPRSF Assessment SSW/WP/07

STATUS OF FISH STOCK ASSESSMENT ACTIVITIES DOMINICA

by

Harold Guiste
Fisheries Officer

Fish Catch and Effort Data Collection started in Dominica in 1985 with eight (8) data collectors. Later, the data collection capability improved and by 1987, twelve (12) data collectors were employed by Government and the data entered into Lotus 123. However, there were some problems with data management on the computer due to lack of training.

To date, data entry persons have been trained and are quite competent in the management of data on the computer. In 1991, length frequency measurement was started on some important species at some landing sites, As a result of the difficulty experienced with fishermen not allowing time for fish to be measured, a method was developed where length data was collected from one fisherman on a regular basis and from a few other fishermen who fished in the same area for the same species to check the data.

Future data collection exercised include a Fishery Independent Survey which will involve the collection of biological data and will cover more than three quarters of the fishing grounds around Dominica and will seek to identify locations, and depth of areas fished as well as a comprehensive record of species caught.

Finally, a map will be produced to indicate productive fishing areas and species found therein. Age/growth, maturity studies and data analysis will be done in collaboration with ORSTOM - a Fisheries Research Institute based in Martinique.

LPRSF Assessment SSW/WP/08

STATUS OF FISH STOCK ASSESSMENT ACTIVITIES GRENADA

by

Paul E. Phillip
Fisheries Officer

INTRODUCTION

Grenada is basically a tri-island state comprising of three inhabited islands (Grenada, Carriacou and Petit Martinique) and a number of uninhabited islands and cays, forming the most southerly of the O.E.C.S. states.

Together these islands have a total area of 348 ^{k}, a figure which is dwarfed by the surrounding shelf area of 3100 ^{k} and an even larger EEZ.

The waters around these islands support a fishery which has become very important in the country's economy. This fishery comprises:

(a) Large offshore pelagics (yellowfin tuna, billfish, etc).
(b) Small inshore pelagics (jacks, seals, rainbow runners, etc) and
(c) Demersals (lobsters, conch, snappers, etc.).

This report outlines briefly the changes in the data collection system in the Grenadian fisheries system.

DATA COLLECTION

Since the initiation of a data collection system in the Fisheries Division (FD) of Grenada, basically catch data were collected. This data included catch (weight) by species and were collected at the primary landing sites (these included fish markets in the main towns each of which employed a clerk to record the data).

However, a substantial amount of data was lost at secondary landing sites (sites without markets but with substantial catches landed) and tertiary landing sites (processing plants and trading vessels where catches are landed directly).

Biological data collection has been rather sporadic over the period with length frequency being collected at Grenville in 1984, 1985 1986 and 1989.

There was also a system of registration of fishers and boats, licensing of boats, records of imports and exports etc.

RECENT DEVELOPMENTS

Over the last few years, the Fisheries Division with funding and technical assistance from CFRAMP has been working towards the improvement of the data collection and storage of fisheries data.

- computer hardware and software and other equipment was acquired for the Fisheries Division
- Fisheries officers received training in the use of computers
- Two data collectors were hired and trained. They are presently conducting a 'frame survey' at secondary landing sites. This information will be used to institute a sampling programme for the secondary landing sites
- One data entry person was hired, and existing records were computerised
- The market log which recorded catch by species was redesigned to include catch by boat by species, area fished, effort, gear and value of catch. This new data can be input directly into TIP a computer programme instituted by CFRAMP.

Presently, the Fisheries Division of Grenada is ready and waiting to participate in the upcoming phases of the CFRAMP Workshop.

LPRSF Assessment SSW/WP/09

STATUS OF FISH STOCK ASSESSMENT ACTIVITIES GUYANA

by

Reuben Charles
Chief Fisheries Officer

The current state of Guyana's Fisheries Management and Fisheries Research activities may be summarised as follows:

A draft Fisheries Management Plan (FMP) has been prepared in conjunction with CFRAMP's FMP Subproject. There are three fisheries identified in the FMP that are pertinent to this SSW:

1. the deep slope species, which appear to be underutilised in Guyana but are exploited illegally by Venezuelan fishers;

2. the small pelagics and red snapper, will require close linkage with Surinam Fisheries Management; and

3. the large pelagics.

An analysis of the last fishery has been conducted by CFRAMP at the request of Guyana and indicated that while Guyana does not exploit the large pelagics in it's EEZ there are other countries which do. Also of relevance to the planning of CFRAMP's activities in Guyana is the CIDA-funded bilateral project Fisheries Technical Assistance Project (FTAP) which is intended to result in a Fisheries Development/Enhancement Plan. There will be a significant element of data gathering as part of FTAP which will be integrated with and complimentary to CFRAMP activities in Guyana.

LPRSF Assessment SSW/WP/10

STATUS OF FISH STOCK ASSESSMENT ACTIVITIES JAMAICA

by

Stephen Smikle
Fisheries Officer

ICOD/UWI/JAMAICA/BELIZE REEF FISHERIES MANAGEMENT PLANNING PROJECT 1989-1992

In Jamaica, the project was designed to estimate annual production of reef fin fish on the south shelf of Jamaica. This was done by collecting catch data over a one year period. Fish catch and catch effort data were also collected to be fitted to the Munro - Thompson adaptation of the Surplus Production Model. Unfortunately the data did not produce a relationship between catch per unit effort (CPUE) and fishing effort (F.E.). As a result no maximum sustainable yield (MSY) could be determined for the fishery. However, the study showed that there was a decline in fish catch and catch/effort. The study also showed an annual yield of 995 tons and yield/area of 0.55 ton/km sq./yr. C.P.U.E. was estimated to be 1.03 tons/canoe/yr.

ICOD LOBSTER STOCK ASSESSMENT PROJECT

The general objective of the project is to contribute to the development of a comprehensive management program for the spiny lobster *(Panulirus argus)* fishery of Jamaica. The specific objectives are to assess the status of the spiny lobster stocks and to determine the potential yield of spiny lobsters in Jamaican waters. The project began in February 1991, and is scheduled to be terminated in March 1994. Experimental results are relatively low with an average catch rate of 115.0g/trap in comparison to the commercial lobster fishery which yields average catch rates of 340.2g/trap. Mean carapace length (CL) and modal classes observed were significantly lower than that reported by Munro (1983a) and comparable to that estimated by Haughton (1988), lengths (98.9mm & 90.5mm), modal classes (95-100mm, 85-90mm) male and female respectively. The figures are a reflection of the significant increases in fishing pressure over the last 5-7 years. Completed analyses and assessments are not yet submitted.

THE CONCH FISHERIES MANAGEMENT PLAN

The Conch Fishery grew even more in 1993. There was a total of 18 vessels representing 13 industrial/commercial operators. A total export figure of 1.6 mil kg or 1,600 metric tons valued at over US$11.0 mil. was estimated for 1993. As shown by Mahon, Kong & Aiken (1991) this level of production is not sustainable and will overexploit the conch stock very shortly, showing the need for sustainable management. Increasing concerns from CITES about the level of conch export from

Jamaica, is further adding pressure on the Jamaica government to implement greater management measures to control the fishery. The unfortunate possibility exists that the CITES member states might put queen conch on appendix I of endangered species. This, combined with several conch shipments being held up at port due to CITES certification, is now causing the conch operators to pay serious attention to government's effort to control the fishery.

The draft Conch Fishery Management Plan (CFMP) now states a total allowable catch (TAC) for the fishery, with a breakdown for artisanal and industrial operators. These figures were arrived at after discussions with the industry personnel. However, as the draft DFMP states, a full scientific investigation of the biology of the queen conch on the offshore banks is needed. Fortunately such a survey is currently being carried out by Acadia University and the Jamaica Fisheries Division. However, the resources available to do a complete survey of the area are limited. The research involves two field studies on the Pedro Bank dating May-August 1993, and January-April 1994. The study will gather the most current and detailed data concerning the Jamaican queen conch Fishery on Pedro Bank. The information will include population abundance and distribution, population character and total catch. The information will enable the Jamaican Fisheries Division to impose the most effective measures to reduce fishing effort and thereby stabilise the fishery. The study will compliment the activities (lobster, finfish and conch resource assessment) of CFRAMP.

THE LICENSING AND REGISTRATION SYSTEM

In September 1993, the Fisheries Division embarked on a mission to reconfigure and update the entire licensing and registration system for Jamaica's fishermen. The registration forms that were developed are based on CFRAMP's LRS software package. The aim is to provide a database on the number of fishermen involved and the type of fishery they impact on. This can be extended further to determine the effort on the various fisheries. In addition, the new system will provide socio-economic and biological data on the Jamaican fishery. Consequently, the division has launched a program of re-registration of all persons involved in the marine fishery. The LRS involves the licensing and registration of commercial fishermen, sport fishermen, commercial fishing boats and motor vessels, sport fishing boats and the issuing of temporary licenses to fishermen.

Recently (December 1993), the Fisheries Division conducted a re-registration exercise aimed specifically at Pedro Cays fishermen in St. Elizabeth. Such exercises will continue (once the necessary resources are available) until all the fishermen island-wide are re-registered and licensed.

JAMAICA FISHERIES DIVISION/CFRAMP FISHERIES RESOURCE DATA COLLECTION SYSTEM/PROJECT

The Jamaica Fisheries Division ,with the help of CFRAMP is embarking on a program which seeks to assess and properly manage the fisheries resource of Jamaica. A major aim of such a program is the development of a computerised licensing, registration and data collection system.

CFRAMP will be funding five project personnel: one Data Manager/Analyst, three Data Collectors and one Data Entry Operator, for a period of two years. The Data Manager/Analyst, Mrs. Stephanie Auil-Marshalleck has already begun her work in Jamaica. The project aims at implementing a system to collect on an ongoing basis catch, effort and species data by census of sample based estimation. All major fisheries will be looked at (conch, lobster and reef finfish). Underutilised fisheries such as crabs, bivalves, shrimp, sea cucumbers and sea urchins will also be investigated. The data collection system will work closely with the licensing and registration system to develop a computerised data base, giving current information on the fishing effort, sustainable catch/yield, and the total Jamaican fishery resource available.

THE DISCOVERY BAY/UWI FISH MESH EXCHANGE PROGRAM
(Fisheries Improvement Program)

The UWI Discovery Bay Marine Lab. in St. Ann, on the north coast has an ongoing project in which they swap with fishermen two (2) fish pots of 1 1/2 in. mesh size in return for one (1) fish pot of 1 in. mesh size. The University is planning to extend the range of the project to include areas outside of Discovery Bay.

OTHER RECENT DEVELOPMENTS

The Fisheries Division of Jamaica has recently acquired two new Fisheries officers to fill a gap of six positions that has been vacant for over two years. With this complement of staff, the Division can now embark on urgent matters that it formally could not address before, due to lack of staff. The Division has also recently acquired two computers to bring it up to a total of three computers owned by the Division.

LPRSF Assessment SSW/WP/11

STATUS OF FISH STOCK ASSESSMENT ACTIVITIES MONTSERRAT

by

John Jeffers
Assistant Fisheries Officer

PROJECTS IMPLEMENTED FOR THE LAST 3 YEARS

1. Demarcation of Artificial Reef

Montserrat was chosen as a site for an artificial reef pilot project in the early 1980's. The specific site selected has a sandy bottom and covers an area of 4500m of bottom space.

The artificial reef was created:

- as a means of removing selected solid waste materials e.g. derelict vehicles from where there is limited space
- to serve as a breeding ground for the restocking of natural reefs within the immediate vicinity
- to facilitate the collection of scientific marine data in a pilot situation.

In order to achieve the afore-mentioned, management measure was required.

The Fisheries Act No. 18 of 1982 empowers the Minister to declare any part of the marine environment as a marine reserve.

While the initial project was a success the reef suffers from a lack of proper supervision and control due to the shortage of material and financial resources and surface demarcation. As a result illegal fishing has been observed. Hence in order to ensure the realization of maximum benefits from the artificial reef, surface demarcation and management activities are a priority.

Objectives of the Project

General

To initiate Management activities for the protection of the artificial reef in Montserrat.

Specific

1. - To demarcate the reef, thus providing a reserved marine area for recreational, educational, scientific and touristic activity.

2. - To train staff to adequately manage/monitor the reef to prevent undesirable activities within and around it.

3. - To continue educating the public on the importance and benefits of the artificial reef to fishermen, tourism and marine life.

4. - To begin preparation of a management plan for the artificial reef and other natural reefs of Montserrat.

The afore-mentioned activities will maintain the reef as a breeding ground for juvenile fish and promote its use in tourism and education.

Beneficiaries

The department of tourism, dive operators and the fishing community will be the main beneficiaries. The entire population will benefit as a result of an underwater video and from the data collected from monitoring activities and the training of selected personnel, re teachers, fisheries staff etc. Divers and media personnel educators will benefit through the transfer of technology during the training session. The project will also serve to stimulate the economy through increased job opportunities, the creation of an additional dive site in a controlled environment and enhanced fish catches on nearby reefs.

Current Status

The location is used primarily as a recreational site, some scientific data on the species composition is also collected from the area periodically. This is also used by the patrol craft as a safe haven in the event of bad weather in Plymouth. The reef was last expanded in 1991 with derelict vehicles. There will be a need for replenishment of the reef with vehicles or other suitable substitutes in the near future. There is some degree of algae cover in the area.

Data Collection

Fisheries statistics have been collected since 1987 from the Plymouth landing site, and from March 1993 from Caris Bay which is the number one landing site. While the data for Plymouth do not cover the whole year from 1987-1991, based on the data provided, the local statistics office was able to compile some information on fisheries, including its contribution to G.D.P. The data collection forms were revised in 1993 and will be revised again in 1994 to capture species and value of catches being discarded for fear of being toxic. At present no biological data is being collected. This is expected to be done in 1994 after our data collectors would have completed some attachments to another fisheries department in the region.

There is the possibility that Montserrat and Guadeloupe will be working closer on some aspect of closer cooperation as it relates to fisheries. This will be clarified in February.

Difficulties encountered include:

- Data not being collected on weekends i.e. Saturday and Sundays.
- Data not collected after normal working hours i.e. 4 p.m. Mon-Fri.
- Scarcity of funds.
- Shortage of staff.

LPRSF Assessment SSW/WP/12

STATUS OF FISH STOCK ASSESSMENT ACTIVITIES ST. KITTS AND NEVIS

by

Joseph Simmonds
Senior Fisheries Officer

BACKGROUND INFORMATION ON ST. KITTS

General Information

St. Kitts/Nevis is a two island country which is part of the Leeward Islands of the Eastern Caribbean.

St. Kitts

St. Kitts is located at latitude 17°,15 minutes North and longtitude 62°, 45 minutes West. Its area is 172 sq. km. (68 sq. miles); 36.8 km (23 miles) long and shapes like a chicken drumstick with the narrowest part extending from the southeastern end.

There are 32,320 people (1990 estimates) on St. Kitts with over half of the population 18,500 concentrated in the capital, Basseterre. Average population density 209 persons/sq. km.

The highest point is Mt. Liamuiga (1156 m or 3792 ft). The central mountain is dominated by Mt. Liamuiga and surrounded by cane-covered slopes. Most of the beaches are of grey to black volcano sand except in the Southeast peninsula area which is surrounded by golden sandy beaches.

The climate is influenced by the steady northeast Trade winds with an average temperature of 81°F (27°C). The annual average rainfall is 64 inches (1625 mm)

NEVIS

Nevis is located 3 km (2 miles) southeast of St. Kitts at 17°,10 minutes North latitude; 62°,35 minutes West longtitude. Its area is 93 sq. km (36 sq. miles) and 12.3 km (7.64 miles) long with an almost circular shape.

The estimated population is 9600 and most dense around Charlestown and Gingerland. Charlestown's population is approximately 1700.

Nevis peak is the highest point at 985m (3232 ft.) The island is of volcanic origin and is dominated by this peak. There are no bays, inlets or cays but it is surrounded by golden sandy beaches.

ECONOMIC INFORMATION

Historically, the economy of St. Kitts and Nevis has been based largely on agricultural production, particularly sugar cane. Sugar was dominant in both St. Kitts and Nevis, but was abandoned in Nevis in the early 1960's. Sugar, however, remains the most important industry in St. Kitts and accounts for about 60% of total exports. In addition to its importance as an earner of foreign exchange, the sugar industry and its directly related activities account for about one third of total employment in St. Kitts.

In recent years, from about the early 1970's when Government assumed responsibility for the sugar industry at the request of the then private owners. The industry has been experiencing very serious financial difficulties. These problems have come about mainly from high and rising production costs and also from fluctuations in the export price of sugar. Fluctuations in output and productivity have also served to exacerbate these problems. A realisation of the serious economic consequences which could result from such heavy reliance on a single export crop, led in the mid 1970's to an attempt to initiate the process of economic diversification in the country. This process has been intensified since then.

Economic diversification involves the establishment of new industries as well as the expansion of existing industries. It also exphasises the promotion of tourism and the expansion of non-sugar agriculture (which includes the development of livestock and fisheries). St. Kitts and Nevis is however still highly dependent on sugar though the contribution of sugar production to GDP has shown some decline, particularly during the past three years.

Table 19 shows the GDP for agriculture sugar, other crops livestock, forestry and fisheries.

DESCRIPTION OF THE FISHERIES SECTOR

A 1987 survey showed that there are approximately 631 fishermen in St. Kitts/Nevis. 482 in St. Kitts and 149 in Nevis. In St. Kitts 20.1% of the fishermen do trap fishing, 59.1% hand lining and 14% diving and 4.6% net fishing.

In Nevis there are 32% trap fishermen, 50.1% doing hand lining, 12.2% diving and 3.8% net fishing.

In his 1984 draft report "Fishery Assessment St. Kitts/Nevis", David Olsen stated that there were 570 fishermen (346 SK; 224 N) that used 283 boats (165 SK; 118 N) with a total landing of 943,000 for St. Kitts and 1,200,600 for Nevis. It is evident that there is more fishing activities in Nevis. Of the total number of fishermen in the Federation 25% are full time, 75% part time fishermen.

Most of the fishing is done from small wooden (pirogue type) open fishing boats with outboard motors ranging from 25 hp to 150 hp. though most boats using 40 hp engines. The sizes of boats ranges from approximately 16ft (4.8 m) to 25 ft (7.6 m) with an overall size of about 20 ft (6m). Boats that target offshore pelagics are a bit larger and are the ones with more hp engines.

The landing sites in the Federation are as follows:

NEVIS

Charlestown, Jessups, Cotton Ground, Jones Bay, Newcastle, Long Haul Bay, Indian Castle and Cane Bay.

ST. KITTS

Basseterre, West Form, Challengers, Old Road Town, Verchilds, Sandy Point, Newton Ground, Dieppe Bay and Conaree.

There are three active Fishermen Cooperative Societies in St. Kitts. The Sandy Point Fishermen Cooperative Society, Old Road Fishermen Cooperative Society and Dieppe Bay Fishermen Cooperative Society. There is a new one being formed in Basseterre. The Sandy Point Cooperative has a building which is used for storage of gear and equipment plus sales of the fishing equipment to its members.

There is no freezing facility or ice machines at this facility. In Dieppe, a building is under construction.

Many members of the Old Road Fishermen Cooperative are full time fishermen and the fish landing of offshore pelagics from this area is higher than any other single fish landing area in St. Kitts.

In Nevis there is Nevis Fishermen Marketing and Supply Cooperative. This cooperative has a facility which is used by many of the Nevisian Fishermen. The Facility provides gear and equipment, ice and walk-in freezers, outboard motor repairs, fish processing and stalls for marketing the fish. It is also a source for estimating landings in Nevis since most fishermen use the facility.

CONSTRAINTS

The major constraints in the cast of fisheries consist of:

1. the small size of the boat which prevents fishermen from exploiting deep sea resources. This has resulted in the progressive depletion of inshore resources;

2. Inadequate landing and storage facilities which have resulted in the inability of fishermen to dispose of surplus catch;

3. Lack of technical capability in the use of modern fishing techniques and methods which has restricted better exploitation of fishery resources;

4. The over-exploitation of lobster and conch resources which has served to deplete existing resources and also to restrict development of stock; and

5. Absence of adequate data on various species which has constrained effective evelopment and planning.

FISHERIES DEVELOPMENT PLAN

The program for fisheries development is geared towards transformation from the present traditional form of fishing to a modern technology oriented industry by the end of the plan period. The main objectives are to:

i. Increase local availability of fishery products for improved nutrition and reduced seafood imports;
ii. Develop new fishery resources and aquaculture projects for increased employment opportunities;

iii. Improve production of high-value species for the local market as well as export; and

iv. Ensure sustained development of the industry through the design and application of sound management programs for fishery resources.

Table 19. GDP by economic activity, at factor cost in constant prices (EC$million) Source: St. Kitts Statistics Division

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Agriculture	13.4	15.0	15.0	12.0	12.0	11.7	11.4	11.6	12.3	11.7	9.6	11.2
Sugarcane	8.0	8.0	8.3	6.5	7.1	6.2	6.1	6.2	6.4	6.0	4.0	5.2
Crops	2.0	3.0	1.7	1.3	1.1	1.3	1.4	1.5	1.7	1.8	1.4	1.6
Livestock	2.2	2.5	3.0	2.1	2.06	2.4	1.8	1.9	1.9	2.0	3.0	2.2
Forestry	0.1	0.0	1.0	0.1	0.08	0.1	0.1	0.1	0.1	1.1	0.1	0.2
Fishing	1.1	1.4	1.5	1.6	1.53	1.7	2.0	2.0	2.1	1.9	2.0	2.1

PROGRESS IN FISHERIES DEVELOPMENT

Within the past two years the Fisheries Division has experienced some growth in personnel. The staff has grown from two to five. The new staff includes data collectors, who now play a very significant role in Fisheries development.

Staff training has been received through regional organisations such as the OECS Fisheries Unit, CFRAMP and CCA. The OECS Fisheries Unit has not only provided training for staff and for fishermen but also provided funding for various other projects.

The data collection program and vessel registration programme are two CFRAMP programs that St. Kitts/Nevis is currently undergoing.

CCA has also assisted in marine resource development in the areas of development of marine reserves.

Funding for aquaculture training of staff members has been provided by OAS.

The Fisheries Division is also currently involved in two other projects, namely, (a) a beach profile program, where the beach dynamics around the island are studied - data is collected monthly and (b) a coral reef monitoring program, where monitoring stations were set up and the changing condition of the reef is monitored regularly.

CURRENT ACTIVITIES IN FISH STOCK ASSESSMENT

Regular data collection activities in St. Kitts/Nevis started 3 months ago. As a result the Fisheries Division is not yet able to do any scientific stock assessment. However, the trends over the years have shown a depletion of fishery stocks especially in reef fish and inshore pelagics. For example there is a noticeable difference in sizes and amount of lobsters that were landed 10 years ago as compared to today. Today fishermen are fishing farther away for lobsters and harvesting smaller ones. The conch fishery has its share of troubles. Nowadays conch are all harvested using scuba and this practice is resulting in stock depletion in many areas.

As regular data collection is still in its infancy there are some problems to be addressed. These include adequate training in the use and understanding of the computer software, training in analysis and reporting and so on.

LPRSF Assessment SSW/WP/13

STATUS OF FISH STOCK ASSESSMENT ACTIVITIES ST. LUCIA

by

Ms. Sarah George
Fisheries Officer

THE FISHING SECTOR

Fisheries in St. Lucia are still artisanal in nature with estimated landings of 967 tons for 1992 (Table 20) and an estimated 2 tons of aquaculture production for 1993 (Table21). Dominant species in the catch are dolphinfish (*Coryphanea hippurus*), wahoo/kingfish (*Acanthocybium solandri*), flyingfish (*Hirundichthys spp*), and various tuna species. An estimated 538 fishing vessels operate out of some seventeen landing sites (Figure 4 and Table 22), with about 75% being traditional wooden canoes (5 to 8 metres long). The remainder are either smaller "transoms" or the rapidly increasing number of larger fibreglass pirogues. Virtually all boats are powered with outboard engines (mostly 35 to 75 h.p.).

There are over 2000 fishermen operating in the island, two thirds of which are full-time. The fisheries sector only contributes 2% to GDP, however, some 2,000 families directly depend on this industry as a substantial source of income, and the sector provides one of the major sources of local protein. It is thought that the industry has potential for expansion given that less than half of all fish demands are currently met by local supply. In 1991 St. Lucia imported some 977,610 kg of fish (valued at EC$9,278,922) with minimal fish exports of 12,320 kg (EC$125,239). In that same year the main fish marketing organization, the St. Lucia Fish Marketing Corporation (SLFMC), purchased some 301,496 kg of fish from local fishermen.

Most of the fish landings (60-70%) comprise migratory pelagics such as those mentioned earlier. These species move through the Eastern Caribbean region seasonally, with landings being concentrated between December and June each year. Other major species include snappers and groupers (found on offshore banks and slopes), coastal demersals (lobsters, conch, reef fishes), and coastal pelagics (jacks, ballyhoo, sardines).

The offshore pelagics are fished mainly to the east, south east, and north east of the island (Figure 4) using traditional hand trolling and now longlines. The bank and slope species are caught with fish traps in shallower areas and bottom longlines in deeper regions (Figure 4) Reef fish and lobsters are caught by fish traps, and conch is collected with the use of scuba gear. These species are exploited on the narrow shelf area, mostly within reef and seagrass habitats (Figure 4).

Recent attempts to develop suitable longlining techniques and technology for targeting the traditional surface pelagic and demersal fish resources and accessing the underexploited midwater and deeper demersal species will hopefully increase both gear efficiency and total landings. The current move into a larger, more stable vessel is seen as an important component in achieving this expansion.

Landings are decentralised, however the establishment of the SLFMC in Castries with its cold storage capacity of 99,792 kg and purchasing depots in Vieux Fort and Dennery, has resulted in a larger proportion of the catch being landed in these areas (Figure 4). A Japanese Assistance Project has recently built landing and marketing facilities at many of the larger landing sites. Smaller cold storage facilities are also available at Anse la Raye and Laborie (Figure 4). A large landing and distribution facility is planned for the Dennery landing site as the second phase of the Japanese project. A Vieux Fort processing and packaging facility is also in the pipeline.

The lead government agency involved with fisheries development and management is the Department of Fisheries in the Ministry of Agriculture. The Fisheries Act of 1984 and the Fisheries (lobster, turtle, and fish) Protection Regulations of 1987 provide for the creation of protected areas (marine reserves and fishing priority areas and closed areas), the licensing of local and foreign fishing vessels, leasing of aquaculture sites, protection of lobster, turtle, conch and coral resources, and a variety of other fisheries management measures. Revised regulations presently about to be enacted cover additional areas such as scuba diving activities, seaweed harvesting, and marine pollution.

The Fisheries Department is currently understaffed, with several senior technical officers on secondment to regional organisations. The Department does, however, have expertise in the fields of fisheries extension, marine biology, coastal zone management, fish processing technology, public education, and audiovisual production. The Department has two research vessels at its disposal, and some five members are trained scuba divers.

GENERAL POLICY OVERVIEW FOR THE DEPARTMENT OF FISHERIES

In the National interest, Government recognises the need to have an integrated policy as it relates to the Marine space over which St. Lucia exercises sovereign rights. In this regard there is the Binding obligatory common policy to develop the living marine resources present in the 200 mile exclusive economic zone (EEZ). This policy is to be pursued in harmony with the development of Shipping or Marine Transportation, Tourism and the recreational aspects in the coastal waters, along with a sound programme for coastal zone management and development.

In developing its fisheries policy, Government enunciates that there is no free access to the living marine resources which are to be managed for the long term benefit of present and future generations. In this regard Foreign and Local Fishing Licenses, along with a Fishing Industry Regulations Programme are to be instituted.

Competing uses of the marine space for Fisheries, shipping, tourism and recreation are rationalised thereby ensuring that all sectors which impact on such marine space are afforded the opportunity to develop within the guidelines established by this policy.

The cornerstone of this policy is the management of the living marine resources using an integrated approach established under the Fisheries Act No. 10 of 1984. The objectives of which are:

1.	Biological	-	to conserve stocks;
2.	Economic	-	to maximise rent;
3.	Gear restrictions	-	to specify gear and mesh sizes;
4.	Close seasons	-	for stock protection during spawning period of the life-cycle;
5.	Closed areas	-	to protect spawning areas/fishing access;
6.	Catch Quotas	-	to avoid pressure on stocks; and
7.	Limited entry	-	through licensing system/scheme.

Monitoring of annual fishery landings of targeted marine species will continue to be a major focus in terms of ensuring the success of development initiatives and identifying appropriate management strategies.

A Total Allowable Catch (TAC) needs to be developed for foreign fishing for stocks which nationals are not able to target in the immediate future. However, efforts will be made to ensure that such national capabilities are developed as a matter of priority. While foreign vessels will have a right of passage there will be no freedom to fish.

The need on the one hand to adequately supply the nation with animal protein acknowledges the production potential of the sector while on the other hand, a cut back on a high fish import bill and the consequent drain on foreign exchange is recognised. In this regard, increased production of fish will be encouraged while avenues for the export of high priced (value added) products will be explored.

In pursuance of this high level of fish production, there will be the requirement for measures to be taken to ensure adequate safety at sea. In this connection, it will be a condition of license to carry basic navigation and safety gear e.g. compass, life jackets, radio, radar reflector and distress flares.

The Development of the Coastal Zone can have negative impacts on the marine environment. In order to mitigate negative impacts, the Department of Fisheries will be required to advise Government and the Development Control Authority on all coastal development projects. This would include advising on the placement of outfalls, the impacts of which have significant negative consequences for both human health and marine organisms. In this regard pollution from domestic, municipal and industrial sources including the shipping sector will be closely monitored, controlled and taxed.

In promoting sustainability within the Fisheries sector there is need for a concerted effort at marine environmental education. In this regard, the Department of Fisheries will undertake to encourage a level of marine environmental awareness within the school community and to the public at large.

Recognising the broad range of competence of the staff of the Department of Fisheries it is expected that the Department will be called upon to play a more meaningful role not only in the development of the Fisheries sector but also in matters related to the marine environment and Coastal zone. In this context Government will continue to train Fisheries personnel in the relevant disciplines in order to give support to the development of marine and coastal zone matters.

FISHERMEN'S TRAINING

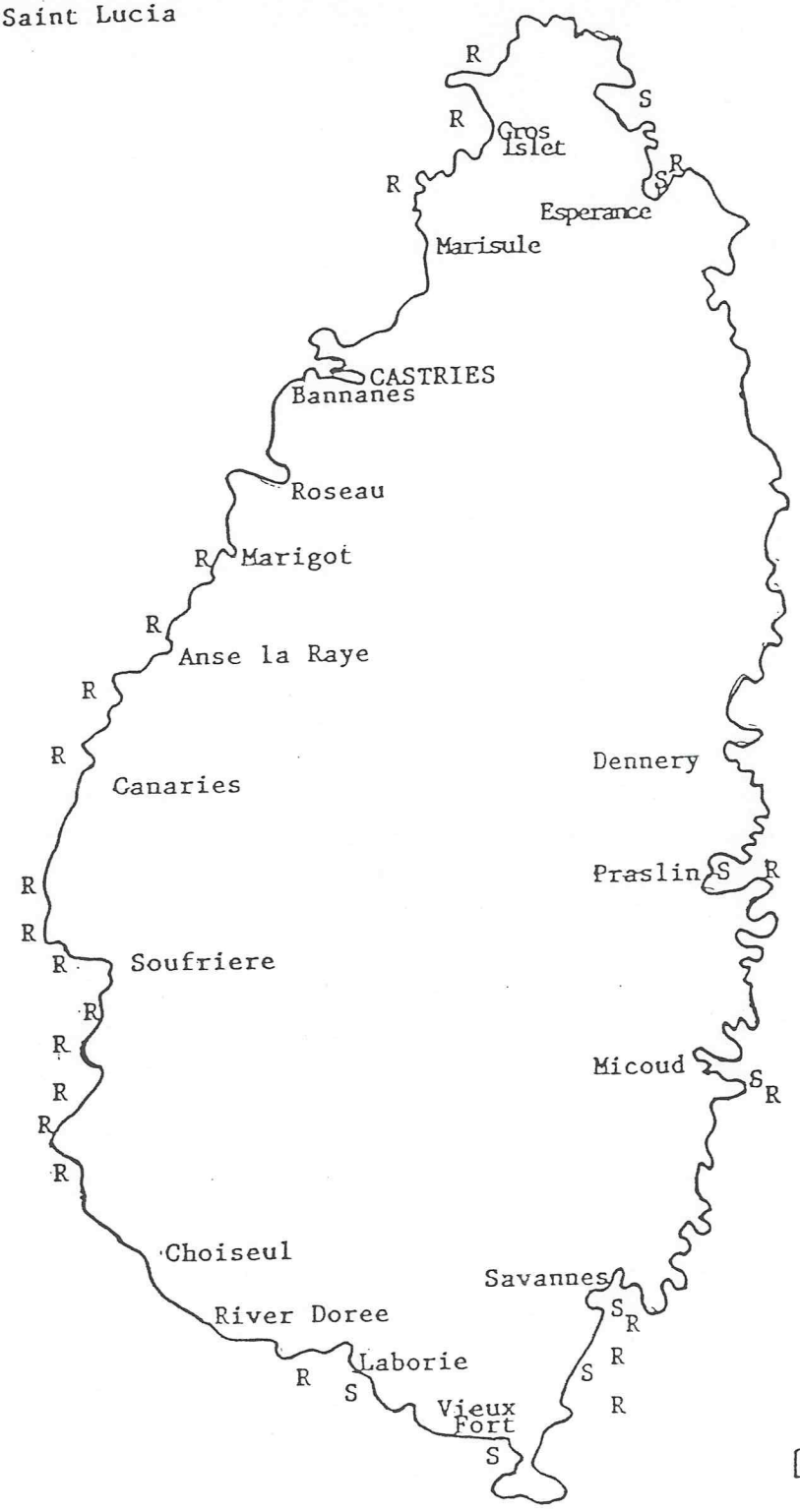
Government as a matter of policy recognises that the expansion of fish production capacity and capabilities require that a well-trained cadre of fishermen is available. Consequently, fishermen, and especially the young, will be targeted to receive training in the use of improved fishing vessels, gear and methods, navigational and other equipment necessary for the identification of fish stock; particularly the deep resources which are present in the exclusive economic zone of St. Lucia.

AQUACULTURE

Cutting back on a high fish import bill is one of the key policy issues of government. In this particular regard, it is recognised that the importation of marine shrimp also contributes significantly to this import bill.

Government proposes to promote as a matter of policy the development of aquaculture of prawns and fish so as to provide a diversification opportunity to farmers, using the produce for both local consumption and in the tourism sector. Government also proposes to encourage the production of prawns to capitalise on the value presented by this high priced species for the export market.

Figure 4. Marine Resources and Fish Landing Sites of Saint Lucia



KEY

P – offshore pelagics

INFRASTRUCTURE

With the assistance of the Governments of Canada and Japan infrastructural facilities and fish landing sites have been established. Government proposes to continue in this direction so as to satisfy the need of all fish landing sites, particularly Dennery and Vieux Fort.

Table 20. Estimated landings for 1992 (figures in tons)

Site/Species	Fly. fish	Dolphin	Kingfish	Tunas	Snappers	Sharks	Others	Total
Site								
Bannanes	0.12	3.7	1.71	0.21	0.41	0.00	3.13	19.19
Castries	6.70	4.39	2.02	22.40	17.36	0.08	66.72	119.66
Choiseul	5.21	6.89	8.95	22.94	2.10	0.08	2.04	48.20
Dennery	3.57	54.68	30.01	44.98	2.13	1.12	18.16	154.65
GrosIslet	1.66	1.45	0.91	3.47	1.05	0.57	48.36	57.47
Laborie	2.78	3.00	4.19	9.36	1.53	0.25	5.70	26.90
Micoud	1.09	4.08	2.48	3.79	0.31	0.09	2.90	14.74
Praslin	0.00	24.48	12.97	14.62	3.21	0.09	11.67	67.04
Savannes	0.00	18.47	7.31	20.14	7.77	0.00	15.54	69.22
Soufriere	2.09	34.75	10.01	42.17	4.70	0.12	37.69	131.53
Vieux Fort	8.98	82.98	69.25	39.19	10.14	1.16	46.68	249.37
TOTAL	32.20	238.87	149.81	223.27	51.72	3.55	268.67	967.10

Note: The 1991 estimated landings were more than double those for 1990. This is not a real increase in landings, but rather a result of the improved data collection and extrapolation system as described above. The Department feels that the 1992 estimates are even more accurate than those for the previous year and far more accurate than the earlier estimates. The higher accuracy of the 1992 estimates are due to the newly improved system being operational throughout the year. Extrapolation from recorded catch include a bump-up factor to account for days not sampled in each site and a 10% increase to account for minor non-sampled sites and occasional boats missed at sampled sites.

Table 21. Aquaculture Production 1993

No. farmers 16		
Acreage 9.4 acres		
	FISH	**SHRIMP**
Production (lbs)	882	3,642
Value ($EC)	2,293	54,630
	FISH	**SHRIMP**
Previous Production (lbs)		
1989	200	20
1990	79	586
1991	148	586
1992	276	2387

Table 22. Types of fishing vessels operating in St. Lucia (October 1992)

Vessel Type **Landing Site**	Tansom	Canoe	Fibreglass	Total
Anse la Raye	4	24	3	31
Bannanes	26	15	3	44
Canaries	6	20	3	29
Castries	13	24	13	53
Choiseul	1	38	0	39
Dennery	0	30	6	36
Esperance	7	2	4	13
Gros Islet	14	12	9	35
Laborie	0	40	5	45
Marisule	6	1	1	8
Micoud	0	9	5	14
Praslin	0	10	2	12
River Doree	0	12	0	12
Roseau	6	1	0	7
Savannes Bay	0	10	2	12
Soufriere	30	45	3	78
Vieux Fort	0	55	16	71
TOTAL	113	348	75	539

Note: The Fishing Vessel Register is being updated through a Vessel Licensing System

DATA MANAGEMENT

The Department of fisheries has maintained a fisheries data collection system for the past twelve years. From its inception the programme comprised a number of data collectors, each responsible for one of the major fish landing sites. Initial training was carried out in the field by the Department's data officer. Data collected included bulk weight estimates and length frequencies for sub-samples of species which comprised the bulk of the catch. Data was compiled, originally by hand and in later years by computer, and the sampled landings assumed to represent 60% of the total landings. Thus, total annual weights for species were bumped up by 40% for government statistics.

The Programme suffered from inadequate supervision thus the quality of data received was uncertain. In addition it was felt that the arbitrary bump-up factor was too vague. Thus in 1990 the entire system of data collection and analysis was reconsidered and an effort was made to adequately train data collectors.

The following activities were undertaken during the course of mid 1992 - late 1993:

1. A workshop held where the data collectors were tested in (a) species identification, (b) their ability to fill out multiple information on the data forms;

2. Training sessions held in (a) how to select features for identification, (b) fishing gear identification and species caught, (c) pelagic, snapper, coastal pelagic, and reef fish identification;

3. Development of a new data form: to also include useful information such as sea state, primary and secondary gear, type of weight estimation (visual, fisherman's, or weight measurement;

4. Replacement of delinquent collectors and reinitiation of data collection in two major landing sites;

5. Regular supervision of data collectors.

The initial workshop (number 1 above) where the collectors' ability was tested (most of whom had more than seven years experience) showed that very few of them were skilled at basic identification (except for the major large pelagics) and were not entering all available information on data forms. It was therefore felt that activities 2-5 were necessary in order to upgrade the quality of the data used in analysis.

In addition, the Department utilised the existing working relationship with biologists from the French institute OSTORM in neighbouring Martinique to undertake a review of the system for data analysis. In scanning several years of data stored in the computer it was realised that many discrepancies existed. These included cases where, for example, data was entered several times, species and gear did not correspond, and incorrect species codes given. Now, with an error-detecting programme developed by the scientists at OSTORM in collaboration with our research officers, the data can be scanned to identify all entries with possible errors, and these can either be automatically or manually corrected. This dramatically improves the quality of the data to be manipulated.

In addition, these two countries in addition to Dominica and Guadeloupe have planned an assessment of demersal fish stocks, (primarily using fish traps as the year for sampling). The St. Lucia segment will be undertaken if a request for french research biologist to be attached to the project, is facilitated.

The final improvement involved the creation of a more appropriate method for extrapolating from sample catch (i.e. data forms) to actual landings. Records for the number of days worked by each collector (ie. days when forms were given in) were used to estimate a bump up factor for the peak season (January to June) and the lean season (July to December). Thus, that landing site's data would be raised in proportion to the number of days worked versus the number of fishing days (eg. six days per week times 54 weeks minus 10 public holidays). It was felt that this had to be done per season since there are dramatically different species caught during these two periods in most landing sites, and averaging for the entire year would underestimate some and over estimate others. The total catch for each species was achieved by placing a 10% increase over the initial bump-up figure which would account for a combination of boats missed (which were not being recorded until 1993) and minor landing sites where no data is currently collected.

It is recognised that these estimations still contain several sources of error, however, it is felt that they are a vast improvement over the system in place previously. Data Collectors had to be convinced that it was better to miss a few boats and get good data on the rest, as long as the number of boats missed was recorded and the sub-sample was representative of the days effort.

The result of all these improvements was a virtual doubling of the estimated landings in 1991 and 1992 over previous years, primarily a result of the computer no longer rejecting a large part of the data due to errors and the renewed enthusiasm of the data collectors. It is felt that these figures are far more representative of current fish landings than those made a few years ago.

It is planned that, under the new improved system, length frequency data will be collected for major species at all landing sites. This data was collector in previous years, however, this was put on hold while the system was being re-examined and improved.

NEARSHORE FISHERY ASSESSMENT

In 1990 the Department initiated a number of assessment programmes for the more valuable nearshore fisheries such as the lobster and sea urchin fisheries. Lobsters have always proved difficult for data collectors to estimate since they are often concealed by fishermen due to commonplace illegal landings and, in addition, are also often landed in sites other than the major fish landing areas.

The development of the Fisheries Complex as a central marketing facility (particularly for the hotels and restaurant market) aided in the procurement of large sub-samples of landings during the first three weeks of each year's open season. Weight, length (total and carapace), tar spot incidence, and sex are recorded each year for all major landing sites.

The re-opening of the sea urchin fishery, after several years of closure due to over-fishing, allowed for the development of an innovative co-management system where prospective harvesters are involved in population analysis and enforcement. Each year several visual surveys are carried our in major harvest sites and then a number of quantitative surveys (size frequency and density measurements) are undertaken in representative areas. This data is used to decide (a) if a harvest period will be granted and, if so, (b) how many full time harvesters the resource can support in each

area, (c) the length of the harvest period, (d) the size limit ie. a size which would ensure that at least 25% of the individuals (including all juveniles) remain in the water to attract larval settlement for the subsequent year.

HABITAT MONITORING

With the recent addition of two new biologists and the return of a senior biologist from study leave, the Department has once again embarked on an effort to monitor critical coastal marine habitats. These programmes, which had been in operation some years previously, are manpower sensitive and had to be put on hold due to temporary staff shortages.

The Department's new approach is to liaise with other agencies and resource users interested in the welfare of the habitat. In this regard, the current mangrove survey is being undertaken with the St. Lucia Naturalists Society and a reef monitoring programme for the Soufriere area will be set up and undertaken with assistance from local dive operators. The mangrove survey will attempt to survey and categorise all the island's mangrove areas using visual surveys and quantitative transect lines. The reef monitoring sites are being selected after an indepth visual survey of the coastline yielded representative locations for photo-monitoring sites. Dive operators will be responsible for taking occasional photographic records of these sites in addition to regular measurements of factors such as temperature, visibility, and salinity.

The Department is also reactivating a beach monitoring programme with a variety of interested agencies (the St. Lucia National Trust, the Ministry of Health, the Ministry of Communications and Works). A number of beaches will be surveyed monthly so as to monitor their dynamics in light of adjacent coastal developments. The two major sand mining beaches will be monitored twice monthly, in addition to assessing the quantity of sand being removed from each. It is hoped that this programme will be activated in early 1994. Presently a large number of beach profiles are being taken along the island's northwest coast for a government coastal conservation project being undertaken in collaboration with Atria Engineering of Canada.

RECENT RELATED DEVELOPMENTS

The Department has recently acquired a new fisheries biologist in addition to another biologist being attached to the Department as a Professional Cadet. The Senior Biologist has recently returned from study leave. This additional personnel in the research/resource management branch will greatly enhance the capability of the Department. The Department now has two vessels available for use in the fisheries extension and research branches, one 40 foot Japanese fishing vessel and one 25ft pirogue. One officer who was deeply involved in the data management programme is currently pursuing a BSc in Biology at Cave Hill under the sponsorship of CFRAMP.

LPRSF Assessment SSW/WP/14

STATUS OF FISH STOCK ASSESSMENT ACTIVITIES ST. VINCENT AND THE GRENADINES

by

Raymond Ryan
Fisheries Officer

The Fisheries Sub-sector in St. Vincent and the Grenadines is comprised of the following: the coastal pelagic fishery, the offshore pelagic fishery, the conch fishery, the shallow shelf fishery, the deep slope and bank demersal fishery, the recreational fishery and miscellaneous fishery (sea urchins, turtles, flyingfish etc.). Assessment information with regards to these resources is limited, however, efforts are being made to alleviate the problem. A catch, effort and price monitoring programme has recently been implemented for the entire country and is now being refined to ensure the efficient collection and analysis of data. It is envisaged in the near future that the data collection and analysis will expand to include biological data and through the licensing and registration programme, socio-economic data. This information flow, along with additional research studies (e.g. specific gear selectivity studies) will facilitate a more comprehensive assessment of the fishing industry.

PAST ASSESSMENT ACTIVITIES

Data Collection

A catch assessment survey for union Island was implemented by a Peace Corp biologist (Matthes 1984). The source of the information was primarily fisherman interviews. However, this survey was abandoned after the information was found to be unreliable.

Total fish catch landings at the Kingstown market were obtained from the market toll records 1979 to 1989. These landings were analysed by FAO (1991) to determine trends in abundance for the offshore pelagics (e.g. Wahoo and Dolphin).

Research Activities

There has been no past research activities.

CURRENT ASSESSMENT ACTIVITIES

Data Collection

The upgrading of the St. Vincent and the Grenadines Fisheries Information system was initiated by the Fisheries Division under a CIDA Funded Fisheries Development Project (Ryan 1992, St.Vincent and the Grenadines and Canada Fisheries Dev. Proj., 1992). The development of the St.Vincent and the Grenadines Fisheries Information System is continuing through the collaborative efforts of the Fisheries Division and CFRAMP. Catch, effort and price data are being collected from all landing sites in St. Vincent and the Grenadines. On processing the data, catch landings, catch per unit effort and value of catch are reported routinely by month, landing sites and species (Table 23).

Research Activities

Chakalall (in prep.), a MAREMP student funded by CFRAMP, has studied the movement of trading vessels in the Grenadines through the co-operation of the St.Vincent and the Grenadines and Grenada Fisheries Divisions. Results are currently being analysed.

Gomes (in prep.), also a MAREMP student funded by CFRAMP, has studied the association of pelagic fishes with floating objects through the co-operation of the St.Vincent and the Grenadines, Grenada, St. Lucia and Dominica Fisheries Divisions.

Catch and effort data, from the pelagic Fisheries of St. Vincent and the Grenadines were examined to determine the importance of yellowfin tuna within the fishery (Mahon et al 1993). It was ascertained that more data is required to draw conclusions about the seasonal patterns of yellowfin tuna. However the data suggest that there is relatively low fluctuation in the main pelagic season.

A pilot study on fish growth was carried out by CFRAMP in cooperation with St.Vincent and the Grenadines Fisheries where length frequencies and hard parts (otoliths, fin rays) of the blackfin snapper were sampled. These samples are now being processed. Another pilot study where similar data were collected for the blackfin tuna was presented at ICCAT, (Neilson, et al, 1993).

Exploratory fishing is currently being carried out by the Fisheries Division and the following species have been encountered in significant quantities within the EEZ of St.Vincent and the Grenadines:

Yellowfin tuna
Swordfish
Sailfish
Dolphin
Sharks
Barracuda

FUTURE ASSESSMENT ACTIVITIES

Data Collection

Length frequency samples would be collected twice weekly for reef and slope species, and once weekly for coastal and offshore pelagic species (Table 24). A stratified random sampling scheme will be implemented among landing sites for length frequencies. Sampling would be done twice per month at each of the two primary sites, once per month at each of three secondary sites and once per month at each of two tertiary sites. Landing sites from each stratum (primary, secondary or tertiary) would be chosen at random for the collection of these length frequency samples. Maturity observations and hard parts sampling would be done monthly for each species. The above sampling scheme is subject to review at this meeting. It is also anticipated that the scheme will be funded under the CFRAMP programme.

The information will be entered on a data collection sheet (II) which is designed to capture the biological information required for stock assessment. This form will complement data collection sheet (I), designed to capture catch and effort data. These data will be entered in TIP and analysed using SPSS or Statsgraphics software.

Sampling would be undertaken and/or supervised by a person trained in the collection of biological data who will be assisted by the catch and effort data collectors. The collector of biological data should be capable of: processing hard parts of fishes for storage and future study, sampling fish gonads and making preliminary deductions on the maturity of fishes, preliminary processing of length frequency data, diving and carrying out visual surveys on marine species and other miscellaneous duties assigned. The level of qualifications required for this position is a diploma or equivalent.

Research Activities

The Fisheries Division in cooperation with CFRAMP, will be carrying out a study of the selectivity of hook and line gear for deep slope resources (LPRSF Assessment SSW/WP/30).

The Fisheries Division in collaboration with ICCAT (Dr. Eric Prince) will be starting a billfish tagging programme which will eventually extend to other offshore pelagics, such as the yellowfin tuna. This programme will be funded by CFRAMP and ICCAT and the Fisheries Division will provide its research vessel subject to its availability (SSW/WP/32).

The Fisheries Division in cooperation with the Japanese Government, specifically JICA, will continue with the gear and methods trial programme.

A programme for monitoring coral and fish species in marine reserves and other nearshore habitats will be implemented to assess the status of critical habitats. This will take the form of visual surveys and underwater photography.

Other Notes

At present, one basket (standard size of fish), is estimated to be fifty lbs for most coastal pelagic species. However, the Fisheries Division will investigate the relationship between size of fish and weight of fish required to fill a basket to determine the variability among baskets.

A critical aspect of stock assessment will be the analysis of biological data, catch and effort data to determine the following: growth parameters, mortality rates, recruitment patterns, importance of critical marine habitats and locations of spawning aggregations and maximum sustainable yield. The efficient assessment of stocks and continued research activity in St. Vincent and the Grenadines would require a person trained at the post graduate level.

The St. Vincent RAU

There has been a positive increase in the number of Resource Assessment research activities in St. Vincent and the Grenadines. This type of activity is critical to St.Vincent and the Grenadines owing to the low level of assessment activities in the past. The heightened activities in stock assessment can be partly attributed to the CFRAMP Resource Assessment Unit.

The assessment unit allows for quick technical assistance and training, which is critical to implementation of assessment projects. Pilot studies undertaken within the EEZ by the Fisheries Division in cooperation with CFRAMP, in many cases, reflect research in new habitats and on under-utilised species. This therefore emphasises the need for heightened research activities in St.Vincent and the Grenadines.

REFERENCES

Chakallal, Y., in prep. An examination of the Activities of fish trading vessels in the Grenadine islands. U.W.I., Barbados.

Gomes, C., in prep. Association of pelagic fishes with floating objects: U.W.I., Barbados.

FAO, 1991. Factors responsible for low catches of large pelagic fishes in the Eastern Caribbean. FAO: Rome. FI:TCP/RLA/8963.

Mahon, R., S. Singh-Renton, S. Jennings-Clarke, J. Rennie, R. Ryan and s. Willoughby, 1993. Yellowfin tuna catch and effort data from Barbados, Grenada, St. Lucia and St. Vincent and the Grenadines. ICCAT/SCRS/93/40.

Matthes, H., 1984. St. Vincent and the Grenadines formulation of a Fisheries Development Program in St. Vincent. Field Document 1 FAO: Rome. FI:TCP/STV/2201.

Neilson, J.D., S. Heileman-Manickhand, & S. Singh-Renton, 1993. Assessment of hard parts of blackfin tuna (*Thunnus atlanticus*) for determining age and growth. ICCAT SCRS/93/89.

Ryan, R., 1992. Fisheries data collection in St. Vincent and the Grenadines. The report of CFRAMP Data Collection and Information Systems Subproject specification workshop report. Barbados PPXX.

Table 23 - Catch per unit effort report - Month 1 1993

Site	Species	Total (lbs)	Total Site Catch(lbs)
LOBA	BALIVE	6	6
BARR	BELDAC	31	31
ROBA	CARABI	12	12
ADBA	CARACR	2000	8292
ASHT		6000	
BARR		46	
BUBA		125	
CHAT		110	
ROBA		11	
BARR	CARAMA	425	465
CHAT		40	
ADBA	CARCBR	145	175
PEBO		30	
BUBA	CONGOC	3	3
ADBA	CORYHI	60	76
LPBA		16	
ROBA	EPHIFA	4	4
BARR	HEMIBA	303	1153
CHAT		500	
DARK		350	
ADBA	HOLOAS	10	23
LOBA		13	
ADBA	ISTIAB	225	225
ADBA	ISTINI	300	300
ADBA	ISTIPL	35	35
ADBA	LUTJBU	45	121
BUBA		6	
PEBO		15	
ROBA		55	
BARR	LUTJOC	17	40
BUBA		8	
LOBA		15	
ADBA	LUTJPU	21	534
CLIF		440	
LOBA		13	
ROBA		60	
ROBA	LUTJVI	16	16
PAFA	PALAIR	100	100
FRBA	PALIAR	392	836
PAFA		444	
BUBA	PRIAAR	12	12
ASHT	SCARUS	70	70
ADBA	SCOMAA	428	428
ADBA	SCOMAB	748	748
ADBA	SCOMAT	69	139
LPBA		41	
ROBA		29	
BARR	SCOMPE	142	167
BUBA		25	
LPBA	SCOMSO	25	25
ROBA	SERRAD	10	10
LOBA	SERRBU	6	6
ADBA	SERRFL	26	117
ASHT		65	

LOBA		26	
ROBA	SERRFU	23	23
ASHT	SERRGU	60	226
CLIF		155	
LOBA		11	
ADBA	SHELL	4	4
ADBA	SPHYBA	44	372
FRBA		57	
LPBA		203	
PEBO		45	
ROBA		23	
ADBA	STROGI	205	591
FRBA		198	
PAFA		188	
ADBA	XIPHGL	10	10

RECORDED TOTAL CATCH FOR MONTH 01 IS: 15395 LB
ESTIMATED TOTAL SPECIES WEIGHT: 15395 LB
RECORDED TOTAL EFFORT FOR MONTH 01 IS: 103 boat trips
ESTIMATED CPUE IS: 149.47 LB per trip

Table 24 - Reef and Slope Species

	Common Name	Scientific Name
1	Blem (queen snapper)	*Etelis oculatus*
2	Red snapper	*Lutjanus purpureus*
3	Blackfin snapper	*Lutjanus buccanella*
4	Red Hind	*Epinephelus guttatus*
5	Coney (butterfish)	*Epinephelus fulvus*
6	Silk snapper	*Lutjanus vivians*
7	Rock Hind	*Epinephelus adscensionis*
8	Squirrel fish	*Holocentrus ascensionis*
9	Yellowtail snapper	*Ocyurus chysurus*
10	Blue parrot	*Scarus vetula*

Large Pelagics

	Common Name	Scientific Name
1	Dolphin	*Coryphaena hippurus*
2	Wahoo	*Acanthocybium solanderi*
3	Yellowfin	*Thunnus albacares*
4	Swordfish	*Xiphias gladius*
5	Bonito	*Thunnus atlanticus*
6	Salmon	*Elagatis bipinnulatus*
7	Ocean Gar	*Istiophorus albicans*
8	Blue Marlin	*Makaira nigricans*

Coastal Pelagics

	Common Name	Scientific Name
1	Robin	*Decapterus macarellus*
2	Jacks	*Selar crumenophthalmus*
3	Dodger	*Decapterus punctatus*
4	Ballyhoo	*Hemiramphus balao*
5	Skipjack	*Katsuwonus pelamis*
6	Barracuda	*Sphyraena barracuda*
7	Flyingfish	*Hirundichthys affinis*

SVG DATA COLLECTION SHEET (I)

Sample No: ____ Sample Date: DD MM YY ____ ____ ____

Collector's Initial: ____ Landing site code: ____

Vessel Name: ____ Vessel Type Code: ____

Vessel Registration No: ____ Crew Size: ____

Fisherman's Name: ____ Total Catch: (lbs) ____

Departure time: ____ Date: ____ Return time: ____ Date: ____

Gear Code: ____ ____ Hrs. Fished ____

COMMENTS: (Weather pattern, Special events, Gear damaged)

Species Breakdown:

COMMON NAME	CATCH (LBS)	PRICE (EC$)
TOTAL/DAY		

N.B. Put * if in doubt of common names

SVG FISHERIES DIVISION
DATA COLLECTION SHEET (II)

Species Sample Form

Vessel name _____ Vessel type code _____

Collectors initial _____ Sample date DD MM YY _____

General area fished _____ Specific area fished Lat Long _____

Gear code _____ Mesh size _____ Hook size _____

Sample No.	Common Name	Specific Name	Length range Max. Min	Weight Ind.Tol	No. of fish	Sex	Age

LPRSF Assessment SSW/WP/15

STATUS OF FISH STOCK ASSESSMENT ACTIVITIES TRINIDAD & TOBAGO

Presented by

Sita Kuruvilla
Fisheries Officer

RECENT DEVELOPMENTS THAT WILL INFLUENCE ASSESSMENT AND MANAGEMENT CAPABILITY

(1) Re-fitting of the MV Provider - An eighty (80) foot converted Gulf of Mexico type trawler belonging to the Caribbean Fisheries Training and Development Institute has been recently outfitted with a single stern trawl, pelagic and demersal long-line gear, fish-pot hauling equipment, and a small on-board laboratory.

(2) The upgrading of the Fisheries Division facilities at Chaguaramas to include an age and growth laboratory and an expanded library and documentation service.

(3) The development of a management plan for Buccoo reef in Tobago and the appointment of a reef manager.

COOPERATIVE INSTITUTIONAL ACTIVITIES

Co-operative projects between the Fisheries Division, Tobago House of assembly, Institute of Marine Affairs and the University of the West Indies have resulted in useful inputs into the resource assessment and management capability of the country.

The following Joint Fisheries Division/University activities are listed:

- Geographic Information System (GIS) development (UWI, Dept. of Land Surveying
- Gill-Net selectivity gear study (UWI, Dept. of Zoology/CERMES)
- Trawler operations study (UWI/CERMES)
- Carite bio-economic modelling (UWI/Dept. of Agricultural Economics)
- Trawl By-Catch Estimation (University of Rhode Island, USA)

- Study of the Recreational fishery (University of Hull, UK)

Fisheries Division/Tobago House of Assembly activities include:

- Catch/Effort data collection monitoring/assessment of the flyingfish fishery of Tobago

Institute of Marine Affairs/Tobago House of Assembly projects include:

- Development of the Buccoo Reef National Park/Management Plan

- Fisheries Inputs into EIA studies for tourism industry development

CURRENT AND PLANNED ASSESSMENT ACTIVITIES

The Fisheries Division is currently working on updating the coastal fisheries assessments through:

- Implementation of the recommendations of the FAO Resource Assessment Project

- Expansion of the coverage to include other commercially important species such as kingfish, snappers and sharks

- Placing an emphasis on the Gulf of Paria fisheries

It is envisaged that proposals for implementation of studies of a regional nature will be developed including:

- Development of a joint research programme with Venezuela for data and information exchange on fisheries catches, effort and literature and a bilateral proposal for co-ordinated assessment and management of shared stocks.

- Development of a sub-regional management proposal for North-East South America including data and information exchange on fisheries catches, fishing effort and available literature and a sub-regional proposal for co-ordinated management.

POLICY AND LEGISLATION

Resource assessment activities within the Fisheries Division have over the last 3-5 years been formalised and guided by the National Fishery Policy objectives of the Ministry of Agriculture, Land and Marine Resources in that it seeks to establish an "appropriate mechanism to facilitate resource assessment to better inform the management planning and development process of the marine fisheries sub-sector" and to ensure the "enactment of appropriate legislation and/or consolidation of existing legislation to provide for the proper management of the living marine resources" (National Policy for Food & Agriculture, April 1993).

The framework for these activities has been further defined by the Government "Medium Term Policy Framework: From Stabilisation to Growth 1993-1995" and the "Public Sector Investment Programme 1993-1995" which stress the need to complete stock assessments and develop management strategies for marine fisheries, as well as address the issue of related environmental degradation through integrated planning, locally and regionally.

Following from this the Government, through the FAO Project TCP/TRI/2352 will implement activities towards the formulation of a National Marine Fisheries Policy and a revision of the existing Marine Legislation including harmonisation with Forestry/Environment Legislation.

STOCK ASSESSMENT ACTIVITIES

The first attempt at undertaking preliminary stock assessment of the country's major marine fisheries was initiated from 1990-1992 as part of a technical co-operation project with the UNDP/FAO and the Fisheries Division and institute of Marine Affairs (IMA). This project (TRI/91/003) contributed to the establishment of data collection systems for commercial statistics (nominal catch/landing and fishing effort), and fisheries biological data (length frequencies, reproductive indices, ageing data), and cost-of-production studies. The fisheries analysed were the artisanal gill-net fishery in Trinidad for Carite (*Scomberomorus brasiliensis*), the artisanal trawl fishery in the Orinoco Delta of Venezuela for Shrimp (*Penaeus sp.*), the artisanal fishery for flyingfish in Tobago (*Hirundichthys affinis*) and the snapper/grouper fishery (*Lutjanus sp.*, *Rhomboplites sp.*, and *Epinephelus sp.*) in the northeast of tobago. the Thompson and Bell virtual population analysis method and yield per recruit were the methods of analysis used in these studies. Results were obtained that indicated the present status of the fisheries and scenarios developed by computer modelling to forecast and estimate the impact and the results of variations in fishing effort.

A report on the bioenergetics and spawning stock biomass of the Croaker (*Micropogonias furnieri*) was also prepared by the Institute of Marine Affairs.

Recommendations were made to continue the work initiated by the project on the major commercial fisheries and to increase the scope to include data collection and analysis of fisheries biological data for the shark fishery and kingfish (*Sconberomorus cavalla*) fishery.

Training of Fisheries Division/IMA staff was provided for under the project in the areas of Fish (including shark) ageing techniques/ Interpretation, stock assessment methods, computer software use, statistical techniques and technical writing.

INTEGRATED COASTAL MANAGEMENT

In another recent initiative, the Government of Trinidad and Tobago has agreed to host as one of three pilot sites selected internationally, a project for the integrated coastal fisheries management of the Gulf of Paria. The Gulf of Paria was selected because of its widespread importance in fisheries, agriculture, industry and wildlife and the degree of interaction of these activities. The project is being developed by the UNDP and executed by the FAO. Other selected sites are in the Gambia and Philippines. The objective of the project is to improve the well-being of coastal communities and the society at large, through improved management of marine related land based coastal resources, and through the protection of the coastal eco-system. The project will specifically support the following activities:

- Consolidation of databases on fisheries, habitat and environmental impacts, and assistance in the creation of a GIS on the Gulf of Paria in cooperation with the University of the West Indies;

- Develop educational (and publicity) materials on fisheries and the environment for policy makers, fishing communities and the public with the help of environmental NGO's;

- Assist in selected fishing communities, in the formation and strengthening of community organisations in order to develop their resource management capacity and their ability to interact and negotiate with stake holders of other sectors;

- Strengthen the role of the Fisheries Division in integrated coastal zone management through the organisation of inter-departmental workshops and meetings, and through training activities, and in cooperation with other agencies initiate the development of a coastal zone management plan for the Gulf of Paria.