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FISHERIES MANAGEMENT DATA SYSTEM TERMINAL WORKSHOP PROCEEDINGS

"The way forward – a review and planning session"

25-28 NOVEMBER, 2000

CASTRIES, ST. LUCIA

CARICOM FISHERIES UNIT, BELIZE CITY, BELIZE

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FISHERIES MANAGEMENT DATA SYSTEM
TERMINAL WORKSHOP PROCEEDINGS
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ABSTRACT

The objectives of the Fisheries Management Data System Terminal Workshop were to review the catch and effort data collection activities and achievements of the participating countries and to make recommendations and develop proposals for future implementation. Each country also gave a short report on the status of their data collection program (data collection, management, conclusions and recommendations). Technical documents were presented to provide participants with an overview of the need to collect particular data to enhance their data collection programs.

The following activities were also carried out; review of the CFRAMP supported software (TIP and LRS); discuss ways to strengthen present data collection systems in countries; look at alternatives approaches to conventional data systems; include the collection of social and economic data in present data systems; and discuss the setting up of a regional database to serve the region. The main points arising from the discussions were the need to upgrade TIP and LRS; additional support needed to strengthen the data collection program within countries; the need to include social and economic data in data collection and interpretation; the need for the regional database; refinement of the Fisheries Management plans; dissemination of information to stakeholders and the involvement of stakeholders in regional meetings.

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LIST OF ACRONYMS

CARICOM	Caribbean Community
CFRAMP	CARICOM Fisheries Resource Assessment and Management Program

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CFRAMP would also like to thank Dr. Daniel Hoggarth, Consultant, SCALES Inc.; Ms. Sherril Barnwell, OECS-NRMU; Ms. Rosemary Kishore, IMA Aging Lab; Mr. Stephen Willoughby, Barbados Fisheries Division; and Mr. Peter Murray, OECS-NRMU for their various contributions. CFRAMP also wishes to thank Ms. Sandra Grant, Data Manager/Analyst CFU/CFRAMP for organizing and convening the workshop. Funding for the workshop and production of the report was provided by the Canadian International Development Agency.

EXECUTIVE SUMMARY

1. INTRODUCTION

1.1 Note from the Scientific Director

1.2 CFRAMP's Fisheries Data Management Program

WBS 300: FISHERIES DATA MANAGEMENT PROGRAM

by

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CFRAMP'S overall goal is to promote the management and conservation of fishery resources in twelve (12) English speaking CARICOM countries, and to permit the exploitation of these resources on the basis of sustainable yield. The Fisheries Data Management goal is to enhance the basic information and institutional capacity to manage and assist in the capture, management and analysis of the relevant data. The objectives are to:

- Provide data and scientific analysis necessary to assist Resource managers to make informed resource management decisions
- Augment and support the current catch and effort data collection by sample based estimation for all species landed
- Enhance data storage, manipulation and management using a computerized system

The program plans to achieve this goal by enhancing the basic information and institutional capacity to manage and develop fishery resources. The CFRAMP Catch & Effort Data Collection (WBS 310) and the Licensing and Registration (WBS 320) sub-projects represent two approaches to assist in the capture, management and analysis of the relevant data.

This activity is composed of five sub-activities: (1) identify and compare national systems; (2) organize and implement a regional workshop; (3) provide resources for implementation; (4) short-term training and technical assistance; and to integrate catch & effort and the biological data systems[34].

WBS 310: THE CATCH & EFFORT DATA COLLECTION

Monitoring catch, effort and investments of capital and personnel, is fundamental to evaluating the performance of a fishery. The information gathered, will allow resources manager to monitor changes in fishing activities, evaluate changes in the biological and economic status of the resource. For a data collection programme to be sustainable it should be simple, inexpensive and utilizing existing sources of information[17].

The main objectives of the Catch and Effort Data Collection Systems Subproject are:

- To establish operational systems at the national level to collect, manage and report on quantities of catch by species and the effort (human and technical) made to obtain this catch;
- Enhance capabilities at the national Fisheries Divisions to design, implement and manage their Catch & Effort Data System;
- Computerize the data management system (TIP);
- Enhance the capabilities at the National Fisheries Divisions to analyze their data and report on the performance of their fisheries sector.

The CARICOM Fisheries Unit (CFU) implemented this activity. The Scientific Director and Data Manager/Analyst(s) have responsibility for technical input, however, the Data Manager/Analyst(s), will play leading role in providing on-going assistance to individual countries. Earlier activities targeted CARICOM countries, which were not involved in an earlier OECS/ICOD activity. In the eastern Caribbean, activities were built on work carried out by the OESC Members States and Barbados[17]. Resources required by countries to implement this activity included: data collectors, training in species identification, computers (hardware and software) and computers etc.

The expected outputs are catch and effort data collection systems operating in each participating country. The achievement of these outputs will be indicated by the ability to gather the raw data, use the appropriate software, generate fisheries statistical reports of sufficient quality to be of use in decision-making.

WBS 320: LICENSING AND REGISTRATION

Registration is the process of classifying and enumerating the physical resources utilised in fishing (fishers, vessels, gear), either for information purposes, or to ensure that they meet certain criteria such as safety standards. A license is permission to fish according to certain specifications. A licensing system for boats, gears, and personnel involved in fishing is a basic component of management. The process provides essential data on fishing effort and investment, and can be a source of revenue for the fishery administration [17].

The main objectives of the Licensing and Registration System subproject are:

- to establish national systems to monitor and manage the fisheries by tracking change in numbers of fishermen, fishing boats, fishing gear etc.;
- enhance the national and regional capability to design and manage their Licensing & Registration System (LRS);
- computerize the LRS function of the Fisheries Departments and enhance their ability to analyze and report on the data.

This activity was implemented by the CFU. Its success depended on the participating country's willingness to implement a licensing system and to provide appropriate incentives for compliance by the fishing industry. CFU provided technical support and assistance with computerization of the systems[17] .

The expected outputs are national licensing and registration systems operating in each participating country. The achievement of these outputs will be indicated by registration records and use of information in fisheries management decisions.

Advantage of implementing a Registration and Licensing System:

An appropriate registration and licensing system should:

1. Provide the FD with accurate information on the number of vessels and number of fishers involved in fishing by location. The information could be used to design more interactive educational and public relation programs
2. Assist in identifying vessels and their owner(s) for legal and surveillance purposes, and to facilitate the disbursement of incentives.
3. Identify and strengthen the linkages between catch, effort, processing, marketing and aquaculture systems.
4. In collaboration with the Data Collection sub-project allows for the design of more effective management strategies by identifying and focusing on persons who depend on the sector for their livelihood. This should include persons involved in marketing, processing and aquaculture. Any management measure will impact on these persons, and since their compliance would determine its success or failure, they should be involved in the planning phase.
5. Through the licensing system facilitate regulation and monitoring of the implementation of any management strategy.
6. Generate through the Registration and Licensing System the revenue to defray or minimize increases in administrative costs of implementing the system.
7. Strengthen the relations between the fisheries and planning, finance and statistical divisions of Government in terms of exchange of reliable data. Additionally, relations with private sector agencies should improve.
8. Create a cadre of fisheries personnel with a better understanding of the relationships between the various environments within fisheries; the need for accurate data and the means to collect, analyze and interpret this data; and the ability to use computers to achieve their objectives

ECONOMIC DATA COLLECTION

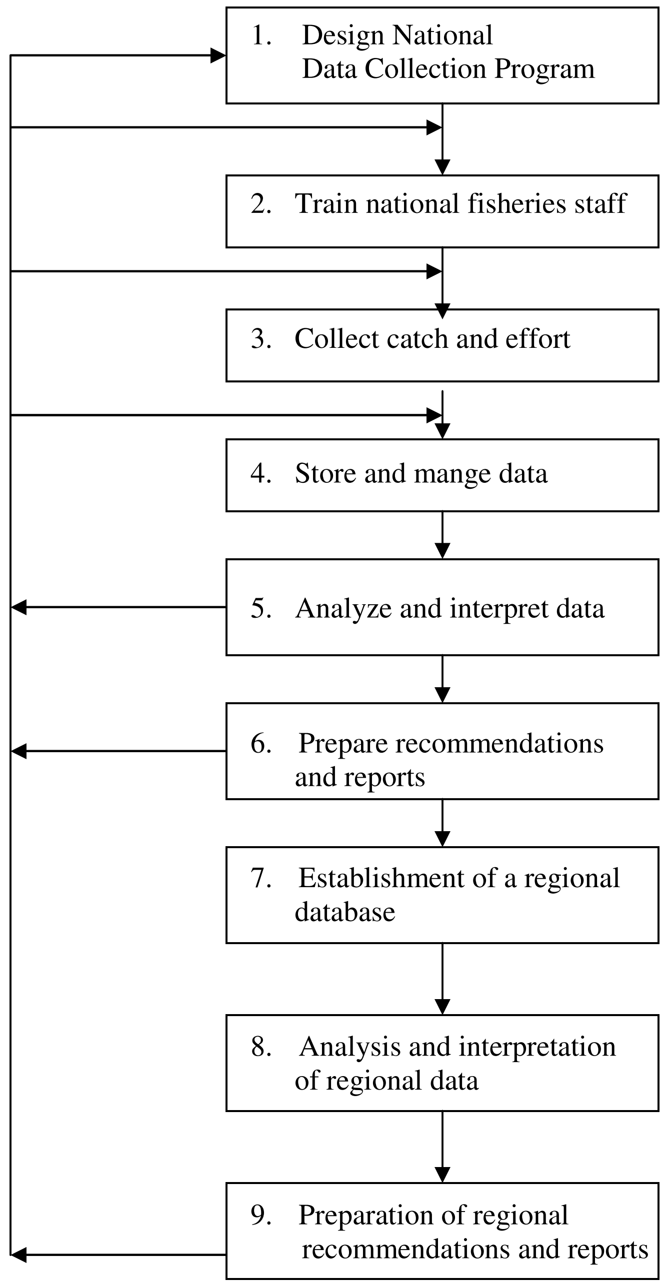
Each CFRAMP draft management plans identify the need to capture economic data to monitor the average cost and average revenues associated with each fishing trip. Economic data will contribute to the fishery management process through valuing the cost of effort and revenue derived from production. It will provide decision-makers with information to attract value to each management option available to them.

Prices are needed in order to convert landings data to landed value and to estimate the total value of the fishery. Prices will be tracked at various levels in the system to permit the estimation of value added as fishery product move form the fisher to the consumer. Price data will be incorporated as a component of the catch & effort system.

The second type of economic information that is needed for fisheries management is the costs of the various inputs to fishing. From this information, the profitability and efficiency of various types of fishing can be compared. These data also enable managers to evaluate the need for subsidies and/or the feasibility of economic management measures. In view of the trend if increasing size and sophistication of vessels, economic management measures are likely to be more feasible in the future for management of some fisheries, particularly the industrialized fisheries[57].

The Data Collection System

The process of establishing the CFRAMP data collection system involves the following elements:



1. Designing national data collection program[37]
A properly designed data system is important as it lays the foundation on which the operation and administration of the system will take place. Available historical data should be reviewed and used to determine the current data elements needed. A sampling plan is developed from information on sampling frame and product pathways for each commercial species or species group. The information from the sampling frame is used to identify the sites where catch, effort and biological sampling will occur.

2. Train National fisheries staff[37]
Data collection staff (data collection supervisor/data manager, data entry operators and data collectors) needs training in the knowledge and skills necessary to do their work. Training is provided in the following areas: introduction to fisheries management; the role of catch and effort and licensing and registration systems in management; the role of biological data in fisheries assessment and management; species identification; data collection and reporting (weight estimates, length and weight, maturity stages, otolith and other hard part extraction); interviewing techniques; introduction to computers and computers software; data entry, data management procedures and reporting using computerized programs such as TIP; tagging and releasing of fish; data analysis, reporting, basic statistics and fish stock assessment.

3. Collect catch and effort[37]
The fishing trip is the main data unit. Data elements required per trip are **catch and/or landings** (estimated weight for each species or species group in the catch by gear type, area and fleet); measures of **fishing effort** (by boat type per day for a particular gear type and numbers of gear types); and **price** per unit weight (by species or commercial category). The data elements to be collected for species targeted for stock assessment would include biological data such as: **size frequency** data (length or weight frequency data); **maturity data** (size at maturity, maturity stages); and **hard parts** for aging (otoliths or scales).

Human resources is the most important part of any data collection system. Data collectors are responsible for the acquisition of data, data entry operators are responsible for entering data into the computerized database and data collection supervisor/data manager is responsible for the overall data collection.

4. Store and manage Data[37]
Data collected is entered into the Trip Interview Program (TIP). TIP is designed to accept the following types of data and information per fishing trip: background regarding the trip and data collector; information on the fishing activity including fishing effort, catch or landings, gear, prices, etc.; bioprofile data including length and weight measurement, otoliths samples. TIP can export data in database (DBF), DOS text (ASCII) and spreadsheet (Lotus or Excel) formats. Reports can also be created using TIP. Using a common database such as TIP facilitates comparative analysis of data from differenct countries and allow sharing and pooling of compatible data sets for assessment and monitoring of shared stocks.

5. Analyze, interpret data and prepare reports[32]
Analysis of data is important as it provides decision-makers with information to manage their respective resources, to test the statistical quality of the information provided and to allow designers of sampling programs to make the necessary adjustments to achieve the desired level of precisions and accuracy.

6. Establishment of a Regional Database[28]

The regional database will be a repository for fisheries data including biological, economic, catch and effort, fishing vessels, fisheries, fishing companies, fish processing plants and aquaculture. The database will provide regional planners and decision makers with information regarding the performance and status of the fisheries sector in order to facilitate regional and national policy formulation and resource regulation and management decision-making (CARIFORUM, in press).

HISTORY OF WBS 300 ACTIVITIES

1991

Sub-project Initiation Mission[31]

L. Paul Fanning, September and October, 1991

The primary objective of the mission was to meet fisheries staff and discuss the first three subprojects to be implemented under CFRAMP. These subprojects are Fishery Management Planning (WBS 1.1.1), Data collection (WBS 1.1.2) and Licensing and Registration (WBS 1.1.4). The information collected would be used as the basis for planning activities leading to the CFRAMP sponsored workshop for each of the sub-projects. The first mission (September 8-22), CFRAMP staff visited Guyana, Trinidad & Tobago and Jamaica. The second mission (October 6-28), CFRAMP staff visited St. Kitts & Nevis, OECS Fisheries Unit staff, Antigua & Barbuda, Dominica, St. Lucia, Barbados, Grenada, St. Vincent and the Grenadines, St. Vincent & the Grenadines OECS Fisheries Unit, Montserrat and Belize.

In each country meetings were held with officials of the Fisheries Division/Departments, representatives of Cooperatives and fishers organizations, and others. The meetings were used to investigate the following; **data collection** (status of fisheries data and information systems, types of fisheries data required, CFRAMP utilizing or building on the approach of the OECS fishery report No. 2, problems and difficulties with establishing or enhancing a national fishery data collection system), **licensing and registration** (status in each country, fisheries and fishing units , other aspects to be incorporated in the plan, problems and difficulties with implementing or enhancing a licensing and registration system). A program of activities was prepared for the subproject specification workshop, scheduled for June 1992 (Fanning, 1992).

1992

Attachment of Mr. Peter Murray to the CARICOM Fisheries Management Unit[46]

February 24 – March 13, 1992

Attachment of Mr. Peter Murray, Data Manager of the OECS Fisheries Unit, to the CARICOM Fisheries Management Unit. While this attachment provided a training opportunity for Mr. Murray, it also provided an important opportunity for CFRAMP and the OECS Fisheries Unit to develop a coordinated approach to data management, and particularly, the fisheries data management program TIP. The attachment was for 4-5 weeks. Mr. Murray worked with Mr. Fanning (CFRAMP Data Manager/Analyst), evaluating the TIP package. Discussions were also held with Stephen Meyers (Puerto Rico) and Susan Gold (Miami), to determine it TIP can be adopted as the basic data management program for CFRAMP.

Attachment of the Antigua and Barbuda Fishery Officer to the Fisheries Division of Trinidad and Tobago[5]
Diann Black, February 3-22, 1992

The objectives of this attachment were: to become familiar with the methods of stock assessment with particular reference to pot fishery (the main fishery of Antigua and Barbuda); to become familiar with stock assessment statistical packages; to become familiar with the marine fisheries assessment information sources (FISMIS database) and to be able to search that database including on-line database searching; demonstration of field sampling techniques of the flying fish, fish pots and carite/shark fishery; and demonstration and training in otolith removal, preparation data recording examination for flying fish, otolith removal in snapper, grouper, spine preparation of sharks and gonad removal and preparation of snappers.

Design and implementation of a prototype integrated database for vessel registration, fishing licenses and fisherman registration.[3, 4, 8]
Vernon Bevans and Peter Reid, March, 1992

The contract included the following duties: write programs in FoxPro to implement a generic licensing and registration database system to initiate specifications provided by the Data Manager/Analyst; revise the specifications, in collaboration with the Data manager/Analyst, as the programs are developed; Prepare documentation of the database in the form of a data dictionary, coding definitions and blank forms; document the program internally and in a written manual; prepare a User's Manual including instructions for use, sample screens and reports, coding definitions and blank forms; perform other such ancillary duties which may be identified by the Data Manager/Analyst; and provide weekly reports advising Data Manager/Analyst of progress on duties 1-6 above.

The processes implemented in this database system are: **vessel registration** (records information on vessel specifications, ownership and seaworthiness); **fishing licenses** (grants permission to conduct specific fishing activities); and **fishers registration** (means of identifying specific individuals for legal purposes).

Sub-project Specification Workshop for 1.1.2 Data and Information Systems and 1.1.4 Licensing and Registration Systems[18, 31]
University of the West Indies, Cave Hill, Barbados, June 17-27, 1992

The objective of the data and information systems workshops was to review all data collection systems and any progress made during implementation, and establish an implementation plan and schedule for the next three years for each country. This will include utilization of the resources contributed through CFRAMP (Fanning, 1992). The objective of the licensing and registration subproject was to review the status of licensing and registration in each country, determine the needs, from the point of view of data collection (fishery, economic and social) and design a computer-based system, which can be customized to meet those needs. Thirty-three participants from twelve countries and three international organizations (OECS, National Marine Fisheries Services, CFRAMP) attended the workshops. Jamaica was not represented at this workshop due to the delay in their signing of the contribution commitment agreement. A consultant, Mr. David Gray, was contracted to provide professional and advisory services with respect to the design and implementation of national fisheries data collection systems in consultation with staff of CFRAMP and participating countries.

It was recognized that not all countries were at the same point in the development of their fisheries data collection systems. Participants of the 1987 fisheries data collection workshop had already designed systems appropriate for their individual cases. To account for this the workshop was planned in two parts. Only the second part of the workshop involved 11 participating countries. The workshop program included; **Data and Information Systems, part 1** (introduction to computer facility, elements of data collection systems, St. Lessant data collection system design, review of designs, fishing zones discussion, sampling theory in fisheries, introduction to LOTUS, St. Vincent data collection project report, Belize fishery description, introduction to DOS, Guyana fishery description, design working groups – Belize and Guyana, introduction to WordPerfect, Trinidad and Tobago fishery description, species guides discussion), **part 2** (data collection systems in OECS/Barbados, CFMC data collection, TIP presentation, regional data access, CFRAMP's contributions and implementation plans for CFRAMP activities); **Licensing and Registration Systems** (OECS harmonized Legislation and regulations, fishing vessel marking schemes, demonstration of prototype L&R system and L&R implementation plans).

Recommendations from the data and information system workshop were: CFRAMP Data managers should travel to each country to meet with the Fisheries staff every 3-4 months to monitor and provide technical assistance; CFRAMP to prepare a draft policy governing access to data held by CFRAMP; presentation on TIP by Susan Gold and Stephen Meyers of US National Marine Fisheries Service and Caribbean Fisheries Management Council. New release of TIP to include changes to meet CFRAMP's specification; standardize definitions of vessel and gear categories; need to develop a species guide for Caribbean fisheries that were appropriate for use in the field.

Recommendations from the licensing and registration system were: CFRAMP should distribute LRS by September 1992 and countries should test the software by the end of the year; countries should investigate the Merchant Fishing Act; CFRAMP should recognize the need for social, socio-economic and economic databases and make them compatible with TIP and LRS; LRS compatible with systems of other related national agencies; training program in vessel inspection; countries and CRAMP should work towards officially implementing LRS by February 1993; and CFRAMP should support the OECS countries effort at harmonization.

Training in FoxPro2.1 at Flash Creative Management Inc.
Garret Manwaring, September 8-16, 1992

The course included: X-base programming tools (commands and functions); introduction to new commands and functions in FoxPro 2.0; Use of FoxPro 2.0 power tools; rapid application development and event driven modeless programming including the creation of reusable objects.

Computer Training, St. Lucia
October, 1992

Three Officers from the Division was trained in MS DOS and dbase IV.

CARICOM Fisheries Resource Assessment and Management Program
Baseline Survey of Fisheries Divisions in Participating Countries[42]
Robin Mahon and Stephen Boyce, November 1992

To evaluate the impact of the CFRAMP program, a baseline survey was undertaken. This survey had three components: a Fisheries Division component, an institutional component and a community component. For the Fisheries Division component, a questionnaire was administered to the Chief Fisheries Officer in each of the 12 participating countries. The survey seeks to draw conclusions regarding the status of fishery assessment and management in CARICOM member states. The survey had nine sections: legislation and regulations; status of fisheries management plans; structure, organization and function of Fisheries Department; fisheries resource research; extension programs; fisheries statistics and data collection systems; information available for fisheries management; regional fisheries management mechanism; and gender issues. The main area of interest, as it relates to the WBS 300 activities is fisheries statistics and data collection systems.

The report concluded: "All Fisheries Department had overall responsibility for the collection and management of fishery statistics. Frequently, other Departments or Ministries were responsible for collecting some fishery statistics. No country had comprehensive data collection and management system which produced regular reports of catch and effort by species. The most comprehensive system was in Barbados, but even there, the detailed data were not computerized. Throughout the OECS, and in Barbados, data collection system had been designed but had not been implemented for various reasons."

Computer Hardware and Software[9]
1992

The Technical Committee and the Programme Review Committee approved the acquisition and distribution of computer hardware and software to all CFRAMP participating countries. During the September to October mission, 1991, the computing resources per country was inventoried. The inventory included hardware and personnel. The computer capacity required to meet the needs of the CFRAMP program was identified. Hardware included a 386-based computer, FAX/modem, 24-pin dot matrix printer and UPS. Software included word processing, communications, spreadsheet, database and systems back-up. The operating principle in the allocation of equipment is to ensure that each country has the capability of participating in all aspects of the CFRAMP data collection and licensing and registration subprojects to the fullest degree (CFMU, 1992). One complete basic system was allocated to each of the participating countries except St. Vincent and the Grenadines (2), St. Kitts and Nevis (one system each) and Guyana (2).

National Implementation Plans, CFRAMP participating countries[10, 11, 12, 13]
1992

Work-plans for each participating countries were developed. The plans consisted of an introduction, method, activities, requirement (year 1 &2) and a schedule.

Development of a LRS Manual
Winston Miller and Lucia Fanning, 1992

Developed the LRS manual.

1993

Attachment of Stephanie Auil to the Fisheries Department of Trinidad and Tobago and Guyana[16, 59]
January 17 - February 7, 1993

The purpose of the attachment was to study and review shrimp fishery management methods employed within the Fisheries Department of the Ministry of Agriculture, Lands and Marine Resources, Trinidad and Tobago, and Fisheries Department of the Ministry of Agriculture and Fisheries, Guyana.

Computer Training, Dominica
June, 1993

Fisheries Division staff were trained in DOS basic; LOTUS 123, basic-intermediate; dbase 4, Basic-intermediate; and dbase 4 advance 1 (1 student).

Computer Training, Jamaica
April, 1993

Fisheries Division staff were trained in literacy and awareness; dbase III+; word processing; spreadsheet (LOTUS 1-2-3); and DOS.

Computer Training, Grenada
March, 1993

Fisheries Division staff were trained .

Computer Training, St. Kitts and Nevis
March, 1993

Fisheries staff were trained in database management.

Computer Training, Trinidad and Tobago
January, 1993

Fisheries Division staff were trained in computer literacy and database management using dbase IV.

Computer Training, Belize
March, 1993

Training in dbase IV.

Computer Training, Tobago

February, 1993

Fisheries Division staff were trained in DOS; WordPerfect 5.1; and dbase.

Computer Training, Guyana
January, 1993

Fisheries Division staff were trained in DOS, WordPerfect and LOTUS 1-2-3.

CFRAMP/Canadian Coast Guard Small Fishing Vessel Inspection Training Workshop[15]
Bridgetown, Barbados, 20-24 September, 1993 and
St. John's, Antigua and Barbuda, 4-8 October, 1993

This workshop was conducted in response to the recommendation of the subproject specification workshop for licensing and registration systems, which was undertaken by CFRAMP to provide training for Fisheries Officers in the area of vessel inspection. The concern was expressed at the SSW that fisheries officers were expected to inspect fishing vessels and certify if they were seaworthy, fit for fishing, safety equipment and assess the condition of the hull, machinery and equipment. In most cases the officers were untrained to carry out their duties. The objective of the workshop was to train officers in fishing vessel inspection, specifically, safety inspections and hull and machinery inspections (surveys). Majority of the workshop was spent on the hull and machinery inspections as checklists of safety equipment are relatively simple to monitor. A Canadian Vessel Inspector whose time was provided by Transport Canada through the Canadian Coast Guard provided the technical content of the workshop.

The training was organized into two separate workshops to allow participants of at least two officers from each country and still keep the group at a manageable size (12-15 persons). Two participants, from the Fisheries Division/Department, Customs or coast Guard , were invited from each country. Only Trinidad and Tobago was unable to participate. Part 1, Barbados workshop, participants from Barbados, Grenada, Guyana, OECS Fisheries Unit, St. Lucia and St. Vincent and the Grenadines attended. Mr. Button, the vessel inspector, spent 2 days conducting vessel inspections with the Barbados Fisheries staff. Part 2, Antigua and Barbuda workshop was attended by Antigua and Barbuda, Belize, Dominica, Jamaica, Montserrat and St. Kitts and Nevis. Sessions covered information necessary for inspection of vessels ranging from simple open vessels, outboard powered, through to inboard powered, decked vessels up to 20 metres. The course did not directly address large vessel inspection (>20m), new construction inspection or evaluation for approval of vessel designs. The course covered, overview of vessel inspection issues, hull survey, major fittings and components, machinery, life saving and fire equipment.

Short course training in FoxPro Development at Flash Creative Management of Newwark, New Jersy

Sherill Barnwell, December 6-16, 1993

Ms. Barnwell attended a four modules course covering basic database operations (structured FoxPro and Language series) through to advance application (FoxPro application development series).

1994

Attachment of Ms. Sherill Barnwell, OECS Fisheries Unit Data Technician to the CARICOM Fisheries Management Unit[1]
January – April 15, 1994

The objective of this attachment was to update and add new features (based on participating country's need) to LRS, the CFRAMP supported software package. Ms. Barnwell in consultation with the Data Manager/Analyst: became familiar with the databases, programs, screens and reports that are used in TIP and LRS; solicit user feedback from Fisheries Divisions and relevant sub-regional agencies regarding bug fixes or enhancements required, user responses made to date will be available on arrival to Belize; test all modules of LTS, design bug fixes and enhancement and implement appropriate changes in LRS, in particular those that would allow for it's utilization as a regional registration tool; upgrade documentation of LRS, including a new chapter on the report generator which is undocumented in the current version; develop standard reports for LRS summarizing fishing fleet or fisheries registration, license status, legal infractions and others as needs are established; and develop standard reports for TIP summarizing catch and effort data incorporating simple specification of appropriate expansion factors based on sampling plans.

At the end of the Attachment Ms. Barnwell returned to the OECS Fisheries Unit. Further work was done at the Unit with CFRAMP's technical and financial support.

Computer Training, Montserrat

March 1994

Two, 10 weeks courses, of 2 hours duration were conducted at the Montserrat Technical College for fisheries staff, in WordPerfect, Lotus 123, Graphs and Dbase IV. The course was broadened to include other members of staff from the Ministry of Agrculture.

Species Identification Guide for Shark and Ray Fishery Resources;

Large and Coastal Pelagic Resources; Reef and Deep-slopeResources

(including lobsters and conches); Muddy-Bottom Fishery Resources (including shrimp)[19]

March 1994

Accurate species identification in commercial fishery landings is basic for any fisheries management program. In the Caribbean, appropriate scientific guides to the fish fauna of the region suitable for use in the field are lacking. Resource material exists, however, there is the need to collate and reproduce available information (within copyright restrictions) to produce field guides suitable for use by data collectors. The objective of this activity was to prepare a species identification guide for shark and ray fishery resources occurring in the CARICOM region. It is one of a series of four, the other titles including reef and deep-slope resources (also including lobster and conch), muddy-bottom fish resources (including shrimp), and large and coastal pelagics. The guide included dichotomous keys in tree form, with figures which indicated the major distinguishing features, a primary key to families and separate keys for each family. There is a brief description of the common species giving ways of distinguishing these from the species they are most likely to be confused with. The descriptions also addressed any problem, which will arise in identifying juveniles. Descriptions are accompanied by black and white line drawing.

This activity was forestalled by the recent publication by FAO of a guide entitled "Field guide to the commercial marine and brackish-water resources of the northern coast of South America. FAO species identification sheets for fishery purposes. Rome, FAO. 1993. 513p."

FAO Species Identification Guide[29]

1994

The guide was reviewed by Mr. Karl Aiken (Chief Scientist), Mr. Paul Fanning (Data Manager analyst) and Mr. Peter Murray (OECS Fisheries Unit). It was agreed that the guide covered the vast majority of species of economic importance throughout the region. Copies of the guide was sent to all the CFRAMP participating countries. A plastic special bound waterproof copy for field manual to be used by the data collectors and a standard soft-cover copy for the Fisheries Library. The manuals were also used for the biological training.

Training of Montserrat's Data Collection Staff in Dominica[21]

June, 1994

During this activity data collectors were introduced to basic data collection with a view to improving the data collection system (length frequency, collection of hard parts). Fisheries Clerks were introduced to different types of fisheries data for processing and analysis.

Review In-country Activities for 1.1.2 Data and Information Systems and 1.1.4 Licensing and Registration Systems[20]
CFMU, October 1994

During the period August 25-September 1994, the Data Managers (Mr. Paul Fanning and Mr. Garret Manwaring) conducted a mission to evaluate the status of the data collection and information systems sub-project and the licensing and registration system. This mission formed the basis to evaluating the subprojects. Most of the countries were about one year into the planned two year funding from CFRAMP and both progress and problems could be detected. The general observations and recommendations were the need for training in fisheries statistics and field data collection, fishery census, software development, communication to Ministers and computers.

CFRAMP Field Data Collector (FDC) Training Curriculum[38]
1994

There was the need to train entry-level fisheries department personnel in the collection of field data. The training curriculum should leave field data collectors with a clear understanding of the critical role of acquiring good fisheries data. The curriculum had five models; (1) principle of fisheries data collection; (2) identification of target fish species; (3) measurement and recording of fish length and mass; (4) assessment of reproductive maturity; and (5) removal and preservation of hard parts for aging. Once the training curriculum was developed, Fisheries Data Collectors in CARICOM countries were trained upon request from the individual countries.

1995

Attachment of Ms. Sherill Barnwell, OECS Fisheries Unit Data Technician to the National Marine Fisheries Service, Miami, Florida[2]
March 27 – April 7, 1995

The objective of this attachment was to continue Ms. Barnwell's FoxPro training and increase her knowledge of the TIP software. The training was conducted by Ms.Susan Gold and Mr. Lee Weinburger, as technical resources for the TIP program and FoxPro programming skills. Mr. Manwaring was present on the first day to discuss the goals and ensure that the structure is appropriate to meeting these goals. Mr. Coughtry, the new Data Manager arrived on April 5 and spend the remainder of the week with Ms. Gold. Both Ms. Barnwell and Mr. Coughtry examined the TIP software to obtain a more in-depth understanding of the TIP software while addressing some performance concerns that have been reported by a number of participating countries.

The benefits of this workshop are: to the OECS Fisheries Unit – local expertise in TIP and increased expertise in FoxPro programming that is not dependent upon outside consultancies and can be used to provide additional training of staff within the OECS Fisheries Unit and the OECS countries; the region – allows the Fisheries Unit to become a center local to the OECS countries from which support for TIP and LRS can be obtained. Such a center would reduce the overall expense of maintainance in the region as well as facilitate a faster response if a site visit is required.

Short term Attachment of Ms. Murray and Ms. Peters to the Fisheries Division Information Centre, Trinidad and Tobago
September 3-12, 1995

The Guyana Fisheries Department in its final stage of its present programme to develop a documentation center in its department, had two officers attached to the Fisheries Department of Trinidad and Tobago for 10 days to observe the operations of a number of libraries in Port of Spain and the FISMIS at Chagaramus.

CFRAMP/FAO Workshop on Fisheries Statistics in Fisheries Management [22]
October 13-20, 1995, Jamaica

The objectives of the workshop to: strengthen the national capacity to design, implement and monitor appropriate sampling programs; develop national capability to estimate total catch and effort from sampled catch and effort data; and initiate training in analyzing catch, effort and biological data for stock assessment and other fisheries performance indicators. Topics covered during this workshop were: fisheries data management (role of data collection in the management of fisheries resources); elements of fisheries statistics (concepts, definition, etc.); use of sampling survey for determining populations in artisanal and industrial fisheries; data collection programs for artisanal and industrial fisheries; methods of data collection; review of national data collection program; working group to review national data collection programs; fishing community roles in data collection systems; estimation of fisheries national statistics; basic estimating procedures for total catch and fishing effort using frame survey and catch/effort assessment; estimation for fisheries management advice; report generation and presentation using TIP and LRS; and UNEP presentation on biodiversity conference; data and information management.

CFRAMP/OECS Training in Biological Data Entry and Quality Control
In the Trip Interview Program (TIP) [30]
St. Vincent and the Grenadines, November 20-22, 1995; June 11-13, 1996 and June 17-19, 1996

This training workshop was coordinated by the Pelagic and Reef Fishes Resource Assessment Unit (RAU) as part of the Biological Data Collection Activities. Fisheries Division/Department staff were introduced to skills required to perform additional tasks in data entry, quality control and reporting. The seminars were designed to accommodate three groups over three days, in St. Vincent and the Grenadines. Group 1 met November 20-22, 1995 (Dominica, Grenada, St. Lucia, St. Vincent and the Grenadines); group 2 met June 11-13, 1996 (Antigua and Barbuda, Montserrat, St. Kitts and Nevis, UWI, Cave Hill); and group 3 met June 17-19, 1996 (Barbados, Belize, Guyana, Jamaica, Trinidad and Tobago, CFRAMP). The seminar included resource persons present at the workshop were Ms. Susan Gold, Computer Specialist, National marine Fisheries Service, South East Fisheries Science Center (USA), staff of the OECS natural Resource management Unit, CFRAMP Data Management Technical Advisor and staff at the Pelagic and Reef Fishes RAU. A total of twenty-seven persons attended the seminar. The training seminar provided participants with skills and techniques to improve the quality of data contained in the national fisheries databases, and improve the general efficiency in using the software.

The course comprised five main modules administered over three days: (1) **data entry** (develop skills to enter fisheries data into the TIP software); (2) **management of data and information system** (provide recommendations to enhance the quality of data collection at all level; develop policies for securing fisheries databases); (3) **querying and file extraction** (strengthen skills in building queries and performing file extractions for the fisheries database; enhance ability to identify errors in the fisheries database); (4) **creating standard reports in TIP** (introduce the standard biological reports developed by the RAU; develop skills in creating standard reports using the report writer feature in TIP; and (5) **evaluation by participation** (identify areas of weakness in training curriculum).

Training manuals developed and distributed were: (1) Training material for the Trip Interview Program CARICOM query and custom reporting. Volume I Introductory Material. Draft version 1.0. CFU. 74pp. (2) Training material for the Trip Interview Program CARICOM query an custom reporting. Volume II Intermediate material. Draft version 1.0. CFU. 122pp. and (3) A manual of CARICOM procedures for entry and reporting of Fisheries data with the Trip Interview Program. CARICOM Special Fishery Publication. N0. DRAFT: 99pp.

Data Collection and Processing Aspects related to Fishery Statistics in Guyana[54]
Constantine Stamatopoulos, October 20-25, 1995

Mr. Stamatopoulos, Senior Fishery Data Officer, FAO Fisheries Department, visited Guyana to provide technical advice in data collection and processing relate to the fishery statistical programme of Guyana. He was asked to examine the overall structure and functions of the ongoing sampling system and review the recently established database containing baseline information on artisanal fisheries for the coastal regions 2-7. The visit did not allow for an in-depth study of the computerized frame survey data. The study concluded: data should be related under a new commercial database software; a systematic “record-by-record” check between source forms and computer records; a flexible user-friendlier reporting system to be developed for direct use by DOF staff; conduct a quick census in region 4; compare results from mini-census to those from the frame survey; the frame survey database contains a comprehensive set of inter-related information and data, apply standard statistical approaches to selected subsets of the data.

Computer upgrade and E-mail
1995-98

Computers, computer upgrade and e-mail capabilities were distributed to Barbados, Dominica, Montserrat, St. Kitts and Nevis and St. Lucia.

1996

CFRAMP/FAO/DANIDA Regional Training Course on Fish Stock Assessment,
Hotel Normandie, St. Ann’s, Port-of-Spain, Trinidad & Tobago, [53]
January 15 – February 9, 1996. (FAO, 1996)

The regional training course on fish stock assessment was organized jointly by CFRAMP and thFAO/DANIDA project GCP/INT/575/DEN. The course was attended by 30 participants from 13 countries and 2 international organization: Antigua and Barbuda (1), Commonwealth of The Bahamas (1), Barbados (1), Belize (1), Commonwealth of Dominica (2), Grenada (1), Guyana (3), Jamaica (3), St. Lucia (2), St. Vincent and the Grenadines (1), Suriname (1), Trinidad and Tobago (9), Turks and Caicos Island (1), CFRAMP (2), FAO (1). There was also 11 resource persons from CFRAMP (6), OECS (1) and FAO (4). Only 4 resource persons were present during all four weeks, the remainder participated 1 or 2 weeks each.

The course covered: introduction to fish stock assessment, **basic statistics** (mean, variance, introduction to the use of statistics on the calculator, normal distribution, confidence limits, linear regression, confidence limits and linear regression, basic algebra, correlation coefficient), Bhattacharya method, **Growth** (the von Bertalanffy growth equation, growth plots, comparison of growth curves, FiSAT and Bhattacharya method, data massage, modal progression analysis, ELEFAN, NORMSEP method), **mortality** (cohorts and the exponential decay model, estimation of Z, linearized catch curve, length-based catch curve, Beverton & Holt's Z equation, Powell-Wetherall method, natural mortality, prediction models, Beverton & Holt yield per recruit model, Y/R excerise using EXCEL, Beverton & Holt relative yield per recruit model), **virtual population analysis** (VPA, Pope's Cohort analysis, Jones' length-based cohort analysis, VPA on FiSAT, Thompson & Bell prediction model, surplus production models, selection, multi-species VPA), discussion on the assessment in the CARICOM region, biological reference points, working groups on major exercise, sampling strategies, survey sampling design, CFRAMP's program for biological sampling, ecosystem effects of fishing activities, presentation of country's special datasets.

Short Term Attachment of Ms. Sandra Prescod to the Trinidad and Tobago Fisheries Division[3150]
12-17 February, 1996

The objective of this attachment is to learn more about the fisheries management and research in Trinidad and Tobago. Areas of specific interest were: the work of the IMA fish aging laboratory; literature and other databases accessible through the Fisheries Division; production of scientific reports and publications by the FD; information on fisheries management and aquaculture generally; community involvement in fishery management and fishing facility operations.

Fisheries Management Information System (FISMIS) [48]
1996

FISMIS is a comprehensive repository of statistical and bibliographic information on Caribbean marine species of commercial importance. The bibliographic databases of FISMIS and the library together make up the Fisheries Division Information Centre. The database was developed by the Fisheries Division of Trinidad and Tobago in collaboration with the International Development Research Centre (IDRC) of Canada. The statistical component of FISMIS has catch and effort data for Trinidad and Tobago. The bibliographic component runs on CD/ISIS 3.0. There are six databases on the system, STOCK, INFO, GULP, FISPRO, AGEING, CRUISE and GUIDE. The database covers data on the artisanal, semi-industrial and industrial fishing activity in the Caribbean. The Scope of the database is regional and aims to supply fisheries related data to Caribbean fisheries managers, policy makers, biologists, resource persons and students (Nerissa Nagassar and Chan A Shing,). The database is also noted for its comprehensive coverage of gray literature on Caribbean finfish species and publications and reports produced by the Fisheries Division and other regional organizations in the Caribbean.

CFRAMP provided financial and technical assistance under the Data and Information Sub-project. The project provided funding to hire a Fisheries Documentalist to ensure that the information requirements of researchers, fishers managers, biologists, policy makers, fishermen and students in the Caribbean were adequately met This center increased the awareness of available data and research in the Caribbean. Thus, the Fisheries Division Information Centre was designated the regional center for fisheries and fisheries related information in the Caribbean.

With the termination of CFRAMP funding for this activity, the Documentalist position could no longer be maintained and the Information center could no longer supply CARICOM countries with information in the same efficient and timely manner as before.

FoxPro/TIP Programming Workshop[23]
November 18 to December 3 1996, Radisson Fort George, Belize City and

December 4-6 1996, South East Fisheries Center, Miami, USA

This workshop was organizes and funded by CFRAMP with technical assistance from staff of the South East Fisheries Centre (USA) and OECS-NRMU (St. Lucia). The objective of the workshop was to develop a regional capacity among selected Department of Fisheries Data Managers to make programming changes to TIP. The participants will be expected to provide:

- programming support to Fisheries Division/Department in the CARICOM region in TIP, LRS or other related applications which will be used by staff of these Divisions.
- Provide technical support in troubleshooting and resolving problems with TIP, LRS or other related applications which will be used by staff of these Divisions;
- Training to country staff in the use of TIP, LRS or other related applications to meet country needs for storage, management, retrieval, analysis and reporting from their fisheries data set.

This regional capacity is expected to be sustainable in providing ongoing programming support to the CARICOM region beyond CFRAMP. Based on the criteria of the workshop, three female officers from CFRAMP participating countries were invited to participate in this workshop (Ms. Sherril Barnwell, OECS-NRMU; Ms. Cherly Barnwell, St. Vincent and the Grenadines Fisheries Division; Ms. Willians Joseph, St. Lucia Fisheries Division. Three resource persons were utilized to deliver this workshop, Mr. Garret Manwaring (CFRAMP Data Manager), Gary Coughtry (CFRAMP Technical Advisor) and Susan Gold (SEFC Computer Specialist).

Given the differences in participants skill in FoxPro programming language, week 1 was used to introduced the participants to concepts related to designing a computer application and to basic FoxPro commands. Week 2 was used to introduce participants to concepts and exercises of programming using FoxPro. Week 3 was used to introduced participants to the history, structure and program codes of TIP application and conclude with the present status of the new version of TIP.

Review of Data Collection Systems and Design of Standardized Frame Survey[36]

David Gray, July 1996

In May 1996, the consultant, Mr. Dave Gray was contracted to provide consulting services to CFRAMP, to review current data collection systems and design frame surveys that would best utilize information already collected. A common frame survey design would also improve the consistency of data collected, which would make it easier for regional comparisons and analysis. During this consultancy, the consultant visited the Fisheries Division's in Trinidad and Tobago, Grenada, Barbados, Jamaica, Dominica and Belize; the RAU in Trinidad and the CFRAMP's office in Belize. The objective of the consultancy was to review current systems in place for the collection of the data going into the LRS and TIP databases, the handling of the data collected for data entry, guaranteeing the security of the computerized databases, generation of reports and queries from the database and a frame survey design that can make us of and help verify some of the database information.

Barbados Computer Needs Assessment[45]
Patrick McConney, Sandra Prescod, Garret Manwarring, Dr. Gary
July 1996

The Barbados Fisheries Department spear-headed a computer needs assessment by the above-mentioned persons. The assessment showed an immediate need for seven computer systems. The Fisheries Division had two (including one from CFRAMP). CFRAMP provided funds for an additional machine.

Belize, Computer System Upgrade
July 1996

Upgrading the current computer systems to be e-mail capable.

1997

Joint OECS-NRMU/CFRAMP Development of Licensing and Registration Software (LRS)
(A proposal for finalizing the development of LRS by March 1997)[25]
CFU, January 1997

The development of LRS began in 1992 through a consultancy. A test version was released in June 1992 and the first version was completed and distributed in 1993. An updated version was completed and distributed in 1994. The version for release in April 1997 is expected to satisfy county's needs. Ms. Barnwell was responsible for all programming changes. The OECS by agreement with CFRAMP has responsibility for making programming changes to LRS since 1994.

The objectives of this activity are: to complete development of the LRS software such that it meets data entry, management and reporting needs of relevant staff in Fisheries Division in all CFRAMP participating countries; LRS and its documentation allow users to update their application without data loss; LRS contains no bug that hinders data entry, management and reporting; and to strengthen the CARICOM regional capabilities to make programming changes to LRS by March 31, 1997.

Review of Guyana's Computer System[43]
CFU, April 1997

A review of the changes in computer system was conducted at the Guyana Fisheries Department, October 1996. The outcome provided the Division with the rationale to change or maintain its Novell system.

Computer Needs Assessment for Jamaica Fisheries Division[44]
CFU, April 1997

This assessment was conducted to determine the capability of Jamaica Fisheries Division's existing computers and accessories to satisfy its present and future needs for storing, analyzing and reporting from fisheries databases. The outcome provided the Division with the rationale for upgrading and maintaining the Division's computer system. Issues covered in the report include: fisheries data management; data management for the fisheries loan scheme; managing an accounting and registry information system; managing a fisheries bibliographic information system, desktop publishing for fisheries related information; and e-mail and internet capabilities.

Provision of Laptop Computers to Regional Trainers
1997

One recommendation of the FoxPro/TIP Programming workshop, was the regional trainers should receive Laptop Computers to facilitate there working on the TIP/LRS software. Three laptops were purchased.

Request for a Computer to function as UNIX Server, Trinidad and Tobago
June, 1997

In the Computer Needs Assessment Report, 1996, a computer was recommended to function as UNIX Server. This computer would also be used to upgrade hardware associated with FISMIS bibliographic applications. This activity was funded from the WBS Shrimp and Groundfish budget.

Training in TIP Database Operations for Staff of the Fisheries and Marine Affairs Section (FMAS), Tobago
August 25-29, 1997

A one week training workshop was conducted in the use of the Trip Interview Programme (TIP) for data collectors and data entry personnel of the Fisheries and Marine Affairs Section, Tobago. Ms. Cheryl Jardine of the St. Vincent and the Grenadines Fisheries Division, conducted the training. The workshop addressed priority areas such as data entry, quality control, report generation in formats useful for assessment, management and data sharing. Ten participants attended the workshop, 5 data collectors, 2 field assistance, 1 fisheries extension officers, 1 fisheries assistance and 1 past employee of the Fisheries and Marine Affairs Section.

Analysis of Grenada's 1997 Frame Survey Data[55]
Leslie Straker, July 1997

The Grenada Fisheries Division requested assistance from CFRAMP to analyse data from the 1997 fisheries census. Mr. Leslie Straker, Fisheries Officer (Data), of the St. Vincent and the Grenadines Fisheries Division was contracted to do the analysis. The survey was conceptualized because the Fisheries Division needed information basic information required by government institutions, none fisheries personnel and other organizations. Six survey questionnaires were constructed to capture information from the various sectors within the fishing industry. These were: **fishing boat** (information on boat owners and captains, boat size and target species); **fish**

vendors (information on fish vendors, period of operation, base of operation and species handled); **fish dressers** (information on fish dressers, period of operation and species handled); **fishing gear suppliers** (information on the quality and quantity of fishing gar available in Grenada and the location of these suppliers); **boat builders** (information on types of boats built in the country, relative availability of these vessels, and who are building these vessels); and **processing plant** (information on fish processing capabilities within the country, export capabilities and type of fish handled).

The survey goals were to:

- Provide up-to-date fisheries specific information on different aspects of the fishing industry
- Act as a planning tool for the Grenada Fisheries Division
- Provide a source of socio-economic and planning information for other Grenada Government Divisions, NGO's, or other agencies
- Provide answers to questions, such as the number of vendors, fish dressers, fishing gear suppliers, boat builders etc.
- Provide a methodology, design and implementation approach for similar fisheries studies.
- Aid in the interpretation of more aggregated fisheries related data.

The consultancy was divided into 2 one week trips to the Grenada Fisheries Division. The objectives and outputs of the first trip were: determine survey goals, benefits, methodology etc.; quality checks on data collected; coding system on collected data; and train Grenada Fisheries Division staff in coding and data entry. The objectives and outputs of the second workshop are: quality checks on data entered; data analysis; document findings and train FD staff in data analysis techniques.

Establishment of the Library of the Fisheries Division of the Ministry of Agriculture and Mining, Jamaica[33]
September, 1997

The Jamaica Fisheries Division has probably the largest collection of reference material in fisheries in Jamaica. This collection of books is seen as the important in assisting the Fisheries Division in managing and studying the Jamaica fisheries. Proper cataloging of the library is important to ensure easy access and retrieval of material to staff and the general public. The objectives of establishing the library are: to provide a mechanism for arranging, ordering and storing fisheries information; to ensure that the material is readily accessible to persons in the Fisheries Division; to encourage the exploration of fisheries and related subject areas by the public; and to ensure the efficient retrieval and access of information via electronic media. Funding was provided by CFRAMP to assist the Fisheries Division in contracting a consultant to: develop a main collection and references collection; cataloguing and classifying current material; computerize the library system; train officer in library maintenance; and installing fixtures to enure a comfortable working environment.

The 1997 TIP Installation & Training Workshop in CFRAMP Countries
Cheryl Jardine, Williana Joseph and Sherrill Barnwell, October 1997 to January 1998

The objective of the workshops was to install the latest version of TIP (ver. 3.4) and train Fisheries Department Staff in all countries in its use. The three regional programmers who hae been trained to provide technical support to the countries will be responsible for delivery of the training in the countries. These are Ms. Cheryl Jardine (St. Vincent and the Grenadine Fisheries Division), Ms. Williana Joseph (St. Lucia Fisheries Division) and Ms. Sherrill Barnwell (OECS-NRMU, St. Lucia). The training curriculum has been developed by the Regional Programmers in collaboration with CFRAMP staff. It included: installation and back-up, review and discussion of new features of Tip 3.4, review and discussion of data entry, review and discussion of querying, review and discussion of reporting and wrap-up.

1998

Review of catch, effort and biological data collection system
Dr. Robin Mahon, January 1998

The objective of this consultancy was to review the inshore and offshore industrial fisheries data (catch, effort, biological, economic and social) collection and management program of Guyana; to provide recommendations for refining and strengthening the integration of the catch, effort, biological, economic and social data collection programmes.

Review of Catch, Effort and Biological Data Collection Systems of the Inshore Artisanal and Offshore Industrial Fisheries of Guyana[41]
Robin Mahon, February 1998

The report outlined preliminary summary of main findings and recommendations. This activity reviewed the **artisanal fishery** (stratified sampling programme, logbook program, discarding); **industrial fishery** (logbook programme, vessel sampling programme, discarding); and **biological data collection system** (length frequency targets, size/age maturity).

Training Attachment in Data Collection and Management: St. Lucia Fisheries Division[49]
Melissa O'Garro, February 24 – March 7, 1998

Ms. Melissa O'Garro, from the Montserrat Fisheries Unit, was provided with on-the-job training in data collection and management at the St. Lucia Fisheries Division. The objective of this attachment were to provide the officers with an overview of the fisheries of Jamaica; field sampling program design; supervision of data collectors; support to data collectors; interaction of data collectors with fishers; collection and recording of data elements; data entry and quality control; effective management of TIP and LRS databases; analysis of data and presentation of statistical reports and dissemination of information to stakeholders. Ms. Williana Joseph, Data Manager, supervised the attachment. The format of the attachment involved presentations, field trips, practical sessions with TIP and LRS databases, visits to processing plants, etc.

Regional Fisheries Statistics Training Workshop[6, 7, 32]
March16-27, 1998, Trinidad and Tobago

This workshop was conducted in collaboration with the Continuing Education Programme in Agricultural Technology (CEPAT) of the University of the West Indies (St. Augustine). Mr. Paul Fanning (CFRAMP consultant) and Mr. Bruce Lauckner (CARDI) were the instructors. The objective of the workshop is to organize and convene a training workshop on basic fisheries statistics for fisheries officers from CARICOM countries to ensure that they are proficient at the statistical techniques for analyzing and interpreting their data. The focused goal was ensuring participants were trained and capable of producing national and regional fisheries statistical atlases. Participants were also evaluated with respect to their participation in the workshop, identified training requirements and potential for further training at advance levels. After consultation with three countries (Belize, St. Lucia and Trinidad and Tobago), CFRAMP staff and CEPAT staff, the workshop curriculum was finalized under the course title ' Regioanl Statistics Training Workshop.

Twenty-six participants from twelve CFRAMP participating countries attended the course. They represented Fisheries Officers and administrative personnel from the respective Fisheries Division/Department. Topics covered were, statistical concepts, sampling theory and design, statistical analysis (mean), lab review and presentation, data quality checks, regression, software introduction (SPSS, Genstat), fisheries statistics, frame survey, raising factors, TIP data, analysis of CPUE, CPUE standardization, national and regional atlas, statistical reports, national statistics and exploratory data analysis. One important result of the workshop was a draft outline of a CARICOM national statistical atlas and by extension a regional atlas.

CARICOM National Statistical Atlas[32]
1997-2001

The objective of this activity is to graphically present information on the marine fishing industry and fish species including statistics, biology, economics and social context in a manner useful for resource management, public awareness and a regional atlas. The atlas will address the information needs of fisheries stakeholders and senior managers of ministries responsible for fisheries, other governmental ministries and agencies, non-governmental and regional fisheries organizations, education, financial and other non-fishery institutions and the general public. The atlas will present information in text, graphs, maps, tables and pictorially. The national atlas will be organized into five primary sections with appropriate supporting sections such as references, index, table of contents and acknowledgements. The five content section includes, **introduction** (scope and constraints, glossary and definitions, country profile, fisheries profile, conservation and coastal zone management issues, legal framework), **national statistics** (data collection and sampling, catch and effort, distribution of fish, socio-economic and community structure statistics), **fishery-specific statistics** (fisheries sector, species and species group), **short summary and appendices**. Consultants were contracted to provide technical assistance for the analysis and interpretation and presentation of data for completing atlases for Belize, Jamaica, St. Lucia and St. Vincent and the Grenadines.

One-day LRS Workshop for Regional Trainers
St. Lucia, July 1998

In preparation for the in-country workshop, a one-day workshop for Regional Trainers was held in St. Lucia. The objectives of the workshop are: (1) to finalize the re-testing of LRS version 3.0, (2) to familiarize Regional Trainers with the latest features of the software, (3) to discuss and resolve problems encountered with the software, and (4) to initiate plans for 12 National LRS installation and training workshop.

***In-country LRS Installation and Training Workshop*[26]**
Cheryl Jardine, Williana Joseph, Shellene Reynolds, Sherril Barnwell
September to October, 1998

The licencinsg and registration software (LRS), can be used to store and retrieve information pertaining to the potential fishing effort within a country and the actual effort being currently expended in the industry. The objective of this workshop is to install LRS version 3, train fisheries staff in the use of the program and develop instructional material to be used during the workshop. The new version of LRS will allow Fisheries Division/Department to keep more detailed record of socio-economic information and vessel safety and to produce country specific standard forms. Course outline: review of LRS use (previous and present version); data entry; querying; and reporting. Training was as follows: Ms. Barnwell (Guyana, Antigua and Barbuda, St. Kitts and Nevis), Ms. Jardine (St. Vincent and the Grenadines, Trinidad and Tobago, Grenada), Ms. Joseph (St. Lucia, Dominica, Barbados, Montserrat) and Ms. Reynolds (Jamaica and Belize).

***1998 Jamaica Marine Fisheries Census*[58]**
1997-2001

The data collection programme was designed in 1995, using information from the licensing and registration programme (LRS). Based on the information from LRS, Jamaica was split into two statistical areas, the north and south. Further sub-categories were developed based on number of boats at landing sites, gear type and fishery. At least one beach from each category was sampled twice monthly. By 1996 and 1997, the data collection programme was further modified to include the following fisheries, shrimp, coastal pelagics, lobster and conch. Catch, effort, biological and economic data were collected. The information gathered was entered into a computerized database called the Trip Interview Programme (TIP) for storage and management. Since the data collection programme was based on information in the LRS database, only registered vessels were being classified. The Division was in urgent need on an accurate vessel count to refine landing estimates, thus a decision was taken to conduct a marine fisheries census.

In 1998, a census of the marine capture fishery was conducted, the aim was to undertake a survey of the artisanal, industrial and recreational fisheries to determine the number of boats by gear types and fisheries at each landing site, and to use the data and information obtained to conduct the following (CFRAMP, 1998): (1) Refine the existing data collection system for catch, effort, biological and economic data from these fisheries; (2) Review and revise the data in the Licensing and Registration System (LRS) in keeping with the objectives for the use of the System; (3) Contribute to the development of a geographical information system for the Marine Capture Fishery; and (4) Analyze to provide baseline information for national accounting.

In 1998, the CARICOM Fisheries Resource Assessment and Management Programme (CFRAMP) contracted a consultant to analyse the data from the 1998 Marine Fishery Census and review the catch, effort and biological data collection systems for the Marine Capture Fishery of Jamaica[58]. The task was divided into 3 phases:

Phase 1. Tabulation of the Outputs from the Marine Capture Fishery Census

Prior to the completion of the field activities of the Marine Capture Fishery Census:

- Review existing information on the data collection system for the Marine Capture Fishery and the Project for the Census for the Marine Capture Fishery.

- Following on discussions with the Fisheries Division and STATIN, review the data from the Census; identify the types of analyses to be done and as a result advise on the type of database to be developed.
- Based on the objectives of the Fisheries Geographical Information System being developed by the Fisheries Division, advise the Fisheries Division and other collaborating agencies on the most suitable types of data to be incorporated into the System.

Phase 2. Analysis of the Data from the Marine Capture Fishery Census

Following on the completion of the Census and data entry into the database:

- Undertake the identified analyses of the data.
- Using data from the Census, review and revise the data in the Licensing and Registration System (LRS) in keeping with the objectives of the LRS programme.
- Provide information for inclusion in the Fisheries Geographical Information System and, with the collaborating agencies, devise a plan of action for its incorporation into the required database.

Phase 3. Review and Analysis of the Catch, Effort and Biological Data Collection Systems of the Marine Capture Fishery of Jamaica.

Utilising the information from the analysis of the Census data, Licensing & Registration System (LRS) and the experience of the current Marine Capture Fishery Data Collection Programme:

- Review the Artisanal, Industrial and Recreational Fisheries Data (Catch, Effort, Biological, Economic and Social) Collection and Management Programme of Jamaica.
- Suggest the most suitable means to obtain data on the discards by the various gear types in the Artisanal Fisheries
- Review the log-sheet system and advise on its suitability as a data collection tool in the Industrial Fishery.
- Make recommendations for refining and strengthening the integration of the Catch, Effort, Biological, Economic and Social Data Collection Programmes.

1998 National Census of Fishing Vessels: Trinidad and Tobago[56]

A frame survey was conducted to update the one conducted in 1991. The objective of the survey was to (1) provide a reliable basis for obtaining precise raised estimates of total landings; (2) provide data required for input to stock assessments from the catch and effort data collection system; and (3) provide field verification for the Licensing and Registration System (LRS). The last census of fishing vessels and gear was conducted in 1991 under the UNDP/FAO/GOT project.

Training Attachment in Data Collection and Management: Jamaica Fisheries Division[40]
Ian Horsford and Tricia Lovell, November 8-20, 1998

Two Officers, Mr. Ian Horsford and Ms. Tricia Lovell, from the Antigua and Barbuda Division, were provided with on-the-job training in data collection and management at the Jamaica Fisheries Division. The objective of this two weeks attachment were to provide the officers with an overview of the fisheries of Jamaica; field sampling program design; supervision of data collectors; support to data collectors; interaction of data collectors with fishers; collection and recording of data elements; data entry and quality control; effective management of TIP and LRS databases; analysis of data and presentation of statistical reports and dissemination of information to stakeholders. Ms. Sandra Grant, Data Manager/Analyst, supervised the attachment with assistance from her co-workers. The format of the attachment involved lecture presentation, field trips, practical exercises and demonstrations using TIP and LRS databases.

A review of the Catch, Effort and Biological Data Collection System of the Marine Fisheries of Belize[39]

Dr. Daniel Hoggarth, December 1998

Dr. Daniel Hoggarth, an independent fisheries consultant conducted a review of the catch, effort and biological data collection systems of the marine fisheries of Belize. The report began with a brief description of Belize's main marine fisheries and current management. The review included, the use of co-management approach, CFRAMP-funded and implemented programmes for catch, effort and biological data collection, licensing and registration system, 1994 frame survey and CFRAMP TIP database. An implementation plan was also drafted, describing the requirements for the new programmes and their interdependencies.

1999

Short Term Attachment of Sandra Grant of the Fisheries Division of Jamaica to the CARICOM Fisheries Unit in Belize[35]
May 30-July 31, 1999

The objective of this excerise was to provide Ms. Grant, Data Manager/Analyst, Fisheries Division Jamaica with a training attachment to the CARICOM Fisheries Unit, Belize to obtain practical on-the-job training in data analysis, and other areas related to fisheries resource management within the Caribbean. The training provided practical work experience implementing various aspects of the technical work program of CFRAMP. During the attachment the following activities were accomplished: preliminary analysis of the Jamaica frame survey data; preparation of national marine fisheries atlas; preliminary analysis of reef and pelagic fish data in Belize; monitoring LRS installation and training workshop; edit, layout, printing and distribution of technical report.

Making the TIP Computer Software Program Y2K Compliant
Sherril Barnwell, July to November 1999

The Trip Interview Program (TIP), which was developed by the Southeast Fisheries Science Center of the National Marine Fisheries Service, USA, was adopted and modified for use by the CARICOM countries to manage their fisheries data. The countries are presently using TIP as a database for catch, effort and biological data with support provided by CFRAMP. Professional assistance was sought from Ms. Barnwell to modify the TIP computer software program to make it Y2K compliant, thus it will be able to operate during the new millennium. The work involved five phases: (1) diagnosis of problems, (2) upgrading TIP to be Y2K compliant, (3) testing of the upgraded software, (4) debugging and finalization of TIP, and (5) distribution and installation of TIP.

2000

Agreement between the CARICOM Fisheries Unit and Project Management Office for
***Maritime Cooperation and Training regarding the use of the Licensing and Registration System Software Program*[51]**
Barbados, May, 2000

The CARICOM Fisheries Unit, the developer of the licensing and registration system computer software program agreed to provide the Project Management Office for Maritime Cooperation and Training (PMO) with copies of the LRS program for the purpose of developing national vessel and aircraft databases for its member states. The terms and conditions are: CFU will be responsible for modification, update, servicing and maintenance of the LRS software; PMO will submit any request for modification, updating, servicing and maintenance of the program; expenses associated with any work needed to modify etc, requested by PMO will be borne by PMO; CFU will assist with training of personnel in the use of LRS, PMO will be responsible for the cost; PMO will acknowledge CFU in publications; and PMO will not sell, rent or lease the LRS software.

Fisheries Management Data System Terminal Workshop
Castries, St. Lucia, November 25-28, 2000

The objectives of the workshop are to review the achievements and failure of the CFRAMP initiatives to strengthen catch & effort and LRS systems in the region and make recommendations and develop proposals for future data collection programs, which will be implemented under the Caribbean Regional Fisheries Mechanism. Participants will include Data Manager/Analyst or Data Collection Supervisor and Chief Fisheries Officer/Director of Fisheries/Fisheries Administrator or Policy Maker responsible for Fisheries Division/ Department from each CFRAMP participating countries. Bahamas, Dominican Republic, Haiti and Suriname (Integrated Caribbean Regional Agriculture and Fisheries Development Programme – Fisheries Component) will also participate in this workshop. The workshop can be divided into three parts: country reports (18 country reports), technical presentations (Regional Overview of Fish Catch and Effort in CARICOM and CARIFORUM Countries; National Data Management Software Systems (TIP and LRS); Alternatives to Conventional Data Systems) and 5 working groups (TIP/LRS software – the future; strengthening data collection systems; social and economic data collection systems; regional data management center; and alternative approaches). The major priority areas identified by the countries were: Upgrade TIP/LRS; Support to strengthen data systems; Addition of social and economic data collection program; Regional database instituted; Revise and refine Fisheries Management Plans; and Involving stakeholders in regional meetings.

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ANTIGUA AND BARBUDA

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1. INTRODUCTION

Antigua and Barbuda is an archipelagic state that lies in the northeastern Caribbean. Three main sectors, government services, transport and communication and tourism dominate the country's economy. For the period, 1996, the total Gross Domestic Product for Antigua and Barbuda amounted to $1227.39 million EC, calculated at factor cost current prices. Of that, government services contributed 17.72% amounting to $217.50 million EC. The agriculture sector of which fisheries is a subsector contributed 3.83% ($47.01 million EC). Fisheries' contribution to that was $21.80 million EC or 46.37% of the agriculture contribution.

The Fisheries Division of the Ministry of Agriculture is the agency responsible for regulating and managing all activities related to the fisheries in Antigua and Barbuda. The *Fisheries Act, No.14 of 1983* and the *Fisheries Regulations, No.10 of 1990*, are primary legislative bases for fisheries management and development. The Minister responsible for fisheries has full legislative authority, as outlined in the Act and Regulations. Under the Act, the Minister has authority to create new regulations for management and conservation as and when necessary.

The *Fisheries Act (1983)* provides for access agreements, fishing licences, the establishment of marine protected areas as well as conditions and restrictions of fishing methods and gear. The *Fisheries Regulations (1990)* prescribes for the establishment of a Fisheries Advisory Committee as well as introduces a number of conservationary measures including setting size restrictions and the setting up of closed seasons for a number of important species.

Other fisheries related legislation include:

- the *Barbuda Local Government Act (1976)* - which gives the Barbuda Council (local governing body of no less than 9 elected and 2 *ex officio* members) authority over its fisheries including the right to retain taxes on exported seafood;
- the *National Parks Act (1984)* - for the designation of any land area or water as a national park;
- the *Marine Areas (Preservation and Enhancement) Act (1972)* - for the declaration of marine protected areas; and
- the *Beach Control Ordinance (1991)* - for the control of sand mining.

The guiding principles of the Fisheries Division as outlined in the Draft Plan for Managing the Marine Fisheries of Antigua and Barbuda (1996) is to:

- Develop and increase the potential of marine living resources to meet human nutritional needs, as well as social, economic, and development goals.
- Maintain or restore populations of marine species at levels that can produce the maximum sustainable yield as quantified by relevant environmental and economic factors, taking into consideration relationships among species.

2. DESCRIPTION OF THE FISHERY

2.1 Registered Fishers and boats

There are presently 899 registered fishers in Antigua and Barbuda, 816 of which reside in Antigua and 83 in Barbuda (Table 1). Of the 899 registered fishers 424 are full time.

Table 1. Work status of fishers registered in Antigua and Barbuda.

WORK TIME	ANTIGUA	BARBUDA	TOTAL
Full Time	382 (42.49%)	42 (4.67%)	424 (47.16%)
Part Time	209 (23.25%)	32 (3.56%)	241 (26.81%)
Weekend Only	41 (4.56%)	2 (0.22%)	43 (4.78%)
Investor	9 (1.00%)		9 (1.00%)
Status Unknown	175 (19.47%)	7 (0.78%)	182 (20.24%)
TOTAL	**816 (90.77%)**	**83 (9.23%)**	**899**

There are currently 495 vessels registered in Antigua and 60 in Barbuda. The Antiguan vessels range in size from 3.4 to 23.5 m while Barbudan vessels range between 3.0 and 9.4 m (Table 2). These vessels are located at 25 landing sites around Antigua and 5 in Barbuda (See Appendix 1a and 1b). Sites range from secluded beaches to the busy waterfront of St. John's Harbour, where the widest cross-section of fishing vessels can be found due to onshore infrastructure (processing plants, ice, marine supplies, etc.). Most of the larger vessels, (sloops and launches, powered by inboard diesel engines) are based in this area. The major landing sites in St. John's are Point Wharf, Market Wharf and Keeling Point. The other major landing sites in Antigua are Urlings and Jolly Harbour. Codrington Wharf is the main landing site in Barbuda. Open boats and open boats with cabin are the most common type of fishing vessel on both islands. Vessels range from wooden dories to fibreglass pirogues and boston whalers; approximately 98% of the fishing vessels in Barbuda are fibreglass pirogues or boston whalers powered by 30 kW outboard engines.

Table 2. Fishing vessels registered by size in Antigua and Barbuda.

LENGTH CLASS(ft)	ANTIGUA	BARBUDA
≤20	199	23
21-30	206	32
31-40	54	1
41-50	19	0
>50	9	0
Size Unknown	8	4
TOTAL	495	60

2.2 Gear and Methodology

The majority of fishers use traps to catch both finfish and lobster. They are constructed from mesh wire and braced with wattle or steel. One or two funnel-shaped entrances are present, through which fish and lobster can enter more easily than exit. In Barbuda, traps are mainly constructed with large funnels to target lobster. The most common type of trap is the rectangular box followed by the arrowhead; least common is the antillean Z. Traps are normally left to soak for 2 - 7 days. Soak time may depend on whether or not traps are baited and the work status of fisher; a part time fisher may haul traps once a week due to other work commitments. Traps are usually baited with fresh sprat or non-marine products such as coconut and animal hide. The size and number of traps may vary according to the size of the vessel and the equipment onboard (e.g. presence or absence of trap hauler). Fishing trips for small open boats (≤ 9 m) range from 4 to 6 hours while those for sloop and launches (> 9 m) can vary from 12 to 48 hours.

Hand lines, vertical long lines, gill nets, and in one instance beach seines are among the other gear types widely used around Antigua and Barbuda. Trolling is normally done by the larger vessels to and from the fishing grounds. A small percentage of fishermen are granted a permit to spear fish, however this method is currently being phased out (no permits were granted for 2000). Conch is caught by free divers or divers using SCUBA gear in depths up to 30 m.

2.3 Fishing Areas

Traditionally, fishermen have exploited at least 13 fishing areas around the islands, including the shelf that runs between Antigua and Barbuda (See Appendix). It is estimated that Antigua and Barbuda has a total shelf area of 3,568 km^2. Most of the fishing areas are located on the western portion of the insular shelf where the shelf is widest. Vessels tend to fish within 24 km of the coast, in depths up to 30 m. A few larger boats venture further afield to South Bank and Nevis Bank.

2.4 Types of fishery

For the most part, the fisheries are small scale and artisanal in nature, and the catch is generally marketed locally. In Barbuda almost all the lobster (*Panulirus argus*) caught is exported live to Guadeloupe and other French territories in the region. Finfish may be considered as a bycatch of this lobster trade; it is consumed locally by the villagers and the few restaurants and hotels on the island. In Antigua, on the other hand, finfish, lobster (*Panulirus argus*) and conch (*Strombus gigas*) are caught and sold mainly on the local market, to hoteliers, restaurateurs and housewives. While finfish is by far the most widely targeted, both lobster and conch sell for a greater value on the market. Live lobster and finfish are also exported from Antigua. The current retail price for finfish range from EC$ 5-8 per lb, while that for lobster range from EC$ 10-12 per lb (exchange rate US$1: EC$2.6882). Conch cost approximately EC$ 8 per lb. The average value of exports from Antigua and Barbuda (1996-1998) was EC$ 2.50 million (Table 3).

Table 3. Total fish exports and value of exports for Antigua and Barbuda.

	YEAR					
	1996		1997		1998	
	Quantity (mt)	Value EC$ Million	Quantity (mt)	Value EC$ Million	Quantity (mt)	Value EC$ Million
ANTIGUA						
Finfish	88.4	1.12	56.8	0.61	55.4	0.58
Lobster	27.1	0.70	17.0	0.40	8.5	0.19
Conch	1.5	0.02	0	0	0	0
BARBUDA						
Lobster	60.1	1.32	78.4	1.73	36.6	0.81
TOTAL	177.2	3.17	152.2	2.74	100.5	1.58

Coral reef and shallow shelf fish which are targeted by the fishers include, grunt, hind, parrotfish, triggerfish and surgeonfish. Coastal pelagic species including jacks and ballyhoo, and deepslope fish such as snappers and groupers are also caught commercially. Large pelagics (tunas, dolphinfish, wahoo) are caught primarily by recreational and sports fishermen as well as by a few commercial fishers. These are also targeted by a few charter boat services.

2.5 Trends in catch and effort

Over the past 5 years, there has been a continuous growth in the number of boats fishing in the waters of Antigua and Barbuda (Table 4).

Table 4. Number of fishing vessels registered in Antigua and Barbuda by year.

YEAR	ANTIGUA	BARBUDA	TOTAL
1995	132	13	145
1996	239	24	263
1997	350	30	380
1998	429	43	472
1999	473	50	523
2000 (mid-year)	495	60	555

This increase in effort has resulted in an overall increase in the total fish landed within the country. However, this has led to a decrease in individual catches for each boat.

2.6 Landings

The following is a summary of overall landings of finfish, lobster and conch for the period 1995 to 1999 (Tables 5 - 8). The estimates of finfish landings were calculated by stratifying the data by length class. While estimates of conch and lobster were calculated using mean values of landings by all vessels. In the case of hurricane years; 1995, 1998 and 1999; it was estimated that an average of 1 month of fishing would have been lost for each storm. In 1999, Antigua and Barbuda were affected by two storm systems, Jose in October, and Lenny in November.

Table 5. Average catch per unit effort of finfish by length class for Antigua.

LENGTH CLASS (ft)	AVERAGE CPUE (kg/day trip)				
	1995	**1996**	**1997**	**1998**	**1999**
≤20	36.37	47.95	33.09	26.08	33.83
21-30	62.08	50.33	53.23	41.46	20.28
31-40	135.17	90.46	120.44	43.83	97.47
41-50	155.17	287.50	117.26	71.89	157.96*
>50	233.50	217.97	79.18	176.87*	176.88*

*average cpue from previous years was used in calculating average cpue for that length class.

Table 6. Estimated landings of finfish for Antigua.

ESTIMATED LANDINGS OF FINFISH (mt)				
1995	**1996**	**1997**	**1998**	**1999**
1115.6	2217.138	2635.471	2149.25	2207.52

Table 7. Average catch per day trip and estimated landings for *Strombus gigas* in Antigua.

YEAR	AVERAGE CPUE (kg/day trip)	ESTIMATED LANDINGS (mt)
1995	63.26	45.55
1996	53.84	38.77
1997	48.66	35.03
1998	62.02	44.65
1999	63.83	45.96

Table 8. Average catch per day trip and estimated landings for Spiny Lobster in Antigua.

YEAR	AVERAGE CPUE (kg/day trip)	ESTIMATED LANDINGS (mt)
1995	20.91	266.93
1996	27.70	542.49
1997	24.55	702.28
1998	20.36	684.0
1999	26.58	931.38

3. PRESENT STATUS OF THE FISHERY

Shallow Shelf and Coral Reef Fishery

Decline in average fish size and catch in addition to algal overgrowth on some reefs suggest that the shallow reef fishery is over-exploited around Antigua. Barbuda by contrast appears to be in better shape in this regard.

Deep Slope Fishery

Only a few vessel exploit the deep slope resource, using primarily traps and to a lesser extent bottom longline (palang and kali pole). Deep slope fish are considered to be underexploited by Antiguan fishers. However, a precautionary approach towards further expansion should be followed since foreign effort (by French vessels) cannot be quantified and vessels using a large number of traps can easily over-fish the small areas of the slope where the resource is found.

Conch

The queen conch, *Strombus gigas*, is considered to be over-exploited in shallow waters around Antigua. Depletion of nearshore stocks has resulted in an increase in the use of SCUBA gear. The status of stock around Barbuda is unknown; few Barbudan fishers target conch, however, the impact of Antiguan vessels is unknown. Over the past five years (1995-1999), the present level of harvest range from 42-46 mt. In the recently completed conch abundance survey of the main area of commercial exploitation (the southwestern area of the shelf of Antigua), estimates of exploitable biomass were 32 mt within the study area. Reasonable estimates of potential yield for the study area ranged from -9.3 mt to 17.9 mt. Based on these figures and the present level of harvest, the conch resource in the study area is over-exploited.

Spiny Lobster

The spiny lobster, *Panulirus argus*, is considered to be over-exploited in nearshore areas, particularly around Barbuda. Fishers have reported smaller average catch in these traditional fishing grounds. Lobsters are targeted mainly around Barbuda, where the majority of the catch is exported. In 1998, 36.6 mt was exported from Barbuda while 8.5 mt was exported from Antigua.

Coastal Pelagics

Coastal pelagics are not widely targeted by local fishers. Currently, only one vessel uses beach seine as its principal gear. A few fishers on a seasonal basis target jacks, herrings and ballyhoo. Coastal pelagics are considered to be underexploited.

Large Pelagics

The status of large pelagics is unknown, however, the general consensus is that these resources are not fully utilised. This fishery is seen as an area for future expansion of the fisheries sector. Large pelagics are targeted mainly by the sport and recreational fishery and the few fishing charter boat services.

4. MANAGEMENT OBJECTIVES

The management objectives, as outlined in the Draft Plan for Managing the Marine Fisheries of Antigua and Barbuda (1996), are as follows:

4.1 Shallow Shelf and Coral Reef Fishery
The primary objective is to promote stock recovery, as this resource if properly managed will continue to provide a stable yield with minimal investment. The current regulations is based on size restrictions on meshed gears (traps and net). The primary objective is to be achieved by diverting future efforts to offshore waters as well as dealing with the problem of ghost-fishing. The Fisheries Division has plans to legislate trap construction, which will include escape vents and biodegradable panels. Other options under consideration include size limits for certain species and closed areas and seasons.

4.2 Deep Slope Fishery
Management objectives are to maximise catches within the limits of the potential yield and to preserve stocks of preferred species. Particularly, snappers and groupers that are vulnerable to over-exploitation because of the low selectivity of traps and the small areas on the slope where the resources are found.

4.3 Conch
The management objective for conch is to rebuild stocks in depleted areas through various management measures. Options under consideration include initiating a flared lip thickness restriction, closed areas/seasons, and effort reduction.

4.4 Spiny Lobster
Rebuilding stocks in depleted areas is of primary concern here. Management options include further gear restrictions (biodegradable panel in traps) and effort reduction.

4.5 Coastal Pelagics
This resource is underutilised in certain areas, thus efforts to promote development of a small-scale fishery in these areas would increase domestic supplies of protein. Once this resource is exploited, monitoring of the fishery is essential for long-term sustainability of the resource.

4.6 Large Pelagics
As this resource is not as widely exploited, the main management objective is to promote the development of this fishery through the application of appropriate technology to the extension of efforts into non-traditional areas and through the promotion of recreational fisheries for these species. Also to introduce fishery conservation measures through collaboration with other agencies or groups involved in management and exploitation of these resources.

5. HISTORY OF THE DATA COLLECTION PROGRAMME

The first data collection system in Antigua was set up with the assistance of OECS Fisheries Unit. It involved eight part-time Data Collectors located at eight landing sites in Antigua. Since the system only offered partial coverage of the sites in Antigua and none of the sites in Barbuda, it was considered inadequate. In 1993 this system was upgraded as part of the regional CFRAMP programme. The general objectives were to:

- provide general information for management and policy development within the fisheries sector;
- determine the total landings of finfish, conch, lobster and other seafood;
- provide trends in the fisheries sector; and
- determine the contribution of the fisheries to the economy.

Components of the programme include:

- Catch and Effort Data Collection (Appendix 3 & 4);
- Biological Data Collection (Appendix 5 & 6); and
- Licensing and Registration System of fishers and vessels (Appendix 7).

With the introduction of this programme, the eight part-time Data Collectors were phased out and replaced by two full-time and two part-time Data Collectors; it was felt to be more economically viable for the Government on expiration of CFRAMP funding. One part-time Data Collector was responsible for Codrington (in Barbuda) and the other to census landing at Mill Reef Club (in Antigua). CFRAMP provided training for the two full-time Data Collectors, as well as, the Data Entry Operator and the Data Collection Supervisor (local Fisheries Officer).

Upon review of the data collection programme in 1998, it was found that insufficient reliable or useful data was collected. Hence the goals for Antigua and Barbuda were not met, in that, the data collected could not be used to develop management and development plans. As a result, the two full-time data collectors were terminated in December of 1998. The Data Collector Supervisor transferred from the Division in 1998. Review of the problem, resulted in a simplified system of collecting data. This involves, not full-time persons in the field, but random sampling of the rural sites and planned sampling of the primary landing sites in St. John's, to be carried out by members of staff. To facilitate maintenance of the data collection program, CFRAMP sponsored an attachment for two Fisheries Officers with the Data Collection and Assessment Unit, Jamaica Fisheries Division, in 1998.

6. PRESENT CATCH & EFFORT DATA SYSTEMS

With the termination of the Data Collectors in 1998, the task of collecting all data fell on the remaining technicians within the division. Thus, the sampling plan is often *ad hoc*, at best. Also, as fishers generally bring in their catch outside of normal working hours (late evenings, weekends, etc.), it is often necessary to visit landing sites very early in the mornings or later in the evenings. On a number of occasions, it has become necessary to visit fishermen at their homes in order to collect data. Presently, the most easily acquired data is for shallow shelf and reef fish and some deep slope species. For these, catch and effort as well as biological data is collected on those occasions when sampling is possible. As for conch and lobster data (particularly biological), this is almost never collected.

There is no data collection programme, for catch and effort or biological data, for Barbuda. This is due to the fact that the one part-time Data Collector is no longer employed by the Barbuda Council (i.e., local governing body). Attempts to revive the data collection programme by training local Fisheries Officers (those hired by the Barbuda Council) have not been successful. One week of training was conducted in June of 1999 by the staff of the Fisheries Division however to date no data has been collected. Reasons cited for the non-collection of data include lack of equipment (scales, calipers, etc.). Supervision of the programme is hampered by financial constraints (availability of funds to travel to Barbuda).

6.1 Recommendations

In order to combat some of the problems that are being faced with the data collection system in the Division it may be best to set up a quota system in the short-term. That is, set targets, which must be met for each month by the Division as a whole. Quotas for both biological and catch and effort data should be made. **Quotas should be realistic given the limited staff and their multidimensional roles.** Once this is done, sampling days can be worked into the work programme. It is then the responsibility of every person within the Division to ensure that the quotas are met by the end of the month. Quarterly census may be used to "top-up" this quota system. The implementation of logbooks in larger boats will be initiated in order to further improve the quality of data being collected by the Division.

In the long-term, the Division needs additional resources both human and financial, in order to execute its functions with respect to data collection. However this is hindered by the country's present economic situation. According to the Finance Minister, John St. Luce, "The Government … has recently agreed to place a freeze on employment unless it is a special circumstance." A freeze also applies to unnecessary overtime. Presently, Fisheries Officers are not paid for overtime. When Officers work on weekends or after hours the time is recovered by days-off during the work week which creates additional manpower problems. Austerity measures also include: a limit on fuel utilised by government vehicles and restrictions on weekend use of vehicle (late Friday and early Saturday are the best days to collect data).

Under the present organisational structure, Fisheries Officers lack a suitable base to carry out their various duties (insufficient field technicians at the lower end). The present technical staff complement is as follows:

- 1 Chief Fisheries Officer (on leave)
- 3 Fisheries Officers (one acting for the Chief Fisheries Officer)
- 4 Fisheries Assistants (one on study leave)
- 1 Fisheries Cadet/Data Entry Operator

It should be noted that under the present structure there are two vacant positions for Fisheries Officer. These were not filled upon instructions from the Ministry of Finance.

Fisheries Officers duties in addition to data collection and analysis include:

- Gathering and Compiling Fish Export and Import Data
- Beach Monitoring Data Collection and Analysis
- Surveillance and Enforcement (Fisheries Act and Regulations)
- Habitat Mapping (Coral Reef, Seagrass and Mangrove)
- Habitat Monitoring (Coral Reef, Seagrass, Salt Pond and Mangrove)
- Training and Extension
- Aquaculture Potential Survey (Project Proposal)
- Food Safety, Quality Control and Processing (Develop Legislation)
- Environmental Monitoring (Water Quality)

7. DATA MANAGEMENT

The data that are collected (catch & effort, biological and socio-economic) are held on a single computer within the Division. Data are entered into the computer by the Fisheries Cadet or the Data Collection Supervisor. The Data Collection Supervisor is then responsible for checking and validating the entered data.

8. DATA ANALYSIS

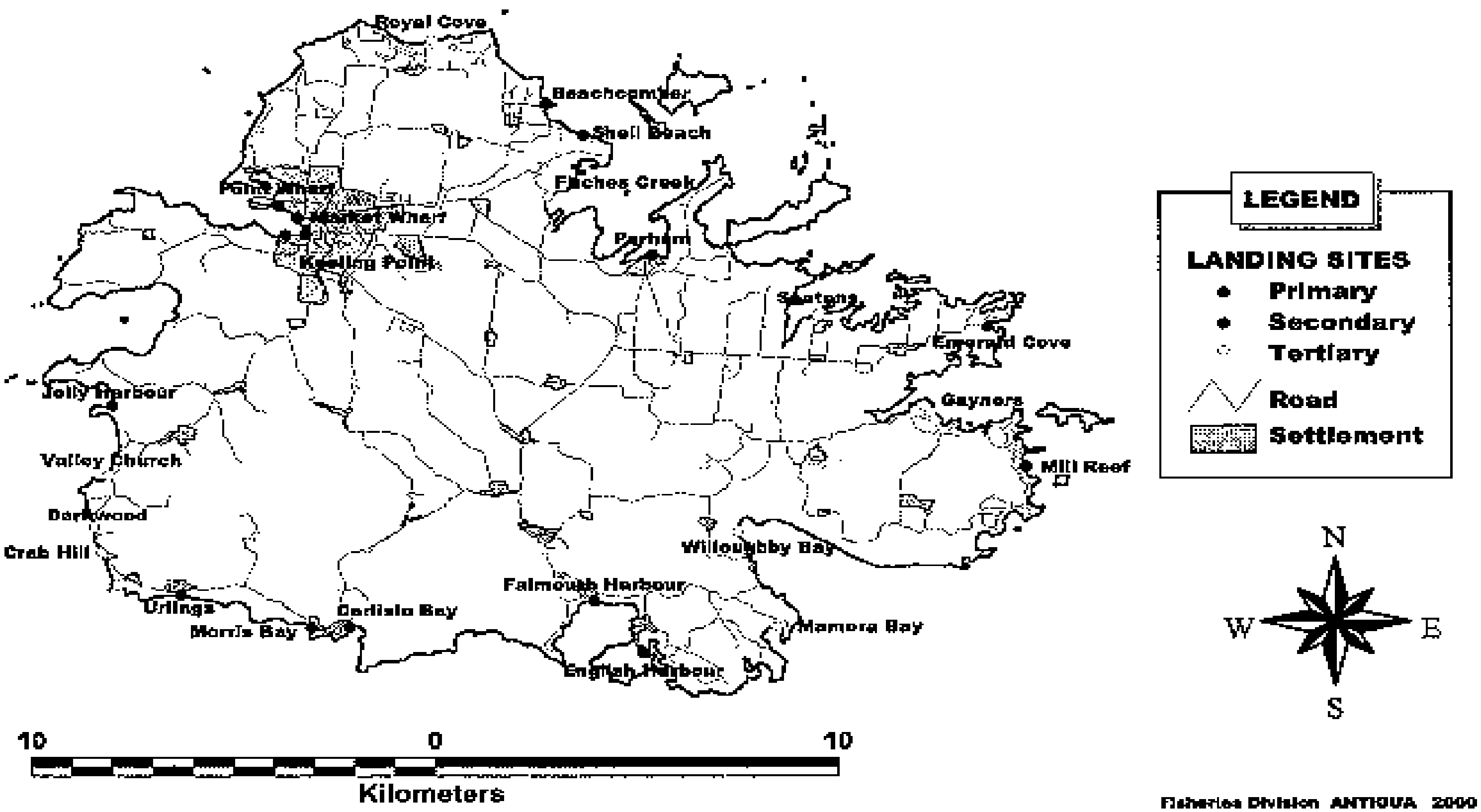
The catch and effort data collected is used to estimate total year's landings for finfish, conch and lobster, as well as catch per unit effort by boat length classes.

9. CONCLUSION AND RECOMMENDATIONS

The present data collection system for Antigua and Barbuda is hampered by a number of problems. As a result, data is inadequate for making sound management decisions for the fisheries sector. There is a definite need to revamp the entire data collection and data management system, however, the lack of sufficient technical support within the Fisheries Division limits the scope. It is therefore necessary, to develop a mechanism for obtaining data, which does not rely solely on manpower within the Division itself. The use of logbooks by the fishermen would greatly enhance the Divisions ability to gather meaningful data. It would also reduce the strain on the already limited staff. This approach is better suited for the recreational or sport fishery where the literacy level is higher, however, it might be problematic for the commercial fishery where the average fisher has an elementary education. So the need for resources both human and financial cannot be understated.

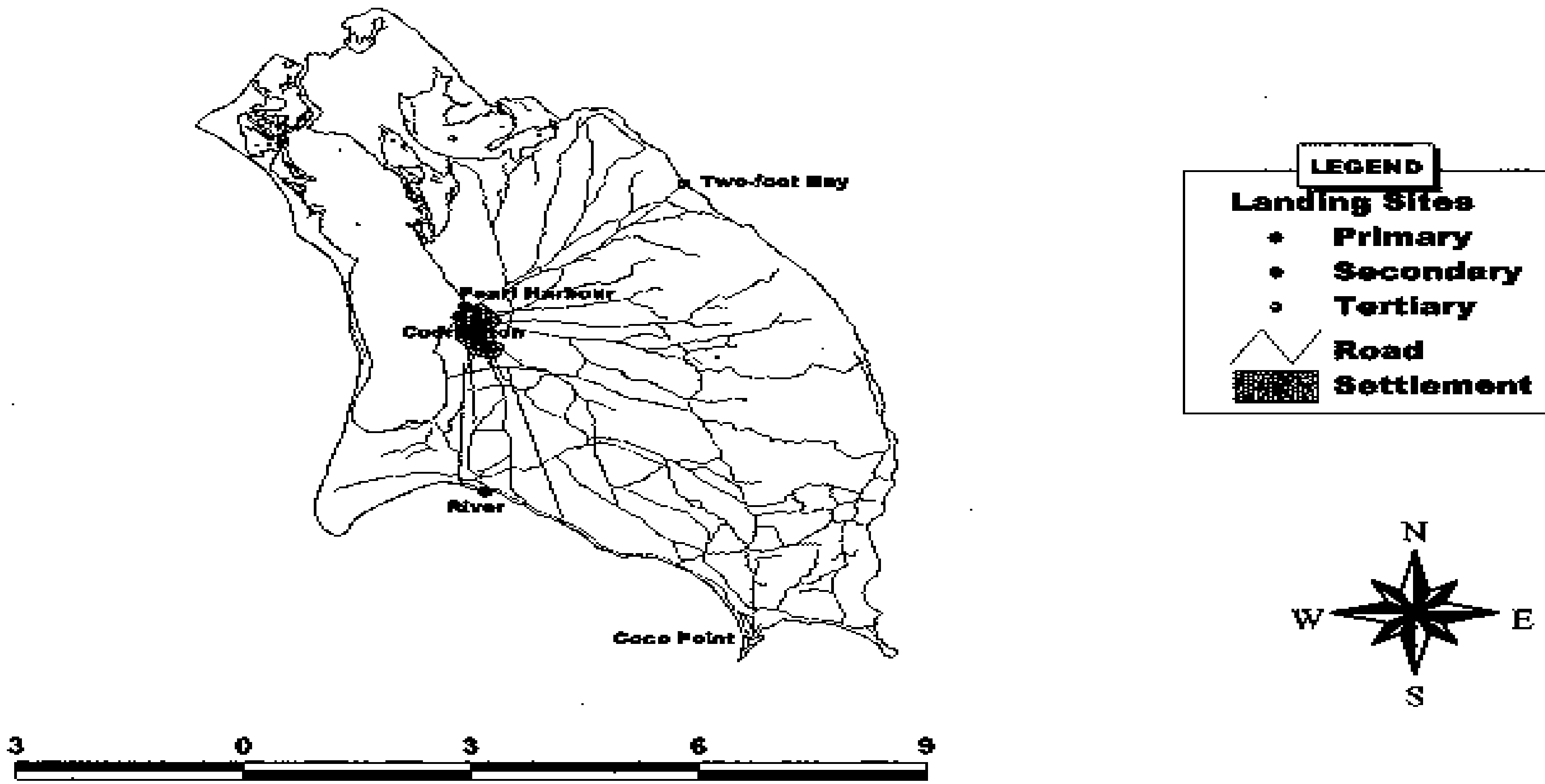
APPENDIX 1a

FISH LANDING SITES : ANTIGUA



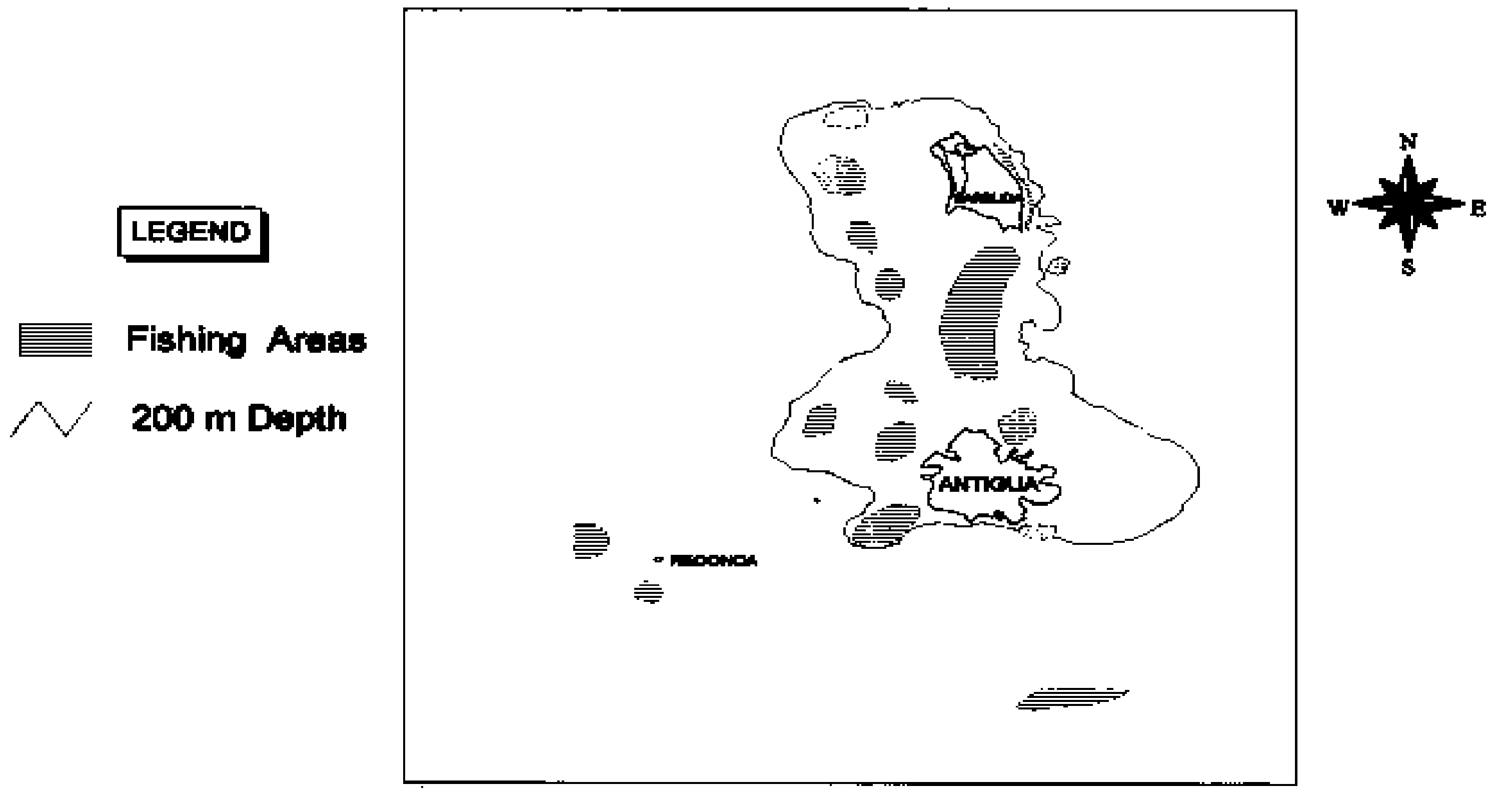
APPENDIX 1b

FISH LANDING SITES: BARBUDA



APPENDIX 2

MAJOR TRAP-FISHING AREAS ANTIGUA AND BARBUDA



Fisheries Division Antigua and Barbuda 2000

APPENDIX 3

DATA SHEET FOR LANDING OF FISH & SHELL FISH

Antigua Fisheries **Field Data Sheet**

		Entered	Checked
Landing Site	Weather	Date	Date
Date	Sea State	By	By

Landing No.							
Boat ID							
Time-Departed							
Time-Returned							
Area Fished							
Gear-Primary							
Gear-Secondary							
Number of sets /lines fished /traps hauled /dives							
No. of Crew							
Depth fished							
Weight type							
Catch by Species							

Comments:

APPENDIX 4

CATCH ESTIMATION WORKSHEET

Landing Site	Date	Landing Number	Data Collector

Mixed Fish

Calculation of Unsorted Catch Weigth		
Quantities	Tally	Total
	Total Weight	

Species Composition of Unsorted Catch		
Species	%	Est. Wt.
	100%	

Sorted Fish

Calculation of Sorted Catch Weights		
Species	Weights	Total Wt.

APPENDIX 5

LOBSTER

ANTIGUA AND BARBUDA CONCH BIOLOGICAL DATA COLLECTION FORM

(Strombus gigas)

LANDING SITE	DATE	DATA COLLECTOR

Data Entry Only

Entered	check
date	date
by	by

Boat no.		
Boat name:		
Total Weight		g kg oz. lbs.
Sample Weight		g kg oz. lbs.

Gear	Scub Dive Fpot Lpot
Area Fished	
Weight type	Whole Headed
sample type	SU LU LS

Lobster Length & Maturity Data record for species caught in same gear only

Sex and Maturity F M T D E	Length (mm) (Carapace Length)	Sex and Maturity F M T D E	Length (mm) (Carapace Length)

Key to codes: 1. sample type: SU=measured at sea;LU=landed unsorted; LS=Landed Unsorted

2). Fishing Gear: FPOT=fish pot; LPOT=lobster pot; SCUB=SCUBA; DIVE=skin diving

3). Sex and maturity: M=male; F=female no egg no tar;T=female with tar. D=female with orange eggs

E=female with brown eggs. Comments: ____________________

Page 1

APPENDIX 6a

BIOLOGICAL DATA SHEETS

CFRAMP LENGTH FREQUENCY DATA COLLECTION

LANDING SITE	DATE	DATA COLLECTOR

Data entry only

ENTERED	CHECKED
DATE	DATE
BY	BY

SCIENTIFIC NAME		SCIENTIFIC NAME		SCIENTIFIC NAME		SCIENTIFIC NAME	
COMMON NAME		COMMON NAME		COMMON NAME		COMMON NAME	
AREA FISHED (Fishing Ground)		AREA FISHED (Fishing Ground)		AREA FISHED (Fishing Ground)		AREA FISHED (Fishing Ground)	
BOAT NUMBER	BOAT NAME	BOAT NUMBER	BOAT NAME	BOAT NUMBER	BOAT NAME	BOAT NUMBER	BOAT NAME
FISHING GEAR (circle one)	FPOT HLIN TROL LLIN TRAL GNET BSNE SCUB	FISHING GEAR (circle one)	FPOT HLIN TROL LLIN TRAL GNET BSNE SCUB	FISHING GEAR (circle one)	FPOT HLIN TROL LLIN TRAL GNET BSNE SCUB	FISHING GEAR (circle one)	FPOT HUN TROL LLIN TRAL GNET BSNE SCUB
TOTAL WEIGHT (circle one)	g kg lbs	TOTAL WEIGHT (circle one)	g kg lbs	TOTAL WEIGHT (circle one)	g kg lbs	TOTAL WEIGHT (circle one)	g kg lbs
SAMPLE WEIGHT (circle one)	g kg lbs	SAMPLE WEIGHT (circle one)	g kg lbs	SAMPLE WEIGHT (circle one)	g kg lbs	SAMPLE WEIGHT (circle one)	g kg lbs
LANDED STATUS (circle one)	W H G	LANDED STATUS (circle one)	W H G	LANDED STATUS (circle one)	W H G	LANDED STATUS (circle one)	W H G
SAMPLE TYPE (circle one)	SU LU LS (*)	SAMPLE TYPE (circle one)	SU LU LS (*)	SAMPLE TYPE (circle one)	SU LU LS (*)	SAMPLE TYPE (circle one)	SU LU LS (*)
LENGTH TYPE (circle one)	Fork Total	LENGTH TYPE (circle one)	Fork Total	LENGTH TYPE (circle one)	Fork Total	LENGTH TYPE (circle one)	Fork Total
LENGTH (cm only) *record length frequencies for species caught in the same gear only*		LENGTH (cm only) *record length frequencies for species caught in the same gear only*		LENGTH (cm only) *record length frequencies for species caught in the same gear only*		LENGTH (cm only) *record length frequencies for species caught in the same gear only*	

MEASUREMENT	COUNT	TOTAL	MEASUREMENT	COUNT	TOTAL	MEASUREMENT	COUNT	TOTAL	MEASUREMENT	COUNT	TOTAL

APPENDIX 6b

AGEING AND MATURITY

Antigua and Barbuda Biological data collection form for Ageing and Maturation Study

Landing Site	Date	Data Collector

Common Name
Scientific Name

Data entry

date	date
by	by

Area Fished	Boat name	Boat No.	Fishing Gear	Landed Status	Length (cm only)		Weight (g)		sex	maturity (circle one)	age structure	sample number	interview number
					length	type	Total	gonads					
						fork total			M F U	I M D RR S	Otolith		
						fork total			M F U	I M D RR S	Otolith		
						fork total			M F U	I M D RR S	Otolith		
						fork total			M F U	I M D RR S	Otolith		
						fork total			M F U	I M D RR S	Otolith		
						fork total			M F U	I M D RR S	Otolith		
						fork total			M F U	I M D RR S	Otolith		
						fork total			M F U	I M D RR S	Otolith		
						fork total			M F U	I M D RR S	Otolith		
						fork total			M F U	I M D RR S	Otolith		
						fork total			M F U	I M D RR S	Otolith		
						fork total			M F U	I M D RR S	Otolith		
						fork total			M F U	I M D RR S	Otolith		
						fork total			M F U	I M D RR S	Otolith		
						fork total			M F U	I M D RR S	Otolith		

Comments: ____________________

Key to Codes:
1. Landed Status: W: Whole
2. Length measurements: cm = centimeter; FL = fork length; TL = Total Length
3. Weight Measurements: kg = kilograms; g=grams
4. Sex: M = male; F = female
5. Maturation Stages: I = immature; M = mature (but underdeveloped; D = developing RR = ripe and running; S = spent

APPENDIX 7

MINISTRY OF AGRICULTURE, LANDS AND FISHERIES

FISHERIES DEPARTMENT.

FISHERMAN REGISTRATION FORM.

Name of Fisherman...

Address...Age......................................

Size of Vessel...Crew.....................................

Type of Boat...

Does Boat Have a Communication Radio?...

Name of Each Crew Member..

....

....

....

Type of Fishing..

Fishing Area...

Fisherman's Signature...

Approved by..
Fisheries Officer

Date of Approval...

COMMONWEALTH OF THE BAHAMAS

by

Michael Braynen
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Tel: 242-393-1777; E-mail: fisheries@batelnet.bs

1. INTRODUCTION

The Commonwealth of The Bahamas is an archipelago that extends from south-east of Florida in the USA to the large island of Hispaniola in the Caribbean Sea. The Bahamas covers an area greater than 259 000 Km^2 and has a mean temperature around 25ºC. The Bahamas has a shallow water area of some 116,550 Km^2 and consists of approximately 3,000 small islands and cays with a land area of about 13,935 Km^2. The shallow water banks have an average depth around 9 m but water depth can exceed 1.6 km in the Tongue of the Ocean. Just west of the Tongue of the Ocean is the world's third longest barrier reef, running along the west coast of Andros, the largest island in The Bahamas.

The Department of Fisheries is responsible for the administration of the fishing industry and for the management and development of fisheries in a sustainable manner for the benefit of all Bahamians. Therefore, a prime responsibility of the Department is the formulation and implementation of sound fisheries policies and development objectives.

The fishing industry is important to The Bahamas both socially and economically. Its contribution to GDP of 2.25% in 1995 is more important than that of the agriculture sector (0.94%), banking sector (1.76%) and insurance sector (2.19%).

Map of The Bahamas

Fisheries Policy

The Government of The Bahamas policy reserves the commercial fishing industry, as far as is practical, for exploitation by Bahamian Nationals. Commercial fishing vessels fishing within the Exclusive Economic Zone (EEZ) must be 100% Bahamian owned. Seafood processing facilities have been placed on the list of areas specifically targeted for overseas investors. Further, all investment projects with non-Bahamian interest must have the approval of the Government's National Economic Council (NEC).

Fisheries Legislation

Bahamian fisheries are governed by the Fisheries Resources (Jurisdiction and Conservation) Act 1977. This is currently under revision. The aims of redrafting the legislation include:

- Giving the Minister and the Director of Fisheries broader scope for developing conservation measures for fish stocks, and identifying marine reserves and no take zones
- Simplifying the procedure for forfeiture of arrested vessels and catches
- Bringing legislation in line with UNCLOS (Law of the Sea)

2. DESCRIPTION OF FISHERIES

The commercial fishing industry of The Bahamas is based primarily on its shallow water banks, principally the Little Bahama Bank and the Great Bahama Bank. Other shallow water bank areas are also found adjacent to several of the southeastern islands. These banks cover an area of about 116 550 sq. km. and have a bank edge estimated at 4 000 km, along which the depths plummet to between 370 m and 3 700 m. These banks are notable for the diversity of species and clarity of water, rather than for high productivity, although standing stock and potential yield estimates compare favorably with estimates for comparable fishing grounds throughout the Caribbean.

The principal categories of fishery resources caught in commercial quantities from the Bahamian Exclusive Fishery Zone are spiny lobster (Panulirus argus), conch (Strombus gigas), shallow and deep water scalefish (Epinephelus spp, Mycteroperca spp, Lutjanus spp, Haemulon spp, Caranx spp, Selar spp), sponges (Hippospongia lachne, Spongia spp), marine turtles (Chelonia mydas, Caretta caretta) and another marine gastropod, the queen helmet shell (Cassis madagascarienis). Most of the catch is landed in the islands of New Providence, Abaco and Eleuthera, however Grand Bahama, Long Island and Andros have lesser but still significant landings of fishery resources.

Fishing Vessels and Fishermen

Using data derived from the 1995 Bahamas Fisheries Census, the commercial fishing fleet consists of approximately 650 active and licenced vessels, each having a length greater than 6.1 m and about 1500 smaller boats which currently are not required by law to be licenced for commercial fishing.

During 1999, a total of 395 vessels were licensed to engage in commercial fishing in The Bahamas. Fishery products are also transported from the Family Islands to New Providence, the main market, by approximately 23 mailboats that ply between New Providence and the Family Islands on a weekly basis.

Status of The Commercial Fishery

During 1999, the total production of fishery product for The Bahamas was 10,337 tons. Total landings was 4,874 tons valued at $72 million, the difference in weight between production and landings resulting primarily from the fact that most crawfish are tailed at sea and the head, which represents two thirds the total weight of the animal, is discarded.

The crawfish tail is the single most important fishery product harvested and, on a live weight basis, accounts for over 79% of the total catch. Divers using Hawaiian slings or hooks catch most of the crawfish and are sometimes aided in breathing by an air compressor carried on a small boat. Some crawfish are still caught by using traps. The Department of Fisheries through the issuance of permits authorizes the air compressor and trap for use.

The percentage composition of the 1999 landings by weight was as follows: crawfish 55%, snappers 17%, grouper 12%, conch 9%, others 3%, jacks 2%, stone crab claws and grunts 1%.

Fisheries Exports

On average, over 90% of the crawfish landed are exported, primarily in the form of 'individually quick –frozen tails' (IQF) crawfish tails. During 1999, nine (9) exporters shipped a total of 2 553 tonnes of crawfish (1999/2000), three (3) exporters 96 tonnes of scalefish, seven (7) exporters 91 tonnes of conch and five (5) exporters 48 tonnes of stone crab claws (Table 2). The total value of these fishery product exports and resources was $74 million.

The main countries of export are the United States (US), France and Canada.

Fishing Methods and Gear

Fishermen use a variety of gears and techniques when fishing. These are usually classified into five categories, namely:

a) nets;
b) hook and line;
c) impaling gear; and
d) pots or traps.
e) casitas (also referred to as lobster habitats condos)

Gears from all five main categories are used in the commercial fishing industry of The Bahamas. The primary method and gear used for catching crawfish is diving, in many instances using an air compressor to enable the diver to breathe whilst under water, and using a Hawaiian sling to propel a spear to impale the animal. Today many fishermen also utilize casitas. These are constructed from sheets of corrugated metal nailed to 4x4 or 2x4 boards and set on the Banks. Their locations are not marked with floats, rather GPS units are used to return to the locations where they are set. Crawfish trapping is another, less popular, method of fishing for crawfish. The traps are made of wooden slats and are not usually more than 3 feet in length, 2 feet in width and 2 feet in height with the slats placed not more than 1" apart.

Conchs are mostly harvested by diving and collecting by hand, or by using a water glass and a conch hook. A conch hook consists of a long pole with two pronged bits of wire attached at right angles at one end. The conchs are spotted from the boat by looking through the water glass, the wire prongs of the hook are placed under it and the pole and conch is hauled to the surface.

Scalefish are caught by using fish pots, hook and line, Hawaiian sling, and seine nets. The most popular methods for capturing the groupers and other "big fish" are diving using the Hawaiian sling and trapping using the wire arrowhead shaped or wire rectangular shaped trap. Scalefish traps are required by legislation to have a minimum mesh gauge of 1 x 2 inches for rectangular traps and 1 1/2 inches (greatest length of mesh) for hexagonal wire mesh traps. The primary fishing gear used for catching the smaller scalefish such as jacks, snappers and grunts is the seine net. Deep-water scalefish are caught using electric or hydraulic snapper reels.

3. HISTORY OF THE DATA COLLECTION PROGRAM

Landings of commercial fishermen in Nassau were recorded by weight, value and type by the supervisor of the Nassau Public Market. In the early 1970s in addition to the data formerly collected, effort and fishing location information was collected by a Marine Inspector, who was also responsible for enforcement of the existing regulations. The Marine Inspector visited the various landing sites in New Providence on a daily basis.

The collection system was improved in the following decade by the expansion of the system to a number of the other islands of The Bahamas, as there was an expansion of the representation of the Department of Fisheries. In addition account was taken of the fish being transported to Nassau from the other Islands via the system of inter-island freight vessels.

In 1988 FAO provided the Department of Fisheries with two PCs and The Bahamas Fisheries Information System. This program, written in dBase III+, established a database for the storage of information collected by the Daily Landing Form (DLF) and for the recording of commercial fishing permits issued. Shortly after this the staff of the Department developed, also in dBase III+, a number of databases to keep track of all exports of fish and fishery products from The Bahamas, all permits and licences issued, enforcement activities and other aspects of the Department's work.

Few changes were made to the status quo until 2000 despite the general dissatisfaction with BFIS due to the limited number of built-in queries, the user unfriendliness of dBase III+ , the lack of flexibility to respond to changes in the fishery and the inability to provide truly useful CPUE data on a species by species basis.

4. PRESENT CATCH & EFFORT DATA COLLECTION SYSTEM

No sampling plan exits. Traditionally landings data has been collected on a census basis in areas where fish is landed, and adequate staff represents the Department. This census information is supplemented and cross-checked with other sources of information.

The Department has officers in New Providence, Andros, Abaco and Grand Bahama who visit the landing sites to collect catch and effort data on a daily basis. The information is recorded on a Daily Landing Form, which takes note of the fishing area, gears used, the time factor, the number of men involved, the catch, its weight and value by species. Also, all processing plants are required to submit to the Department a Monthly Purchase Report that details total purchases by weight and value, the source of the resource and date of purchase on a monthly basis. Further, the data collectors record all marine resources shipped from the Family Islands to New Providence as Freight Landings in New Providence. The freight landings are then correctly associated with their island of origin. Note that in calculating the total recorded landings for The Bahamas those products known to have been landed in the Family Islands and shipped to New Providence as freight are not duplicated. The catch and effort data is recorded into the Bahamas Fisheries Information System (BFIS). The final results are compiled and included in the Department's Annual Report. The registration of fishing vessels, permits/licences, duty free concessions and all fishery exports are also recorded into the BFIS system. This computer system is currently in Dbase III+, but there is an effort underway to transfer several of its components to Microsoft Access.

The DLF has a major drawback in that it sometimes lumps a number of species together into broad family groups e.g. "Snappers" does not distinguish between the shallow and deep-water species. It records effort only in the form of man-days fishing and does not allow for the distinction of effort generated through the use of different gears or in the pursuit of particular species.

5. AVAILABLE DATA AND RECENT DEVELOPMENTS

Fishery-Dependent Data

Recorded catch figures are available for the entire country. However, catch and effort data are only recorded for several of the main fishing islands, where a fisheries officer is posted.

The effort data are not recorded in the most of the Family Islands as there are no fishery officers available to collect these data. In the past, New Providence, being the capital and main population centre, received most of the marine resource landings, but in recent years, as the Family Islands have become more developed and as the processing and export facilities in the Family Islands expanded, this is no longer the case.

The data that has been collected over the last five years indicates that both the weight and value of the total landings of fishery products have steadily increased. This is especially so in the case of the spiny lobster. This increase is mainly due to the enhanced landings of spiny lobster due to increased fishing effort, changes in fishing techniques and increased resources applied to harvesting that resource. The total recorded landings of fishery products in 1997 was 10 487 tonnes with a value of B$69.5 million. In 1998 and 1999 total recorded landings of fishery products was 10 278 and 10 502 tonnes with a value of B$65 and B$72 million respectively. Note that these recorded landings figures are known to be less than the actual landings because there are no fishery extension officers in some of the Family Islands where there are major fishing communities. Since there is no one to collect the required information, the landings data are simply lost.

One of the major problems with the catch and effort data recording system involves the lack of manpower and equipment available to collect the data. Also, the very archipelagic nature of The Bahamas makes data collection as well as the enforcement of fisheries regulations quite difficult. There are currently no fishery officers available to collect the relevant data in all of the Family Islands. However, efforts continue to be made to correct this situation. This results in the loss of very important data to the Department of Fisheries, especially in light of the recent shifts in marine resource landings to the Family Islands. Therefore, the total recorded landings information that is received and distributed is accepted to be incomplete.

Socioeconomic Data

The commercial fishing industry makes a significant contribution to the country's economy. Fishing vessel owners and operators earned in excess of B$69 million during 1997, B$65 million during 1998 and B$75 million in 1999 through the harvesting of fishery resources during each respective year (B$1.00 = US$1.00).

The harvesting of spiny lobster is by far the most commercially important fishery product in The Bahamas (Table 1). During 1998, it contributed 75 percent by weight and 83 percent by value of the total recorded landings of fishery products in The Bahamas. During 1999, it contributed 79 percent by weight and 87 percent by value of the total recorded landings of fishery products in The Bahamas.

About 90% of the spiny lobster landed are eventually exported by processing plants. Exports of all fishery resources and fishery products during 1998 and 1999 had a value of B$61 and B$75 million respectively. Spiny lobster exports accounted for 94 and 95 percent of each total value.

Spiny lobster exports for 1999 amounted to 7 642 tonnes with a declared value of B$72 million (Table 1.3). Most of the spiny lobster was exported as 'individually quick-frozen' (IQF) tails.

The labour force estimates from the 1995 census indicate that there were about 9,300 persons employed on a permanent basis in the commercial fishery sector during 1995. Fishermen comprise about 93 percent of this total, numbering about 8,800. The remaining persons are employed mainly as workers in either processing plants or buying stations throughout the country.

6. IMPORTANT DEVELOPMENTS IN THE FISHERY

During the last year the Department of Fisheries implemented its training programme for quality assurance and seafood safety. The objective of this training programme was to ensure a successful implementation of a Hazard Analysis and Critical Control Points (HACCP) based programme within the processing facilities of the country. This programme will allow the international markets to remain open to Bahamian seafood products, thereby allowing the continuation of commercial harvests of the spiny lobster. Thus far, the Department of Fisheries has agreements in place with the Food and Drug Agency (FDA) of the USA, allowing the continued entry of Bahamian fishery products into the USA.

Exploratory fishing and resource assessment surveys have revealed substantial resources of deepwater and shallow water species on the Bahama Banks. The application of deep-water traps over recent years has confirmed the feasibility of using this method to effectively harvest snappers and groupers from the deep.

Studies also revealed potential for developing a fishery for stone crabs on the Banks. Recently, more and more fishermen have begun to realize its feasibility. Future efforts will be concentrated on encouraging the further development of the industry. Further diversification into areas of stone crab fishing, deep-water fishing, aquaculture and mariculture will help to minimize the fishing pressure on the traditionally exploited resources.

Table 1
FISHERY PRODUCT and RESOURCE LANDINGS
1995 – 1999

YEAR	1995		1996		1997		1998		1999	
PRODUCT	**LBS.**	**VALUE ($)**	**LBS.**	**VALUE ($)**	**LBS.**	**VALUE ($)**	**LBS.**	**VALUE ($)**	**LBS.**	**VALUE ($)**
Crawfish Tails	5,579,059	59,825,703	5,711,903	52,666,139	5,674,127	58,669,158	5,478,508	53,364,247	6,026,508	62,592,798
Crawfish Whole	43,996	156,345	359,629	1,342,257	167,069	677,626	215,144	776,233	51,327	221,908
Conch (fresh)	1,088,079	2,106,925	1,298,336	2,715,510	1,428,745	2,942,065	1,477,374	3,651,628	1,040,307	2,619,768
Stone Crab	87,212	622,616	55,639	394,837	92,801	658,967	85,126	609,001	109,599	680,894
Green Turtle	1,568	1,615	3,600	3,661	5,328	5,923	5,072	6,571	2,513	4,336
Loghd. Turtle	3,826	3,826	2,000	2,310	1,690	2,557	2,052	3,693	744	1,454
Nassau Grouper	788,369	1,613,648	729,719	1,699,039	1,132,264	2,477,255	1,125,817	2,674,401	841,044	1,999,204
Other Grouper	9,085	16,216	32,737	64,417	167,512	365,099	228,235	460,581	228,034	426,670
Grouper (fillet)	133,412	394,817	113,548	349,051	149,087	438,563	108,803	327,422	79,534	259,594
Snappers	654,788	658,607	751,138	1,001,784	1,655,756	2,303,289	1,721,359	2,363,558	1,908,443	2,388,552
Jacks	159,117	150,188	200,466	226,336	227,626	220,602	202,411	216,381	175,058	184,849
Grunts	17,258	12,521	30,230	26,129	148,396	121,516	198,232	155,601	144,441	104,916
Sharks	0	0	9,900	24,471	6,013	14,252	4,312	10,248	3,202	7,223
Others	840,755	875,392	848,778	876,422	581,004	644,148	343,214	415,479	307,156	337,802
TOTAL	**9,506,524**	**$66,438,419**	**10,147,623**	**$61,392,363**	**11,437,418**	**$69,541,020**	**11,195,659**	**$65,035,044**	**10,917,910**	**$71,829,968**

(*Source: Department of Fisheries*)

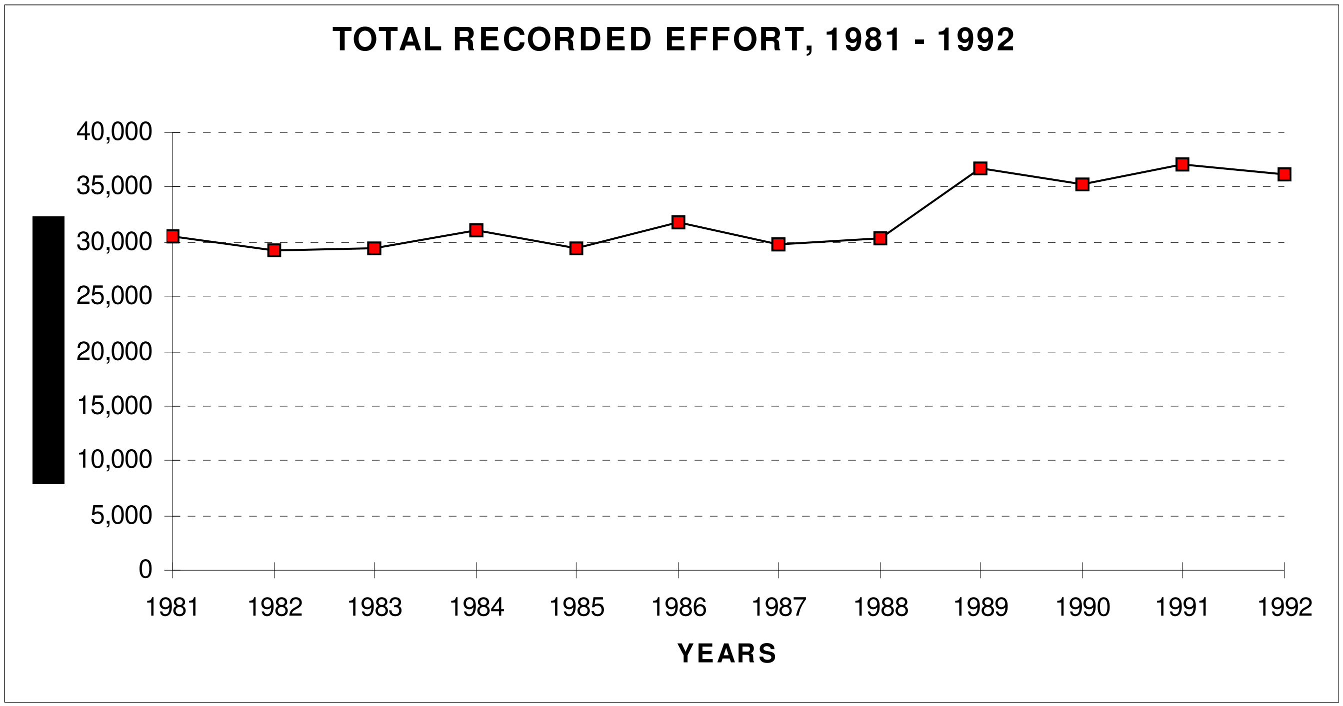
Table 2
FISHERY PRODUCT and RESOURCE EXPORTS
1995 – 1999

YEAR		1995		1996		1997		1998		1999	
PRODUCTS	*UNITS*	**QUANTITY**	**VALUE ($)**	**QUANTITY**	**VALUE ($)**	**QUANTITY**	**VALUE ($)**	**QUANTITY**	**VALUE ($)**	**QUANTITY**	**VALUE ($)**
Crawfish	LBS.	4,994,025	56,212,952	5,427,623	53,871,850	5,175,335	59,066,521	5,055,578	57,412,398	5,615,950	71,586,006
Scalefish	LBS.	92,752	112,024	294,764	456,224	321,907	695,427	465,380	890,770	211,185	401,027
Conch Meat	LBS.	277,934	614,555	365,744	874,921	362,922	981,961	201,810	561,101	200,612	556,402
Stone Crab Cl.	LBS.	61,489	426,443	55,711	386,911	48,657	394,022	96,500	770,677	105,127	903,150
Total Sponge	LBS.	120,731	865,943	136,075	1,072,786	132,633	979,027	131,175	1,324,460	190,241	1,650,678
Q. Helmet Sh.	Pieces	13,461	1,112,930	8,998	694,860	3,834	120,300	3,795	163,015	1,326	90,000
Conch Shells	LBS.	65,110	11,500	1,200	980	9,000	4,675	76,488	66,644	42,067	23,927
Other Shells	LBS.	0	0	0	0	0	0	0	0	9,705	2,426
Mar. Tropicals	Indiv.	6,539	76,984	0	0	0	0	350	1,012	0	0
Mar. Invert.	LBS.	2,697	38,757	90	189	2,154	43,080	0	0	1,636	49,080
Aquaculture	Indiv.	79,195	39,601	0	0	0	0	3,413	83,140	0	0
Live Rock	LBS.	17,198	8,695	0	0	0	0	0	0	0	0
H. Crabs (live)	LBS.	0	0	0	0	0	0	0	0	0	0
TOTAL			**$59,520,384**		**$57,358,721**		**$62,285,013**		**$61,273,217**		**$75,262,696**

(*Source: Department of Fisheries*)

Table 3

Recorded Fishing Effort
1981 - 1992



(Source Department of Fisheries)

BELIZE

by
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1. INTRODUCTION

Belize is located in the Western Caribbean just below the Yucatan Peninsula of Mexico and is bordered on the west and south by Guatemala. Belize has been blessed with numerous coastal resources, which have provided sustenance and an economic foundation for its human population. The most striking feature is the longest barrier reef in the Western hemisphere which supports a thriving fishing industry.

The Capture Fisheries Industry contributes significantly to the economy of Belize mostly from exports of lobster, conch, and shrimp. The Fisheries Sub-sector contributed 5.6% to Belize's Gross Domestic product (GDP) in 1999. Export statistics (Figure 1), seasonal for lobster and conch, show that lobster contributed $13,561,192.37 (US$6.8M) and conch $3,064,918.14 (US$1.5M).

The sector is characterized as a commercially artisanal industry except for the industrial trawl fishery of shrimp. The artisanal fishing fleet is composed of open boats, sail sloops and canoes. The industry is considered to be lucrative and successful mainly because of the good prices obtained on the foreign market and because most fishermen belong to one of the four main cooperatives. They play a dominant role in the industry and are entirely owned by local investors which consist of the fishermen who own shares in the cooperatives.

The Belize Fisheries Department, and the Ministry of Agriculture, Fisheries and Cooperatives were established in 1965 and have the responsibility for administration and management of the fisheries resources. Nevertheless, the Fisheries Advisory Board (FAB) comprised of fishermen, government and NGO representatives serve as an advisory body to the Minister of Fisheries.

The overall objective of the Fisheries Department is to develop clear research policies and adequate, relevant and systematic research and monitoring programs to generate information for policy formulation and decision-making. However, there are still great concerns about overfishing of target species like lobster and conch that need to be addressed through a comprehensive consistent research program.

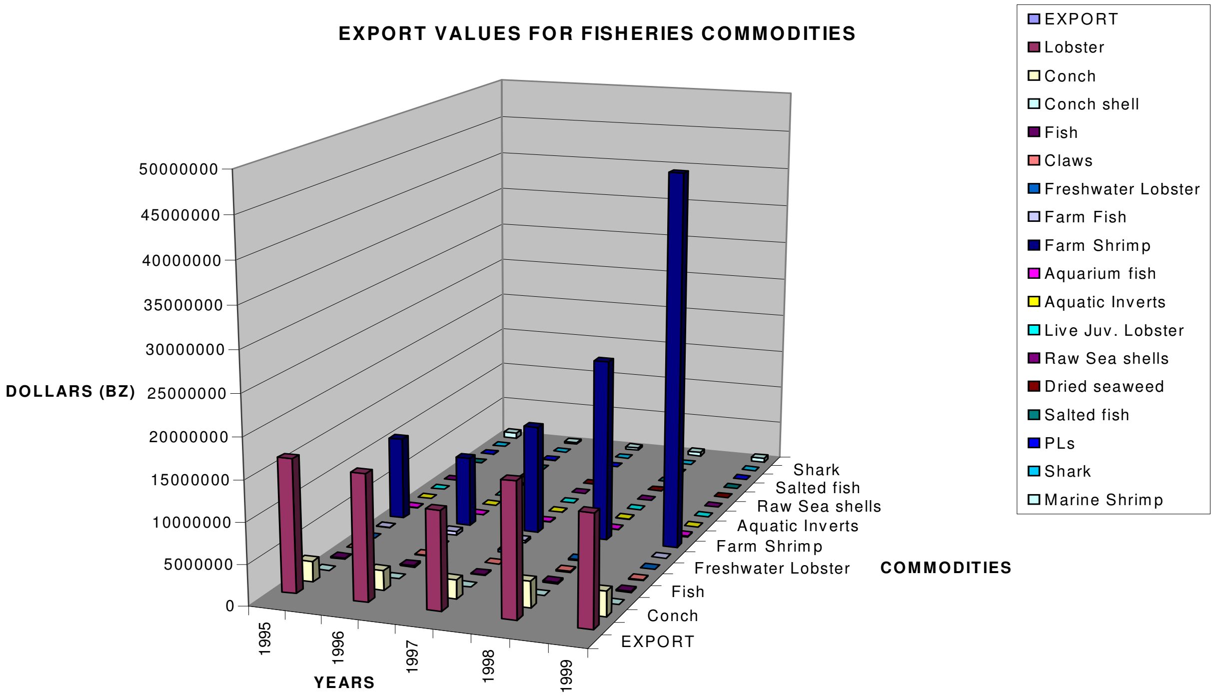


Figure 1. **Lobster, conch and farmed shrimp are the main foreign exchange earner for the Fisheries Sub-sector.**

1.1 Government's Policy

i. To properly manage the resources so as to make it beneficial to all Belizeans.

ii. To encourage diversification in the industry and increase exploitation of non-traditional species and areas. Fishermen are being encouraged to make use of areas outside the Barrier Reef that has the potential but is not normally fished.

iii. To continue to protect and maintain the industry for the benefit of Belizeans.

iv. To investigate and establish as far as possible the state of the fish habitats, fish population and fishery resources of Belize and to restore where necessary, monitor and rationally utilize all of the fish resources of the country.

1.2 Legislation

The fishing industry is governed by the Fisheries Ordinance (dated September 24, 1948) in Chapter 174 of the Laws of Belize 1980. These regulations define the powers of fisheries officers; prohibit commercial fishing, research, and exportation without proper licenses; control the use of poisons and explosives, allow for the inspection, seizure and forfieture of nets; and set guidelines for the levying of penalties for breach of fisheries regulations.

Draft fisheries regulations are genarally prepared by the Fisheries Department, which then passes them on to the Miniter responsible for fisheries for further action. Under section 9 of the Fisheries Ordinance, Chapter 133 of the Laws of Belize 1980, the Minister responsible for fisheries can make regulations with respect to fisheries. Where principal acts are concerned, however, the decision is made by the Cabinet and the House of Representatives.

The Pricipal Regulations for fisheries are the Fisheries Regualtions 1977 passed under statutory instrument No. 66 of 1977. With its enactment, the Fisheries Regulations of 1963 and its amendments were revoked.

The most recent fisheries management regulations are the Fisheries (Amendment) Regulations 1999 which were passed in January 1999, when the statutory instrument was passed to amend the Fishereies Regulation of 1977 (the Principal Regulations). The amendment enacted a new schedule of fees for licenses and permits, including commercial fishing vessels license, sports fishermen license, marine bio-prospecting license, black coral license, research permits, fish processing plant permit, and fish exporters permit. This also calls for the re-registration of all vessels and fishers.

2. DESCRIPTION OF THE FISHERY

The industry is mainly artisanal, characterized by relatively small vessels that fish commercially, involving 790 licensed fishing vessels and 2,662 licensed fishermen. It is estimated that about 72% are full-time fishers and the remaining 28% are part-time, that fish only during the peak of a fishery season. About 75 % of all full-time fishermen in Belize are members of one of the four Fishermen's Cooperatives, Northern, National, Placencia and Caribena or the recently formed Toledo Fishermen Cooperative. These cooperatives purchase, process, and export fisheries products on behalf of the fishermen. Cooperative members are categorized as Producers, Non-Producers and Probation (Table 1). A fisherman is placed on probation for a period of time until he produces a certain amount of a particular commodity. Also each cooperative is presently being impacted by non-producing members who are members but are not selling their product to the respective cooperative. Independent fishermen sell their produce on the local markets and directly to restaurants. They target mostly scale-fish, although from time to time they engage in other fisheries.

SITE	**Non-Producers**	**Producers**	**Probation**
Caribena Cooperative	67	39	

Northern Cooperative	177	418	
National Cooperative	138	444	42
Placencia Cooperative	35	40 full- time 37 Part-time	
Independent Fishermen		1522	

Table 1. Total number independent and cooperative fishermen 1999.

The two larger cooperatives process mainly for export. Since there is an increasing local demand for marine products, governmental policy is that a percentage be sold in Belize since seafood should be available to the tourist industry and for domestic consumption. Most of the processed lobster, conch, shrimp and finfish are exported as frozen products. There is still interest primarily by "Northern" to export live lobster to both the USA and Asian markets. The live lobster market is very attractive since the price is higher, but there is a risk since post-capture mortality is too high. The Fisheries Department with technical assistance from Cuba will address this matter. A substantial and probably growing volume of seafood products are being sold directly to restaurants, hotels, and illegally across our neighbouring borders.

2.1 Gear types

The lobster fishery is Belize's biggest with over 62 thousand traps and over 2 thousand lobster shades ('casitas') in use. Free divers use hooksticks to catch lobster, spears (mostly made by fishermen) for scalefish and dive for conch. Independent fishermen mostly target scalefish utilizing gillnets, fish pots, fish traps, tires, drums and handlines.

2.2 Fishing fleet

The fishing fleet is comprised of wooden or fiberglass skiffs 12 to 28 feet (3-8.5 m)in length approximately, propelled by outboard engines and are primarily used for lobster trapping. Many wooden sloops up to 30 feet (9 m) originate from the northern fishing villages. These are equipped with sails and auxiliary engines and are used for free diving lobster, conch and scale fish. They carry up to 8 small canoes and remain out at sea from 6 to 12 days. The only trawlers operating in Belize are two owned by Northern Fishermen Cooperative. They are the Gulf of Mexico type, 22 metres in length with double outrigger shrimp trawlers. They are steel hulled with gross tonnage ranging from 68 to 103, and net was estimated at 40,000 lbs (18 mt).

2.3 Area Fished

Practically all the fishing is done in the shallow waters of the barrier reef and the shallow waters of the three atolls. There are nearly 160 miles of barrier reef and 180 miles of reef around the outer atolls. The shallow lagoon between the mainland coast and barrier reef and inside the coral atolls provide ideal habitats for the development of often extensive seagrass beds which provide breeding or feeding areas for numerous commercially valuable species including lobster, conch and many fish species.

The waters of Belize are divided into six (6) fishing zones (Appendix 1). This was done by Marhsalleck in conjunction with a report done by Randolph B. Burke in 1982. Burke's report showed that the northern, central and southern part of the coastline had distinctly different habitat types, and therefore it was imperative that each individual species, whether or not it is distributed throughout the coast must be treated as a separate population within each zone.

3. STATUS OF FISHERIES

3.1 Lobster

Lobster and conch contribute over 90% of the total value of exported seafood products. Internationally the demand for these exclusive products is high and prices are good for quality products. Prices fluctuate with catches. 1995 was a very good year for lobster, resulting in a catch of nearly 800,000 pounds (363 mt), while approximately 500,000 pounds (227 mt) is an average.

Lobster is harvested from traps inside the barrier reef in shallow water and by free diving with hook sticks on rocky bottom and also in deeper waters (18-21 m). The use of hook sticks kills the lobster and it cannot be sold as a cooked or live product, which fetches the higher prices. An introduction of new or modified traps to be used on rough bottoms should have potential for developing the fishery in special rough bottom areas, i.e. near Placencia. During the early exploitation of the resource there was a marked increase in catch with only a small increase in fishing effort. However, there are now indications that the resource is fully exploited and is characterized by catch rates fairy stable despite increases in effort and catch fluctuation according to recruitment and environmental conditions (Fig. 2 and 3).

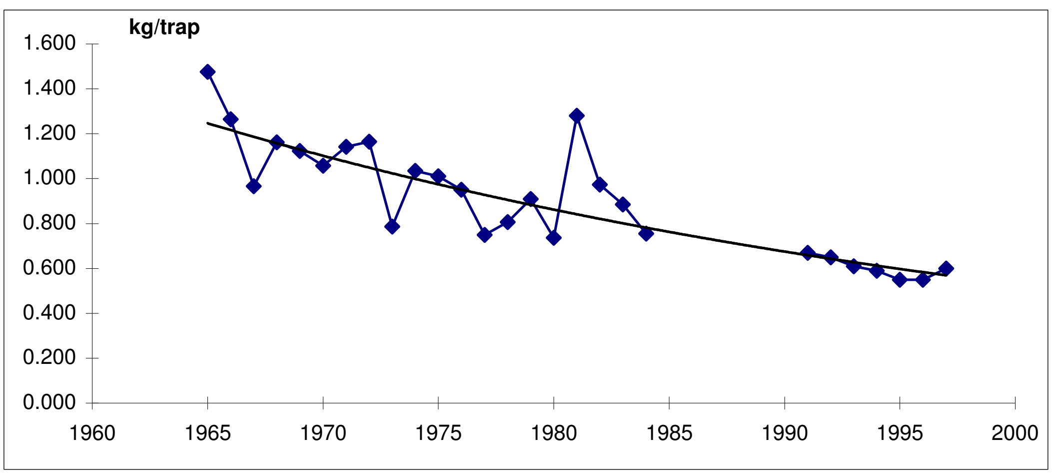


Figure 2. Over the years increasing fishing pressure has decreased CPUE (Estela, 1999).

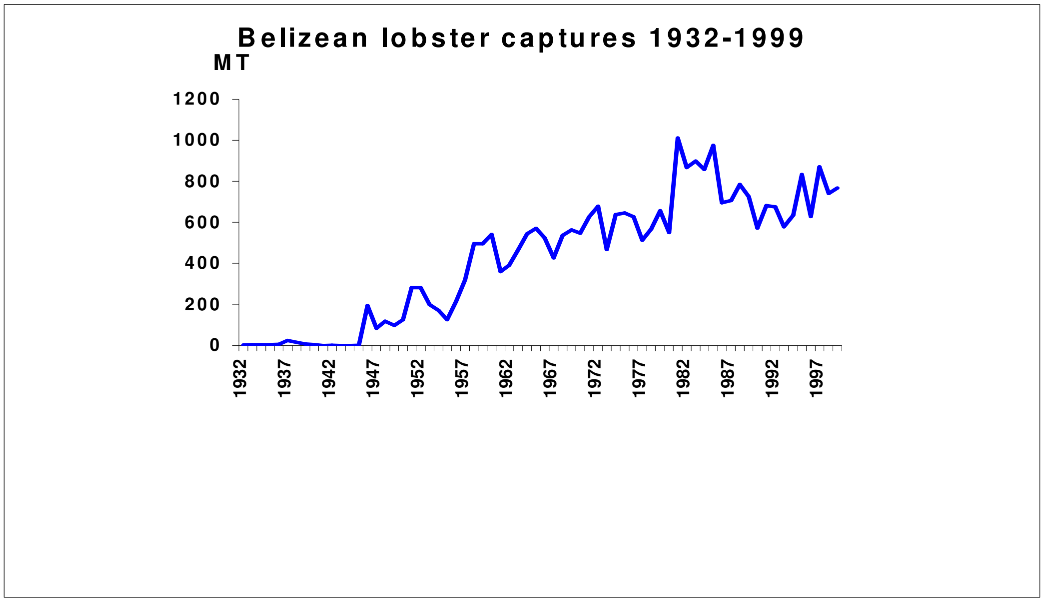


Figure 3. **Historical data show an increase in catches up to 1981. (Estela, 1999)**

3.2 Conch

Conch is the second largest capture fishery. This commodity is harvested solely by free diving in the shallow sea-grass beds and back reef areas. The conch abundance survey conducted in 1996 concluded that the estimated population of legal sized conch in Belize was 2, 259,000 individuals. At a mean value of 170g (6 oz) per individual, the estimated value of maximum sustainable yield (MSY) was approximately 190,000 kg (420,000 lb) (Appledoorn *et al*, 1996). The degree of caution in applying this estimate cannot be overemphasized. These results however indicate that this fishery is being exploited close to its MSY.

3.3 Inshore artisanal fishery

This fishery includes reef and estuarine fishes and crabs. Fishing methods are handlines, gillnets, spears, traps and weirs. The fish caught is primarily sold in Belize. The species are smaller snappers, and groupers, grunt, porgy, hogfish, barracudas, kingfish, mackerels, and jacks. These species are sold at local markets in Belize City and fished for subsistence use by coastal communities. Snook, tarpon and permit are popular species for sport-fishing. Some crab claws are exported, stone crab (Mineppe sp.) and blue crab (Callinectes sapidus), but the fishery is small and involves few fishermen. The demand for fish is high and prices are high and quantities small.

3.4 Deep slope and bank fishery

In this fishery mainly snappers and groupers are caught by artisanal and commercial fishermen. These use handlines, and snapper reels. A few cabin and decked boats with inboard engines also are used. Annual spawning aggregations make the fish accessible for the fishermen. These fishes are the main composition of the seasonal finfish exports from Belize since they are caught in a short period in bigger numbers than can be sold in the local markets. Reports are that several spawning grounds have collapsed as a result of fishing pressure.

3.5 Shark fishery

Sharks have been targetted for their valuable skin, fins, oil and to a lesser extent the meat. The fishery is mainly seasonal during the Lenten season and peaks just before Easter Sunday. Over the last three years exports have increased from 1,250 lbs. (567 kg) to 4,800 lbs (2,177 kg). Most of the salted shark meat is exported to Guatemala. Although catch rates are relatively low there is a need to conduct an assessment of this fishery and develop a management plan.

3.6 Commercial shrimp trawl fishery

The shrimp fishery is economically quite important, starting up in 1984 with increasing catches until 1988 and then declining to 75,000 lbs. (34 mt) in 1995. This is an industrialized fishery with beam trawlers, fishing in a restricted area. Initially the trawlers were owned by Hondurans and operated through joint venture agreements with the local fishing cooperatives. Presently, only two Belizean owned trawlers are operating.

3.7 Deep sea fishery

Only a few large boats exploit the deep water further outside the barrier reef. Several attempts have been made to investigate the deep-sea resources, but with few results so far, also indicating that the fish is not easily available. Large pelagic species e.g tunas, are highly migratory and seem to occur sporadically in the Belizean offshore waters. More information is needed before a fishery can be developed.

3.8 Marine aquarium fishery

A few specialized operators are involved in this fishery. They operate in designated areas that were selected through a study that was conducted to identify suitable areas that could sustain this industry. This fishery also needs a management plan.

4. MANAGEMENT MEASURES

Presently, the fisheries resources are managed through the enactment of Fisheries Regulations, which utilize the principles of closed seasons, closed areas, prohibited methods, protected females and protected young. Nevertheless, a development strategy, which includes operational objectives and proposed management action has been formulated.

Below are the Fisheries Regulations which apply to the Fishing Industry of Belize.

Coral

1. It is illegal for any person to take, buy, sell or have in his possession any type of coral.

2. An exception is made in case of black coral (order *ANTIPATHAR*IA) which may only be bought, sold or exported with a license from the Fisheries Administrator.

Bone Fish
(*Albula vulpes*)
Locally known as MACABI- no person shall buy or sell any Bone Fish.

Shrimp
(*Peneaus* spp)
Closed Season April 15th – August 14th, inclusive of any year.

Conch
(*Strombus gigas*)
1: Shell length should exceed 7 inches.
2: Market clean weight should exceed 3 ounces (85 g).
3: Closed season is from July 1st -September 30th.

Lobster
(*Panulirus argus*)
1: Minimum carapace length is 3 inches.
2: Minimum tail weight is 4 ounces.
3: Closed season is February 15th-June 14th
4: No person shall take berried females or molting individuals.

Marine Turtles
Turtles of the following description should not be disturbed:

1. Green turtle (*Chelonia midas*) curved carapace length greater than 60 cm (24 inches)

2. Loggerhead turtle (*Caretta caretta*) curved carapace length greater than 60 cm (24 inches).

3. No person shall buy, sell, or have in his possession any articles made of turtle shell.

4. No person should interfere with any turtle nest or take any turtle found on land.

5. Closed season is April 1st- October 31st, inclusive in any year.

6. Hawksbill turtle (*Eretmochelys imbricata*) it is illegal to fish, sell, purchase, or have in your possession any article of this turtle.

Hicatee
(*Dermatemys mawii*)

1. No person shall have in his possession more than three (3), or transport in/on any vehicle more than five (5), such turtles.

2. No person shall fish for females that are greater than 43 cm (17.2 inches) or smaller than 38 cm (15 .2 inches).

3. Closed season is May 1st- may 31st, inclusive in any year.

4.2 General Regulations

- No Lobster fishing in the fore reef.
- no setting of traps or nets on the reef or the fore reef
- SCUBA equipment is prohibited in any type of fishery

Restriction on the setting of nets as follows:

a. One hundred yard from the reef or the fore reef.
b. At river mouths
c. A half mile in any community
d. In a channel
e. Mesh size regulation
f. Prohibit setting nets and traps in spawning areas
g. Prohibit use of poisons and explosives

5. MARINE RESERVES

Seven marine reserves have been established in Belize. These areas have different functions including as a fisheries management tool since fishing is restricted and they enhance local and regional fish stocks through increased recruitment and spillover of adults and juveniles. Appendix 2 shows the marine reserves of Belize.

6. HISTORY OF DATA COLLECTION IN BELIZE

The Fisheries Department has been involved in data collection since 1948. Although this was not a census data collection program at the time it provided adequate data on the state of the Fishing Industry. The data collecetd during the period from 1948 – 1975, was entirely export and production figures gathered from the operational cooperatives (landing data). In 1975, effort data was introduced by adding the time taken to catch the recorded quantity of fishery product. However, the data collected in this latter phase was not collected on a consistent basis. Consequently, the data could not be used for research purposes, and policy formulation.

Since the inception of the CARICOM Fisheries Resources Assessment and Management Program (CFRAMP) in 1992, focus has been placed on assessment of lobster, conch, shrimp and finfish fisheries. The Department with financial and technical assistance from CFRAMP implememted projects to collect catch and landings information, morphological and some biological data on lobster, conch and some commercial species of finfish.

There has been a decline in the amount of financial and material resources within the unit, which had 5 staff members in FY 1995/1996. This has been accompanied by a steady decline in human resources. As a result, training received in the first 5 years has to a large extent not been passed on and much of the data and information gathered over that period has not been properly documented.

Nevertheless, a significant report was produced in March 1995. This report includes a background on the fishing industry, outlines the objectives of the program, describes the methodologies used for data collection, presents catch by fishing area and landing sites for commercial species for 1994. Included are commercial finfish landing and estimates on the commercial value of the fishery (Richards, 1994).

Other work undertaken under the auspices of CFRAMP included research on the Industrial Trawl Fishery of Belize. Information was obtained on the fleet; fishing grounds, landing sites, catch composition and landing procedures, which serves as a base for any further research. Also a conch abundance survey conducted in 1996 revealed vital information on this fishery, for example, that marine reserves even when small can have a significant beneficial impact. It is envisaged that results of that information along with the results of a second survey will be used to develop new management measures. The Puerulus Settlement Monitoring Program was implemented and two of its objectives were achieved (Appendix 3 - data sheets). Suitable sites for setting the collectors were identified and a decision was made on the most viable one for Belize based on its efficiency and cost.

The Licensing and Registration System (LRS) was implemented in 1998 and has yielded many benefits for the administration of the fishing industry. Prior to the implementation of the LRS fishermen were already being licensed but there were many loopholes that resulted in accountability problems. Overall the program has met its objectives and will become completely successful after some hardware and software constraints are addressed.

Basic information required for fishery management decision–making were obtained, however because of the inconsistency in data collection it is suggested that the information should not be used yet to make important broad-based decisisons. For example, trend in the lobster catches for all areas indicate that the fishery is comprised of one lobster stock. Also there seems to be two peak seasons for lobster: one from June – August and the other from November – January.

Observation of the conch fishery indicate that in most of the areas there is a gradual decline in catch from October at the opening of the season to December, at which point there is a gradual rise and a peak of catch in the February – May period.

In conclusion it can be stated that although the Department is faced with many constraints it has critical data that can compliment further data that should be collected through a robust data collection program. This program would then provide adequate information for the formulation of policies and management measures.

7. PRESENT CATCH AND EFFORT DATA SYSTEMS

The Belize Data Collection Plan (BDCP) was developed along two paths:

Firstly, it was based on needs identified by the Belize Fisheries Department. Based on the current data set it was realized that there was a need for a more comprehensive and accurate data collection program. The then data set only included catch from the cooperatives (which indicates pounds of landed fishery produce). It had no component of domestic consumption, which is very important for a holistic view of the exploitation of the different fisheries.

Secondly it was developed taking into consideration the requirements of CFRAMP's stock Assessment sub-projects, especially in vew of the fact that those requirements were very similar to Belize's own objectives in upgrading and expanding the then current BDCP.

The BDCP also had to take into consideration the geographic location of the different fishing grounds along the coastline of Belize.

The data collection program has an existing sampling regime that determines the method of data collection. Landing sites are divided into groups, each group having a particular sampling protocol.

7.1 The cooperatives

The procedure for data collection at these locations are as follows: fishermen come in to sell their produce to the coopeartive, the sale is recorded by a clerk who takes not merely catch information but detailed effort information as well. The purchase slips are then collected by the Department's Data Collector or the statistician and he transposes and compiles the data into monthly sets. This becomes the Department's hard-copy and from this hard-copy it is then computerized.

7.2 Market sites

Data collectors also conducted random sampling for catch and effort at market sites throughout the country. They are divided into two groups. Primary and secondary sampling sites.

Primary Sampling Sites are sampled three times per month. A complete day's landing is obtained on each sampled day.

The data collector in Belize City was responsible for all the sites except Punta Gorda. He was required to visit each site at least once a week. He rotates the days such that in a month he does not visit the site on the same day. This rotation was not done on a random basis, Public Servants don't work on weekends. The idea behind this type of convenience sampling was that, if the sample size is kept large enough and supplemented by anecdotal data, this becomes a known bias and can be included always so as to make it a constant in the data set. Vessels were stratified into fleets according to vessels type/target species/gear/ and area fished, then each fleet is sampled at the conveneience of the data collector i.e., if he finds it when he goes out. That is why on the days he does sampling at the market site he must get a census of the catch/effort information of that day. This isn't difficult since most of the market sites are only open half-day and the others are sites where only fish is sold and this is done for 4-5 hours in the late afteernoon.

Secondary Sampling Sites are done once or twice per month, hotels and resorts are done on a convenience basis.

The sampling regime for these sites are as follows. A day is chosen at random (Mon. – Fri.) and for the next five-week period the next consecutive day is utilized for sampling. e.g. if Monday was the day chosen, then the following week Tuesday would be the sample day etc. At the site sampling is done on every nth boat that comes in and since the entire landing period is monitored then a fairly standard sample is taken. This sampling approach also includes collecting of basic catch and effort information (Appendix 4) as well as some biological data (Appendix 5 and 6).

7.3 Strengths

- Secondary sampling sites are in Belize City and easily accessible.
- A very high number of fishermen belong to Fishermen Cooperatives especially the bigger ones located in Belize City.
- The Cooperatives sales records are available to the Department.

7.4 Weaknesses

- It is believed that fishermen are still not being honest about their actual effort.
- Some cooperatives ignore recording the effort data on the sheets consequently, assumptions have to be made.
- There is a need for logistical support to collect data.
- Only two Data Collectors collect data from all the landing sites.
- Data is not entered on a timely basis.

7.5 Sampling Schedule

Presently CPUE is being collected only for lobster. Sampling is carried out once a month by two Data Collectors. Data is collected at the two largest fishermen cooperatives located in Belize City. The other landing sites are in Placencia Village in the south of Belize and at Caye Caulker in the north. Data is collected from the six fishing zones from these landing sites.

7.6 Recommendations

- ✓ Cooperatives need to commit themselves in assisting the Government in obtaining data.
- ✓ More Data Collectors are needed.
- ✓ Financial and material support is needed if data collection should be consistent.
- ✓ Present data collectors need to be trained.
- ✓ Data collection regime presently being used is not accurate therefore information will not be reliable.

8. DATA MANAGEMENT

There has been a major constraint with data management due to administrative changes within the Fisheries Department over the last two years. However, the Ministry of Agriculture, Fisheries and Cooperatives is taking every step necessary to rectify this situation.

The TIP software being used is not Y2K compliant, therefore no further data has been inputted and the existing data needs cleaning. There is also a need to salvage usable data and to establish a reliable database.

Catch and effort data for fish, conch and lobster are stored in the TIP program. Backups are done after every month's entry. The LRS program is still functional and providing invaluable information.

8.1 Strengths

- The Cooperatives are facilitating the collection of historical catch-effort data for further analyses such as effort standardization. (Available series of CPUE are inconsistent.)

8.2 Weaknesses

- Presently Belize has no Data Manager.
- None of the two Data Collectors have formal training on how to use TIP.

8.3 Recommendations

✓ That Data Collectors be formally trained to use TIP, if it is continued to be used.

✓ The option of using a user-friendly database be explored.

9. DATA ANALYSIS

The administrative constraints and problems encountered have delayed analysis of data available. Nevertheless, preliminary analysis of series CPUE data for lobster was conducted this year with the assistance of a Cuban expert and results indicate that this resource is being fully exploited.

Once the constraints being faced by the Data Collection Unit are addressed, the analysis of existing compiled data will generate valuable information like development of fishing trends, landings by zones and size composition for catch by fishery.

9.1 Strengths

- There is enough compiled data which could generate invaluable information on especially lobster, conch and some fin-fish species.
- Once all information from the fishermen license application forms are entered on the LRS that information could be easily retreived for management purposes.

9.2 Weaknesses

- It is difficult to generate reports using TIP since it is not user friendly and it seems as though there is a problem with the software that nobody can rectify.

9.3 Recommendations

- ✓ A Data Manager is needed to oversee management of data collected.
- ✓ Hire a data entry technician to be fully responsible for data entry.

10. CONCLUSION AND RECOMMENDATIONS

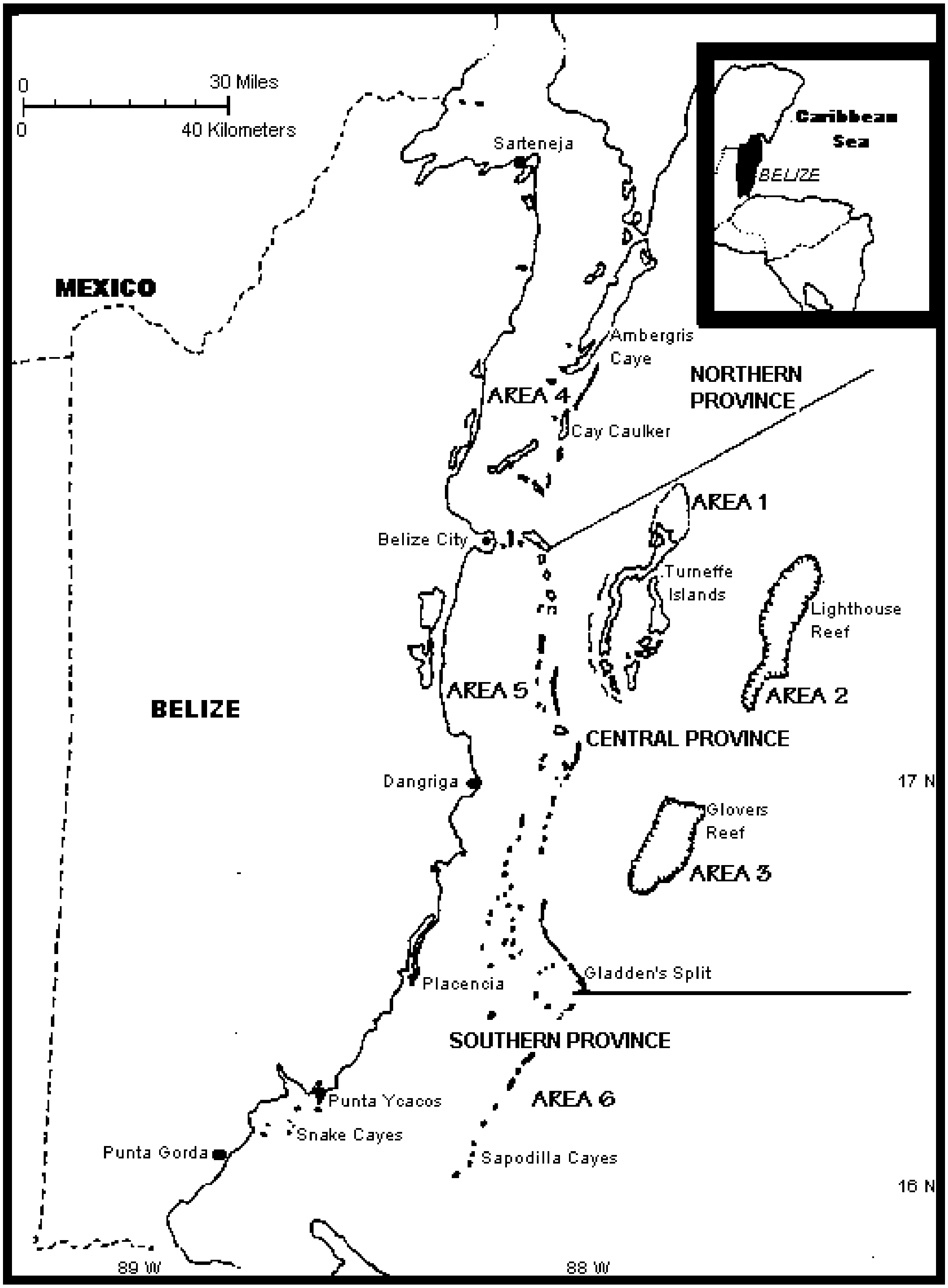
Belize is not yet at a crisis point in terms of our fish stock, however, it is imperative that an accurate and reliable database is established. This will ensure access to a solid information base which can be used for sustainable management decisions.

A robust data collection program is an integral component of the Fisheries Department Development Strategy for Capture Fisheries. Government recognizes that the Fisheries Subsector is very important to the economy of Belize and must make every effort to maintain its existence.

In the face of macro-economic policies to reduce public expenditure, the Department will embark in managing our fisheries resources in partnership with the primary users or fishermen. The data collection program will include the fishermen cooperatives in the collection of data.

It is recommended that additional staff be hired for the data collection unit and that the staff be trained in the relevant areas so as to enhance their capabilities to fully realize their work. Training should include basic and intermediate statistical modelling for fish stock assessment, computer programming and information management and strategic planning and policy formulation so as to enhance the fisheries management capabilities of the Department.

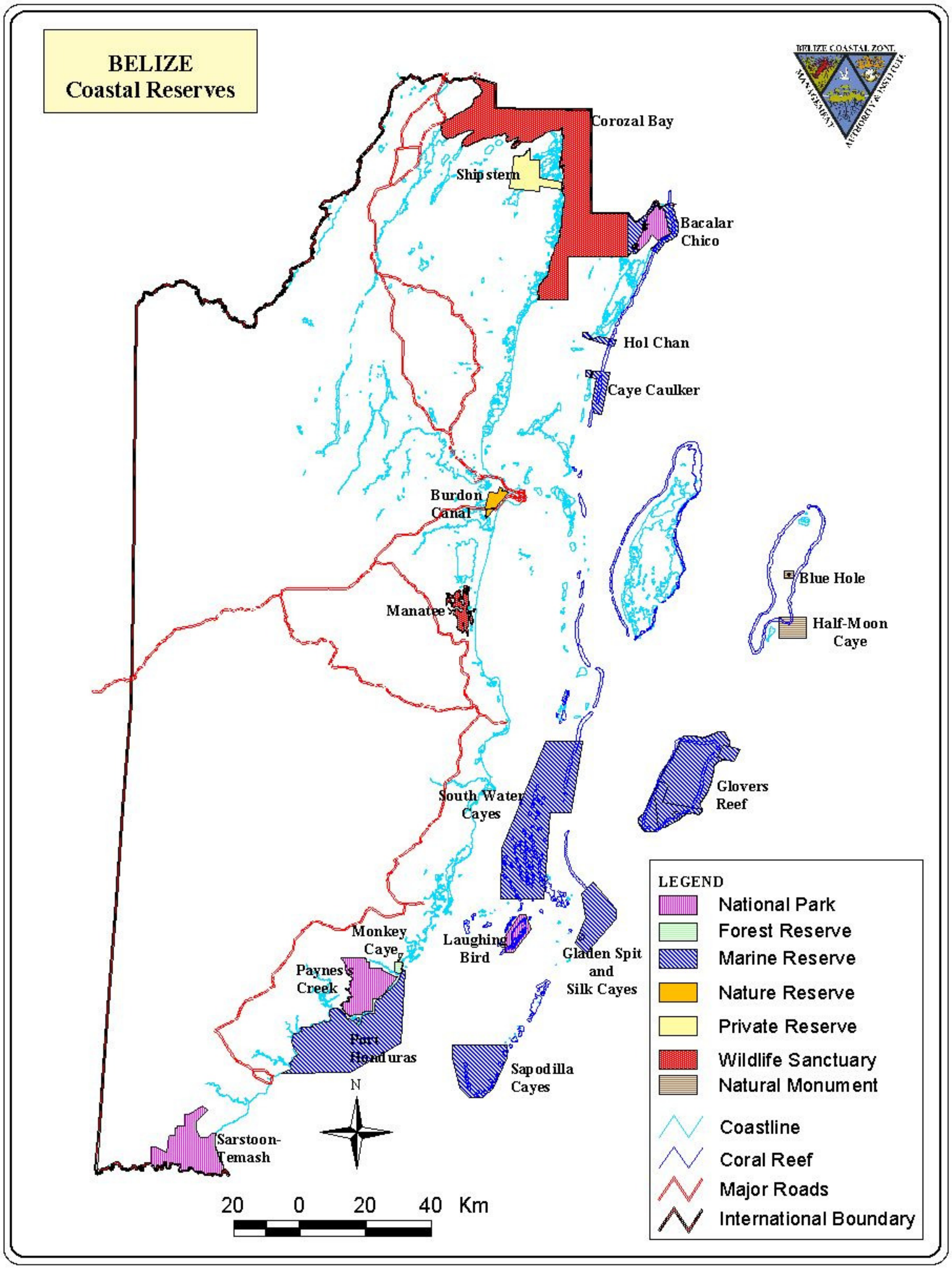
APPENDIX 1



MAP OF FISHING AREAS IN BELIZE

APPENDIX 2

BELIZE COASTAL RESERVES



APPENDIX 3
LOBSTER PUERULUS COLLECTOR DATA FORM

LOBSTER PUERULUS COLLECTOR STUDY

Date of Sampling: (month=)
Location:
GPS Readings:
Sampling Personnel:
Boat Captain:

Surface Water Temperature:
Salinity:
Wind Direction:
Est. Wind Speed:
Weather Conditions:

Type of Collector	Replicate	Collector ID #	# weeks out	# of Pueruli				# of Juveniles	Other Animals/Plants/ Comments
				I	II	III	Post - P		
Cuban	1								
	2								
	3								
Floridan	1								
	2								
	3								
Mexican	1								
	2								
	3								

Additional Comments:

Identification of Puerulus Stages:
Puerulus I : completely transparent; only eye pigmented
Puerulus II: light lateral pigmentation; body dorsoventrally flattened and transparent
Puerulus III: laterally pigmented (well-defined light brown colour); body depressed and transparent
Postpuerulus: undergone one moult, dark bands along sides; on appendages, dark bands are fragmented
Juvenile: undergone two or more moults; species colouration apparent

For data entry purposes only, codes are:
Site1=Gallow's Point 1, ..., 12 = calendar month
2=Hol Chan

Collector 1 = Cuban type
2 = Florida type
3 = Mexican type

APPENDIX 4

CATCH & EFFORT DATA FORM

LANDING SITE:	DATE:	DATA COLLECTOR:	WEATHER

LANDING NUMBER			
BOAT ID			
CREW NO.			
DATE/TIME - DEP			
DATE/TIME - RET			
AREA FISHED			
TIME FISHED			
GEAR			
HOURS PER GEAR			
NO. OF SETS/LINES			
UNITS OF GEAR			
DEPTH FISHED			
WGT. TYPE			
LANDING TYPE			

CATCH DATA BY SPECIES	SPECIES	WGT	LS	SPECIES	WGT	LS	SPECIES	WGT	LS

COMMENTS:

Codes:-
Weight Type - O = Observed; E = Estimated; F = Fisherman's Observation
Landing Type - IS = Incomplete Sorted; IU = Incomplete Unsorted;
CU = Complete Unsorted; CS = Complete Sorted.
Landed Status (LS) - G = Gutted; W = Whole; F = Fillet; H = Headless

APPENDIX 5
LOBSTER BIOLOGICAL DATA FORM

BELIZE BIOLOGICAL DATA COLLECTION - LOBSTER

LANDING SITE	DATE	DATA COLLECTOR

DATA ENTRY ONLY

Entered	Checked
Date	Date
By	By

Boat Name		*Panulirus argus / Panulirus guttatus (circle one)*	Fishing Gear (circle one)	FPOT LPOT GNET HOKA SCUB DIVE
Boat No.		*Caribbean spiny lobster / Spotted spiny lobster*		
Total Weight (circle one)	g kg lbs oz.	Area Fished (Fishing ground)	Weight type (circle one)	Whole Headed
Sample Weight (circle one)	g kg lbs oz.	Sample Type (circle one) SU LU LS		

Lobster Length & Maturity Data *record for species caught in same gear only*

Sex & Maturity: M F T D E S	Length - mm (circle one): TL CM SW	Sex & Maturity: M F T D E S	Length - mm (circle one): TL CM SW

Key to Codes (Form: 13/10/98)

1) Indicate recreational fishing boat by R
2) Weight: g=grams, kg=kilogrammes, lbs=pounds, oz=ounces
3) Sample Type: SU=[illegible], LU=landed unsorted, LS=landed sorted
4) Fishing gear: FPOT=Fish pot, LPOT=Lobster Trap, GNet=Gill Net, Hoka=Hooka, SCUB=SCUBA, DIVE=Skindiving
5) Measurement: CM= Carapace length, TL= Total tail length, SW= 2nd segment width
6) Whole = whole lobster landed, headed = tails landed
7) Sex & Maturity: M= Male, F = female, T= female with tar, D=female with orange eggs, E= female with brown eggs, S=female with scratched tar only

APPENDIX 6
CONCH BIOLOGICAL DATA FORM

BELIZE CONCH BIOLOGICAL DATA COLLECTION FORM
(Strombus gigas) - Sampling conch meats

LANDING SITE	DATE	DATA COLLECTOR

Data Entry Only

Entered	Checked
Date	Date
By	By

Boat No.		
Boat name		
Total Weight (circle one)		g kg oz. lbs
Sample Weight (circle one)		g kg oz. lbs

Area Fished (Fishing ground)	
Sample Type (circle one)	SU LU LS

Fishing Gear (circle one)	DIVE

For Reference Only

*Weight Type	UN PF PS PE PR

Weight		
Amount Weighed gm kg lbs oz.	Number of meats	Weight Type*

Weight		
Amount weighed g m kg lbs oz.	number of meats	Weight Type*

Key to Codes

1) Indicate recreational fishing boat by R
2) Weight: g = grams; kg = kilograms; lbs = pounds; oz = ounces
3) Sample Type: SU = uneorared at sea LU = landed unsorted LS = landed sorted
4) Fishing Gear: DIVE = Skindiving
5) Landed Status: UN = meat unprocessed, PF = meat 50% processed
PS = meat 65% processed, PE = meat 85% processed
PR = meat 100% processed.

Comments: ______________________________
____
____

(Form: 25/10/96)

BARBADOS

by

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1. INTRODUCTION

Barbados is the most easterly of the Caribbean Islands situated at approximately 13° 05' N; 59° 35' W. Total land area is around 432 km^2 with a 92 km coastline. Coastal shelf area is estimated at 320 km^2, with the 180m depth contour located at an average distance of 2.9 km from shore. In 1998 the size of the resident population was estimated at 266 800. In 1998, total GDP at factor cost was estimated at $3 925 million Bds. of which the fisheries sector contributed $23.5 million (0.6%). During the period 1978 to 1998, the fisheries sector contributed from 0.5% to 1.0% (mean 0.8%) annually to the GDP of the island. It has been estimated that 2,200 persons are employed in the fishing harvest sector and between 200-500 persons are employed in the post-harvest sector, mainly as vendors and processors (Barbados Fisheries Management Plan [BFMP], 1997).

1.1 FISHERIES POLICIES AND PLANS

The Barbados Government's current fisheries policies and plans for the period 1993-2000 were outlined in the island's national development plan of 1993. In summary, the plan described the further development of the local fishing industry as a "key objective" of national development policy, recognising the importance of the industry as a source of employment for many Barbadians and food security for the populace. Following is an extract of the specific objectives presented in the plan:

- Improving the quality of life of all persons involved in the fishing industry;
- Upgrading facilities at major landing sites throughout the island;
- Improving efficiency in the industry;
- Increasing the output of high quality fish to a sustainable level;
- Increasing exports of fish;
- Promoting enhanced protection of the marine environment

The following strategies will be pursued to achieve the above objectives:

- Intensification of efforts through the Fisheries Division to educate fishermen in the areas of fishing-gear technology, new fishing techniques, maintenance of boat engines, navigational techniques and safety practices. Seminars and workshops will be convened to cover these areas. Special fishing expeditions will be mounted to enable fishermen to gain hands-on experience in the use of new techniques.
- Training programmes in proper fish handling techniques will also be mounted.
- The strengthening of fisheries legislation so as to provide more effective support for the development of the industry and management of the fisheries resources. New regulations will be formulated with a

view to improving the provisions governing safety at sea, conservation and protection of the living marine resources and fish handling practices, as a follow-up to the new Fisheries Act.

- Provision of improved facilities for fishermen and vendors operating from Conset Bay, Skeete's Bay, Tent Bay, Six Men's, Speightstown and Read's Bay. The facilities will be provided on the Northwest coast to cater to the needs of the larger, long-line vessels, as well as day boats and ice boats.

- Intensification of the efforts of the Fisheries Division at helping fishermen to increase their catches; and continuation of research into the use of Fish Aggregating Devices (FADs). Additionally, the search for new fishing grounds, especially within Barbados' Exclusive Economic Zone will be intensified, with the waters stretching from the North-east to South-east of the island receiving special attention.

- New office accommodation and improved facilities and equipment will be provided for the staff of the Fisheries Division. Provisions will be made to enable the Division to obtain access to an appropriate fishing vessel, in order to undertake research and demonstration programmes.

- Mounting educational programmes to encourage consumers to use iced fish.
- Active and vibrant fishing associations and cooperatives will be promoted.
- The assessment and management of the country's fisheries resources remain a high priority. A project to assess the major fisheries resources to be exploited will be developed and implemented on the basis of these findings. A detailed plan for their exploitation and management will be formulated and implemented.
- The diversification of the country's fishing effort will be encouraged. In this connection, long-line fishing will be vigorously promoted in order to increase catches of larger pelagic species. The Fisheries Division will continue to assist fishermen in this area of activity.
- Government will seek to assist the fishing industry in upgrading fishing boats, constructing or purchasing long-liners and multi-purpose fishing vessels and purchasing improved fishing and safety equipment. It will also seek to assist boat owners in repairing and maintaining their boats; and to assist fish vendors in improving facilities for the storage and retailing of fish. Such assistance will also be used to cover the purchase and installation of safety equipment.
- In an effort to help improve the distribution of fish, retailers especially supermarkets and mini-markets located in controlled areas, will be encouraged to stock fish for sale to the public."

With the stated objectives of the national development plan as a basis, the first Management plan specifically for Barbadian fisheries was produced in 1997 following wide public consultation and review. The Barbados Fisheries Plan (FMP) contains the schemes for the management and development of fisheries in Barbados. The plan is subject to review and revision every three years and the review process of the 1997 plan is currently underway. The recommendations in an FMP may be used as the basis for the derivation of fisheries regulations to manage local fisheries.

1.2 FISHERIES RELATED LEGISLATION

The following text has mainly been extracted from the Barbados Fisheries Management Plan (1997) and Parker (2000a) and describes the major fisheries legislation presently existing in Barbados.

Since 1993 most of the legislation related to the management of the fisheries of Barbados have been consolidated into the Fisheries Act (1993). The Act is based on the OECS harmonized legislation and covers formulating and reviewing fisheries management and development schemes. It vests the Minister responsible for fisheries with the responsibility of making regulations relevant to the management of fisheries. The Act also establishes a Fisheries Advisory Committee (FAC) consisting of representatives of the harvest and post-harvest sectors of the fishing industry as well as government representatives. The role of the FAC is to advise the Minister on the development and management of the island's fisheries. Topics such as fisheries access agreements, local and foreign fishing licensing, sport fishing, registration of fishing vessels, construction and alteration of fishing vessels, fisheries research, fisheries enforcement and the obligation to supply information are included in the Act. Specification of conservation measures such as prohibiting the use of any explosive, poison or other noxious substance, closed seasons, gear restrictions, creation of marine reserves fall under the mandate of the Act.

The first suite of fisheries regulations under the Fisheries Act (1993) were enacted in the Fisheries (Management) Regulations(1998). These regulations are still in force. The specific regulations include mesh size restrictions for seine nets (3.81cm, stretched mesh, minimum size) and fish traps (3.18 cm at narrowest point), mandatory installation of escape panels and identification marks on fish traps, prohibiting the use of trammel nets and other entangling nets, prohibiting the capture of lobsters carrying eggs or removing the eggs from lobsters (scrubbing), prohibiting the capture, possession or sale of marine turtles, turtle eggs and turtle parts, banning the use of SCUBA for harvesting sea eggs, regulating the sea egg fishery through the designation of closed seasons and closed areas by the Minister responsible for fisheries, prohibiting landing tunas of less than 3.2 kg live weight; stipulating that aquatic flora or fish to be used for ornamental purposes may only be fished with the written permission of the Chief Fisheries Officer and stipulating that corals may not be damaged, destroyed or fished without the written permission of the Chief Fisheries Officer. The only regulation pertaining to the flying fish fishery in this first set of regulations is the restriction of the maximum length of gill nets to less than 2.5 km. As no local vessel uses this length of net, this regulation is really targeted at international fleets, none of which have been authorised to fish in Barbadian waters. The maximum penalty for breaking any of these regulations is a fine of $50,000 Bds and/or two years imprisonment. In 1998 a three-year (1998-2001) moratorium on the harvesting, sale and possession of the Barbadian white sea-egg *Tripnuestes ventricosus* was also imposed.

Barbados has established a 12 nautical mile territorial sea limit around the entire island and a 200 nautical mile exclusive economic zone (EEZ) off the eastern side of the island. Negotiations on the delimitation of EEZ boundaries around the other sides of the island where there is overlap with the EEZ's of the island's Caribbean neighbours are ongoing. The total potential extended maritime jurisdiction has been estimated at an area of around 48 800 km^2 (FAO). Foreign vessels may be legally allowed to fish in Barbadian waters via licensing by the Minister responsible for fisheries if a number of criteria are satisfied. However, surveillance within the island's maritime area is poor and there are several reports of illegal foreign fishing activities.

Registration and licensing of local commercial fishing vessels is free but mandatory. The vessel is first inspected for general sea-worthiness and must have on-board a suite of safety equipment and navigational gear. The list of gear requirements varies with the category of vessel.

Permission from the Chief Fisheries Officer must first be obtained before constructing or altering a fishing vessel. No duty or taxes are charged on inputs into the fishing industry including boat construction materials, engines, fishing gear, along with navigation, safety and communication equipment. Every person fishing commercially in Barbadian waters is expected to apply for a fisher's license. Fishing vessels are to be registered annually with the Division.

2. DESCRIPTION OF BARBADIAN FISHERIES

2.1 THE FISHING FLEET

The Barbadian fishing fleet may be divided into four basic hull designs. The smallest vessels are open dinghies, referred to locally as "moses" the other three types of decked vessels constitute the local pelagic fishing fleet. These include the "dayboats", "iceboats" and "longliners". In 1999 the Barbados commercial fishing fleet comprised a total of 845 vessels. There were 392 moses ranging in hull lengths from 8' to 38', typically propelled by either oars or by 5-75 HP out-board engines in the Barbadian fleet in 1999. Only around 13% of these vessels had wooden hulls. In 1999, there were 273 dayboats registered in the local fleet. The vessels were mainly wooden hulled (70%) ranging between 18' to 40', overall length and were propelled by 15 to 300 HP onboard engines. In 1999, 149 iceboats were registered in the fleet. These vessels were also mainly wooden hulled (70%) and ranged between 33' to 55' overall length and were propelled by 25 to 450 HP onboard engines. Only 5% of the 30 longliners registered in the Barbados fleet had wooden hulls. These vessels ranged in overall length from 38' to 90' and were propelled by 135 to 470 HP engines.

2.2 LOCAL COMMERCIAL FISHERIES

Barbados has a comparatively small island shelf (approximately 320 km^2). As a result most fishing effort has traditionally been focused on pelagic piscine species rather than demersal species. Following are synopses of the major local fisheries as defined in the Barbados FMP. Much of the text is taken directly from that document.

2.2.1 SHALLOW SHELF REEF FISHES.

This category includes demersal species. The families most commonly caught are the parrotfish (*Scaridae*), surgeonfish (Acanthuridae), grunts (Haemulidae), hinds (*Serranidae*) and triggerfishes (Balistidae). Squirrel-fishes (Holocentridae), moray eels (Muraenidae) and reef fishes are also occasionally taken along with lobsters (Palinuridae).

Mainly small, open, outboard-powered boats (moses) are used. Fishing is most intense during the period July - October when pelagics are scarce, but reef fishes are captured year round at some sites. Fish traps of various shapes (Z, A, S, and rectangular) and of various sizes are mainly used in the fishery. S-traps and rectangular traps are not common. Z-traps are prevalent on the south coast, and A-traps on the west. Hexagonal wire mesh 1.25 inch (3.25 cm) is most commonly used to make traps. The traps are often baited with macerated fish or black sea urchins (*Diadema antillarum*) and hauled every 2-3 days. Reef fishes are also caught on handlines, in seine nets and by spearfishing. Fishing may be conducted at various depths to a maximum of around 50 m. This type of fishing is restricted mainly to the sheltered coasts on the west and south of the island. For more information on the fish-trap fisheries of Barbados see Selliah (2000).

2.2.2 DEEP-SLOPE AND BANK REEF FISHES.

This category includes mainly the snappers such as the queen snapper *Etelis oculatus* (locally known as brims), large jacks and groupers. The jacks landed include the black jack (*Caranyx lugubris*), greater Amberjack (*Seiola dumerili*), horseeye jack (*Caranyx latus*) and the bar jack (*Caraynx ruber*). Dayboats are usually employed in this fishery. Queen snapper and vermilion snapper (*Rhomboplites aurorubens*) are usually taken on hand-lines. Fish pots (traps) are used to capture silk snapper (*Lutjanus vervanus*) and some vermilion snapper. Most of the catch is taken from July to October when the availability of large pelagics declines. Each vessel may have a crew of several fishers each tending a line. Snapper fishing is done around the island with large catches often landed at the Oistins fish market.

2.2.3 COASTAL PELAGICS.

Jacks (*Carangidae*), herrings (*Clupeidae*), silversides (*Atherinidae*), anchovies (*Engraulidae*), ballyhoo (*Hemiramphus spp*.), robins or scads (*Decapterus spp.),* barracuda (*Sphynaena spp*.), garfish, small tunas and the young of large tuna such as yellowfin (*Thunnus albacares*), may also be caught. Mainly "moses" and dayboats are employed in this fishery. Boat seines, cast nets, and trolling are used. Cast netting and seining takes place mainly on the south and west coasts. Trolling occurs on the same coasts along reef edges.

2.2.4 LARGE PELAGIC FISH.

This category includes tunas (*Scombroidei*), wahoo (*Acanthocybium solandri*), billfishes (*Istiophoridae*), dolphinfish (*Coryphaena hippurus*), swordfish (*Xiphias gladius*), mackerels (*Scombermorous spp.*) and occasionally shark (Elasmobranchii). The most commonly landed tuna is the yellowfin (*Thunnus albacares*) all of the large tunas are commonly referred to locally as albacore. Kingfish is the local name given to a number of fish such as wahoo (*Acanthocybium solandri*) and some mackerels (*Scombermorus spp).* Wahoo comprises the majority of the "kingfish" landed at Barbados. The billfishes landed at Barbados include the blue marlin (*Makaira nigricans*), the white marlin (*Tetrapturus albidus*) and the sailfish (*Istiophorus albidus*). Many species of shark are occasionally caught but the blue shark (*Prionace glauca*) is perhaps the most common species.

Mainly longliners and iceboats are employed in this fishery, however large pelagic catches are also taken by dayboats and occasionally moses. Most large pelagics, but mainly dolphin and wahoo, are usually harvested on the same dayboat and iceboat fishing trips, often together with flyingfish. Fishing methods include trolling and lurk-lining. With fishing range being proportional to size, local boats either fish within national waters and on the high seas amongst international fleets. The fish are mainly landed at the Bridgetown Fishing Complex. Some are also landed at Oistins and small quantities at secondary landing sites on the south and west coasts. Fish for trans-shipment is off-loaded at the Bridgetown Port. See Parker (2000a) for a more detailed description of the large pelagic fishery of Barbados.

2.2.5 FLYINGFISH.

The margined flyingfish, (*Hirundicthys affinis*) comprises the majority of the catch. The guineaman (*Cypselurus cyanopterus*) is occasionally taken while other species are too rare or small to be commercially important. The majority of the catch (86%) is taken by dayboats and iceboats. However, moses and longliners also land catches of flying fish. The fish are captured with surface gillnets, handlines and dipnets after being lured near boats with tethered fish-attracting devices (screelers) and chum. Bait baskets are also used to attract these fish. Flyingfish are landed at all sites except those on the east coast. Flyingfish are generally landed early in the afternoon by the dayboat fleet. Ice boats, which can stay out on fishing grounds for up to two weeks, tend to land their catch early on mornings. The fishing season extends from November to July, with a major peak in May and a minor peak in November/December. Of the 31 landing sites on the island, the two largest primary sites (Bridgetown and Oistins) account for over 60% of the total flyingfish landed. See Parker (2000b) for a more detailed review of the flying fish fishery of Barbados.

2.2.6 SEA URCHINS.

Of the species occurring locally, only the white spine sea urchin (*Tripneustes ventricosus*), commonly know as sea-eggs, is harvested. Sea-eggs occur all around Barbados. However, the main landing sites are located on the east and southeast coasts. Oistins, Silver Sands, Consett, Crane, Foul Bay, Long Bay, Martins Bay, Sam Lords, Skeetes Bay, Tent Bay and Bath. Stroud Bay on the northwest coast is also used. Sea-eggs are harvested close to shore by skin divers using mask, snorkel and fins. Fishers who swim out to the sea urchin ground will often carry a floating log, usually the trunk of the maypole (*Agave* sp.) from which bags of harvested urchins will be suspended until returning to shore. The sea urchins are removed from the seafloor by hand or with metal scrapers and collected in a net bag. When vessels are used, the launch is common, but the moses is also employed. The occasional ice-boat is also observed. Since 1998 it has been illegal to harvest sea-eggs with the assistance of SCUBA. See Mahon and Parker (1999) for a more detailed description of the Barbadian sea-egg fishery.

2.2.7 SEA TURTLES.

Hawksbill turtle (*Eretmochelys imbricata*), green turtle (*Chelonia mydas*) and the leatherback turtle (*Dermochelys coriacea*) are the three species seen in Barbadian waters. The green turtle only feeds in Barbados waters but the hawksbill and leatherback also nest on Barbadian beaches. A harvesting moratorium for all species has been in place since 1998.

2.2.8 LOBSTERS.

The Caribbean spiny lobster (*Panulirus argus*) is the most abundant of the four local species. The other three species are the spotted spiny lobster (*P. guttatus*), the smoothtail spiny lobster (*P. laevicauda*) and an unidentified species of slipper lobster. The latter two species are the most rare. Boats may or may not be used to transport and support divers using SCUBA. Lobsters may be caught in traps that are usually landed by moses, and occasionally dayboats. Lobsters are occasionally taken as by-catch in fish traps on the south coast. Lobsters are also taken by free or SCUBA diving using spears or gloves for capture along the east coast. Catches are potentially landed at any point around the island and are often taken directly to hotels so they do not often appear in public fish markets unless caught by trap.

2.3 TRENDS IN CATCH AND EFFORT.

Total annual recorded catches of fish landed at primary and secondary landing sites in Barbados over the last ten years are presented in figure 1. The graph clearly illustrates that the majority of total catches have been pelagic species markedly dominated by flying fish and dolphin. The graph also indicates that there has been a slight increase over the period in catches largely driven by increased catches of the dominant species of flying fish and dolphin.

Figure 2 illustrates the catch composition of each vessel type, based on landings records from secondary and primary sites. The graph illustrates that the vast majority of the catches of dayboats and iceboats are comprised of flyingfish followed by dolphin. For longliners, the catch composition is fairly evenly divided among the larger pelagics such as billfishes, tunas and dolphin. It is interesting to note that flyingfish constitute an almost equal proportion as the large pelagics just mentioned, of the longliner catches. It should be noted here that longliners engage in capturing flyingfish if hold space is available. Of course conventional gill nets are used from these vessels for capturing flyingfish and not the longline gear. With the exception of dolphin no other large pelagics constitute large proportions of catches by the other vessel types. In addition to the significant contributions of flyingfish and dolphin to the catches of moses the catches of these vessels also included significant proportions of pot-fish, carangids, snappers and other kinds of demersal fish.

Figure 3 illustrates a breakdown of the island's total recorded catch from secondary and primary sites by vessel type. The graph clearly illustrates that the vast majority of the large pelagics such as tunas, billfishes and swordfish are taken by the longliners. Iceboats take the majority of dolphin and wahoo, flyingfish and the broad category AOV. It should be noted that a large proportion of the category "AOV" is comprised of turpits, these fish are taken in deep waters. Although appreciable quantities of several of the categories of fish are taken by dayboats it is interesting to note it is only the snappers catch that is dominated by this type of vessel. The largest proportions of total catches of pot-fish and carangids are taken by the moses.

It is estimated that there are 2,200 fishers in Barbados. Around 80% of this number, are believed to be full-time fishers. Various recent studies have attempted to estimate the number of fishers involved in specific fisheries. For example it has recently been estimated that 96 fishers are actively involved in the fish trap fishery (Selliah, 2000) a decrease from the estimated number of 150 in 1983 (Wilson, 1983). An estimated 1100 fishers are believed to be involved in the flying-fish and associated pelagic fisheries (Parker, 2000a). In a recent survey, approximately 270 persons were identified as participants in the sea-egg fishery. This number includes both harvesters and persons involved in the processing and selling aspects of the fishery (Mahon and Almerigi, 1999). Note that the same fishers may be involved in different fisheries.

Based on the fisher registration data of the Fisheries Division, local fishing boat captains range in age from 20 to 80 years old (mean 51 years) while regular crew range from 21 to 80 years old (mean 41 years). Note that the accuracy of this age structure is limited by the fact that many local fishers have not actually registered with the Division. However, the data suggests that youth comprise a comparatively small proportion of the present fisher community. This accurately reflects the general perception of this demographic aspect of the Barbadian fishing industry.

The registered local commercial fishing fleet size and composition over the last ten years are presented in table 1. The values demonstrate that fleet size has increased over the last ten years with a notable increase in the number of long-line vessels occurring over the decade. It should be noted that the number of registered vessels for any year includes inactive and otherwise unaccounted for vessels. Vessels may be inactive for several reasons such as when awaiting sale, under repair or derelict. In 1999 fish landings were recorded for only 388 vessels and 444 in 1998. These figures are believed to more accurately reflect the numbers of vessels actively fishing during these years.

Table 1. Barbados commercial fishing fleet composition (1989-1999). Source: Fisheries Division.

Vessel type	Number of registered vessels by year										
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Moses	245	225	220	279	379	323	355	368	399	400	412
Launches	470	450	300	352	285	353	302	298	303	276	288
Iceboats	80	80	82	75	68	54	93	115	123	146	149
Longliners	?	?	?	?	10	10	13	19	22	25	30
Total	**785**	**755**	**602**	**706**	**742**	**740**	**763**	**800**	**847**	**847**	**879**

Figure 1. Total recorded weight of fish landed at primary and secondary sites in Barbados
(1989-1999)

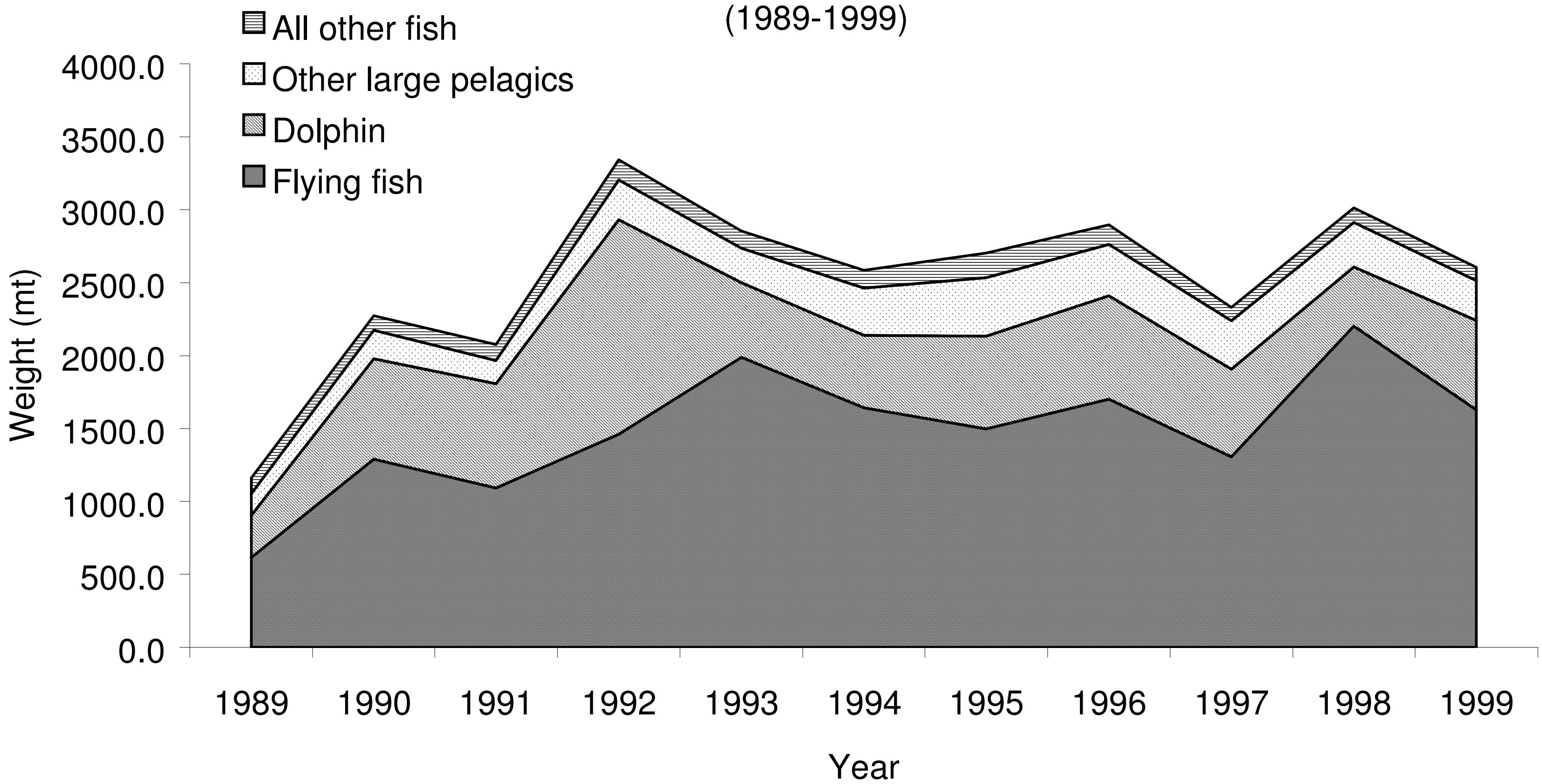


Figure 2. Catch compositon (%) of total recorded fish landings for each fishing vessel type in 1999

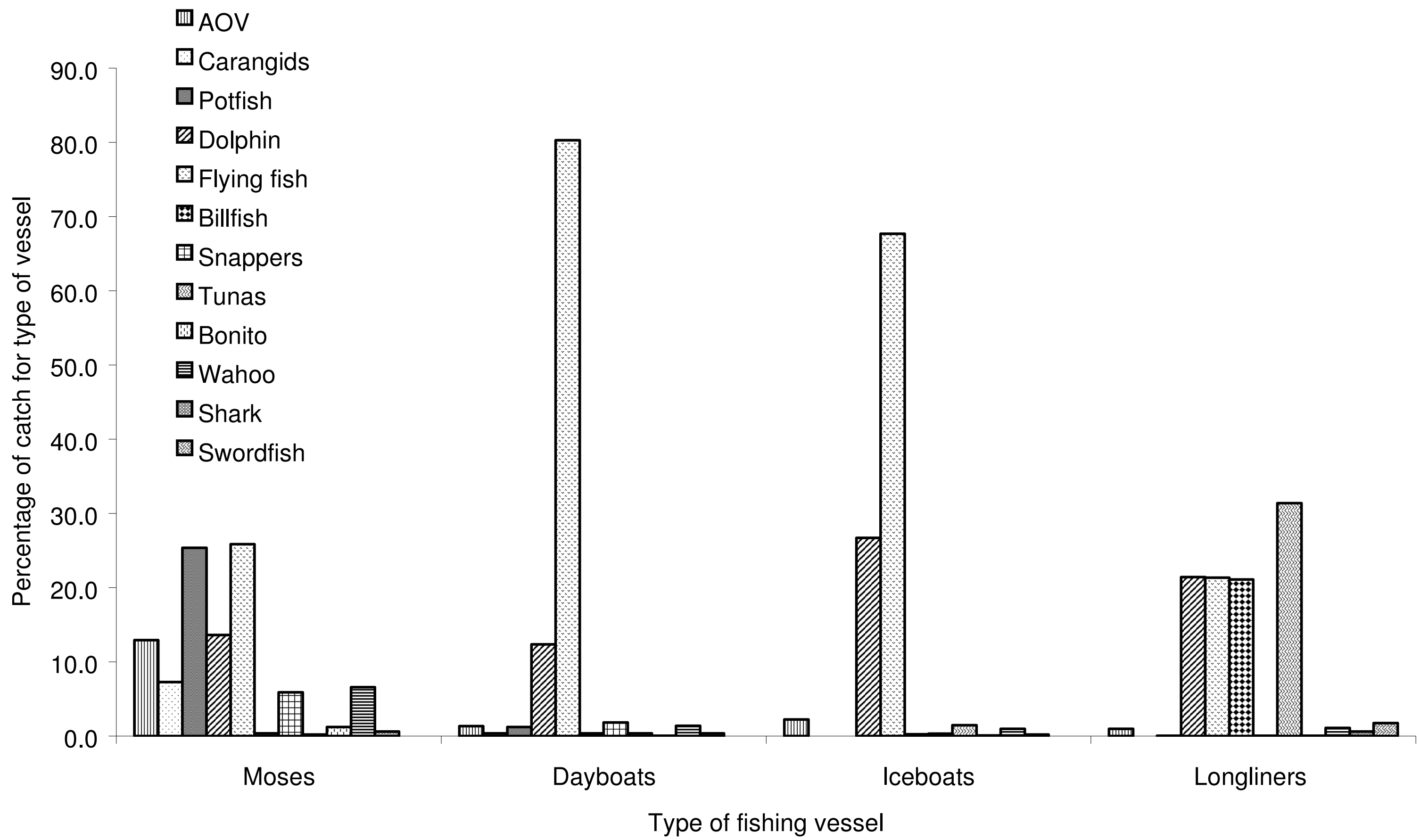
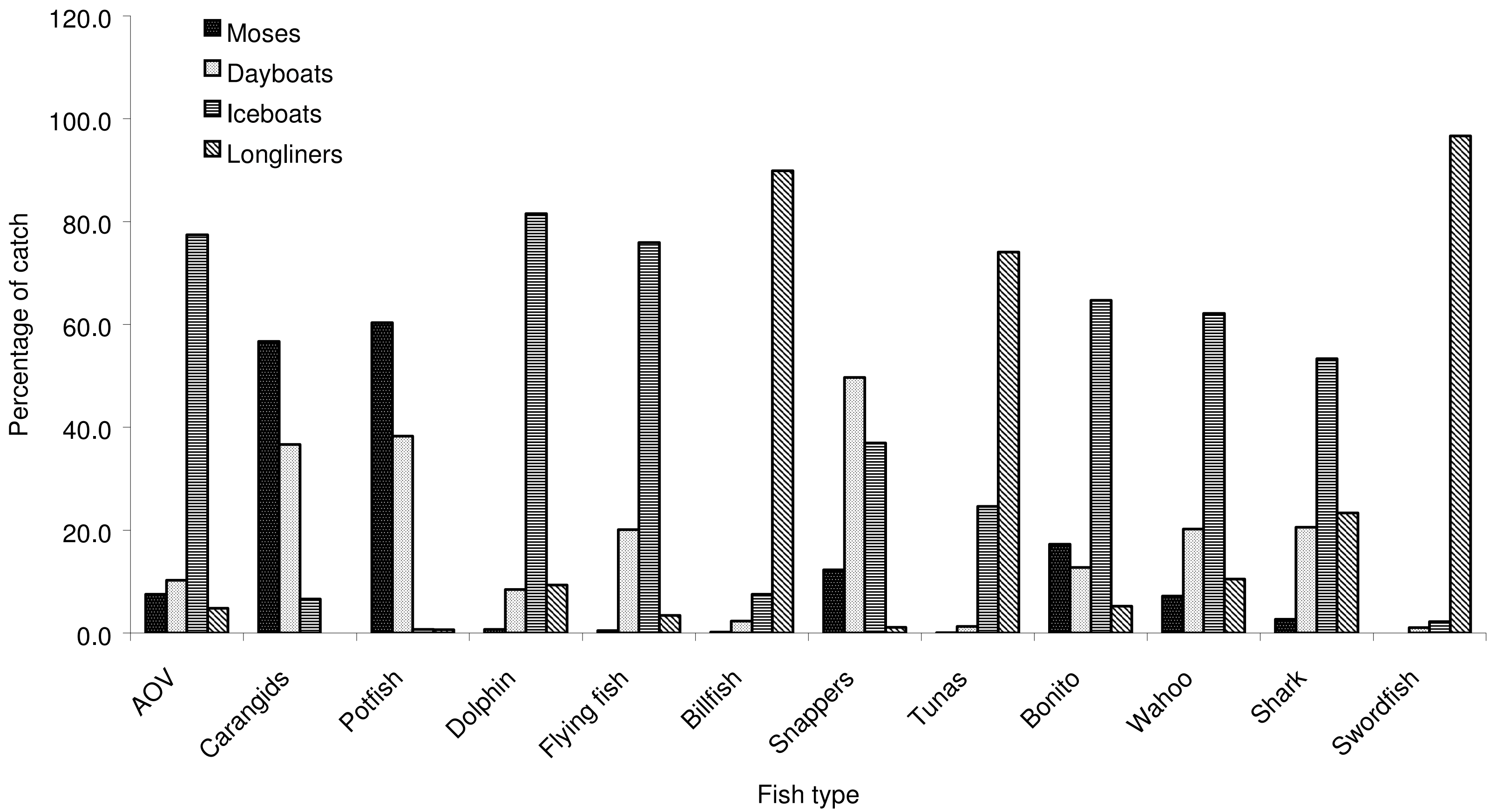


Figure 3. Percentage of total recorded catch of each fish type for the whole island by vessel type in 1999.



2.4 PRESENT STATUS OF THE FISHERIES.

The following information has been extracted from the Barbados fisheries management plan (1997):

2.4.1 SHALLOW-SHELF REEF FISHES.

The island shelf is the prescribed management unit for juveniles and adults but distribution may be wider for larvae due to dispersal via ocean currents. Some reefs, especially along the west and south coasts, are believed to be over-fished and fishers have reported reduced catch-per-unit effort and fish size. Enough scientific information is not available to determine potential yield. The need for co-management arrangements in the context of integrated coastal management is recognised by government to handle the complex issues involved in controlling this fishery.

2.4.2 DEEP-SLOPE AND BANK REEF FISHERIES.

Given the relative isolation of the Barbadian shelf from other island shelves, it is believed that local stocks that local stocks may be discrete and treated as island specific management units. It is believed that the resource is fully exploited in some areas, but not in others. Potential yield estimates for the island shelf range from 18 to 80 tonnes year^{-1}.

2.4.3 COASTAL PELAGICS.

The management unit is defined by the same criteria as for shallow-shelf reef fishes. The status of this resource is presently unknown.

2.4.4 LARGE PELAGICS.

The eastern Caribbean is considered to be the minimum management unit for these straddling stocks. ICCAT reports that many large tuna species are fully or over-exploited in the Atlantic Ocean in general. However, the status of most other tuna and tuna-like stocks in the regions of the western central Atlantic and Caribbean are unknown. It is believed that there is room for some expansion of the fishery. Within the area of Barbados it is believed that the potential yields are: yellow fin-767 MT, albacore-115 MT; bluefin tuna-19 MT; skipjack-223 MT; big-eye-182 MT (Singh-Renton and Neilson, 1994).

2.4.5 FLYING-FISH.

Tagging and genetic studies suggest the existence of a single discrete southeast Caribbean stock. Fluctuations in inter-annual abundances are observed and are believed to be the result of a combination of natural factors. The high probability of low recruitment at low stock size suggests that over-fishing in years of low abundance could cause stock collapse.

2.4.6 SEA-EGGS.

Discrete stocks are believed to exist on the Barbados shelf given its isolation from, and location upstream of the other islands. The stocks have been over-exploited and potential yield reliant on stock recovery is unknown.

2.4.7 SEA-TURTLES.

Management units vary with species but in all cases the unit is at least the wider Caribbean. All stocks are over-exploited and some are threatened with extinction. All sea-turtles require conservation.

2.4.8 LOBSTERS.

The level of stock discreteness is unknown. The island shelf may be used for the demersal juveniles and adults but interaction between regional stocks may occur via planktonic early life stages. Insufficient information is available on local stock size and precludes estimations of potential yield.

3. MANAGEMENT OBJECTIVES OF FISHERIES

The stated management policy and objectives for each of the fisheries under the Fisheries Management Plan (1997) are as follows:

3.1 SHALLOW-SHELF REEF FISHES

Reef fish populations must be rebuilt to satisfy demands by commercial fisheries and other recreational or tourism non-extractive uses, to maximise social and economic benefits.

3.2 DEEP-SLOPE AND BANK REEF FISHERIES.

Apply a precautionary approach to further develop this fishery to obtain an optimum and sustainable yield.

3.3 COASTAL PELAGICS.

Optimise catches of target species to be used as bait in other fisheries while minimising by-catches of reef species.

3.4 LARGE PELAGICS.

Maximise, within regional and international guidelines for conservation, catches of large pelagics taken by local and regional fishers by ensuring a fair and equitable distribution of the resources.

3.5 FLYING-FISH.

Establish a catch and effort regime that ensures long-term resource sustainability while minimising risks of social disruption caused by catch variability, in order to derive optimal economic and social benefits from the fishery.

3.6 SEA-EGGS.

Rebuild populations and establish co-management arrangement with fishers to sustain long term optimum yields for social and economic purposes.

3.7 SEA-TURTLES.

Promote the protection, conservation and recovery of sea-turtle populations.

3.8 LOBSTERS.

Promote the sustainable harvest of lobsters to satisfy the demands of the local population and tourism sector for maximum economic returns from the resource over the long-term.

4. HISTORY OF THE LOCAL DATA COLLECTION PROGRAMME.

To understand the data collection system for Barbadian fisheries that has developed over the years, it is first necessary to review the marketing system of Barbados. The following section includes extracts from Parker (1999 and 2000a) and provides an overview of the marketing system.

One of the first tasks undertaken by the Fisheries Division in 1944 was the upgrading of fish landing sites around the island. At that time fish were sold at several landing sites around the island's coast. As would be expected, certain sites became major marketing nodes largely driven by the concentration of the human population and thus potential buyers in the area. If a fisherman's home base was near enough, he would tend to land his larger catches at one of these major sites where the chance of selling them was comapratively greater. The three most important marketing centres were located at Bridgetown, Oistins and Speightsown where some crude infrastucture for the selling and processing of fish existed (Bair, 1962). Fish was also transported and sold by hawkers to areas within the island including other inland markets (Firchild Street and Eagle Hall) and households. Recognising the importance of improving the system of marketing fish, government erected fish marketing buildings in the three main towns: Cheapside (1946) in Bridgetown, Oistins (1950) and Speightstown (1954). In 1960 another market in the vicinity of Bridgetown was opened at Bay Street. The market buildings were all similar in their basic design and facilities.

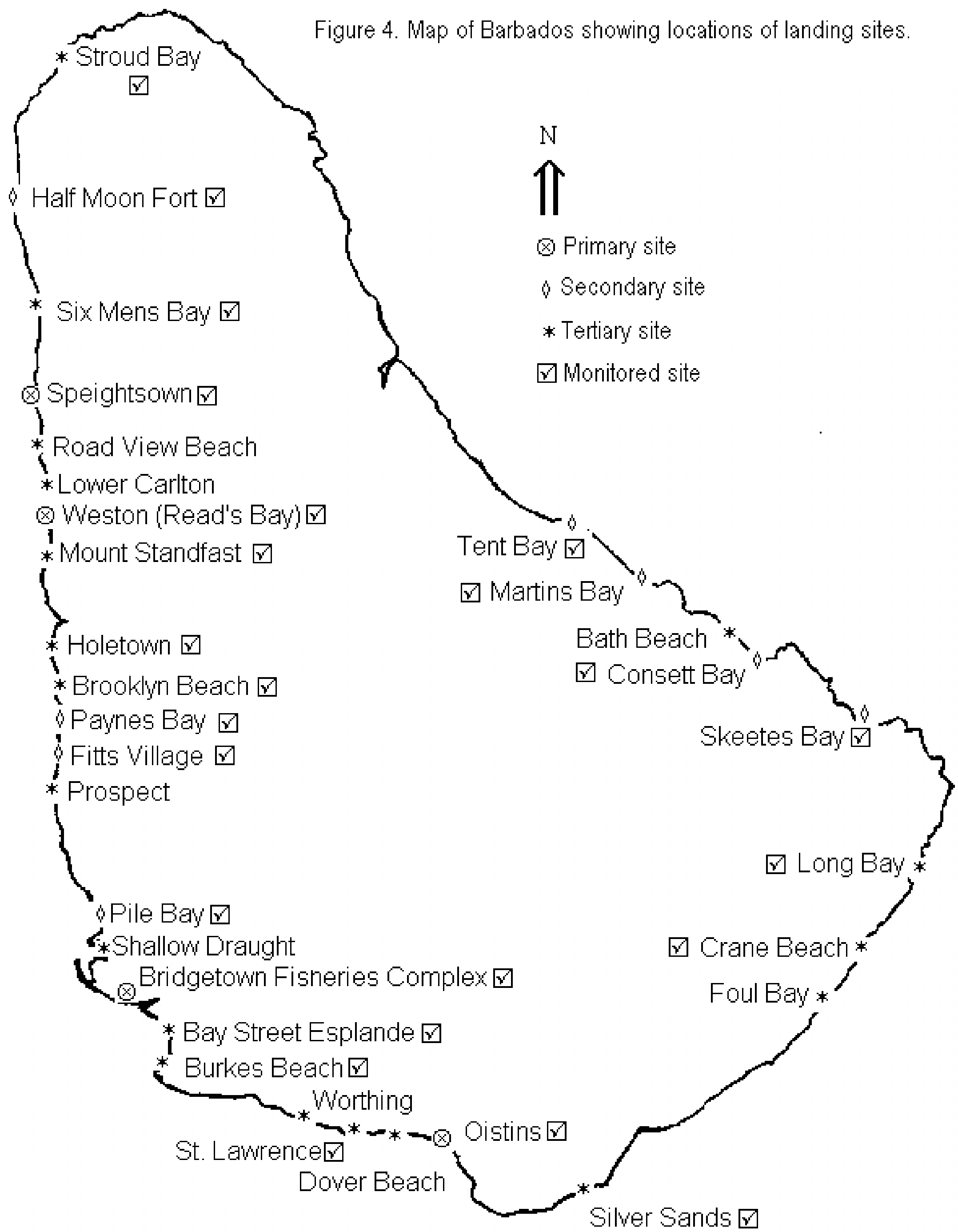
In addition, over a number of years, ten fish landing sheds were erected at some of the other more active fish landing areas namely, Consett Bay, Skeetes Bay, Tent Bay, Paynes Bay, Martins Bay, Half Moon Fort, Holetown, Reads Bay, Fitts Village and Pile Bay. These sites became known as secondary landing sites. The sheds offered basic facilities including a shelter, a concrete slab for cutting and boning fish and running water. Finally, there were also a number of other areas around the island where, despite the absence of any permanent, physical infrastructure, fish continued to be landed and sold. Largely these sites were simply the home bases of some of the fishers. These sites are now referred to as tertiary landing sites. See figure 4 for the locations of fish landing sites around Barbados.

Although the overall list of fish landing locations around the island has remained more or less the same over the last fifty years, several infra-structural changes have occurred at several of the sites during this period. For example, the old market buildings at Oistins and Cheapside were replaced by the much larger and improved Oistins Fisheries Complex (1983) and Bridgetown Fisheries Complex (BFC) (1989), respectively. The secondary landing site at Reads Bay was upgraded to a primary site with the construction of the Weston fish market in 1997 and the Bay Street market was closed shortly after the opening of the BFC. The secondary landing sites at Fitts Village, Paynes Bay and Martins Bay are used much less for the marketing of fish and are no longer staffed by caretakers. On the otherhand, the quantity of fish landed and sold at the tertiary site at Six Mens has increased substantially over the last years warranting the stationing of a caretaker at that site.

A programme of upgrading fish landing and marketing facilities at sites around the island is continuing through the present time. Within the last year new small market buildings have replaced the rundown fish sheds located at two rural sites (Skeetes Bay and Consett Bay). A major modern marketing complex is shortly to be constructed at a site in the northwest of the island. It is envisaged that these improved facilities will have the effect of further aggregating fish landings as the Oistins complex and BFC have done. To demonstrate this trend, in 1999, the majority of fish were landed at the BFC (72.4%) with the second largest portion of the catch being landed at Oistins (18.8%). The average proportion of the catch for each shed was under 2%. These infra-structural improvements form part of the government's plans to improve fish handling and processing standards on the island. An added advantage will be improved recording of catches for pelagic fisheries in particular.

In addition to the physical infra-structural differences between the three categories of landing sites on the island, there are significant differences in both the staffing and marketing operations at the sites. The first major difference is that there is no official management of landing and marketing operations at the tertiary landing sites. The responsibilities of managing fish markets were passed to the Markets Division immediately after the markets first began operations in the 1950's. These markets required more staff than were needed at the sheds. The Fisheries Division retained the responsibilities of managing the fish sheds. Usually someone living in the vicinity of the shed was appointed as caretaker.

Figure 4. Map of Barbados showing locations of landing sites.



Fish landings have been recorded at the island's markets since the early 1950's. Tolls are paid based on the quantity and types of fish landed at the market (Appendix 1). At the market, fish are placed into broad taxonomic groupings and weighed for the calculation of the tolls payable. In the case of flying fish, the number of fish is estimated and the weight calculated by the formula 3 flying fish = 1lb. The weights of fish within each group are recorded in toll books. At the end of each day, the weights of each fish group are totalled and this information, along with the number of boats that landed fish on the day is reported on standardised data summary sheets (Appendix 2). The summarised data is then submitted to the Fisheries Division at the end of the month. In addition to fish landings the prices received at the market for each type of fish are recorded and periodically forwarded to the Fisheries Division (Appendix 3).

Fishermen are not required to pay tolls for the use of the fish shed. However, it is part of the responsibilities of the caretaker to record fish landings. For this purpose, the Division provides a hanging scale at each secondary site. Summarised fish landing statistics are recorded on standard data summary sheets and periodically submitted to the Fisheries Division.

The summarised fish landing statistics are useful in assessing some of the economic aspects of the fishing industry (for example calculation of the industry's contribution to GDP etc.). However, the only measures of fishing effort recorded are, the numbers of boats landing fish and the number of days that fish were landed. Note that neither the number of unsuccessful fishing trips, unsuccessful fishing days nor the number of days spent fishing on multi-day fishing trips are recorded. Historically, these data are also rendered less useful by the fact that the types of fishing vessels landing the fish were not originally recorded.

5. PRESENT CATCH AND EFFORT DATA SYSTEMS

The format of the data summary sheet was changed in 1981 in an effort to improve the accuracy and usefulness of the data collected for fisheries management purposes. Improvements included changing the group headings to better define the fish species to be included and separating the boats into the categories of launches and dinghies (moses). When iceboats were introduced, some market keepers also reported them in separate columns.

The quality of fish landings statistics was greatly improved under the CFRAMP programme that started in Barbados in 1993. A key feature of the improved data collection programme was the addition of data collectors and a data entry operator to the staff of the Fisheries Division. The main duties of the data collectors were to:

(1) Obtain estimates of the quantities and types of fish landed at tertiary sites through regular, scheduled visits to the sites. The sites are visited on a rotational basis for the collection of catch and effort data. See figure 4 for the thirteen tertiary sites currently routinely visited. Note that at the start of the programme an additional twelve sites were visited but these were subsequently removed from the roster as the level of fishing activity at these sites was too low to be worth monitoring.

(2) To gather basic morphometric data (Appendix 4 & 5) on certain key fish species and to gather more detailed information on fishing operations (e.g. types of gear used to catch the fish, length of fishing trip, approximate location of fishing activities, etc.). The original number of fish species for which this information was collected has been greatly reduced over the years. Currently this information is only collected for the yellowfin tuna, dolphin and

wahoo, three of the most commercially important fish species to Barbados at present. Most of this data is collected from the main markets, the BFC and Oistins.

6. DATA MANAGEMENT

The data entry operator is in charge of the computerised recording of all fisheries data and fisher registration data. Catch and effort as well as biological information of the fish is recorded in the Trip Interview Programme (TIP). Toll book records continue to be the main sources of fish landing data collected from the markets and these records are entered directly into TIP. The landings records are periodically backed-up on 3 ¼ " floppy disks during the course of the year while the active database is retained for continual updating on a computer operated exclusively by the data entry operator. At the end of each calendar year the TIP database is closed and copies backed up on floppy disks, the hard drive of the data entry operator's computer, the network server and magnetic tape.

Vessel information (type, length, engine power etc.) is first recorded by fishing boat inspectors in the field. The information is then transferred to a card filing system. One of the inspectors is charged with the responsibility of inputting the data in the Licensing and Registration System (LRS). The data entry operator also retains copies of the registration database, but the active database is maintained and updated by the vessel inspectorate on a separate computer. All computers within the division are connected to a network running with the Windows NT operating system. Annual archiving of the LRS database was only started in 1999. As a result only a few archived LRS databases for previous years are available.

By integration of the two databases (from TIP and LRS), a variety of useful information relevant to fisheries management can potentially be obtained. For example, catch per unit effort data may be obtained for specific vessels, vessel types, vessel size, engine power etc. The data collector regularly produces monthly, quarterly and annual summary statistics of fish landings by fish type, site and month. These reports are distributed to relevant government agencies. Special summary reports may also be generated.

While the TIP system is well designed for its function of storing fisheries data, it is a very difficult programme to master. This results in a heavy dependence on the skill and time of the data collector to extract the information required by officers not *au fait* with the operation of the programme. This becomes a major problem when time is a critical factor or when the data operator is not available. It is therefore, strongly recommended that the programme be restructured to be made more user friendly.

Another in-house data management problem is the former bad practise of not regularly archiving the vessel registration databases. Without corresponding LRS databases for past years of TIP landings data, the latter database can only be linked to the current LRS database. In Barbados vessel registration numbers are reissued for a number of reasons, for example after the owner has failed to register it for a number of years or the ownership has changed etc. As such, different types of vessels may have carried the same registration number over the years. Therefore linking the archived landings database with the current LRS data-base often gives some very erroneous values that can only be corrected by consulting the card filing system and making the appropriate changes to the registration data. While this operation has been performed on the databases for some years, a concerted effort is now being made to accurately rebuild the registration information databases for each year since 1993, based on the information from the card filing system.

7. DATA ANALYSIS

Apart from the recent assessment of the status of eastern Caribbean dolphin and wahoo stocks, no other major stock assessments have been performed using the local fisheries databases. The information has so far been mainly summarised as described before and presented in ways that are more useful for general and economic descriptions and analyses of the fisheries than for stock assessment purposes. Therefore, the potential usefulness of this information in the management of key fisheries has not yet been fully realised.

For a number of years total fish catches have been estimated for the whole island by raising the total recorded landings at primary and secondary sites by a factor of around 3. The rationale for this value is still unclear. With the improvements in landing facilities and the consequent increased use of these improved landing sites at which landings are more systematically recorded, it was decided that the coverage of total landings was much greater than 33% of the total and the raising factor was decreased to 1.2 from 1997. A more systematic formula for calculating annual raising factors that includes estimates of landings from tertiary sites should be worked out in time for the summary of the year 2000’s data set. However, while it is potentially simpler to institute such a system in the future, values calculated by the new system are likely to differ from those that would have been calculated by the older systems. Retroactively calculating estimated landings based on respective annual raising factors calculated by the new formula to allow for accurate inter-annual comparability will be a major challenge.

The final major deficiency in the local system of collecting and recording fisheries statistics is the lack of effort data such as the number of fishing trips per year, gear soak time etc. While overall estimates of such information has in the past, and can be obtained via the interview process, it would be better for such information to be gathered on a more regular and systematic basis. The best method for doing this is through the use of a logbook filled in by fishers. A draft format for a logbook has been developed by the Fisheries Division in association with CFRAMP and is awaiting trial use by fishers. However, in reality it is unlikely that most local fishers will be inclined to use such logbooks if not legally required to do so. Upon introduction, a monitoring system will also have to be devised to validate the information being supplied.

At present the time series of local fish landings collected using the data collection and management systems developed under the CFRAMP programme is probably too short to allow much meaningful trend based analyses to be conducted on fish stocks, given the appreciable inter-annual variation in catch sizes, perhaps reflecting stock sizes, which is a characteristic of the most important target species. While the archived card vessels’ registration system at the Fisheries Division can be used to identify what type of vessel bore a particular registration number in past years, many of the toll books and ledgers in which the catch records for individual vessels were recorded at the landing sites in the past have been lost. Without this information, it is impossible to link fish catches to vessel type, therefore losing even this level of assessing fishing effort. However, a project is currently underway to track the catches of a number of specific day-boats over the last based on landings recorded in ledgers that still survive at the Oistins Fishing

Complex. From this study a longer time series of fish landings per a more standardised level of fishing effort may be obtained for analyses.

8. RECOMMENDATIONS

1. Continue to improve landing and marketing facilities where data collection systems are already in place or could be instituted. It is expected that most of the landing and marketing activities would become concentrated at the improved sites where necessary data can be collected. This is a more viable option than trying to collect data from several other spatially separated sites.

2. Continue to improve links with the fishing community to facilitate feedback on the status of fisheries. This is necessary to tap into the store of local knowledge that fishers have of the fisheries in which they participate. Such information is often important in assessing the status of fisheries and is often not captured by conventional routine data collection systems. The first people to notice changes in the status of a fishery are usually those who are directly involved in the fishery on a daily basis. Such prompt feedback to mangers enables quick responses to potential problems that may not be identified until much later via the longer processes of collecting and analysing scientific data.

3. Conduct more frequent social and economic studies of fisheries. It has been accurately stated that it is only possible to manage people and not fish. Despite this greater effort tends to be channelled into biological data collection rather than the collection of data and information on the human aspects of fisheries. The human social and economic aspects of fisheries are dynamic and should be assessed more frequently.

4. Increase the number of technical staff at the Fisheries Division.

5. Introduce more user-friendly databases to make data readily accessible by technical staff and policy-makers.

6. Continue to develop and promote interaction between fisheries managers within the region. This facilitates the sharing of information and ideas. This is especially important for the assessment and management of shared stocks.

9. REFERENCES

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APPENDIX 1

TOLL RECEIPT

F 3401 AUG 1 7 2000 B.F.C.2
BARBADOS .... 19 ....

BRIDGETOWN PUBLIC MARKET (FISH) TOLL

BOAT FA·FA· ES4

			$	C.
	kgs.	Flying Fish		
	"	Dolphin		
	"	King Fish		
	"	Shark		
	"	Tuna eg. "Albacore"		
	"	Bill Fish		
33	"	Brims (Queen Snapper)	1	98
	"	Other Snappers		
	"	A. O. Deep Water Species		
	"	Jacks		
	"	Cavalty (Crevalle Jack)		
	"	Bonito		
	"	Inshore Pot Fish		
	"	Any Other Variety		
33 Kgs			1	98

RECEIVED from Mr Turton

the sum of One *dollars and*

ninety-eight *cents being toll paid on*

33 *kgs. of fish as allocated above.*

B G Hall

Senior Superintendent of Markets.

APPENDIX 2
PRIMARY SUMMARY SHEETS

MONTH June 19 2000 LOCATION Oistins Fishing complex RECORD KEEPER: Miss Sharon [illegible]

Date	No. of boats: Day boats	No. of boats: Ice boats	Pelagic species: Flying Fish	Pelagic species: Dolphin	Pelagic species: Kingfish	Pelagic species: Shark	Pelagic species: Tuna	Pelagic species: Bill Fish	Deepwater species: [illegible]	Deepwater species: Other Snappers	Deepwater species: Other Demersal	Jacks	Cavally	Bonito	[illegible]	[illegible]	Turpids			2000 Total Kgs
00-06-01	2	3	3084	745			80													3909
00-06-02	5	1	1614	451			38									12				2115
00-06-03	1	1	900	314																1214
00-06-04	2	0													97	23				120
00-06-05	1	3	5167	840													500			6507
00-06-06	0	0																		—
00-06-07	3	7	1350	284	15												200			1049
00-06-08	1	3	2625	680	23	34	15													3377
00-06-09	3	1		147	79															226
00-06-10	2	0			24									23						47
00-06-11	1	0												36						36
00-06-12	0	1	625	370																995
00-06-13	1	3	1200	906		10	26							43			400			2575
00-06-14	1	0		16																16
00-06-15	1	1	300	132					24											456
00-06-16	2	0		46	28									58						132
00-06-17	0	0																		—
00-06-18	2	0		37												25				62
00-06-19	0	1	900	153		10														1063
00-06-20	2	1	1350	238			58									14				1660
00-06-21	1	0	28	40																68
00-06-22	0	1	2960	106																3066
00-06-23	1	1	1350	173		70	39									33				1605
00-06-24	1	1	550	155				15												720
00-06-25	4	0													198					108
00-06-26	1	3	3150	71		8	49									9				3307
00-06-27	1	1	1350	133	10															1493
00-06-28	0	1	1740	152																1892
00-06-29	1	0		10																10
00-06-30	0	1	1350	29																1379
			31563	6438	179	72	305	15	24					160	295	116	1200			40397 kgs

Fish Total	F5996 = 9000 / E3374 = 3369	2096 14
Dollars taken	C 5351 - 5807 = 14564.15	343 50
TOTAL		2380 [illegible]

APPENDIX 3
TERTIARY LANDING SITE DATA SHEET

Fisheries Landings Statistics **Field Data Sheet**

Mth	Day	Year

Date

Entered
Date
By

Checked
Date
By

12001

Landing Site ____________

Data Collector ____________

Landing Number							
Boat ID							
Time – Departed							
Time – Returned							
Area Fished							
Gear – Primary							
Gear – Secondary							
Number of sets							
Depth fished							
Weight type (O/G/F)							
CATCH BY SPECIES							
Flying fish							
Dolphin							
King fish							
Shark							
Tuna							
Albacore							
Bill fish							
Snapper							
Brim							
Jacks							
Cavally							
Bonito							
Swordfish							
Pot fish							
A O V							

COMMENTS

APPENDIX 4
SUMMARY BIOLOGICAL SHEET

CARICOM FISHERIES RESOURCE ASSESSMENT AND MANAGEMENT PROGRAM (CFRAMP)
BIOLOGICA DATA COLLECTION REPORTING FORM

COUNTRY: BARBADOS REPORTING PERIOD : to

1	**Fishing Ground Demarcation Exercise** *(indicate progress made and projection for conclusion of exercise)*				
2	**Species Information** *(indicate the total numbers of data collected for each species listed)*	Length Frequencies		Maturity	Otoliths
		L	I		
	Blackfin tuna (*Thunnus atlanticus*) LMA				
	Crevalle Jack (*Caranx hippos*) L				
	Dolphin (*Coryphaena hippurus*) L				
	King mackerel (*Scomberomorus cavalla*) LMA				
	Sailfish (*Istiophorus albicans*) L				
	Skipjack tuna (*Katsuwonus pelamis*) LM				
	Wahoo (Acanthocybium solandri) L				
	Yellowfin tuna (*Thunnus albacares*) LM				
	Mutton snapper (*Lutjanus analis*) L				
	Blackbar soldierfish (*Myripristis jacobus*) L				
	French grunt (*Haemulon flavolineatum*) L				
	Mahogany snapper (*Lutjanus mahogoni*) L				
	Red hind (*Epinephelus guttatus*) L				
	Stoplight parrotfish (*Sparisoma viride*) L				
	Yellowtail snapper (*Ocyurus chrysurus*) L				
	Queen snapper (*Etelis oculatus*) LMA				
	Southern red snapper (*Lutjanus purpureus*) L				
	Silk snapper (*Lutjanus vivanus*) LMA				
	Vermillion snapper (*Rhomboplites aurorubens*) L				
	Yellowfin grouper (*Mycteroperca venenosa*) L				
3	**General Logistics of Sampling** *Total number of biological sampling trips for period*				
	Total amount of days spent sampling				
	Indicate problems meeting data target				
	Reaction of fishermen to Biological Data Collectors				
4	**Funding** *Amount Transferred*				
	Period				
	Date first salary payment made				
	Balance in account for period ending July, 1995				
	Name of Biological Data Collector(s)				

APPENDIX 5
BIOLOGICAL DATA COLLECTION SHEET

CFRAMP LENGTH FREQUENCY DATA COLLECTION

LANDING SITE	DATE	DATA COLLECTOR

Data entry only

ENTERED	CHECKED
DATE	DATE
BY	BY

SCIENTIFIC NAME	SCIENTIFIC NAME	SCIENTIFIC NAME	SCIENTIFIC NAME
COMMON NAME	COMMON NAME	COMMON NAME	COMMON NAME
AREA FISHED (Fishing Ground)	AREA FISHED (Fishing Ground)	AREA FISHED (Fishing Ground)	AREA FISHED (Fishing Ground)
BOAT NUMBER / BOAT NAME	BOAT NUMBER / BOAT NAME	BOAT NUMBER / BOAT NAME	BOAT NUMBER / BOAT NAME
FISHING GEAR (circle one): FPOT HLIN TROL LLIN TRAL GNET BSNE SCUB	FISHING GEAR (circle one): FPOT HLIN TROL LLIN TRAL GNET BSNE SCUB	FISHING GEAR (circle one): FPOT HLIN TROL LLIN TRAL GNET BSNE SCUB	FISHING GEAR (circle one): FPOT HLIN TROL LLIN TRAL GNET BSNE SCUB
TOTAL WEIGHT (circle one): g kg lbs	TOTAL WEIGHT (circle one): g kg lbs	TOTAL WEIGHT (circle one): g kg lbs	TOTAL WEIGHT (circle one): g kg lbs
SAMPLE WEIGHT (circle one): g kg lbs	SAMPLE WEIGHT (circle one): g kg lbs	SAMPLE WEIGHT (circle one): g kg lbs	SAMPLE WEIGHT (circle one): g kg lbs
LANDED STATUS (circle one): W H G	LANDED STATUS (circle one): W H G	LANDED STATUS (circle one): W H G	LANDED STATUS (circle one): W H G
SAMPLE TYPE (circle one): SU LU LS (*)	SAMPLE TYPE (circle one): SU LU LS (*)	SAMPLE TYPE (circle one): SU LU LS (*)	SAMPLE TYPE (circle one): SU LU LS (*)
LENGTH TYPE (circle one): Fork Total	LENGTH TYPE (circle one): Fork Total	LENGTH TYPE (circle one): Fork Total	LENGTH TYPE (circle one): Fork Total
LENGTH (cm only) *record length frequencies for species caught in the same gear only*	LENGTH (cm only) *record length frequencies for species caught in the same gear only*	LENGTH (cm only) *record length frequencies for species caught in the same gear only*	LENGTH (cm only) *record length frequencies for species caught in the same gear only*

MEASUREMENT	COUNT	TOTAL	MEASUREMENT	COUNT	TOTAL	MEASUREMENT	COUNT	TOTAL	MEASUREMENT	COUNT	TOTAL

FISHERIES DEVELOPMENT DIVISION

DAILY CATCH AND EFFORT FORM

Landing site: ______________________ Collector: ______________________ Date: ____________

KEY: Gear Types; POTS - Pots, BSNE - Beach Seine, GNET - Gillnet, F/F - Flying Fish Net, DNET - Dip qet
TROL - Trolling, BLIN - Bottom Longline, SLIN - Longline or Surface Longline
CNET - Cast Net, OT - Others

Boat type; CANO - Canoe, Keel - Dory, O - Other, FRP - Fibreglass

Boats fishing but not sampled

Trip type	*Demersal*	*Pelagic*	*Lobster*	*Conch*	*Seine*	*Total*
Canoes (CANO)						
Keel (DORY)						
FRP (FRP)						

TOTAL BOATS LANDED ____________

Boat Sampled (Boat type & Registration No.	DEMERSAL											PELAGIC																							OTHER				Total catch	Trip/ gear type	Area Fished	Hours fished	Motorized Fuel	
	Snapper	Grouper	Parrotfish	Squirrelfish	Grunts	Triggerfish						Tuna	Yellowfin	Skipjack	Blackfin	Kingfish	Wahoo	Kingmackerel	Dolphin fish	Barracuda	Jacks	Flying fish	Ballyhoo	Sprats	Black durgon	Bill fish					Shark	CONCH	Lobster	TURTLE										
TOTAL																																												

Remarks ______________________ Catch is made up of ____________ % ____________ Species ______________________

____
Signature of Observer.

FISHERIES DEVELOPMENT DIVISION

DAILY CATCH AND EFFORT FORM

Landing site: ______________________ Collector: ______________________ Date: ____________

KEY: Gear Types; POTS - Pots, BSNE - Beach Seine, GNET - Gillnet, F/F - Flying Fish Net, DNET - Dip qet
TROL - Trolling, BLIN - Bottom Longline, SLIN - Longline or Surface Longline
CNET - Cast Net, OT - Others

Boat type; CANO - Canoe, Keel - Dory, O - Other, FRP - Fibreglass

Boats fishing but not sampled

Trip type	*Demersal*	*Pelagic*	*Lobster*	*Conch*	*Seine*	*Total*
Canoes (CANO)						
Keel (DORY)						
FRP (FRP)						

TOTAL BOATS LANDED ☐

Boat Sampled (Boat type & Regis-tration No.	DEMERSAL										PELAGIC																						OTHER				Total catch	Trip/gear type	Area Fished	Hours fished	Motorized Fuel	
	Snapper	Grouper	Parrotfish	Squirrelfish	Grunts	Triggerfish					Tura	Yellowfin	Skipjack	Blackfin	Kingfish	Wahoo	Kingmackerel	Dolphin fish	Barracuda	Jacks	Flying fish	Ballyhoo	Sprats	Black durgon	Bill fish				Shark	CONCH	Lobster	TURTLE										
TOTAL																																										

Remarks ______________________ Catch is made up of ____________ % ____________ Species ______________________

____
Signature of Observer.

DOMINICAN REPUBLIC

by

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1. INTRODUCTION

The Dominican Republic shares the island of Hispaniola (the second largest island on the Antilles) with Haiti and occupies the eastern portion of this volcanic island. There is a border of 388 Km between the two islands that was established in a series of treaties, the most recent of which was the 1936 Protocol of Revision of the Frontier Treaty of 1929. The Dominican Republic is shaped in the form of an irregular triangle. The short side of the triangle is 388 km long, while the two long sides form 1,575 km of coastline along the Atlantic Ocean, the Caribbean Sea and the Mona Passage. The total area of the country is approximately 48, 442 square kilometers. Dominican Republic is bordered by the Atlantic Ocean to the North, the Caribbean to the South, Haiti to the West, and separated from Puerto Rico by the Mona Passage to the east (Appendix 1).

Until 1989, the fishing industry was underdeveloped and undercapitalized consisting only of small coastal fishermen with no refrigerated boats, who barely exploited the 1,600 km of coastline. The government provided very little financial or other assistance to fishermen. The fisheries country profile given by FAO for Dominican Republic provides no data for 1998-97. For 1993-1996 the total imports of fisheries products in live weight equivalent (MT) was constant in value: 81, 395; the total export of fisheries products for the same period was 672 (MT) and the fish protein as a proportion of total protein supply was 5%.The Gross Domestic Product (GDP) at market prices for 1996 was US$13, 169 MLN (FAO, FAOSTAT, 1999).

In March, 1999, the Coordination Commission of the Natural Resources and Environment established that the Dominican Government would regulate the subsistence, commercial, and industrial fisheries activities, by prescribing permitted fishing methods and practices, areas, seasons and species, minimum size limits, sex restrictions and number of specimens that can be caught. (COSERENAMA, 1999).

In March 2000, a document was discussed on a new proposal for Fisheries and Aquaculture Law for the Dominican Republic. In that document, the following were proposed:

- creation of the Dominican Institute of Fisheries and Aquaculture;
- establishment of procedures to develop fisheries activities;
- measures for controlling the access of foreign boats to Dominican Republic waters;
- the establishment of places for aquaculture;
- the modification and suspension of fishery licenses and payment of taxes;
- general measures for the administration of lake fisheries;
- general prohibitions and measures of conservation and protection of the aquatic and biological resources;

- administration of protected areas and no-take reserves;
- limitation of fishing effort;
- protected species;
- close seasons;
- size limits and other protective measures.

The main objective of that law is the sustainable establishment of the fisheries production based on principles of responsible fishing.

2. DESCRIPTION OF THE FISHERY

2.1 FISHERY RESOURCES

The main fishery resources in Dominican Republic are demersal and pelagic finfish, spiny lobster, queen conch and a small shrimp fishery located in Samaná Bay. Colom et. al (1991) identified 160 landing sites in 16 coastal provinces in DR. These landing sites were grouped in five (5) fishing zones: 1) North: Monte Cristi, Puerto Plata and Espaillat 2) Northeast: María Trinidad Sánchez and Samaná 3) East: Hato Mayor, El Seibo, La Altagracia, La Romana and San Pedro de Macorís 4) South: Santo Domingo, San Cristobal and Baní 5) Southwest: Azua, Barahona and Pedernales. Silva (1991) reported 324 species of fishes, crustaceans and mollusks identified in the coastal-artisanal fishery in the southwest of Dominican Republic, most of them bony fishes (287). However, it is recognized that very limited data are available on the status of the finfish resource in DR because the catch per unit effort (CPUE) data are so sparse and divided over so many gears and locations (Appeldoorn, 1997).

The number of boats by zone, the number landing sites and fishermen reported by Colom et. al (1994) are presented in table 1:

Table 1: Number of boats, fishers and landing sites by zone in Dominican Republic

Zone	North	Northeast	East	South	Southwest	Total
# of boats	615	1,252	964	320	601	3,752
# of fishermen	1,878	2,947	1,737	760	1,318	8,640
# of landing sites	27	50	35	16	32	160

Demersal fishes exploited are those typically associated with tropical reef and hard bottom environments. Those include snappers, groupers, grunts, parrotfishes, triggerfishes and goatfishes. Principal gears for exploiting demersal resources are traps, hook-and-line (Appeldoorn and Meyers, 1993), hookah and free diving. Colóm et al., recogized the following gears used in Dominican fisheries:

- **Hand lines** (cordel, luz, cala, currican and viveo), palangre, gillnets, trammel nets, atarrayas, traps and diving. The target species varies depending on the gear used, as follows.
- **"Cordel"**: the target groups are Scaridae, Labridae, Acanthuridae, Holocentridae and Pomadasyidae.
- "**Luz**": the main groups catch are: Cambridge, Lutjanidae (*Ocyurus chrysurus*, *Lutjanus synagris*), Carangidae (*Caranx latus*, *Caranx hippos*, *Caranx lugubris*, *Caranx bartholomaei*, *Caranx rubber* and *Selar crumenophthalmus*).

- "C**ala**": the main catches are oriented to: *Lutjanus vivanus*, *Lutjanus bucanella*, *Apsilus dentatus*, Etelis oculatus, *Pristipomoides macrophthalmus*, *Romboplites aurorubens* and, the groupers.
- "**Currican**": is usually used to catch *Thunnus* spp., *Scomberomorus* spp., *Acanthocybium solanderi*, *Euthinnus alleteratus*, *Auxis thazard*, *Katsowonus pelamis*, *Coryphaena hippurus* and *Sphyraena barracuda*.
- **"Viveo":** is used to catch *Thunnus* spp., dolphinfish (*Coryphaena hippurus*) and needlefish (*Isthiophorus albicans*). Hook and line fishing is either by hand or by the use of power reels.
- **Palangre**: catch *Lutjanus synagris*, *Lutjanus analis*, *Lutjanus mahagoni* and other lutjanids.
- **Traps**: catch a wide variety of fishes but the main objetive is to catch lobster and *Lutjanus buccanella, L. vivanus*, *Etelis oculatus*, *Pristipomoides macrophthalmus*, *Rhomboplites aurorubens* and groupers (*Epinephelus* spp.).
- **Diving**: the main target species are lobster, conch, octopus, and a wide variety of fishes but mainly snappers and groupers**.**
- **Nets**: catch demersal fishes, shrimp and other crustaceans. It is not a selective gear.
- **Collection by hand**: is the harvesting of mollusk and crabs by hand from a boat or without any boat.

The Dominican fleet employed in fisheries is composed by 3,752 boats. These can be classified into five types (Colóm et al., 1991):

- ***Yola***: (2, 136; 59%) built of wood or fiberglass with plane bottom of transversal pieces and longitudinal pieces for protection. The length varies between 3 and 7 meters.
- ***Cayuco***: (1,418; 37.8%) is built of one single piece of wood (generally *Hura crepitans*). Its length varies between 2.9 and 6.4 m of length.
- ***Bote***: (117; 3.1%) is made of wood or fiberglass with "quilla" well defined and "casco" with V shape. It length varies between 5.5 and 8.4 m.
- ***Pivote***: (19; 0.5%) is like a big "yola" made of wood with an icebox and the front part of the boat is covered.
- ***Ship***: (62; 1.6%) could be built of iron, wood or fiberglass with "casco" with a V shape and one or more "cubiertas". It has an internal engine and the length varies between 8.8 and 29.9 m . These kinds of boat are usually employed for fishing off Silver and Navidad banks. Fishing is conducted in all areas of the shelf, with areas where the shelf is wider being the most important (Appeldoon and Meyers, 1993).

A number of boats from the Dominican Republic actively fish in foreign waters, particularly in Turks and Caicos to the north, and Saba Bank to the southeast (Appeldoorn and Meyer, 1993) but also in Jamaican, Bahamian and Colombian waters. Landings in these waters are not recorded in the DR fisheries statistics.

2.2 SOCIO-ECONOMIC CONDITIONS

For the last 10 years fishing harvestors and forestry have maintained 0.6% of the contribution to the national GDP, with a production annual average of 13,000 MT/Year. The annual average importation of fishing products for the last 3 years (1996-1998) has been of 23,000 MT/year, while the exportation for this same period has been a minimum of 31 and a maximum of 94

MT/year. Annual fish consumption is 3.7 kg per capita (Reporte del Depart. De Economia Agropecuaria).

The importance of this sub-sector is not only in its contribution to GDP, but also to the following:

- ***Work Generation***
  The fishing population is estimated at 8,640 fishers, according to the Central Bank (1976). The average family consists of 5 members, this means that marine fishing directly supports between 40,000 and 43,200 people. Marketing of fishing products indirectly benefits over 2,000 people. Thus, 42,000 to 45,200 people depend directly and indirectly on marine fishing.

- ***Revenue Generated***
  The national production only covers the 43% of the fishing products demanded by local consumption and the tourism sector. The remaining 57% is imported. Wholesales-owners, fishmongers and medium fishing enterprises do almost the 80% of fish production and commercial fishing in the Dominican Republic, where fishers are forced to sell their products to the owners at a stable price. 20% of the fisheries are independent.

- ***Age of the Fishers***
  According to the Fisheries Department (1992), 76% of Dominican fishers are more than 40 years of age and 34% are less than 25 years old. The average size of Dominican family is 5.5, however, 70% of fishers have 3 children or less.

- ***Education***
  17% of DR fishers are illiterate (never been to school), 16% functionally illiterate (1 or 2 grades in school), with less than 4% passed primary classes. 50% of those who passed the primary superior class have not done high school.

2.3 COMMERCIALLY IMPORTANT SPECIES

According to the Fishing Department, the species of major commercial value are *Strombus gigas* (16.7%), Chillos - Snappers (14.6%), Meros - Groupers (4.2%), Langostas - lobsters, Cojinuas - Jacks, Carites – King Mackerel (10.5%), Tuna (3.8%), others (41%).

2.3.1. Queen conch fishery

The queen conch (*Strombus gigas*) fishery is one of the most important in the Dominican Republic. Free diving, SCUBA diving and diving with hookah (air pumped from the surface) are all used to harvest conchs which are usually taken from depths of 45-55 m. Today, some information on landings, distribution and abundance of queen conch are available for some location in the DR as well as export and import information.

In DR the conch fishing is largely concentrated on the south coast, historically centered on the island of Beata, Parque National Jaragna, (FDL, 1980) and the Catuano channel between the Saona island and the mainland (Pargue del Este). Some quantitative assessments for the queen conch status in DR has been made specifically for the resource in Parque Nacional Jaragua (PNJ) (Appeldoorn, 1993; Tejeda, 1994; Posada and Mateo, 1998) and Parque Nacional del Este (PNE) (The Natura Conservancy, MAMMA Foundation, Rubén Torres). In PNJ a study on the conch larvae distribution and abundance was conducted as a thesis work in biology. Some other reports have been made (Gómez Mena, 1972; Diaz Carela, 1977; Bonelly de Calventi, 1986 e Infante & Silva, 1992) about conch fishery but they are not exhaustive studies.

2.3.2 Spiny lobster fishery

Spiny lobster is an important resource in the Caribbean region. Lobsters are harvested in traps and by diving. Traps are either standard fish trap or specific lobster trap. These are fished for periods of several days to a week before hauling. Diving harvesting is by free diving, SCUBA or hookah. No specific parameters of growth and mortality exist for spiny lobsters in DR. Probably the main source of information about the lobster fishery is from the Southwest part of DR.

Herrera (1995) made an analysis of the historical information about the structure of the population of lobsters available in the landing reports for the species in PNJ. This analysis found that the average length of lobsters in the catch has varied over six years from 31.1 to 67.4 mm Cl with a general mean of 51.0 cm Cl. The maximal average values are 88.7 and reach 126, but 92% of the specimens were less than 69 mm Cl. The legal length of lobsters is 80 mm Cl, meaning that about 73-100% of the total catch is sub-legal. According with this information the lobster resource in PNJ has been affected by "growth over-fishing". That means that lobsters have been exploited before they reach the necessary length to get the first maturity.

The most recent study regarding the status of the spiny lobster in PNJ was carried out by Herrera (1997), based on an exploratory fishery during June,1997. Herrera found that only lobsters in classes bigger than 60 mm Lc (37% of the total catch) were collected for commercial purposes while the smallest are discharged into the sea or maintained in traps in order to attract bigger lobsters. There is a high exploitation of small lobster but it was found that the juveniles' abundance remained constant. Apparently the Southwest platform of the country constitutes a good place for the settlement of post-larvae which are abundant in the surrounding oceanic region due to the currents and gyres typical of this zone which favour larval retention (Herrera, 1997).

2.3.3 Finfish

For 1999 the Department of Fisheries Resources reported total landing values for 73 species of finfish, mollusk and crustaceans. They reported also the total landing values for 5 zones individually. For the 5 zones together the total landing value was 8,518,061.6 kg (Table 2).

Table 2: Total landings by family group by zones (kg)

Family/Group	North	Northeast	East	South	Southwest	Total
Lutjanidae	364,772.7	171,263.0	153,613.9	96,188.5	138,644.7	**924, 482.8**
Serranidae	324,058.1	91,598.2	118,978.3	80,548.4	67,649.8	**682, 832.8**
Scombridae	309,256.9	138,616.1	113,239.5	142,264.3	167,731.0	**871,107.8**
Carangidae	24,480.3	20,873.1	25,124.9	19,904.5	13,592.3	**103,975.1**
Haemulidae	114,302.3	112,504.0	1,343.9	38,836.1	84,404.5	**423,104.5**
Coriphaenidae	77,310.1	26,639.2	39,062.9	10,000.0	22,279.0	**175,291.2**
Mullidae	14,850.9	12,136.5	22,012.0	14,807.3	26,075.3	**89,882.0**
Labridae	77,310.1	26,639.2	39,062.9	4,236.6	22,008.5	**51,900.0**
Strombidae	498,961.7	147,524.4	203,940.1	33,995.3	358,048.5	**1,242,470.0**
Palinuridae	266,919.0	88,711.2	137,559.4	95,936.4	239,153.9	**828,279.9**
Ginglymostomatidae	24,542.2	17,666.7	14,329.1	9,150.5	5,054.1	**70.472.6**
Dasyatidae	17,057.5	11,858.9	14,984.0	9,298.6	10,246.9	**63,445.9**
Sailfish, marlin, needlefish	13, 066.9	5,363.8	10,751.3	6,995.5	27,053.8	**63,231.3**
Engraulidae	21,725.7	33,002.3	25,084.6	17,887.9	19,899.8	**117,600.3**
Other marine fishes	38,359.8	25,607.5	28,295.6	25,210.9	61,287.5	**178,761.3**
Other crustaceans and marine mollusks	32,829.6	9,142.7	10,706.2	10,175.3	13,771.7	**76,625.5**
Freshwater fishes	188,369.8	189,769.3	197,061.7	86,534.8	244,543.4	**906,279.0**
Penaeidae	131.0	24,083.0	24,518.3	0.0	0.0	**48,724.3**
Macrobrachium sp.	1,298.8	2,044.1	2,655.3	3,888.0	6,007.4	**15,893.6**
Other products	483,852.8	343,165.1	343,929.1	190,974.3	416,105.8	**1,778,027.1**
Total yield/zone	2,827,860.4	1,477,153.0	1,371,329.7	896,214.3	1,945,504.2	**8,518,061.6**

Table 3 Total yield per year (1992-1999) in tons

Year	Yield (tons)
1992	13,169.0
1993	12,949.0
1994	13,028.6
1995	18,661.6
1996	13,192.6
1997	14,536.1
1998	10,069.2
1999	8,518.1
Total for the period (1992-1998)	**104,124.2**

Table 4: Total yields of the main fished species in Dominican Republic for the period 1992 to 1999 (t)	
Strombus gigas (Lambí)	17,248.5
Other products	12,183.5
Scomberomorus cavalla (Carite)	7,970.1
Panulirus sp. (langosta)	5,443.3
Oreochromis sp. (Tilapia)	4,785.0
Epinephelus adscensionis (Mero Arigua)	4,223.6
Lutjanus apodus	3,984.6
Cyprinus carpio (Carpa)	3,891.0
Lutjanus ays	3,837.9
Ocyurus chrysurus (Colirrubia)	2,828.3
Lutjanus mahagoni (Colorao)	2,787.9
Haemulon sp. (Bocayate)	2,511.5
Thunnus alalonga (Albacora)	2,227.8
Balistes vetula (Peje Puerco)	2,148.6
Pseudupeneus maculatus (Salmonete colorao)	1,849.1
Caranx bartholomaei (Cojínua)	1,620.2
Opistonema oglinum (Machuelo)	1,578.4
Thunnus thynnus (Atún aleta azul)	1,553.6
Coryphaena hippurus (Dorado)	1,492.8
Caranx hippox (Jurel Cola Amarilla)	1,351.0
Micropterus salmoides (Lobina)	1,314.3
Penaeus sp. (Camarón marino)	1,228.7
Apsilus dentatus (Chillo Prieto)	1,122.7
Auxis sp (Bonito)	1,093.0
Sparisoma viride (Cotorra)	1,013.2
Megalops atlanticus (Sábalo)	999.7
Scomberomorus maculatus (Sierra)	793.7
Mugil sp. (Lisa)	776.4
Macrobrachium sp.(Camarón de Río)	715.5
Albula vulpes (Macabí)	652.5
Harengula sp. (Sardina)	597.4
Acanthocybium solandrii (Guatapaná)	575.3

2.4 FISHING AREAS

To the north of Hispaniola, under the jurisdiction of the Dominican Republic are several offshore banks (Appeldoorn and Meyers, 1993). The Silver Bank (Banco de la Plata, 3710 km^2) is visited every year by migrating humpback whales, and also the Northeast (Bahia de Samaná) during the period of December to March which is their breeding season. The Dominican Republic's EEZ extends 200nm to the northeast (Appeldoorn, et. al.) and elsewhere is bounded by the EEZ of Venezuela and Colombia (south), Haití (west), and the Turks and Caicos Islands (northwest).

The northern shelf is very narrow with two exceptions. The first is at Monte Cristi Bank at the western boundary of the country. The bank extends 20 km from shore and contains a wide expanse of shallow habitats, with small islets and coral reefs found near the western edge. This area is one of the most productive fishing areas of the country. The second area is Samana Bay, also a productive fishing area. The bay is generally less than 50 m in depth and is estuarine because the Rio Yuna's discharges into the bay. Some extensive shelf areas are located at the eastern end around Saona Island, toward the center of the coast near Ocoa Bay and Baní, and at the western end around Beata Island where the shelf extend out 35 km. These areas are less than 30 m deep and contain much coral and hard bottom habitats (Appeldoorn and Meyer, 1993).

The Dominican Republic has an impressive marine biological diversity, which includes extensive coastal lagoons, mangroves, sea grass beds and coral and rock reefs, sand and algal plains, soft bottom areas, and sandy beaches. The Dominican Republic's highly productive coral reef forms the basis of an artisanal fishery, developed many decades ago. The main fishing zones are:

- Siete Hermanos Key
- Silver Bank
- Saona Island
- Catalina Island
- Ocoa Bay
- Neyba Bay
- Beata Island
- Las Aguilas Bay

The majority of artisanal fishermen work in the coastal and coral reef areas, which are most overfished.

3. MANAGEMENT OBJECTIVE BY FISHERY

FISHERIES DIRECTION AND ITS CURRENT ACTIVITIES

This Direction, is authorized by Law 5914, to dictate Rules once approved and signed by the Republic President, and can do the following activities:

- Set up the life cycle of Shrimps, Lobsters, Turtles, Clams and others.
- Regulate mesh sizes, net sizes, and other fishing device characteristics in the sea, river, lake, and lagoon all around Dominican Republic.
- Prepare and issue license models for fishermen and boats, according the law (Appendix 2 and 3).
- Collect statistical data on the fisheries exploitation at national level, and issue export and import permissions for fisheries resources.

PROCESSING AND HANDLING

The main causes of fish decay are: microbacteria, autolysis and microorganisms.

Fish handling begins in the boat with the fisher. He has to take the following actions to improve the handling of the product:

- Keep the boat and devices such as knife, basket, and others, free of gasoline and oil.
- Do not damage the fish, do not throw it away, or stand on it, or press it, hit it, without any reason.
- Wash mucus from fish, store the fish on ice as soon as possible. Take care that the fish is completely covered of ice.
- Use clean ice
- No short cuts
- Remove the gills, because they are a source of bacteria. The Ammonia content can be transferred to the fish affecting the quality and flavor of it.
- Store the fish in large amounts
- Lower the temperature of the fish after it is caught

- Freezing is another form of preserving the fish.

4. DATA COLLECTION PROGRAM

Data collection activities are coordinated by three offices in the Dominican Republic:

1. **PROSPESCAR Sur**
   This office coordinates the data collection effort for the south coast (Appendix 4,5 and 6), for the Dominican Republic Fisheries Department. It started data collection in five landings sites and has extended to 20 landing sites covering most coastal regions in the south. About 70-80 percent of the fishing in the Dominican Republic takes place on the south coast.

   Data are collected for stock assessment and fisheries management. Currently, data are collected from each fishing unit at the landing site. A fishing unit is defined as the boat, crew and type of fishing gear. At present data elements being collected are: the number of fishermen, number of boats, boat size capacity, number and type of gear, gender of the fish and length frequency. However, most of these elements are not collected on a consistent or regular basis. In particular, very little or no data on economic or biological aspects of the fisheries are being collected. The system, at this time does not generate data required to conduct stock assessment or economic assessment of any species using the standard models of tropical fish stock assessment or bio-economic assessment.

2. **Fisheries Department**
   The Fisheries Department, with its headquarters in Santo Domingo, collects catch and effort data in the north and east coasts of the country. They not only collect information on marine landings but on freshwater landings (lakes, dams, etc.) as well. The data collected by the Fisheries Department is not reliable, as they do not have adequate data collectors. The fisheries data are collected through the fisheries inspectors with the support of the Unit of Natural Resources. The inspectors are distributed across the country and they collect fisheries data on total catch per species'. The Department also collects export and import data.

3. **CEDEP**
   Coordinates fishing activities in Samana Bay (Appendix 7).

5. CONCLUSION

Historically, the major obstacle confronted by the fisheries sector is the lack of knowledge of the policy-makers on the importance of the fisheries for our country. As a consequence of that the fisheries institutions suffer a lot of endemic weaknesses. One of the main problems in fisheries management is the lack of adequate, reliable statistical data on catch and effort of the various species under exploitation.

The statistical system used in Dominican Republic is based on monthly reports. These reports are prepared by the Fisheries Inspectors distributed across the country. The inspectors collecting the data do not have either the academic capacity or the work instruments to work efficiently or obtain reliable results. It is true that the statistics shown by the actual system are close to the reality, but it is also true that these numbers are not an indication of the fishing pressure over the fisheries resources and they do not indicate the spatial distribution of the fisheries pressure either.

The development and sustainable management of the fisheries sector in the Dominican Republic is limited by the availability of economic resources to develop extension programs and training. Those programs are the cornerstone of a dynamic and vigorous fishery.

6. RECOMMENDATIONS FOR THE FUTURE

The fishing sector has great socio-economic importance, but a management plan needs to be developed in order to value the fisheries potential in its right dimension and use them in a sustainable manner. That management plan should include:

- a training and extension program on fishing gear and methods, fish commercialization, post-harvest handling, etc;
- a data collection system capable of obtaining data and information on fishing effort, catches by species, sex, length, landings and discards, etc;
- a fisher's registration and licensing system, to monitor boats and fishing gears;
- a national network for collection and dissemination of fishery statistical data.

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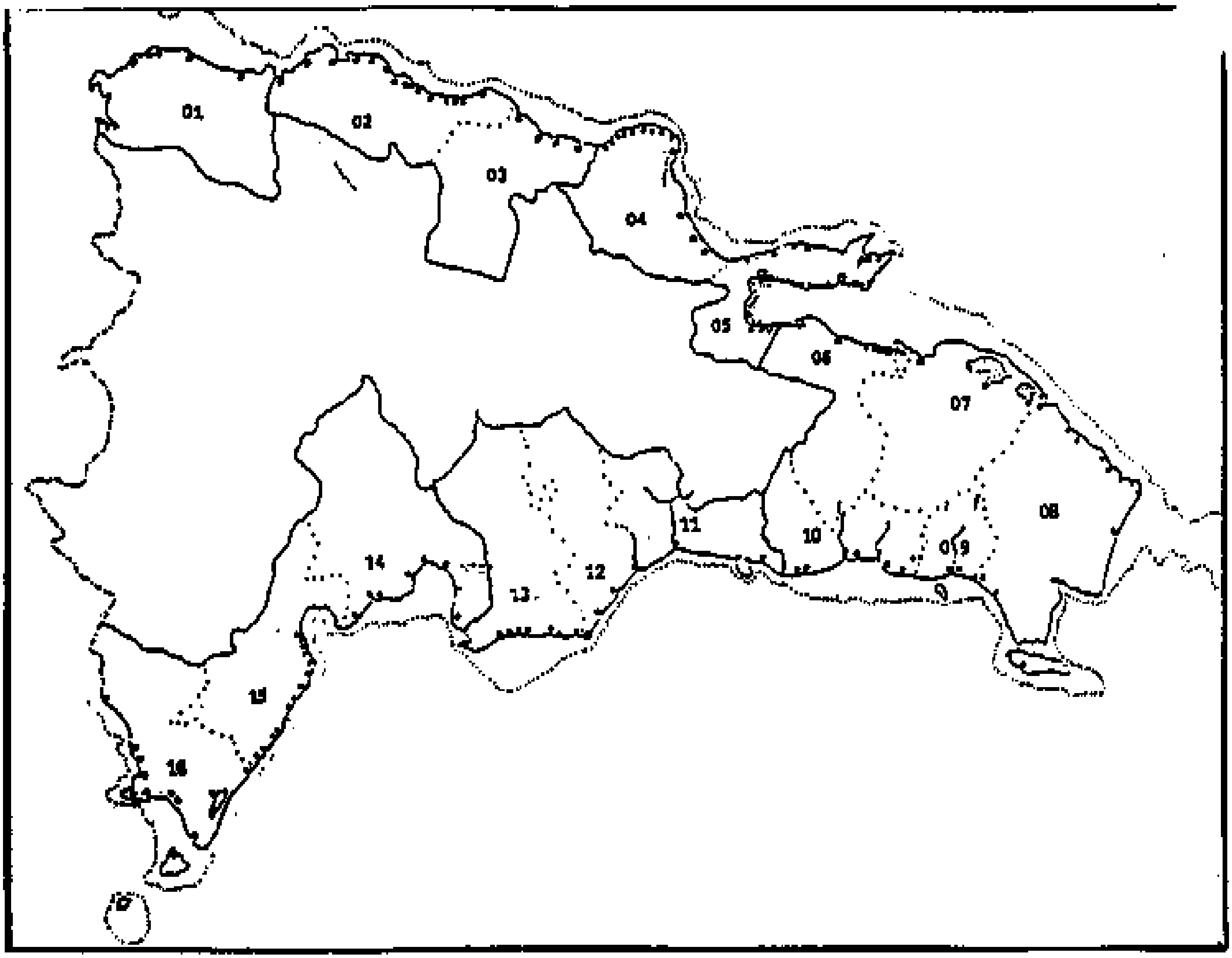
APPENDIX 1: MAP SHOWING LANDING SITES



Names of Fishing Beaches in Dominican Republic

01.01 Los Japoneses
01.02 El Müélle
01.03 Estero Balsa
01.04 Juan del Bolala
01.05 Playa Dipré
01.06 Playa Papa
01.07 Gran Mangle
01.08 Buen Hombre
02.01 Punta Rucia
02.02 Castillo
02.03 El Muelle (Luperón)
02.04 Cambiaso
02.05 Guzaancito
02.06 La Isla
02.07 Bahía de Maimón
02.08 Foca del Río San Marcos
02.09 El Muelle (Puerto Plata)
02.10 Club de las Yolas
02.11 Long Beach
02.12 Boca Nueva
02.13 El Cangrejo
02.14 Bergantín
02.15 El Tablón
03.01 La Cana
03.02 La Hermita
03.03 Playa Magante
03.04 Playa Rogelio
04.01 Playa de los Barcos
04.02 Playa del Cuartel
04.03 Laguna Gri-Grí
04.04 Gallera Vieja
04.05 Playa Gri-Éí
04.06 Caletón Grande
04.07 Playa Grande
04.08 La Catalina
04.09 El Puerto
04.10 El Diamante
04 11 Playa Boba
04.12 Matancita
04.13 Colorado

05.01 las Cañitas
05.02 Playa Bonita
05.03 las Terrenas
05.04 El Estillero
05.05 Punta Coquito
05.06 E1 Linón
05.07 El Morán
05.08 Playa Rincón
05.09 las Galeras
05.10 Playa Francés
05.11 Punta Balandra
05.12 Los Cacaos
05.13 La Flecha
05.14 El Caletón
05.15 Báez
05.16 Gratiní
05.17 Punta de Lirio
05.18 Villa Clara
05.19 Playa Anadel
05.20 Malecón (Samanál
05.21 Río los Cocos
05.22 La Pascuala
05.23 Punta Corozo
05.24 Arroyo Barril
05.25 los Robalos
05.26 los Corrales
05.27 Arroyo Hondo
05.28 E1 Majagual
05.29 las Garitas
05.30 Arroyo Higuero
05.31 Punta Gorda Arriba
05.32 Punta Gorda Abajo
05.33 Sánchez (en el pueblo)
05.34 Naranjo Abajo (Los Hait.l
05.35 la Cueva de Amado l" ")
05.36 El Coco (" " 1
05.37 Naranjo Arriba (" ")
06.01 Playa Arriba y Abajo ISMI
06.02 Capitán
06.03 Las Cañitas
06.04 Magua
06.05 Cabezú
06.06 Arroyo Rico

07.01 La Ensenada de Jima
07.02 Los Mameyes (Miches)
07.03 Laguna Redonda
07.04 Laguna del limón
07.05 La Colonia
08.01 Boca del Nisibón
08.02 La Vacama
08.03 Boca de Maimón
08.04 Macao
08.05 El Cortesito
08.06 Bávaro
08.07 Cabeza de Toro
08.08 Cabo Engaño
08.09 Juanillo
08.10 Boca de Yua
08.11 Marx Juan (I. Saona)
08.12 Playa Bonita (I.Saona)
08.13 Bayahibe
08.14 Boca de Chavón
09.01 Río Ozama
09.02 La Caleta
10.01 Boca de Cumayasa
10.02 Batey Negro
10.0 Batey del Saco
10.04 Boca del Soco
10.05 Playa de Muerta
10.06 Ría Higuamo
10.07 Juan Dalla
10.08 Guayacarres
11.01 Boca Chica
11.02 Andrés
11.03 La Caleta
11.04 Río úzama
'12.01 Haina
12.02 Nigua
12.03 Najayo
12.04 Palenque

13.01 Nízao
13.02 Jabero
13.03 Paya
13.04 Las Almendros
13.05 Agua de la Estancia
13.06 Virreina
13.07 Matanza
13.08 Puerto Hermaso
14.01 Palmar de Ocaa
14.02 Caracoles
14.03 Tortuguero
14.04 Monte Río
14.05 Boca de Jura
14.06 Puerto Viejo
14.01 Caobita
15.01 Las Salinas
15.02 Punta Inglesa
15.03 El Muelle !Barahona)
15.04 Guarocuya
15.05 El Estero
15.06 El Quemaíto
15.07 Batoruca
15.08 la Clénaga
15.09 San Rafael
15.10 La Punta
15.11 las Pocitas
14.12 los Patos
15.13 los Cocos
16.01 Juanclo
16.02 Laguna de Oviedo
16.03 Isla Beata
16.04 Piticabo
16.05 Trudillé
16.06 Ticaletdn
16.07 Lanzabrigd
16.08 Lanzasd
16.09 Bahía de Aguilas
16.10 la Cueva
16.11 Cabo Rojo
16.12 Pedernales
R .i 03-34

APPENDIX 2

FISHERMAN REGISTRATION FORM

SECRETARIA DE ESTADO DE MEDIOA AMBIENTE Y RECURSOS NATURALES
SUB-SECRETARIA DE RECURSOS COSTERO-MARINOS
DIRECCION DE RECURSOS PESQUEROS
DEPARTAMENTO DE PESCA

FORMULARIO DE REGISTRO DE PESCADORES

Nombre y Apellidos______________________________________Apodo________________

Cédula No.______________________Serie______Fecha de Nacimiento____/____/_____

Nacionalidad___________________________Domicilio y Residencia__________________

____Base de Operaciones.

Provincia______________________Lugar____________________Playa______________

Tipo de Arte________________________Inicio de las Actividades de Explotación____________

Licencia No.:____

SECRETARIA DE ESTADO DE MEDIOA AMBIENTE Y RECURSOS NATURALES
SUB-SECRETARIA DE RECURSOS COSTERO-MARINOS
DIRECCION DE RECURSOS PESQUEROS
DEPARTAMENTO DE PESCA

FORMULARIO DE REGISTRO DE PESCADORES

Nombre y Apellidos______________________________________Apodo________________

Cédula No.______________________Serie______Fecha de Nacimiento____/____/_____

Nacionalidad___________________________Domicilio y Residencia__________________

____Base de Operaciones:

Provincia______________________Lugar____________________Playa______________

Tipo de Arte________________________Inicio de las Actividades de Explotación____________

Licencia No.:____

SECRETARIA DE ESTADO DE MEDIOA AMBIENTE Y RECURSOS NATURALES
SUB-SECRETARIA DE RECURSOS COSTERO-MARINOS
DIRECCION DE RECURSOS PESQUEROS
DEPARTAMENTO DE PESCA

FORMULARIO DE REGISTRO DE PESCADORES

Nombre y Apellidos______________________________________Apodo________________

Cédula No.______________________Serie______Fecha de Nacimiento____/____/_____

Nacionalidad___________________________Domicilio y Residencia__________________

____Base de Operaciones:

Provincia______________________Lugar____________________Playa______________

Tipo de Arte________________________Inicio de las Actividades de Explotación____________

Licencia No.:____

APPENDIX 3
BOAT REGISTRATION FORM

SECRETARIA DE ESTADO DE MEDIOA AMBIENTE Y RECURSOS NATURALES
SUB-SECRETARIA DE RECURSOS COSTERO-MARINOS
DIRECCION DE RECURSOS PESQUEROS
DEPARTAMENTO DE PESCA

FORMULARIO DE REGISTRO DE EMBARCACIONES

Provincia______________ Lugar______________ Playa______________

Tipo de Embarcación Barco ☐ Bote ☐ Cayuco ☐ Pivote ☐ Yola ☐ Eslora________pies

Arte______________ No. Arte______________ Propietario______________

Capitán______________ Tiene Matricula? SI ☐ NO ☐ Si la respuesta es positiva:

No. de Matricula______________ Observación: No está renovada desde el año______________

Fecha de Expedición______________ Fecha de Vencimiento______________

SECRETARIA DE ESTADO DE MEDIOA AMBIENTE Y RECURSOS NATURALES
SUB-SECRETARIA DE RECURSOS COSTERO-MARINOS
DIRECCION DE RECURSOS PESQUEROS
DEPARTAMENTO DE PESCA

FORMULARIO DE REGISTRO DE EMBARCACIONES

Provincia______________ Lugar______________ Playa______________

Tipo de Embarcación Barco ☐ Bote ☐ Cayuco ☐ Pivote ☐ Yola ☐ Eslora________pies

Arte______________ No. Arte______________ Propietario______________

Capitán______________ Tiene Matricula? SI ☐ NO ☐ Si la respuesta es positiva:

No. de Matricula______________ Observación: No está renovada desde el año______________

Fecha de Expedición______________ Fecha de Vencimiento______________

SECRETARIA DE ESTADO DE MEDIOA AMBIENTE Y RECURSOS NATURALES
SUB-SECRETARIA DE RECURSOS COSTERO-MARINOS
DIRECCION DE RECURSOS PESQUEROS
DEPARTAMENTO DE PESCA

FORMULARIO DE REGISTRO DE EMBARCACIONES

Provincia______________ Lugar______________ Playa______________

Tipo de Embarcación Barco ☐ Bote ☐ Cayuco ☐ Pivote ☐ Yola ☐ Eslora________pies

Arte______________ No. Arte______________ Propietario______________

Capitán______________ Tiene Matricula? SI ☐ NO ☐ Si la respuesta es positiva:

No. de Matricula______________ Observación: No está renovada desde el año______________

Fecha de Expedición______________ Fecha de Vencimiento______________

APPENDIX 4
LANDINGS DATA SHEET (PROPESCAR SUR)

Anexos

RDLP

PROYECTO DE PROMOCION DE LA PESCA COSTERA ARTESANAL DEL LITORAL SUR
PROPESCAR SUR

REGISTRO DE DESEMBARCO Y LIQUIDACION PESQUERA

Playa ____________ Sitio de Pesca ____________ Nombre Yola ____________

Núm. de Pescadores ______ Hora de Salida ______ Hora de Entrada ______ Arte ______

Número de Arte ______ Profundidad ______ (Brazas) Fecha Ultimo levantamiento (nasas) ______

Inicio de Pesca ____________ Término Pesca ____________

CLASE	PESO (lbs)	PRECIO/lb. VENTA RD$	VALOR VENTA RD$	MARISCOS	PESO (lbs)	PRECIO/lb. VENTA RD$	VALOR VENTA RD$
Carite (1)				Langosta			
Chillo (1)				Cola Langosta			
2da. Roja				Lambí			
2da. Blanca				Pulpo			
3era.				Otros			
4ta.							
TOTAL				TOTAL			

TRIPULACION	INGRESO BRUTO	PRESTAMO PARA PESCA	INGRESO NETO	DISTRIBUCION INGRESOS		DEDUCIONES		NETO A COBRAR
				CAPITAN	AYUDANTE	PRESTAMO PERSONAL	AHORRO	

OBSERVACIONES ____

____

____

Capitán: ____________ Técnico: ____________ Fecha: ____________

APPENDIX 5
CATCH & EFFORT DATA SHEET

REGISTRO DE DESEMBARCO

PLAYA	FECHA
Tipo Emb.	PROPIETARIO
NOMBRE/COLORES	
ARTE Y NUMERO USADO	

Fecha de Ultimo Levantamiento ____/____/____

NUMERO DE PESCADORES	SITIO DE PESCA
PROFUNDIDAD	TIEMPO

SALIDA			
ENTRADA			

INICIO PESCA			
TERMINO PESCA			
DIFERENCIA			

CLASE COMERCIAL	Precio Kg./Lb	Kg./Lbs.	Kg./Lbs.	Kg./Lbs.
1				
2				
3				
4				
SUBTOTAL				
LAMBI				
PULPO				
LANGOSTA				
CAMARON				
OSTRAS				
CANGREJO				
OTROS				
TOTAL				

OBSERVACIONES: ____

NOMBRE ______________________________

APPENDIX 6

MONTHLY SUMMARY SHEETS ON EFFORT

REGISTRO MENSUAL DE ACTIVIDAD DE EMBARCACIONES DE PESCA

LOCALIDAD____________________ PLAYA________________ MES/AÑO________________

NOMBRE	D I A S												
ARTE PESCA													
Nb													
Nc													
L													
Ca													
Co													
Cu													
V													
P													
Chah													
Char													
T													
Bc													
Bp													
At													
Can													

ARTE DE PESCA
Nb = Nasa Bajo
Nc = Nasa Chillera
L = Luz
Ca = Cala
Co = Cordel
Cu = Curricán
V = Viveo
P = Palangre
Chah = Chinchorro Ahorque
Char = Chinchorro Arrastre
T = Trasmallo
Bc = Buceo Compresor
Bp = Buceo Pulmón
At = Atarraya
Ca = Cangrejero

OBSERVACIONES: __________

T. E. F.													
T. E. D.													
T. E.													
T. E. A.													
T. E. I.													
T. E. R.													
T. E. R. A.													

LEYENDA:
T. E. F. = Total Emb. [illegible]
T. E. D. = Total Emb. Dañadas
T. E. = Total Embarcaciones
T. E. A. = Total Emb. Activas
T. E. I. = Total Emb. Inactivas
T. E. R. = Total Emb. Registradas
T. E. R. A. = Total Emb. Registradas por Arte

APPENDIX 7

CEDEP – DATA COLLECTION FORMS

CEDEPE

Captura/Desembarco Pesca Artesanal Hoja ___ de ___

Sitio de Desembarco ______________ Sitio de Pesca ______________
Prof. (m) ________ Capt.Total (kg) ________ Arte ______________ No. Arte ________
Pescador ______________ No. Pescadores _____ Tipo Embarcación ______________
Fecha/Hora Salida ______________ Fecha/Hora Entrada ______________
Estado del Tiempo ______________
Observaciones ______________

Especie	No.	Sex	L (cm) / W (g)									

Total Especies ________
Total Individuos ________ Colector (es) ______________

GRENADA FISHERIES DIVISION **WEEKLY FISH LANDING LOG**

LANDING SITE:		DATE: FROM:					TO:		
COMMON NAMES	**LOCAL NAMES**	**SUN**	**MON**	**TUE**	**WED**	**THUR**	**FRI**	**SAT**	**TOTAL**
Yellow fin tuna	Turgeon								
Blackfin tuna	Blackfin tuna								
Skip jack tuna	Skipjack tuna								
Bullet tuna	Bullet tuna								
Frigate tuna	Frigate tuna								
Bigeye tuna	Bigeye tuna								
Northern bluefin tuna	Bluefin tuna								
Little tunny	Little tunny								
Atlantic bonito	Bonito								
Albacore	Albacore								
Great barracuda	Barracuda								
Common dolphin fish	Dolphin								
Pompano dolphin fish	Dolphin fish								
Spotted Sp. mackerel	Spanish mackerel								
Cero	Spanish mackerel								
Southern sennet	Sennet								
Wahoo	king fish/ ralay								
King mackerel	King fish/malata								
Atlantic sailfish	Ocean gar								
Blue marlin	Blue marlin								
White marlin	White marlin								
Sword fish	Sword fish								
Moon fish	Moon fish								
Round scad	Round robin								
Bigeye scad	Jacks								
Flying fish	Flying fish								
Keeltail needlefish	Long gar								
Jack	Cavalli								
Rainbow runner	Rainbow runner								
Ballyhoo halfbeak	Ballyhoo								
Common snook	Snook								
False herring	Herring								
Atlantic thread herring	Herring								
Brazilian sardinella	Anchovie								
Shark	Shark								
Grouper	Grouper								
Snapper	Snapper								
Red hind	Hind								
Squirrel fish	Marryann								
Parrot fish	Cacabawi								
Sandtile fish	Whitening								
Grunt	Grunt								
Queen triggerfish	Boose								
Goat fish	Goat fish								
Doctor fish	Doctor fish								
Coney	Butter fish								
Conch	Lambie								
Lobster	Lobster								
Turtle	Turtle								
Sea Urchin	Sea eggs								
Squid	Squid								
MARKET CLERK:________							TOTAL:		
COMMENTS:									

P.T.O.

GRENADA

by
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1. INTRODUCTION

1.1 Location

Grenada is a Tri–Island State (Grenada, Carriacou and Petite Martinique) located in the southern Caribbean, approximately 12.07 degrees latitude and 61.42 degrees longitude.

1.2 GDP

Grenada recorded an average annual gross domestic product (at factor cost in constant prices) of five hundred and thirty seven million, two hundred and thirty East Caribbean dollars (EC$537.23 million), for the period 1990-1999. The average growth rate in GDP for the same period was approximately four percent (4%).

For the same period, the fisheries sector experienced an average annual growth rate of 6%. It is important to note that capital investments such as boats, engines, gears, equipment, and other investments in processing are not included in the contribution of GDP, which if included would otherwise result in a much larger contribution to GDP.

Within the past decade, the Fisheries Sector has been a major contributor to the national economy in terms of foreign exchange earnings, job creation, food security, income generation, poverty alleviation and the provision of a valuable source of protein (nutrition).

1.3 POLICY:

The general goal for fisheries management and development in Grenada is the optimal and sustainable utilization of all fisheries resources (fish stocks, fish habitat and sea space) within the fishery waters for the benefit of the country in particular and where necessary, for the benefit of neighboring states with whom Grenada shares fishery resources. As a result, the Fisheries Division pursues the following broad policy objectives that are intended to:

i. Promote maximum sustainable yields from the fishery.
ii. Provide maximum economic returns (surplus) from the fishery.
iii. Provide diversified employment opportunities within the fishery.

iv. Provide opportunities for foreign exchange earnings from the fishery.
v. Promote utilization of the fishery for purposes such as recreational and other non-consumptive uses.
vi. Conserve fish stocks and habitat.
vii. Manage fishing sea use for control of competition and conflict.
viii. Adopt a co-management approach to management.
ix. Maintain a monitoring, control and surveillance system for the purpose of controlling both local and foreign fishing operations.

1.4 LEGISLATION:

In Grenada, the UNCLOS process generated two pieces of legislation in 1978:
i. A Territorial Waters Act.
ii. A Marine Boundaries Act later consolidated into the Grenada Territorial and Marine Boundaries Act #25 of 1989.

In April of 1986, the Grenada Fisheries Act # 15 was passed, and in 1987 subsequent regulations, SRO # 9, were passed, and became part of the OECS Harmonized laws. Three pieces of legislation followed:

i. The fisheries (fishing vessels safety) regulations 1999, SRO # 3
ii. The fisheries (Amendment) regulations SRO #24 of 1996 which replaced part vi and vii (conservation measures and miscellaneous provisions respectively) of the principal Fisheries Regulations of 1987.
The gazetted Amendments (SRO #24 of 1996) were incomplete due to numerous omissions. As a result missing sections are in process of being update and soon to be gazetted.
iii. The fish and fishery products Regulations, SRO #17 of 1999.
This piece legislation makes provision for the import, export, processing, handling, and quality control of fish.

The OECS member sates have also been involved in joint fisheries managements and planning during the 1980's, at a time when the issue of foreign fishing in the sub-region was topical. As a result the OECS states formulated and signed two agreements in support of fisheries management:

i. Common fisheries (surveillance) zone (1991) and the
ii. Common fisheries (fishing) zone 1991.

A Draft Law and Administration for the purpose of implementing these two zones has been negotiated among member states but follow up and implementation is still awaited.

2. DESCRIPTION OF THE FISHERY

2.1 Total number of fishers and boats:

Presently there are a total of six hundred and sixty (660) registered fishing vessels (Table 1) and one thousand six hundred (1,600) registered fishers. However, there are an estimated seven hundred and fifty (750) vessels and two thousand (2,000) fishers existing in the industry.

Table 1: Number of registered vessels by size, categories and gear types.

Size Category(feet)	Number	Gear Type
Under 10	1	Hand line
10-15	68	Hand line / Trap
16-20	185	Hand line
21-25	198	Troll/Hand line/Scuba
26-30	171	Troll/Hand line/Long/long line
31-35	40	Long line
36-40	22	Long line
41-45	17	Long line
46-50	6	Long line
51-55	0	
56-60	1	Long line
61-65	0	
66-70	0	
71-75	0	
76-80	1	Long line
Total	**660**	

2.2 Fishing Areas:

The offshore pelagic fish – Yellow Fin Tuna and Bill Fishes – are mainly located along the west coast of the island. The prevailing species on the east coast are the King Mackerel, Wahoo, Dolphin fish and the smaller species of tunas – Skip jack, Black Fin, Bullet, Frigate etc. The deep slope and ray fish are located south, southeast, southwest, north and northeast. Lobsters and conch are found north, south and southeast. The coastal (inshore) pelagic fish are located along the west and north coast.

2.3 Types of fishery / commercially important species.

The fishery resources can be divided into the coastal pelagic – Big eye scads, Round Scads etc; Offshore pelagic – Yellow fin tuna, Wahoo, Dolphin fish, Bill fishes etc; Deep slope and Shallow reef demersal- Snapper, Grouper, Red hind, Coney, Parrot Fish etc; Lobster, Conch and Sea urchin and Sea moss.

Yellowfin tuna (Thunnus albacares) is the most important commercially exploited species in terms of quantity harvested and exported. This species account for 20-30 % of the total quantity of annual landings and between 70-80% of annual exports. In terms of value, it represents 30-40 % of total annual landings and 70-85% of annual exports.

Other species (inshore pelagic, demersal, and other offshore pelagic – Dolphin fish, Wahoo, Flying fish) may not contribute as much to income and foreign exchange earnings as Yellow fin tuna however, they are very important fisheries and contribute an annual average of 75 % of local fresh fish consumption.

2.4 Trends in catch and effort

Generally, total fish landings for the past twenty-one (21) years has shown an average annual increase of 1 %. However, the trend has been different when examining the various fisheries. The offshore pelagic and the demersal has increased by 6% and 8% respectively, while the inshore pelagic has decreased by 4% for the same period. However, the most notable increase has been that of the Yellow fin tuna with an average annual increase of 28 %.

The Fisheries Division has been collecting catch and effort data for the past 6 years. However, most of the data have not been computerized due to resource constraints. Nevertheless a significant change in effort has been noted in the surface long line fishery for the past decade. The 28-30 footer outboard pirogue with twin engines (40-85 HP) has been made obsolete because of its high cost of operation and lack of efficiency. As a result, investment in the long line fleet has been directed towards the larger inboard vessels (34-60 ft) with 70-350 hp engines. These vessels are much more cost effective to operate, and they have a higher level of efficiency.

2.5 Present status of the fishery:

The offshore pelagic fishery especially Yellow fin tuna has shown the greatest potential for expansion in terms of increasing catch and foreign exchange earning. As a result, a great deal of fishing effort has been transferred from the demersal fishery, and to a lesser extent the inshore pelagic, to the offshore pelagic, thereby reducing the level of effort expended on the demersal and the inshore pelagic.

Based on trends in fish landing data and interviews with fishers, the offshore and inshore pelagic, and the demersal fishery appears to be stable. However, it is believed that the Conch fishery has almost reached or surpassed MSY. This is so because of the increased effort and technology applied in the fishery, and also the small size of the Conch being landed. The Lobster fishery is also approaching MSY. Sea urchin has also been depleted and a moratorium was imposed indefinitely on the fishery since 1995.

3. FISHERY MANAGEMENT OBJECTIVES

FISHERY	BASED ON CFRAMP/GDA MANAGEMENT PLAN (1996)	BASED ON CURRENT PERSPECTIVES (2000)
1. Shallow shelf and Reef fishes	. Promote stock recovery	. Promote sustainability: reduce fishing pressure by promoting alternative target stock. . Promote MPAs.
2. Deep slope fishes	. Maximize catches within the limit of the potential yields.	. Cautious promotion of increased harvesting at Deep slopes historically lightly targeted. . Promote more selective gear.
3. Coastal pelagic	. Ensure viability of the fishery . Maintain fish habitat	. Improve gear selectivity by regulations . Promote co-management of fishers and stocks.
4. Large Pelagic	. Cooperate with members of ICCAT particularly Caribbean States to access protect and conserve, large pelagic resources. . Promote development of commercial and sports fisheries.	. Promote a variety of tactics in a strategy to control local and foreign fishery pressure. . Promote long line fishing in historically untargeted zones. . Promote sports fishing with un-landed catches.
5. Sea Urchins	. Maintain current stocks levels.	. Promote stock recovery . Maintain moratorium on harvests
6. Flying Fish	. Ensure that production matches the bait requirements for the large pelagic fishery	. Ensure that available stocks satisfy bait requirements. . Promote regional cooperative stock monitoring and assessment.
7. Lobster (Spiny Lobsters)	. Rebuild stocks in depleted areas.	. Strictly enforce regulations on size limits of specimens; and export inspections

		. Promote co-management
8. Conch (Lambi)	. Rebuild stocks in depleted areas . Reduce over-exploitation	. Strictly enforce regulations on size limits of specimens; and export inspections . Promote co-management
9. Sea moss (Gracilaria)	. Promote cultivation. . Enforce existing regulations	. Promote sustainability of stocks through co-management.

MAIN MANAGEMENT ISSUES

1. Shared stocks; closeness of adjacent states and easy access by neighboring states fishers.
2. High demand for heavily exploited shell-fish species on both the local and foreign market.
3. A large subsistence sub-sector in fisheries and the ease and speed with which damaging and unselective technologies can be accommodated.
4. Increasing impact of underwater recreation and sports fishing activities on stocks and habitat.
5. Increasing actions of fishers unmatched by sufficient willingness to take responsibility for their impact on the target stocks.
6. Difficulties and slowness in translating information on the fisheries into effective management action.
7. A sustainable application of the co-management approach to management while avoiding romantic elements of the approach in stock and fisher management.

4. HISTORY OF THE DATA COLLECTION SYSTEM

Prior to 1992 all fisheries data collection program was entered and stored manually in hard copy format. Raw data on catch by species were collected and partially summarized by data collectors stationed at the seven (7) districts fish markets (Appendix 1). There was no designed sampling plan for which data was collected. The collection process was that of a total sample, that is, all fish that pass through the markets was recorded (Appendix 2 and 3). As a result, landing that by-pass the markets, and also fish that was landed at non-market sites were not recorded. Species which had a low coverage rate were mainly inshore pelagic, conch, lobster, and to a lesser extent demersal and offshore pelagic. This system limited the comprehensiveness of data collection, entry, storage and analysis.

Grenada implemented a licensing and registration system following the requirements provided for in the Fisheries Act and Regulations of 1986 and 1987 respectively. However, the levels of fishing effort could not be managed adequately due to the tediousness of managing the system manually.

Presently we are much more equipped in terms of human and material resource to manage our data collection program. However, our data management program has been hampered due to the high rate of turn over of data entry clerks. Data reporting and analysis have also been improved.

5. PRESENT CATCH AND EFFORT DATA SYSTEMS

5.1 Description of the sampling plan:

Catch and effort data are presently collected at the six district fish markets and the five processors / exporters plants. The collection process is that of a total sample (census), and data collection forms are designed to collect data based on the requirements of the TIP data fields. However, there is no data collection taking place at the non-market landing sites.

5.2 Sampling Schedule:

Both the district fish markets and the Processing Plants collect data on all fish landed at these locations. Centers would receive fish until the last boat returns from the fishing trip.

5.3 (a) Limitations of the sampling plan:

(i) The plan is not random and as a result there would be bias in the level of coverage for certain species, because of the channels of marketing/ distributing certain pieces.
(ii) The exploitation rate for certain species may be under-reported.

(b) Strengths of the Sampling Plan:

(i) It ensures a wider coverage of commercially exploited species.

5.3 Recommendations:

a. A random sampling plan to be designed and implemented for the non-market landing sites.
b. A frame survey be set up to collect information on effort (number of boats by site/ category /size) which can be used to estimate total catch.

6. DATA MANAGEMENT

6.1 Data Entry:

Recently, some catch and effort data have been entered in TIP. However, due to technical problems encountered with installation of the program, and the intricacy of reporting, data entry is presently been done in EXCEL. However, all the required fields from TIP are retained and used in EXCEL.

6.2 Data Storage Systems, Backups:

Data are stored on hard drives and floppy disk drives. Hard copies of data collection forms are retained for future reference.

6.3 (a) Limitations:

(i) Inadequate storage space for backups using floppy disk drives.
(ii) Intricacy of TIP in data reporting

(b) Strengths:

(i) Ability to work with larger volume of data

6.4 Recommendations

The need to obtain computer systems with tape drives to store backups for large data sets.

7. DATA ANALYSIS

7.1 Type of analysis and information generated for catch and effort data

(i) Catch by species/location
(ii) Trends in total catch
(iii) When catch and effort data is fully computerized, CPUE , trends in CPUE etc will be analyzed

7.2 Estimation of total landings

In the absence of an established frame survey, total landing is estimated by raising recorded landing with a factor of 1.75. However, a frame survey will soon be established to determine levels of existing potential effort, which will then be used to estimate total landing.

7.3 (a) Limitations

Cannot conduct extensive analyses until significant amounts of time series data for catch and effort are computerized.

(b) Strengths

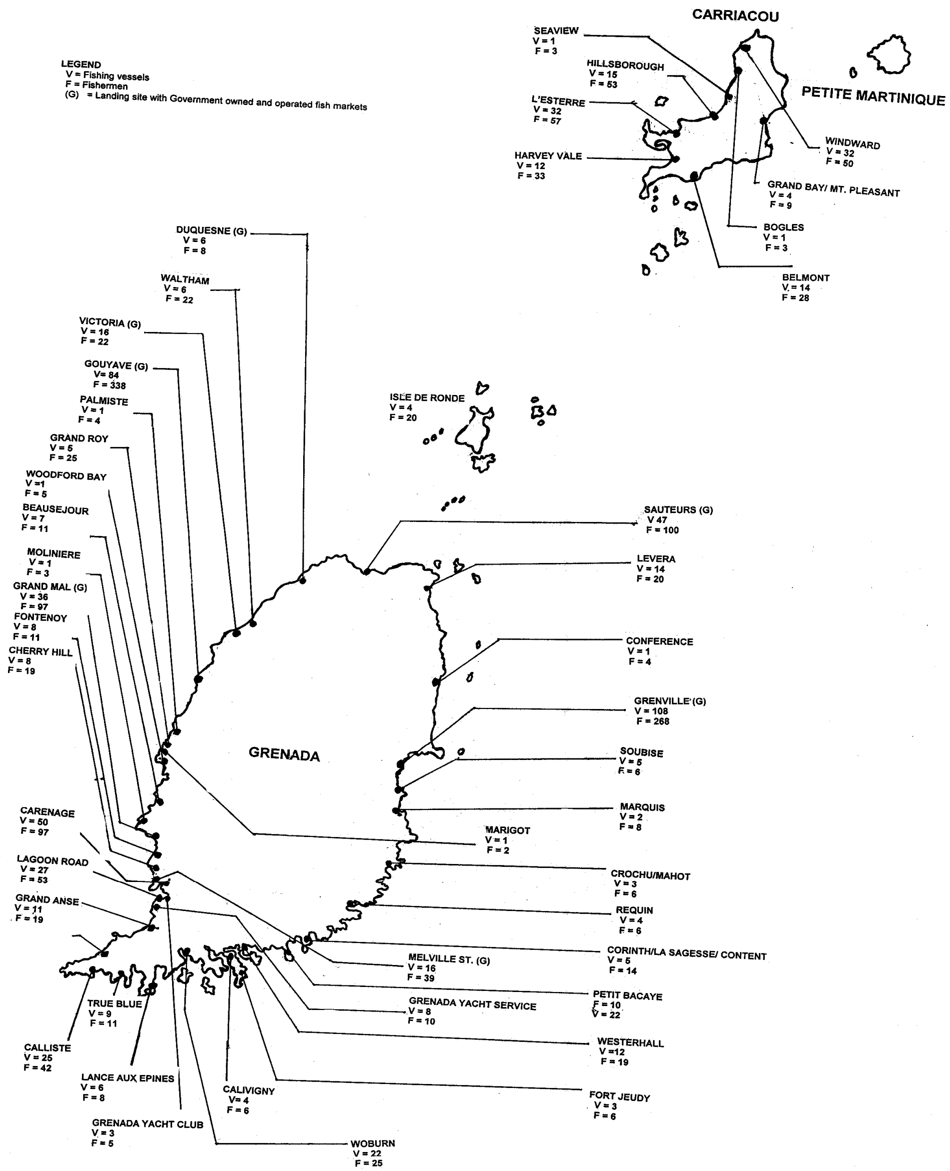
Trends in catches can be analyzed and appropriate management decisions can be taken.

8. CONCLUSIONS AND RECOMMENDATIONS

There is a need to develop suitable program for entry, storage, reporting and analysis of catch and effort data that is less tedious than the existing TIP system.

APPENDIX 1

FISH LANDING SITES



MAP SHOWING

FISH LANDING SITES, REGISTERED FISHING VESSELS & FISHERMEN - GRENADA

APPENDIX 2

DAILY FISH LANDING LOG

FISHERIES DIVISION - GRENADA
DAILY FISH LANDING LOG

LOCATION: LANDING SITE: TIME OF DATA COLLECTION: START: END:

DATA COLLECTOR: INTERVIEW DATE:

BOAT NAME:																				
REG. NO.:																				
BOAT LENGTH:																				
CREW SIZE:																				
AREA FISHED:																				
DAYS OUT / DAYS FISHED:	/		/		/		/		/		/		/		/		/		/	
HOURS FISHED:																				
TYPE OF GEAR USED:																				
QUANTITY OF GEAR:																				
MIN. DEPTH / MAX. DEPTH	/		/		/		/		/		/		/		/		/		/	
WHY FISHING WAS TERMINATED:																				
SPECIES	Qty (lbs)	Ws. Pr.	Qty (lbs)	Ws. Pr.	Qty (lbs)	Ws. Pr.	Qty (lbs)	Ws. Pr.	Qty (lbs)	Ws. Pr.	Qty (lbs)	Ws. Pr.	Qty (lbs)	Ws. Pr.	Qty (lbs)	Ws. Pr.	Qty (lbs)	Ws. Pr.	Qty (lbs)	Ws. Pr.
TOTAL																				
COMMENTS:																				

P.T.O.

APPENDIX 3

WEEKLY FISH LANDING LOG

GRENADA FISHERIES DIVISION

WEEKLY FISH LANDING LOG

LANDING SITE:		DATE: FROM:					TO:		
COMMON NAMES	**LOCAL NAMES**	**SUN**	**MON**	**TUE**	**WED**	**THUR**	**FRI**	**SAT**	**TOTAL**
Yellow fin tuna	Turgeon								
Blackfin tuna	Blackfin tuna								
Skip jack tuna	Skipjack tuna								
Bullet tuna	Bullet tuna								
Frigate tuna	Frigate tuna								
Bigeye tuna	Bigeye tuna								
Northern bluefin tuna	Bluefin tuna								
Little tunny	Little tunny								
Atlantic bonito	Bonito								
Albacore	Albacore								
Great barracuda	Barracuda								
Common dolphin fish	Dolphin								
Pompano dolphin fish	Dolphin fish								
Spotted Sp. mackerel	Spanish mackerel								
Cero	Spanish mackerel								
Southern sennet	Sennet								
Wahoo	king fish/ ralay								
King mackerel	King fish/malata								
Atlantic sailfish	Ocean gar								
Blue marlin	Blue marlin								
White marlin	White marlin								
Sword fish	Sword fish								
Moon fish	Moon fish								
Round scad	Round robin								
Bigeye scad	Jacks								
Flying fish	Flying fish								
Keeltail needlefish	Long gar								
Jack	Cavalli								
Rainbow runner	Rainbow runner								
Ballyhoo halfbeak	Ballyhoo								
Common snook	Snook								
False herring	Herring								
Atlantic thread herring	Herring								
Brazilian sardinella	Anchovie								
Shark	Shark								
Grouper	Grouper								
Snapper	Snapper								
Red hind	Hind								
Squirrel fish	Marryann								
Parrot fish	Cacabawl								
Sandtile fish	Whitening								
Grunt	Grunt								
Queen triggerfish	Boose								
Goat fish	Goat fish								
Doctor fish	Doctor fish								
Coney	Butter fish								
Conch	Lambie								
Lobster	Lobster								
Turtle	Turtle								
Sea Urchin	Sea eggs								
Squid	Squid								
MARKET CLERK:_______							TOTAL:		
COMMENTS:									

P.T.O.

GUYANA

by

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1. INTRODUCTION

The fishery sector is of critical importance to the economy and to the social well being in Guyana. Indeed, the economic contribution of the fisheries has grown dramatically in recent years. The importance of the fisheries is evident in five key areas:

1.1 Food Supplies

Fish is the major source of animal protein in Guyana. It is estimated that per capita annual consumption of fish rose from 9 to 27 kilograms between 1980 and 1988, and was nearly 45 kilograms in 1991. In 1996, it was 59.8 kg and in 1999, it was 88.4 kg

1.2 Contribution to the Guyana Economy

The Guyana Bureau of Statistics estimates that the primary sector of fisheries contributed G$6.9 billion to the total Gross Domestic Product (GDP) or value added in 1999, just under 6 percent of the total GDP. Domestic shellfish sales, aquaculture products and ornamental fish exports also contribute to the value of the fisheries. In addition, significant quantities of fish are harvested for local consumption in inland rivers, lakes, and flood plains. The inland fisheries are an important source of nutrition, particularly for hinterland communities.

Retail prices for essential domestic fish products have risen at more than double the general rate of the increase in consumer prices. The Guyana dollar value of United States import prices for shrimp from Guyana rose approximately 200% between 1990 and 1993, and prices in domestic currency for finfish jumped by 340% over this period because of changes in the exchange rate. The present exchange rate is $US 1 = $G180

1.3 Contributions to Export Earnings

Guyana's 1999 export earnings from fisheries were approximately $G 9.025 billion. In 1997, it was G$6.1 billion (US$41.8 million). Exports of finfish grew from 931 mt. in 1989 to 1,325 mt. in 1994 to 3,548 mt in 1997, 4869.5 mt. in 1999. Prawn and seabob in 1999 were 1280 and 4902 mt respectively (Table 1).

Table 1: Guyana Exports of Marine Products, 1993-1999 (Metric tonnes) (cont. over.)

Fishery products	Year						
	93	**94**	**95**	**96**	**97**	**98**	**99**
Prawns	1630	1483	1819	1583.200	1107.12	1136.73	1280.0
Seabob and whitebelly	1215	1398	2408	2619.000	4416.63	3732.00	4902.0
Finfish and by-products	0	0	0	0	3579.56	6607.38	4869.5
Crabmeat	11	9	27	.136	12.82	36.00	25.0
Total exports	2856	2890	4254	4202.336	9116.13	11512.11	11076.5

Source: Fisheries Department Statistics

1.4 Contribution of Employment and Incomes

The fishing industry employs some 4,800 people in harvesting and 5,800 in processing and marketing. More than 10,000 jobs depend directly on the fishery and many more people benefit indirectly from fishing-related occupations, such as boat building, supply, and repair. The processing industry also employs a significant number of persons. A high proportion of workers in processing, distribution and retail are women, and they are active in harvesting as well. Region 4 (See Fig. 1) has a particularly high concentration of women in all activities of the sector. About 1,000 women in total, work in the sector. A new processing plant (1997) in Region 5 has increased the participation of women in processing in that Region.

1.5 Government Revenues derived from the Fisheries

The fishery is a significant net contributor to Government revenues in Guyana, through export taxes, licence fees and consumption taxes on imported fuel for boats. Licence fees for fishing vessels are an additional source of revenues.

2. DESCRIPTION OF THE FISHERY

Guyana has a coastline of 432 km and a continental shelf area of 48,665 sq. km. The average width of the continental shelf is 112.6 km, while the area of the EEZ is 138,240 sq. km. The living marine resources being exploited within the EEZ are mainly the demersal resources (shrimp and groundfish), and to a limited extent, the pelagic resources over the continental shelf and towards the continental slope.

2.1 Description of the Sub-sectors

The Fisheries Sub-sector of Guyana has three main components, each with further subdivisions as follows:

Marine Fishery
(i) The Offshore Industrial (Trawl) Fishery
(ii) The Inshore Artisanal Fishery

Inland Fishery
(i) Subsistence Fishery
(ii) Ornamental Fish Fishery

Aquaculture
(i) Brackish-water Culture
(ii) Fresh-water Culture

2.2 Offshore Industrial Fisheries

The Offshore Industrial Fishery consists of 126 trawlers, 5 major processing plants, 9 small processing plants, and numerous wharves and dry docking facilities. The trawlers are 48 percent foreign owned. Foreign trawlers mainly exploit penaeid shrimp *(P. brasiliensis, P. notialis, P. schmitti, and P. subtilis)* with finfish and small amounts of squid (*Loligo spp.*) and lobster (*Panulirus spp.*) as by-catch. The locally owned trawlers mainly exploit seabob (*Xiphopenaeus kroyeri*) and various finfish species (*Macrodon ancylodon, Micropogonias furnieri, Nebris microps, Arius spp., Cynoscion spp.*,), with small quantities of penaeid shrimp as by-catch.

2.2.1 Vessel Description

The penaeid and seabob/finfish trawlers are the standard Gulf of Mexico type trawlers. The American and local vessels range from 18.90 to 22.86 m (62-75 ft.) in length, with the American vessels being on the average 20.42 m (67-ft.) in length. The local vessels are powered by inboard Caterpillar diesel engines while the American fleet is powered by Cummings engines. The engine horsepower ranges from 365 to 425 HP. Chinese seine vessels are small flat-bottomed dory type vessels 6.40 to 12.19 m (21 - 40 ft.) in length and are powered by sails or outboard engines (Frame survey 1994).

2.2.2 Fishing Gear

Nylon or polyethylene jib trawl nets with 4 to 5 cm (1.6 - 2.0 inches) stretched mesh in the wings and 2.5 - 3.5 cm (1 to 1 ½ inch) stretched mesh in the cod-end are used in both the penaeid and seabob/finfish fleets (FBR 1994). Turtle Excluder Devices (TED's) are mandatory for the entire shrimp trawl fleet. The Chinese seine vessels use funnel shaped fyke nets with mesh size of 8 cm (3.15 inches) at the mouth and 1-cm (0.394 inches) at the tail end.

2.2.3 Fishing Operations

At the beginning of penaeid shrimping operation, a small try-net is towed for 10 - 30 minutes to test the area for abundance of shrimp. The American fleet, starting in 1982, (and more recently a few of the local vessels) began using 4 *10.67 m (35 ft) nets at a time ("twin trawling"). In "twin trawling" a sledge is used between each pair of nets. The penaeid shrimp trawls are equipped with tickler chains, which stir up the bottom substrate and cause the shrimp to jump into the nets. The seabob/finfish trawls are fitted with drop chains around the mouth opening of the nets. They tow 2 * 13.72 to 15.85 m (45 - 52 ft.) nets at a time.

2.2.4 Crew

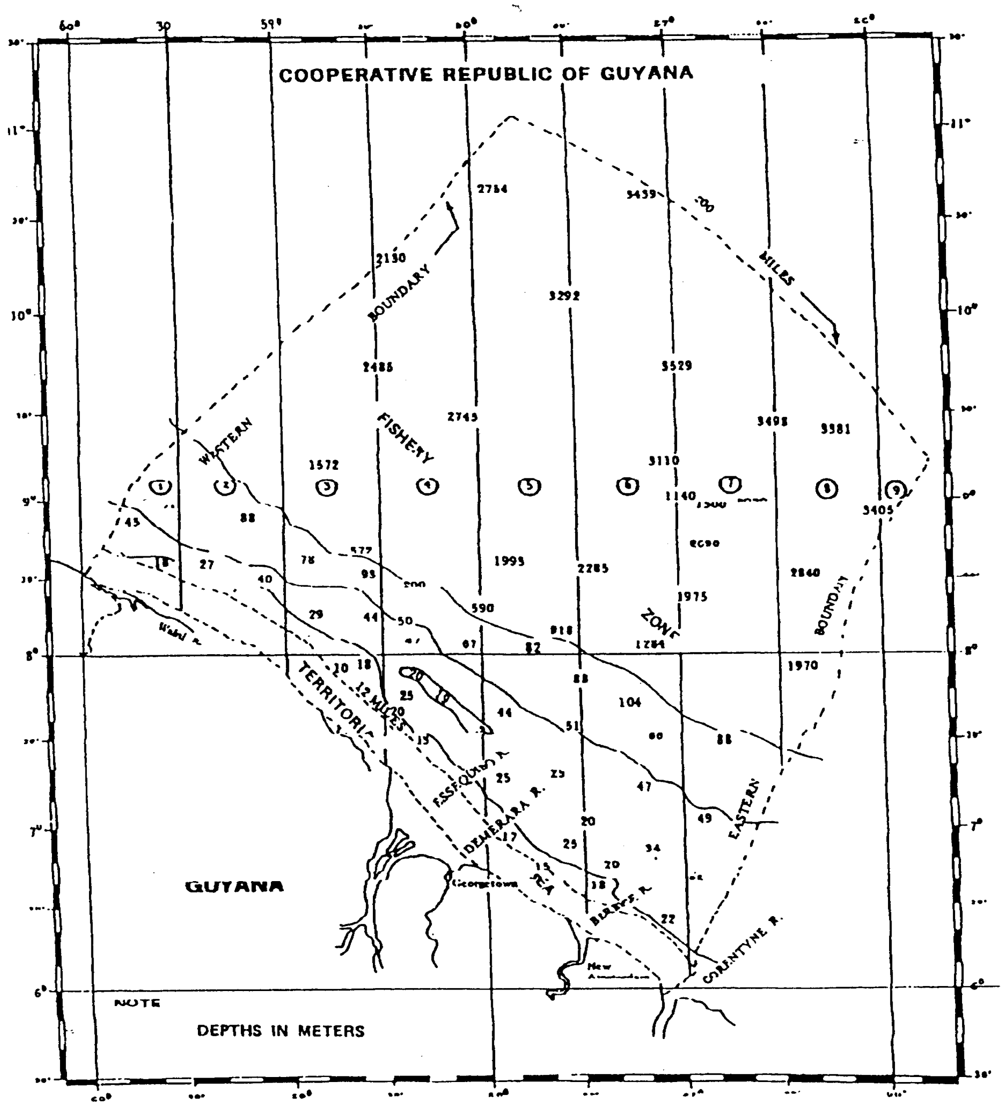
Penaeid shrimp trawl vessels normally have a crew of five while seabob vessels and finfish vessels carry 5 - 6 and 4 - 5 respectively. Chinese seine vessels carry 2 - 4 crew.

2.2.5 Fishing Strategy

The EEZ, for statistical purposes has been divided into Fishing Zones, which are defined according to the degrees of longitude within which they lie, with each zone being separated from the other by an interval of 0.5 degrees (30 minutes) (Figure 1).

Penaeid trawl vessels operate from 40 to 145 km offshore at depths of 18 to 91 m. the bottom areas are usually mud or a mixture of sand and mud (FBR 1994). Trawlers tend to operate in Fishing Zones 1-6 in January, moving gradually eastward to Zones 4-8 in April, returning to Fishing Zones 1-7 in May. In June, July, and August, the fleet tends to operate in Fishery Zones 1-8, shifting to Fishing Zones 2-6 from September to November and moving to Fishing Zones 3-8 in December. In the early 1980's operations were much more concentrated to the east in Fishery Zones 5-9. Most shrimp are caught at night (FBR 1994).

Figure 1: The Statistical Fishing Zones of Guyana



The industrial seabob fishery began in 1985 (Charles, 1990). Seabob trawlers operate 15-30 km from shore in 13-18 m of water. Fishing operations begin in Fishing Zones 4 in January, gradually moving east to Fishing Zone 5 in March and Fishing Zone 6 in April. The fleet returns to Fishing Zone 4 in May, and fishes there until August, after which the fishing operations cease, except for some effort in Fishing Zone 4 in November. Most seabob are caught by day (FBR 1994).

The target species caught by the 76 penaeid shrimp trawlers are *P. brasiliensis, P. notialis, P. schmitti, and P. subtilis*, with assorted fin-fish, small amounts of squid (*Loligo spp.*) and lobster (*Panulirus spp.*) as by-catch. The 38 local trawlers target seabob (*Xiphopenaeus kroyeri*) and various finfish species (*Macrodon ancylodon, Micropogonias furnieri, Nebris microps*, *Arius spp., Cynoscion spp.*), with small quantities of *Penaeus spp.* as by-catch. Only 28 of these vessels are currently in operation. The local shrimp vessels tend to shift their operations from seabob to penaied shrimp (*Penaeus spp.*) during the seasons when the seabob resources are scarce.

The American trawlers make an average of 3 - 4 hauls per day, with each haul being of 4 - 6 hours duration. The local penaeid shrimp vessels make an average of 3 hauls per day, with each haul being of about 4 hours duration. The American and the local vessels average 8 trips per annum. The American vessels spend 35 - 42 days at sea. The locally owned penaeid shrimp vessels would spend an average of 30 days at sea. The seabob trawlers spend 5 - 9 days at sea, but an average trip lasts 7 days. A typical seabob vessel makes 2 - 3 trips per month, and an average of 30 trips per annum. The Chinese seine vessels operate with the tide and as such they make 1 or 2 trips per day, with each trip lasting between 6 - 12 hours.

2.3 Inshore Artisanal Fishery

Guyana is divided into ten (10) administrative regions. Marine fishing occurs off the coast of six (6) of these regions (Fig. 2).

The Inshore Artisanal Fishery is made up of an estimated 1,331 boats ranging in size from 6-18 metre and powered by sails, outboard, or inboard engines. The 1994 Inshore Artisanal Fishery Census only captured a total of 936 vessels Activity in the inshore artisanal fishery, which is pursued exclusively by Guyanese. All the boats are made from wood and are manufactured locally. The fishing gear in use includes pin seines, Chinese seines/fyke nets, cadell lines/"demersal longlines", drift nets/gillnets, circle seine and handlines/snapper lines.

A flat-bottom dory powered by sail, paddle, or small outboard engine is used for Chinese seine, cadell lines, and a few pin seines to give more maneuverability over shallow, muddy and sandy bottom areas. These boats, which operate close to shore, are not equipped with iceboxes.

A V-bottom boat, ranging in size from 7.63 -9.15 m (25 - 30 ft) and with no cabin but with an icebox and powered by an outboard engine is used by smaller gillnet (gillnet nylon) fishermen. A larger V-bottom vessel size 12.2 - 15.25 m (40 – 50 ft), with an inboard engine and cabin is used for larger gillnet and handline operations. Physical characteristics of the boats, their method of propulsion, length of the fishing trip, crew size, catch composition and the principal fishing grounds of the Guyana Artisanal fleet are provided in Table 2.

There are about 4,500 artisanal fishermen and of these about 1,000 are boat owners. Sixty to seventy percent of the boat owners are members of Fishermen's Cooperatives that acquire and sell fishing requisites to their members (Fisheries Background Report, l994). There is onshore infrastructure (wharves, ramps, workshops, fuel depots, requisite shops, ice machines and storage bins, and fish storage bins) at eight sites along the coast, for this Fishery. Four (4) of these complexes have been leased to the fishermen's cooperatives within whose boundaries they fall for management and operations. A joint-venture arrangement is in place for one of the complexes and private individuals operate the remaining three (3) complexes.

2.3.1 <u>Fishing Area</u>

The EEZ, for statistical purposes, has been divided longitudinally into nine (9) Fishing Zones, each separated by 0.5-degree intervals (Fig. 1). Artisanal fishers operate on the continental shelf at distances up to 56 km (30 miles) from the shore, all along the coast.

Figure2: Administrative Regions of Guyana

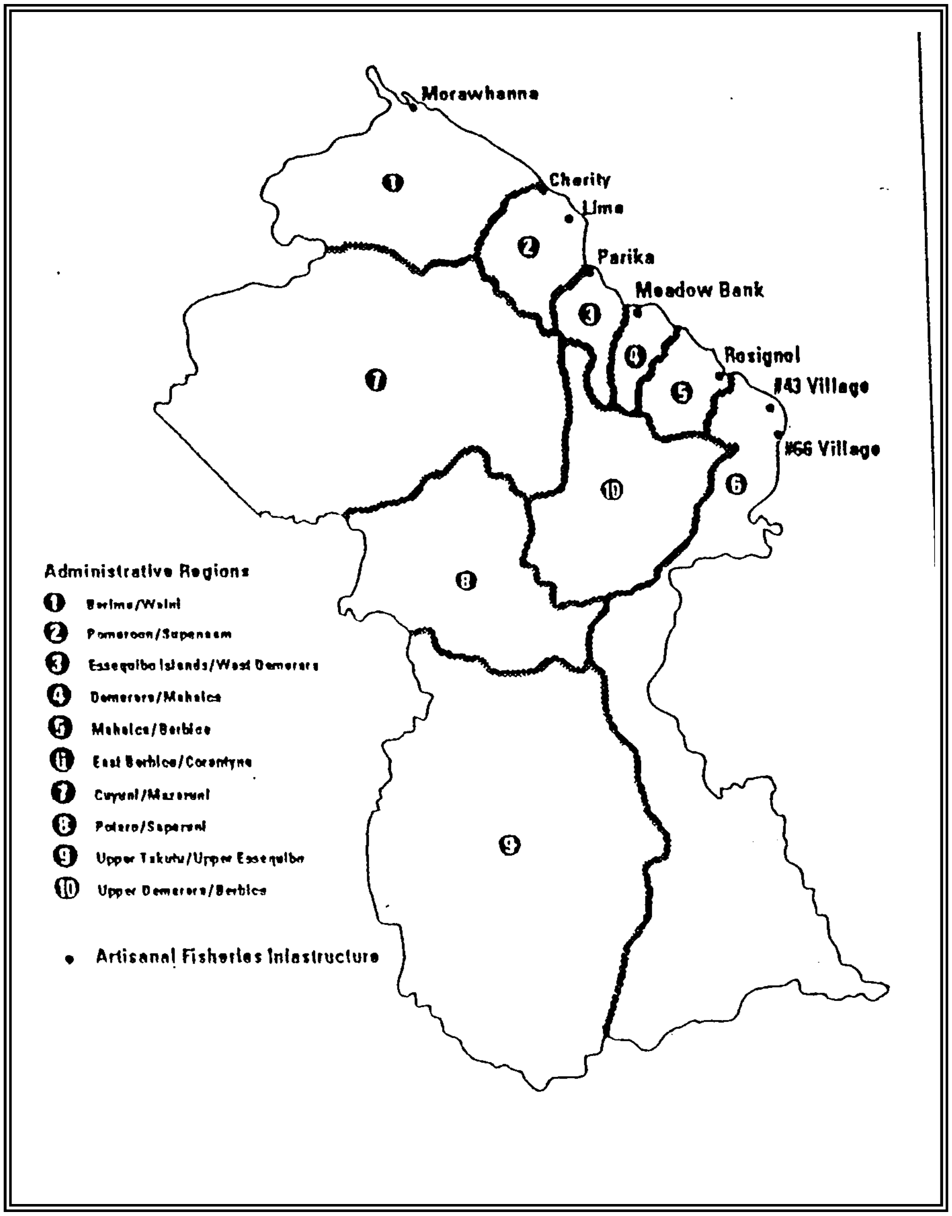


Table 2: Characteristics of the Artisanal Fishing Fleet of Guyana

No. of Vessels		Method of Propulsion	Length of Vessels (m/ft)	Gear Type	Trip length	Catch Composition	Crew Size	Preservation method	Est. annual landings(1997) (Mt)	Principal Fishing Area
1994 Frame Survey	1997 Vessel Count Exercise									
	35	Inboard Diesel	14/45	Handlines, fish pots	12-24 days	Snapper, Grouper	8	Ice	700	Edge of continental shelf, rocky areas (between 10 and 20 fathoms
558	63	Inboard diesel Lister, Perkins 210 hp	12-15/40-50	Gillnet polyethylene(in board)	10-12 days	Grey snapper, sea-trout, gillbacker, tarpon, spanish-mackerel, croaker, snook, shark spp.	4-6	Ice	2175	Area between 10 and 20 fathoms.
	308	Outboard engine 48 hp	8-11/35	Gillnet polyethylene (cabin- cruiser)	6 days	Grey snapper, sea trout, pagee, tarpon, croaker, gillbacker, spanish mackerel.	4-6	Ice		Area between 10 and 20 fathoms
	441	Outboard engine 25 hp	30m	Gillnet nylon	1 day	Bangamary, sea trout, butterfish.	4	Ice	14,707.13	Area between 10 and 15 fathoms
253	373	Sail, outboard engine 6 - 9 hp	6.40-12.19m (21-40ft.)	Chinese seine	6 - 12h	Whitebelly, seabob, immature fish, bangamary, butterfish, catfish	2-4	Fresh	finfish- 2379.25 Seabob- 575.5 Whitebelly- 1717.13	Estuaries, river mouths and banks on the coast.
79	80	Outboard engine 6 - 9 hp	6 - 9/15 -30	Cadell	12h	Catfishes, sharks spp.	2-4	Fresh	2175.28	Areas between 5 and 10 fathoms.
46	35	Sail, outboard engine	6 - 9/15 -30	Pin Seine	12h	Mullet, snook, queriman, catfish, croaker, bangamary.	2	Fresh	206.2	Intertidal zones

Modified from Chakalall, 1979

Note: The 1997 Vessel Count Exercise only accounted for 80% of the artisanal vessels

2.3.2 Gear Types in the Inshore Artisanal Fishery

There are six types of artisanal fishing gear, namely: (i) Chinese seine/fyke net, (ii)pin seine, (iii) cadell, (iv) gillnet (nylon and polyethylene), (v) handline,fish pots (vi) circle seine (Table 3). Circle seines are very few in numbers. The descriptions of each gear type/fishery are as follows:

Table 3: Inshore Artisanal Fleet (Frame Survey, 1994)

Region	Number of Vessels by Gear Type By Region				Total
	Chinese Seine	**Pin Seine**	**Cadell**	**Gillnet**	
2	20	7	9	52	88
3	69	5	14	51	133
4	86	6	27	250	368
5	38	7	18	64	127
6	40	21	11	121	193
7	0	0	0	20	20
Totals	**253**	**46**	**79**	**558**	**936**

2.3.2.1 *Chinese Seine Fishery*

This is the only gear type used in the Inshore Artisanal Shrimp Fishery of Guyana. Chinese seines are funnel-shaped nets, 16m(52ft) long and 4-6m(13.1-19.6ft) wide at the mouth. The mesh size gradually tapers from 8cm at the mouth to 1cm at the funnel. A flat-bottom dory vessel powered by sail, paddle, or small outboard engine is used in the fishing operations. Based on the 1997 Inshore Artisanal Vessel Count, they were 286 chinese seine vessels, accounting for 28% of the artisanal fleet. Counts done in 1997 shows that they are 373 vessels.

2.3.2.1.1 *Fishing Strategy*

These fishing operations work in relation to the tide and spend between 6 to 12 hours per day fishing. Some operators would fish both tides per day. The seines are attached to poles and set on mud banks, mainly in the river mouths, where tidal currents sweep the fish and shrimp into them. The seines are set at depths between 2 and 6 fathoms, at a distance of about one mile from the shore. The crew size on these vessels ranges between 2 and 4.

2.3.2.1.2 *Catch*

The catch consists primarily of *N. schmitti* (whitebelly shrimp), *Xiphopenaeus kroyeri* (seabob), *Macrodon ancylodon* (bangamary), *Nebris microps* (butterfish). An undetermined amount of juvenile fish is caught in the Chinese seine fishery and is discarded or used to produce “fish meal”.

2.3.2.2 *Cadell Line Fishery*

The cadell or demersal longline fishing vessels range in size from 6.71-9.15m (22 - 30 ft). During the 1994 Inshore Artisanal Vessel Count Exercise, 61 vessels were counted. This accounted for 6% of the total artisanal). A flat-bottom dory vessel powered by sail, paddle or small outboard engine is used for cadell line.

A cadell line consists of a horizontal/ground line anchored at each end, with a series of about 800 dangling/vertical lines, set with baited hooks at 2 m. outwards. Each vessel carries between 4-5 wooden trays with each tray having from 2-6 main lines.

2.3.2.2.1 *Fishing Strategy*

Before each trip, the hooks are baited and stored in the trays. Keybrand hooks are normally used. Bait includes bangamary, mullet and shrimp. These vessels operate on a daily basis with each fishing trip lasting for approximately 12 hrs. Most of the fishing activities occur at nights and sometimes during the day. Fishing occurs between 10-12 miles from the coast in waters approximately 5 - 10 fathoms deep. Crew size on a cadell vessel ranges from 2 to 4.

2.3.2.2.2 *Catch*

The catch consists mainly of *Arius parkieri* (gillbacker), *Bagre bagre* (catfish), *Arius proops* (cuirass), (*Arius phrygiatus*) kwakwari and various species of shark, which are sometimes landed headless and gutted.

2.3.2.3 *Gillnet Fishery*

The Gillnet is the most productive gear in the artisanal fishery of Guyana. More than half of the total catch is caught with gill nets. Based on the results of the 1997 artisanal vessel count, it was estimated that there is a total of 1,008 artisanal fishing vessels, of which 622 (62 %) are gillnet. There are several types of gillnet operations.

These are as follows:

(i) Gillnet polyethylene inboard engine
(ii) Gillnet polyethylene outboard engine
(iii) Gillnet nylon outboard engine
(iv) Circle seine -modified gillnet nylon outboard
(v) Tangle seine -modified gillnet nylon outboard

The gillnet vessels of Guyana can be conveniently grouped into two size categories, large12-16m (38.4-52.5ft) and small 8-10m (26.2-32.8ft). Large gillnet vessels, using gillnet polyethylene (GNP) are diesel-powered inboard engine vessels with insulated iceboxes capable of carrying up 5 tons of ice. Most of these vessels are equipped with compasses. The length of their trip is 10-21 days. Typically a gillnet (polyethylene) vessel will have a crew size ranging between 4-6 which consist of a captain and the others being workmen.

There are also gillnet polyethylene outboard engine vessels known as "cabin cruiser". These vessels are equipped with iceboxes and fish for 5-10 days. The size of the crew range from 4-6.

Small gillnet vessels using gillnet nylon (GNN) are equipped with outboard motors up to 48 horsepower, fish and land their catches along the entire coast of Guyana. These vessels with small iceboxes remain at sea for 2-3 days at a time, while others without iceboxes land their catches about every 12 hours. Gillnets (nylon) vessel will have a crew size of 4 consisting of a captain and three workmen (Chackalall and Dragovich 1979).

Both types of gillnets are called "drift seine."

Circle seine is a modified nylon gillnet used in the Corentyne River. Fishermen have developed circle seine of different types and sizes to catch schooling fish when they are abundant.

Gillnets polyethylene (inboard and outboard) vary in length from 1,000 to 1,600 m and are 4m deep with a stretched mesh size of 20cm (6 - 8inches). The fishermen prefer polyethylene nets because the nets last longer and tangle less than those made of nylon do. Gillnet (Nylon), a modified version of the gillnet gear type measured about 300m in length and has smaller mesh sizes 8cm (2.5-4 inches). Some fishermen near the inshore area are using these. Gillnets are very selective, catching only fish of a distinct size.

2.3.2.3.1 ***Fishing Strategy***

A gillnet is a single wall of net which comprises several sheets of netting joined together. It has floats for buoyancy as well as sinkers to enable it to expand vertically when submerged under the water. The depth of the net is determined according to the density of fish schools and the depth of the swimming layer of fishes to be caught. The net can be made to rest on the bottom layer, to hang in midwater, or to float in the surface layer. The ease of handling the gear is also to be taken into account. A gillnet catches fish that swim into it. Its gill usually catches the fish. When the fish swims up to the net it sticks its head right into one of the meshes. When the fish tries to pull its head out of the mesh the thin twine cuts into its skin; its gills and fins get caught in the mesh. The fish stays in the net until it is pulled up.

Fish are also caught when the net wraps around them as in the case of the tangle seine. Drift gillnets are not secured by anchors, but are allowed to drift at the mercy of the winds and/ or currents. They are mostly operated at the surface or mid-layer of the water. Since the gear is not anchored, fishing places are extensive. It is possible to set the net chasing a school of fish.

With Circle seine, the net is lowered into the water from the back of the vessels in such a way that it will surround the fish school. The fish encircled will try to escape out of the net and become entangled as well as gilled.

2.3.2.3.2 ***Catch***

The gillnet fishery accounts for approximately 60% of the artisanal landings. For the gillnet polyethylene (inboard and cabin cruiser), the catch consist mainly of *Cynoscion accouter* (grey snapper), *Centropomus spp*. (snook), *Scomberomus brasiliensis* (spanish mackerel), *Caranx hippos* (cavalli), *Arius parkieri* (gillbacker), *Carcharhinus limbatus* (blacktip shark), *Rhizioprionodon porosus (*Caribbean sharpnose shark) *Micropogonias furnieri* (bashaw), *Megalops atlanticus* (cuffum), *Cynoscion virescens* (sea trout), *Lobates surinamensis* (pagi), *Epinephelus spp*.(jew fish). Swim bladders (fish glue) are landed either fresh or dried. Some GNP vessels practice direct fishing for shark.

For the gillnet (nylon), the catch consist mainly of *Macrodon ancylodon* (bangamary), *Nebris microps* (butterfish), *Cynoscion virescens* (sea trout).

For the circle seine, the catch consist of Micropogonias *furnierei* (bashaw), *Hypophthalmus edentatus* (highwater), *Aridae spp.* (lau lau and bringle) and *Macrodon ancylodon* (bangamary)

2.3.2.4 *Pin Seine Fishery*

Pin seine fishing is practised mainly in Regions two (2) and six (6). Pin seine or beach seine comprise the smallest number of vessels of the artisanal fleet. According to the results of the 1997 Artisanal Vessel Count, there are 27 pin seine vessels, which accounts for 3% of the artisanal fleet of Guyana. They are usually 2 m in depth and 2000 m in length, with a stretch mesh size of 9 cm or less. These vessels are mainly between 6.40 to 12.19 m (21-40 ft) in length and are driven by outboard engine or sail.

2.3.2.4.1 *Fishing Strategy*

The net is set at high tide in the Intertidal zone. A row of stakes arranged in a semicircle holds the net in a vertical position. During the ebbing tide the fish are trapped and then retrieved from the mud flats by the use of "catamarang", which is an upward-curved mud-riding board of about 2m (6.6 ft) in length and 60 cm (23.6 in) wide fitted with a fin underneath and a box for storing fish. The fishermen pick up their catch from a kneeling position on their catamarangs.

2.3.2.4.2 *Catch*

Their catch includes *Mugil spp.* (mullet), *Mugil sp*. (queriman), *Centropomus sp.* (snook), *Macrodon ancylodon* (bangamary), *Micropogonias furnieri (*croaker), and catfishes of the family *Ariidae*. There are also discards of juvenile fishes of which the species and amounts are not known.

2.3.2.5 *Red Snapper Fishery*

The red snapper fishery of Guyana consists of a semi-industrial fleet. Fishing occurs mainly on the continental shelf between 10-20 fathoms. The red snapper fishery was operational since the 1970's with 7-11 vessels harvesting the resources. The gear type used during these years was the handline. There was a decline in this fishery during the late 1970's to 1995. The decline was because some operators have reverted to using the gillnet polyethylene (drift seine) as they did not have efficient technology for catching snapper as their counterparts in Trinidad and Venezuela.

Guyana now has a licensed fleet of thirty-nine (39) vessels; twenty (20) are Venezuelan owned and leased to Royal Caribbean Inc. and nineteen (19) represent the local fleet, which has, expanded from six (6). Sixteen of the Guyanese vessels use pots and traps, the remaining twenty-three (23) vessels belonging to Guyanese and Venezuelan use hooks and line. These vessels are categorized in three (3) types according to gear type and ownership (whether local or foreign) as described in Table 4.

Table 4: Red Snapper Vessel Categories

Vessel Category	Engine Type	Average Horse Power	Vessel Length	Gear Type	Number of Vessels
Local	John Deer Caterpillar	250 hp 402 bhp	54-70 ft	Hook & Line	3
Local	Perkins Lister Peter Gray Marine Diesel	165 hp 115 hp 200 hp	53-65 ft.	Pots & Traps	16
Foreign	Yamaha Isuzu Fait	165 hp 123 hp 198 hp	10-17.60m	Hook & Line	20

These vessels are required to land all their catch in Port Georgetown. There are two major landing sites, Guyana Fisheries Limited (GFL) and Weiting and Richter wharves. All Venezuelan vessels leased to Royal Caribbean Inc. land their catch at Weiting and Richter Wharf.

2.3.2.5.1 *Gear Type*

The vessels targeting red snapper use either hook or line or pots and traps. Pots and traps are constructed of wood. Hook and line fishing method is used for fishing red snappers in deep water over the slope off the Guianas.

Hook and Line
Hook and lines are used while fishing with bait. The hooks are baited usually with sardine. A fisherman holds each line. The gear is made of nylon wire. Each vessel is equipped with 6-9 lines with five (5) hooks per line. The length of the line varies between 30-60 meters whilst the size of the hook ranges from 5-6. The catch of hook and line is Lutjanus species (red snapper), the by-catch is lane snapper and vermillion snapper.

Pots and Traps
The gear is made of nylon or plastic wire mesh and is flat and hexagonal, with two of the sides forming a concave, funnel-shaped angle. Each vessel is equipped with 40-62 traps with a mesh size ranging from ½ - 2½ inches. The traps are often laid out in-groups of 2 or 3 units connected by a rope. The crew size varies from 5-6. The target species for pots and traps is Lutjanus spp. (red snapper) the bycatch landed include cavalli, spanish mackerel, grouper, etc.

2.3.2.5.2 *Management*

Directed by the Government's outlined objectives the Fisheries Division continues to adopt the policy of sustainable management of the red snapper fishery. Although the fishery is a young fishery, a decision to limit the number of vessels would be taken into consideration. Specifications related to gear type, include mesh size and hook size, which serve as effective management tools will also be considered.

There is overseas interest in Guyana's red snapper resources. The red snapper fishing is lucrative and has potential for expansion because local fishermen do not have adequate technology to harvest the fish and the grounds have not been fully exploited. As a consequence consideration is being given to some fishing companies from neighbouring countries that have shown an interest in exploiting the red snapper grounds here.

While this is a resource that can be exploited, there must be a precautionary approach to the issue, as too many boats will destroy the grounds. In the area of deep-sea fishing where expansion can be done cognizance will have to be taken of international regulations since the resource is being caught on the high seas and may be identified as among groups which are threatened. The limited data available to determine the size of the fleet to be licensed is a concern, which should be addressed in the near future.

3. OBJECTIVE FOR THE MANAGEMENT AND DEVELOPMENT OF THE FISHERIES SUB-SECTOR

The overall objective for the management and development of the Fisheries Sub-Sector is to achieve sustainable levels of production, productivity and real incomes of fishery producers and other groups involved in the delivery of products to domestic and export markets, thereby contributing to national production, income and welfare.

Another objective is to substantially improve the functioning of the Fisheries Department of the Ministry of Agriculture and other public sector institutions serving the Fisheries Sub-sector through the provision of adequate legislation, sufficient human resources, modern facilities and improvement in the systems for accountability. Also, one other objective is to ensure that the scientific and technological base of fisheries is improved through adequate funding and organisational improvements to research and extension systems so as to enable the Sub-sector to compete, on an equal footing, in the global economy.

3.1 Specific Objective

The management objective for penaeid shrimp is to stabilise landings/production, whereas that for seabob and finfish is to increase production. In the case of penaeid shrimp and seabob, the fishery is mainly export oriented (foreign exchange). For finfish, the goal is improved nutrition for the population, increased employment and incomes and aggregate output thereby stimulating growth of the national economy.

The seabob and demersal finfish fisheries would be reserved mainly for Guyanese operators. In the case of the penaeid shrimp fishery that already has foreign participation, in any pullouts by companies/individuals both foreign and local from the limited entry fleet, the preference for replacement will go to a Guyanese company/individual.

3.2 Current Management

The penaeid shrimp resource is either being fished at its optimum sustainable yield or above.
The seabob resource, which were relatively under-exploited (mainly by Chinese seines) in the past are now being more fully exploited (Chinese seines and trawlers) with the advent of a number of seabob processing plants. Until more is known about the seabob resource some caution would have to be exercised in terms of fleet expansion.

The state of the finfish resource (groundfish, pelagic & deep-slope) taken as by-catch or by directed trawling, would have to be determined in relation to the activities of the Inshore Artisanal Fishery and the Snapper/Grouper Fishery**.**

In keeping with the Fisheries Act 1958 and Maritime Boundaries Act 1977, trawlers are registered and licensed with the type of licence depending on foreign or local ownership, length of vessel and base of operation. Fishermen are also licensed. Laws prohibit trans-shipment at sea. All shrimp trawlers are required to use TED's when trawling. They are also required to land 32,000 lbs. of by-catch per annum as a licencing condition.

The trawler fleet is demarcated in terms of their operations (penaeid shrimp, seabob/fin-fish, fin-fish) and the vessel license indicates this. The penaeid shrimp fleet, operates as a limited entry fleet with the upper limit having been set at 100.The seabob/fin-fishing fleet operates as a limited entry fleet with the upper limit being set at 30. This number is influenced not only by the paucity of information on the seabob resource, but also by the fact that these vessels operate within the nursery grounds of the marine fishery. The Chinese seine fleet is operated on an open access basis. Fishing vessels have to be registered and licensed. Crew, are also licensed. Chinese seine operators are required to have fish pen permits for each pen set up.

3.3 Proposed Management of the Fishery

3.3.1 Penaeid Shrimp

Current levels of information indicate that a limited entry fixed fleet approach should be maintained, with consideration being given to:

- Prohibition of trawling for penaeid shrimp from 18 fathoms shoreward.
- A closed season for penaeid shrimp.

The limit of 100 vessels currently in use needs to be reviewed. Considering the economic importance of shrimp on the Guiana-Brazil shelf, there is need for a regional management approach.

3.3.2 Seabob

As a precaution, the limited entry fixed fleet approach should be maintained, with consideration being given to the restriction of trawling for seabob to areas of high adult abundance with a view to reducing conflicts with artisanal fishermen and damage to nursery areas and juveniles. The limit of 30 vessels should be reviewed.

3.3.3 Finfish

In the case of directed trawling for demersal finfish, a limited entry fixed fleet approach may be taken as a precaution, with consideration being given to:

- The restriction of trawling with a view to reducing conflicts with artisanal fishermen and damage to nursery areas and juveniles.
- Mesh size regulations and appropriate fin-fishing trawls.
- Adjusting fishing effort to account for by-catch taken in the penaeid shrimp and seabob fisheries.

As these fisheries develop, it may become necessary to apply more complex methods such as fleet quotas, and transferable quotas that would allow more economically efficient use of the resource. There is need to generate bio-economic data to facilitate bio-economic modeling.

The issues of illegal foreign fishing, transshipment at sea (“over the side sales at sea”), conflicts with artisanal fishing operations need to be urgently addressed.

3.4 Management Objective for the Inshore Artisanal Fishery

The management objective for the artisanal fishery is to increase the landings to a sustainable level which, would enable the fishery to contribute, to improved nutrition for the population, export earnings, increased employment and aggregate output thereby stimulating growth of the national economy. The strategy would be to initiate management actions that would lead to rationalisation in the development of the fleet so as to more effectively exploit the resources while seeking to put in place onshore infrastructure and equipment and ensuring their effective utilisation.

3.4.1 Management Options

Priorities would be given to the identification and elimination and/or reduction of destructive gear while developing an effective gillnet (polyethylene) fleet.

3.4.1.1 Chinese Seine Fishery

The chinese seine is the only known means in Guyana of harvesting the white belly ***(N.schmitti***). Thus, in addition to the likely socio-economic aspect there would appear to be some need for the use of the gear.

Regulation could therefore look at first limiting the number of licences to those operators already in the fishery while attempting to reduce support (financial and other eg requisites) for any new or renewal of chinese seine operations. Limits on the number of seines per vessel could also be considered.

Later, by means of survey/investigations the areas of high shrimp concentrations can be identified and mapped as well as the seasons determined. Operations could then be restricted to these locations and seasons of abundance.

3.4.1.2 Cadell Line Fishery

Cadell line fishing should be encouraged but hook size regulations could be looked into as a means of ensuring only larger sizes of the species caught are targeted.

3.4.1.3 Nylon Nearshore Gillnet Fishery

More in-depth study of this situation would be required. If found to be necessary then regulations on mesh size and length of seine could be put in place. Also, the number of licences issued can be restricted.

3.4.1.4 Polyethylene Gillnet/Driftnet Fishery

Regulations on mesh size should be addressed as a means of conserving the resource. Due to good economic returns from this gear type and ease of implementing mesh size regulations. Later, limitations on effort could be addressed.

3.4.1.5 Shark Fishery

Resource must be clearly examined since it is likely that resource can be exploited through specific targeting by different gear types. Reduction of target by imposing limits on the proposition of landed catch or limiting the number of processing plants using shark License.

3.4.1.6 Mackerel Fishery

This fishery may be targeted since there is an increased demand for the species. This resource should be monitored to obtain more information.

4. CATCH AND EFFORT DATA SYSTEM FOR ALL FISHERIES (ARTISANAL AND INDUSTRIAL)

The data collection system consists of the inshore and offshore and logbook programme. This programme involves the collection of catch, effort, and biological data from the various fisheries. The logbook and observer programmes are also part of the data collection programme

4.1 Artisanal and Industrial data collection programme

The data collection programme is a random stratified programme. Stratification is done by vessel/gear type. The landings, employment and value of the catch were important factors that led to this type of stratification. This determined the number of vessels to be sampled per month per gear type. At the starting of every month, sampling schedules are prepared in the three Regions for data collection (Table 5). A total of 82 vessels are chosen to be sampled for data (Table 6). These vessels are randomly selected from landing sites in the Regions. They include 20 chinese seine, 17 gillnet nylon, 4 cadell, 15 gillnet (outboard), 6 gillnet (inboard), 4 pin seine, 3 handlines and 2 traps for the artisanal fishery and 6 seabob and 5 prawns for the industrial fishery.

The vessels sampled in Region 4 are all the industrial vessels and forty-two artisanal. In Regions six and two the number of vessels sampled are 14 and 13 respectively. The number of vessels being targeted for data collection has been reduced due to the manpower shortage. Only 65 vessels are being sampled per month. Sampling is done three days per week Tuesday to Thursday and at least two trips are scheduled per day. The number of vessels targeted per trip would depend on the landing site being targeted, the number of data collectors and the number of vessels at the site. Catch and effort and biological data is collected from the vessels selected randomly at the landing sites.

4.1.1 <u>Limitations and strengths of sampling Plan</u>

<u>Limitations</u>

- Sampling days are fixed and this does not give a true representation of fishing activities at landing sites.
- Inadequate resources to conduct activity
- Ineffective supervision of data collectors
- Ineffectiveness of community participation

Strengths

With the introduction of data collection programme for the artisanal fisheries, production estimates for the artisanal fishery were revised for previous years and the estimates prepared now are more precise.

4.1.2 Recommendations

- Sampling days should be randomized among the possible fishing days in the week to ensure the programme is more representative of daily landings.
- The Department should conduct a census of the artisanal fishery in the near future.
- Improved community participation programme to ensure better participation from the industry
- Improved support from the government for the data collection programme in areas such as subsistence and support staff (drivers)
- More training should be provided for data collectors
- More training should be provided for supervisors of data collectors

4.2 Logbook Programme

This programme consists of the industrial, artisanal and plants logs. The main purpose of the logbook is to record discards and to give the department an idea of what goes on at sea since they are unable to visit all the landing sites every day to interview fisherman.

4.2.1 Industrial Logbook Programme

This has been an on going programme since its inception in the 1970's. This programme targets all trawlers that capture shrimp and finfish. Logbooks are distributed to all registered and licensed vessel owners to distribute to their captains. There are 109 licensed trawlers that are operational. The logsheets are intended to capture fishing activity at sea especially discards, which usually give a true representation of the catch. Log sheets are supposed to be returned at the end of every month. This does not happen instead some vessels would wait until they are ready to relicense their vessels before bring in the log sheets. The logbooks data usually capture fishing area, depth, day or night fishing, weight for each catch (finfish and shrimp separately).

4.2.2 Artisanal Logbook Programme

The logbook programme started in the mid 1970's and declined in the 1980's. The logbook programme was re-introduced in 1995. Visits were made to landing sites and Co-operative Societies where distribution was done.
The training of fishers to fill the sheets was done at all the Co-operative Societies and at some landing sites. A total 500 vessels have been issued with logbooks. The rates of return of sheet are quite low. The consultant (reviewing the data collection programme) made proposals that a more specific focus should be adopted. This however has not been done. This focus was either of the following:

- A sub component of the fleet for which there is good probability of returns.
- A subset of vessels representing all gears for which the captains are known to be co-operative and thus likely to provide accurately completed logs.

4.2.3 Plant logbook Programme

With the introduction of processing plants, the plant logs were introduced to the fishing industry. These logs are distributed to all licensed plant owners. They record all processing activity. These production reports are returned every month.

4.2.4 Observer Programme

The observer programme is an integral part of the data collection programme. The programme is supposed to target the industrial trawlers. The objective of this activity is to capture the by-catch at sea. In this programme, the Fisheries Department is supposed to place an observer at sea to record all fishing activity at sea.
Persons have been trained for the posts but the programme is yet to be started.

4.2.5 Strengths and Limitations of the logbook programme.

- Most vessel owners are not submitting logbooks monthly.
- Artisanal fishers are still skeptical about filling log sheets since they think it can be use by government for taxes.
- Plant logs are used to monitor export.

Table 5: A typical monthly sampling schedule

Landing site (Arranged from west to east)	Vessel/Gear							Sampling Schedule											
								Week 1			Week 2			Week 3			Week 4		
	C S	GNN	CD	GNPO	GNPI	PS	HL	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
Wakenaam 1.		1																	
Parika		3													GNN-3				
Philadelphia				2													GNN2		
Hague			1														CD-1		
Grove Stelling	1			1				CS-1 GNPO-1											
Guy Bridge	1							CC-1											
Houston				4	6				GNP1-1 GNPO-1		GNPI-2 GNPO-1					GNP1-1 GNPO-1		GNPI-2 GNPO-1	
Stabroek Market	1							CS-1											
Betterhope	3												CS-3						
Lusignan		1											GNN						
Beehive		1																	
Unity		2							GNN-2										
Lancaster		2							GNN-2										
Mahaica Bridge				1										GNPI					
Cnt. Machicony Bridge		1												GNN					
Bushlot						1													GNPO
Hope town																			PS
Rosignol	1	1	1	1						ALL									

Sampling Schedule

Table above shows a typical sampling schedule with column 1 showing the landing sites selected randomly and column 2 showing the number of gear/vessels type selected to be sampled. The weekly column shows the vessel type to be sampled daily for the various gear types.

Table 6: Monthly numbers and distribution of samples to be taken

Number of Vessels to be sampled for Catch & Effort										
	F/SB	**Prawns**	**CS**	**GNN**	**CAD**	**GNPO**	**GNPI**	**PS**	**HL**	**PT**	**Total**
Region 2			6	3	1	2	-	1	-	-	13
Region 3-5	6	5	8	12	2	10	6	1	3	2	55
Region 6			6	2	1	3	-	2	-	-	14
Total	**6**	**5**	**20**	**17**	**4**	**15**	**6**	**4**	**3**	**2**	**82**

KEY: **F/SB –** Seabob; **CS** - Chinese Seine; **GNN** – Gillnet; **CAD** - Cadell; **GNPo** - Gillnet outboard; **GMPI** – Gillnet Inboard; **PS** - Pin Seine; **HL** – Handline; **PT** - Pots& Traps

5 DATA MANAGEMENT

Data collected from the sampling is passed to the data manager. Checks are made to ensure all the correct data is entered on the data sheets (Appendix 1). Corrections are made to the data sheets and then the data is entered into the TIP programme.

5.1 Quality Control

Very little quality control is done.

5.2 Backing Up Data
Backing up of the database is done using PKZIP. The backup data are stored at the Department.

5.3 Querying
A series of queries are performed on a monthly basis. These queries are used to generate data from TIP and exported to EXCEL. These data sets are used

a) in estimating production (month and year) from the Fishery sector,
b) to generate data by species for input into models for assessing the size of the fish stock.

5.4 Limitations and strengths of data storage/management programme

5.4.1 *Limitations*

- Production of refined reports.
- Copies of the back up database are not stored offsite even though it was recommended.
- Only few staff members are able to operate TIP and LRS.

5.4.2 Strengths

The use of TIP provides good storage and management of the fisheries data collected.
Retrieval of data from TIP for assessment and analysis purpose is easy and convenient.

The use of LRS serves as a very important management and storage database for the fishing fleet of Guyana. Information for a particular vessel is easily retrieved when needed.

5.5 Recommendations

- There is an urgent need for the TIP and LRS software to be more user-friendly.
- Options for the storage of data should be pursued with the Statistical Bureau.
- More staff should be trained to operate LRS and TIP so that better reports can be generated.

6 DATA ANALYSIS

6.1 Type of analysis and information generated from catch and effort data

- Catch and effort data are used to estimate landings for the fishery, this data is given to the Statistical Bureau, banks and other governmental agencies that have uses for the data. Monthly quarterly and yearly reports are also produced for CFRAMP and the Department's annual report.
- Biological and catch and effort data are used for stock assessment purposes.
- Analysis of the frequency distributions for CPUE by gear types. Normal distribution curves are fitted. In some cases, the CPUE data are skewed, so that for statistical analyses, there will be a need to transform the data.

6.2 Estimation of total landings

Monthly landings are estimated by calculating the average catch per day, per gear type, this is multiplied by the estimated number of days, multiplied by the number of vessels (Table 7).

Estimated Landings = Average landings *estimated # fishing days *of vessels.

Table 7: Estimated landings data for 1995-1999

Total estimated landings (Mt)			Year
Finfish	**Seabob**	**Prawns**	
37248.0		2998.0	1995
37583.0	12752.0	2016.0	1996
36949.0	8570.2	1894.4	1997
39189.4	11090.8	1935.1	1998
41,250.4	10395.7	1595.1	1999

6.3 Limitations and strength of analysis programme

These include:

- Under reporting of landings/catch by some captains.
- Insufficient data to cover all regions where fishing activity is taken place.
- Under/over sampling of some gear types.

6.4 Recommendations

1. Staff training in the following areas
    - supervision of data collectors
    - data collection
    - data entry
    - data generation
    - importance of data storage
    - reporting

2. Update of TIP to be Y2K compliant

7 FUTURE OF FISHERIES DATA COLLECTION AND MANAGEMENT SYSTEM

The department has established a solid ongoing data collection programme. To keep this programme functioning properly and efficient there is need for improvement is some areas:

- The artisanal logbook programme should be adopted as recommended by the consultant.
- The observer programme should be implemented.
- The sampling frame should be reviewed.
- Training of all technical staff in data collection and management.
- Assessments for each fishery especially redsnapper and seabob and continued work on the species already started.
- Improved data storage
- Implementing some of the management proposals recommended in the various fisheries.
- Community involvement programmes in the various fishing communities
- Creation of electronic data base for all fisheries data prior to 1995
- Training of staff in the usage of TIP and LRS
- Update TIP to be Y2K compliant.

APPENDIX 1

GUYANA FISHERIES LANDING STATISTICS CATCH AND EFFORT – DATA RECORDING SHEETS

Region# .... Entered .... Checked ....
Landing Site............................ Date .... Date ....
Date .... By .... By ....
Recorder ....

TIP Interview No.									
Vessel name									
Owner' name									
Vessel I.D. no.									
Gear Type									
# of gear									
Time Departed									
Time Returned									
# of days fished									
# of hours fished									
Area fished									
Depth fished									
# of sets									
# of crew									
SPECIES	**Catch (lbs)**	**Price (per lbs)**	**No. of Fish**	**Catch (lbs)**	**Price (per lbs)**	**No. of Fish**	**Catch (lbs)**	**Price (per lbs)**	**No. of Fish**
Annofolk									
Bashaw									
Butterfish									
Cabio									
Catfish									
Cavalli									
Cuffum									
Curiass									
Gillbacker									
Grey Snapper									
Hammerhead Shark									
Kukuwari									
King Fish									
Lane Snapper									
Pacu									
Pagi									
Highwater									
Southern red Snapper									
Sharpnose Shark									
Silver Bashaw									
Sea Donkey									
Sea Trout									
Seabob									
Blacktip Shark									
Snook									
Spanish Macherel									
Tiger Shark									
Trash Fish									
Whitebelly Shrimp									
Suriname mullet									
Negli									

X-Other									
Totals									

APPENDIX 1 (Continued)
GUYANA FISHERIES LANDING STATISTICS CATCH AND EFFORT – DATA RECORDING SHEETS

Vessel Type	**Frame**	**Vessels at site**	**Vessels went fishing**
Pin Seine			
Chinese Seine			
Gillnet (Nylon)			
Gillnet (Polyethylene) (inboard engine)			
Gillnet (Polyethylene) (cabin cruiser)			
Caddell			
Trawl (prawns)			
Trawl (seabob/finfish)			
Trawl (finfish)			
Other Gear			
Totals			

Comments:

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MONTSERRAT

by

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1. INTRODUCTION

1.1 LOCATION

Montserrat is a volcanic, mountainous island, which belongs to the group of oceanic islands in the Eastern Caribbean collectively known as the Lesser Antilles. It has an area of 104 square kilometers (39.6sq miles). The island is situated between 16˚14' and 16˚50' north latitude and 62˚ 10' and 62˚15' west longitude or 27 miles southwest of Antigua and northwest of Guadeloupe.

1.2 GDP

Since July 1995 Montserrat has been affected by volcanic activity. One major result of volcanic activity has been a decrease in Fisheries contribution to GDP from 1.0% in 1995 to 0.49% in 1999. Fisheries contribution of 0.49% to the GDP or EC$ 0.52 million is lower than all other sectors except other items listed in the agricultural sector within which the fisheries sector is grouped

1.3 POLICY

The Ministry of Agriculture, Lands, Housing and the Environment under which the Fisheries Unit falls has directed its policy towards achieving self sufficiency in certain foods, fish and meat products in an effort to reduce the island's dependency on imports and to reduce the outflow of foreign currency. Emphasis is being placed on developing infrastructure, training and equipping local fishermen to harvest some of the deep-sea resources, in an effort to relieve the pressure on the near shore resources.

1.4 LEGISLATION

The fisheries legislation of Montserrat has been re-drafted to bring it in line with the harmonised legislation of the OECS countries. The legislation addresses regulatory and conservation issues such as licensing and registration of fishing vessels and restrictions on gear use. The legislation also makes provision for the establishment of a Fisheries Advisory Committee, which allows stakeholders to have a direct input into the development and management of the fishery resources among other things. To date the legislation has received its final reading in executive council and it is expected to be brought in force in the near future.

2. DESRIPTION OF THE FISHERY

2.1 VESSELS

Table 1. Number of Vessels by Class Size

SIZE CLASS (feet)	NUMBER OF VESSELS
Up to 12	2
12-20	13
20-30	18
Over 30	0
TOTAL	**33**

Table 2. Number of Vessels by Description

DESCRIPTION/ CLASS	NUMBERS OF VESSELS
Wooden	17
Fiberglass and wood	16
TOTAL	**33**

Table 3. Number of Fishing Gear by Type

TYPES OF GEAR	*NUMER OF GEAR*
Pots	400
Hand lines	66 (each line approx. 1000ft in length)
Long lines	40
Beach Seines	5
Gill nets	12

2.2 FISHING AREAS

Fishing is concentrated between 0 and 2 nautical miles off shore mainly on the eastern and western sides of the island (Appendix 1).

2.3 TYPES OF FISHERY AND TRENDS

Prior to 1995 the fishing industry had over 170 fishermen, approximately 50 boats ranging in size from 10 to 30 feet and fishing activities were carried out from three major ports. The effects of an ongoing volcanic crisis have been a reduction in the number of fishers, boats and ports of operation. Today the number of fishers has been reduced to approximately 80 utilising 33 fishing boats and operating mainly out of a single port. The fishery is primarily artisanal, therefore fishers are not equipped to take advantage of deep-sea resources, which are not as severely affected as those in the near shore.

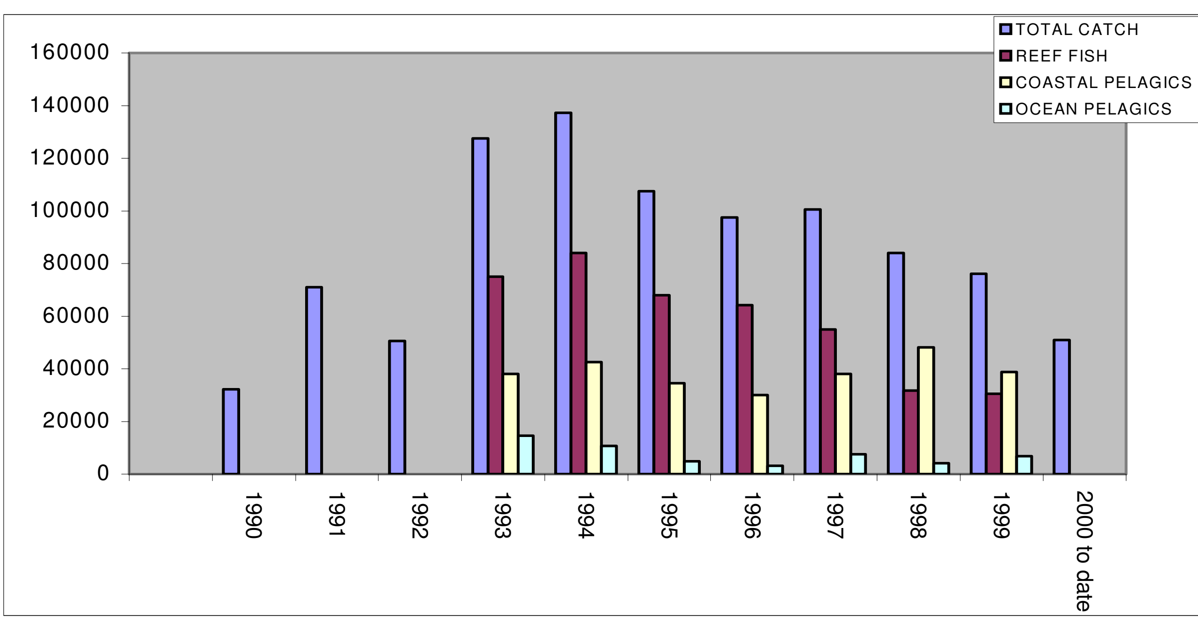
The species groups traditionally exploited are the Shallow Shelf and Reef Fish and the Coastal Pelagics. Both species are moderately to heavily exploited and are unlikely to support increased exploitation. The Deep Slope and Bank Fish are under-exploited and the status of the Large Pelagics and the flying fish fishery is mostly unknown but thought to be adequate to support further exploitation; these groups therefore offer the greatest potential for increased exploitation.

Continuous volcanic activity since 1995 has resulted in the emigration of approximately one half of the island's population and has contributed to a reduction in the tourist population due to the closure of most of the hotels on the island. The principal market for fish is therefore local households and restaurants that cater to the local population and to visitors. Locally caught fish is sold mainly fresh, uncleaned on the local market by the fishermen themselves. The volume of fish caught locally is inadequate for local consumption as a result the major supermarkets import fish approximately twice monthly to supplement local production. No fish or fish products are exported.

Table 4: Estimate of total landings (lbs.) for 1990 –2000

YEAR	FISH PRODUCTION (lbs.) TOTAL	REEF FISH	COASTAL PELAGICS	OCEAN PELAGICS
1990	32,202	NO BREAK DOWN		
1991	70,964	NO BREAK DOWN		
1992	50,603	NO BREAK DOWN		
1993	127,530	75,000	38,000	14,530
1994	137,259	84,000	42,500	10,759
1995	107,474	68,000	34,570	4,904
1996	97,450	64,250	30,000	3,200
1997	100,512	55,000	38,000	7,512
1998	83,990	31,740	48,150	4,100
1999	76,110	30,570	38,740	6,800
2000 to date	51,000			

Figure 1: Total Fish Landings by species groups



3. HISTORY OF THE DATA COLLECTION PROGRAMME

The data collection programme began in Montserrat in 1986 with a one-week attachment in St. Lucia for fisheries staff. Initially only fish landing data were collected. During the following years CFRAMP and the OECS played a critical role in reviewing the procedures used to collect data, as a result the data now collected includes species, areas fished, gears, gear type, time spent fishing, type of boat, sizes of engines, size of crew and weather conditions. Initially fishing activity was carried from 5 major ports and all data was collected by 3 data collectors. Unfortunately although total catch was recorded it was not broken down into categories until around 1993. While the programme suffered many setbacks its importance was recognised resulting in the permanent employment of the data collectors and a data manager and an increase in the fisheries budget by 300%.

4. PRESENT DATA SYSTEMS

Due to the reduced number of fishers and the confinement of fishing activity mainly to one port, all fisheries data is collected. The fisheries unit has on staff 2 permanent data collectors who are situated at the major fishing port. All catch and effort data are recorded (Appendix 2 and 3), as well as fishing hours and numbers and types of gear. Whenever it is not possible to collect the data from the fishers arrangements are made to collect this information as soon as possible. The major constraints of this system are the accuracy of the data that is received from the fishers themselves. It is also possible that some data may not be collected for those ports that are used infrequently. This system however reduces the need to extrapolate data as would be the case if a sampling system was used. Because of the logistics it is important that this survey system be continued, efforts must be made however to verify the accuracy of the data collected at those ports which are infrequently used by the fishers.

5. DATA MANAGEMENT

The data management programme suffered the first of a number of serious setbacks in 1989 when hurricane Hugo totally destroyed the fisheries facility and its contents. In 1995 all the data previously collected and entered were destroyed when the hard drive malfunctioned. All efforts were made to retrieve the entered data but these were not successful. By 1998 the fisheries Unit had lost its data manager and two of the three data collectors all of whom were forced to emigrate due to the ongoing volcanic crisis. As a result of the above the fisheries unit found itself with a backlog of data to be entered and overextended in terms of its ability to collect catch and effort data efficiently. In 1999 a new data collector was recruited and trained by the Fisheries Unit. In 1999 CFRAMP facilitated a training exercise on TIP and LRS for the staff of the Unit in an effort to get the data collection programme back on track. CFRAMP also facilitated the employment of one person to input the data in a timely manner. This process however, took longer than expected but to date all the data from 1995 to present has been inputted. Unfortunately the Unit still has not been able to recruit a data manager as a result very little analysis of the data has been done. The Department of Agriculture recognises the importance of having timely and accurate data for making management and policy decisions, as a result all efforts are being made to strengthen the fisheries unit by employing a data manager as expeditiously as possible. Emphasis has been placed on data management and analysis in the fisheries work programme for 2001.

6. DATA ANALYSIS

Information generated from catch and effort data include:

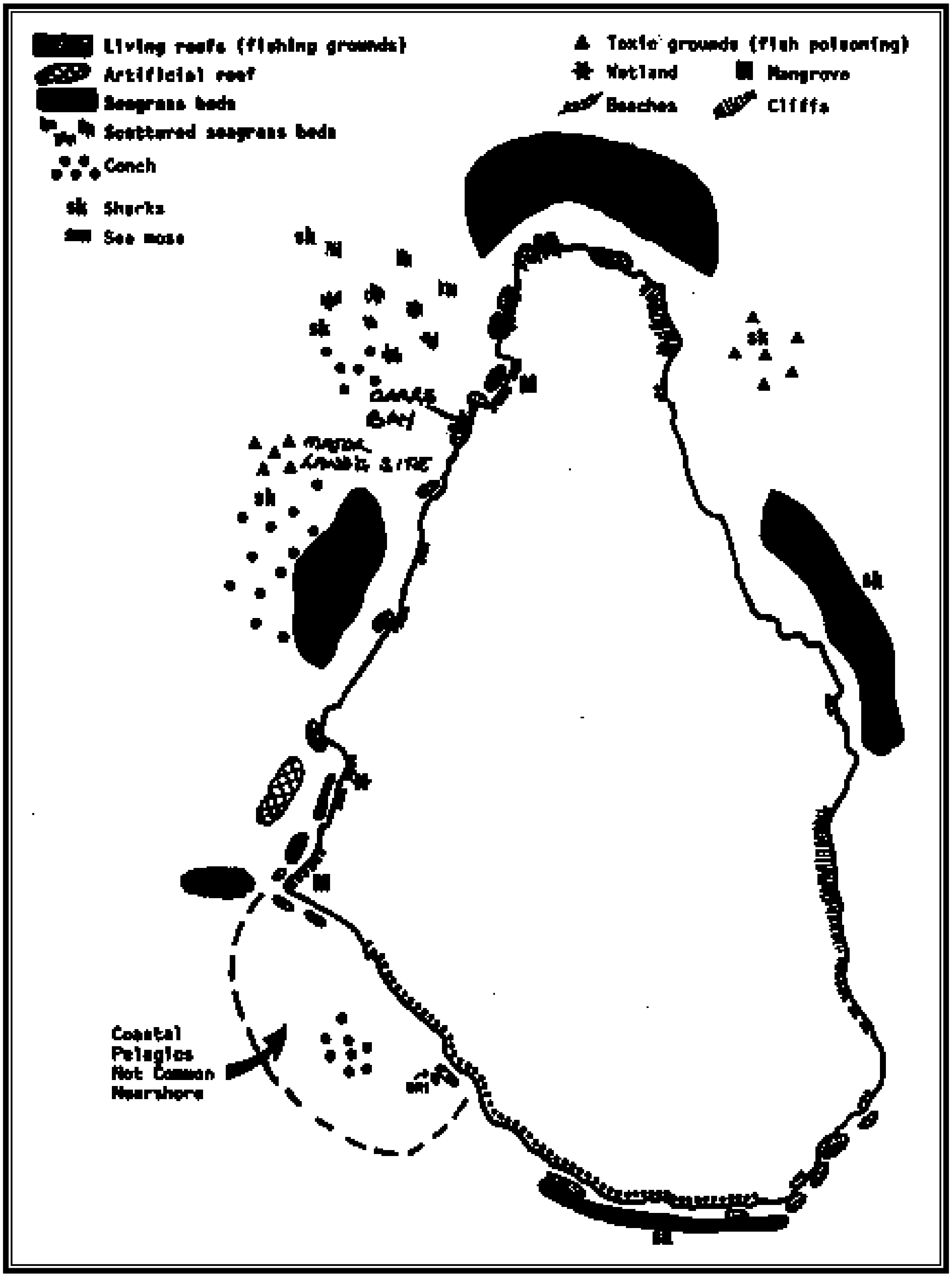
- total amount of catch,
- effort in term of numbers and type of gear
- total catch by fishery type
- trends in terms of total catch

It must be noted that the major limitation recognised by the fisheries unit in regards to the data collection programme is not directly related to the programme itself but to limitations in human resources, which has not allowed the unit to explore or benefit from the various analyses that can be generated from the programmes.

7. CONCLUSIONS AND RECOMMENDATIONS

The data collection programme in Montserrat has suffered many setbacks since it inception in 1986, most significant of these being the irretrievable loss of data and the emigration of three staff member that were critical to the process. Steps have been made however to bring the process on track, the TIP and LRS systems were upgraded, fisheries staff were trained in the input and analysis of the data, and the input of data was facilitated by the short term employment of data entry personnel. Efforts are being made to recruit a data manager as soon as possible. It is important now that the fishing industry has achieved some stability in the wake of the volcanic crisis that the fisheries unit concentrates on ensuring the accuracy and completeness of the data that are now being collected. It is also important that in-depth analysis of the data is carried out, as this will be the basis of any policy decisions made in regards to the fishery.

APPENDIX 1
MONTSERRAT ENVIRONMENTAL PROFILE, 1993



APPENDIX 2
FIELD DATA COLLECTION SHEET

Montserrat Fisheries

Field Data Sheet

		Entered	Checked
Landing Site ________	Weather ________	Date ________	Date ________
Date ________	Sea State ________	By ________	By ________

CREW #

Landing Number	1	2	3	4
Boat Id				
Time Departed				
Time Returned				
Area Fished				
Gear-Primary				
Gear-Secondary				
Number of Sets				
Depth Fished				
Weight Type				
Catch by Species				

Comments

APPENDIX 3

DAILY SUMMARY SHEET

Daily Summary for Fisheries Data Collectors

Site ____________ Date ____________ Data Collector ____________

Summary Of Landings

LANDING NUMBER	BOAT NAME	REGISTRATION NUMBER	FISHERMAN'S NAME	SAMPLED Y/N
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

Comments On Day:-

Weather:-

Sea State:-

Other:-

JAMAICA

by

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1. INTRODUCTION

Jamaica is an archipelagic state, the main island is located approximately 145 km south of Cuba and 161 km west of Haiti or (18d 15m north and 77d 45m west). Maritime Space is estimated at 274,000 km^2, which is approximately 25 times the size of mainland Jamaica. The island is 236 km long, between 35 and 82 km wide, with a total area of 10,940 km^2 and a coastline of approximately 1,022 km. The irregular coastline is punctuated by numerous coastal feature such as harbours, bays, beaches, estuaries, mangrove swamps, rocky shores, cays, coral reefs and lagoons. Jamaica has a tropical maritime climate that is modified by northeast trade winds and land sea breezes. Average temperature is 27 degrees C, ranging from 23 degrees C in winter to 28 degrees C in summer.

Jamaica in 1999 had a population of approximately 2.6 million and Gross Domestic Product of J$ 265,790.2 million (approximately US$6328.34 million). The agricultural GDP (which includes fishing) in 1999 was 14.6% (Statistical Institute of Jamaica, 1999).

Geography	**People**
Area:10,990 km2 **Coastline:**1,022 km **Maritime claims:** **EEZ:** 200 nm **Territorial sea:** 12 n.m. from archipelagic baseline. **International disputes:** none **Climate:** tropical; hot, humid; temperate interior **Terrain:** mostly mountains with narrow, discontinuous coastal plain. **Natural resources:** bauxite, gypsum, limestone **Environment:** subject to hurricanes (especially July to November); deforestation; water pollution Note: strategic location between Cayman Trench and Jamaica Channel, the main sea-lanes for Panama Canal.	**Population:** 2,590,400 (1999 est.) **Population growth rate:** 0.7% (1999 est.) **Ethnic divisions**: African 76.3%, Afro-European 15.1%, East Indian and Afro-East Indian 3%, white 3.2%, Chinese and Afro-Chinese 1.2%, other 1.2% **Languages**: English, Creole **Literacy**: age group 15 – 44, 82% (1999 est.) **Labour force**: 1,115,600 by occupation: agriculture 5.8%, unemployed 16.0% (October 1999)

1.1 FISHERIES POLICY

To ensure the optimal contribution of the fisheries sub-sector to agricultural development through the sustainable development and management of Jamaica's capture and culture fisheries resources, and to enhance nutrition and food security, employment generation and foreign exchange earnings, for the social and economic benefit of our people**.**

Within the framework of the Policy objectives the priority areas are:

i) **Development of Under-utilized Capture Fisheries**
There are several fisheries resources that are either not utilized to the fullest potential or not targeted. Among such resources are sea urchins ("sea eggs"), Holothuroidians ("sea cucumbers") and large pelagics (swordfish, tunas etc.). We are of the view that the sustainable development of small-scale fisheries targeting under-utilized species will give way to specialized export market, diversification and reduced fishing pressure on the Jamaican reef.

ii) Establishment of Proper Institutional Capacity

In order to fulfill our mandate, the Fisheries Division will need added resources for institutional strengthening and capacity building. Training of the staff in areas such as fish stock assessment, fisheries economics and sociology, fisheries law and enforcement are vital. In addition, the establishment of supportive infrastructure such as the wet laboratory will be an asset.

iii) Establishment of Proper Legal Framework
The goal is to achieve enactment of the new fisheries law within the 2001 calendar year.

iv) Enhanced Fisheries Enforcement
Enhanced fisheries enforcement will be achieved through two methods:

1. Pooling of resources among stakeholders. Thus increasing communication and cooperation between environmental NGO's and relevant government agencies.
2. Development of a Community-based Fisheries Management (Co-Management). This involves the active participation of primary stakeholders in the development, implementation and enforcement of management plans.

v) Development of Fisheries Enhancement Programmes
Fisheries enhancement is a viable option in light of the critical state of over-exploitation of our marine capture fisheries. This will be done in two ways:

1. Artificial Reef Structures
2. Spiny Lobster Condominiums and Casitas

vi) Development of Proper Support Infrastructure and Establishment of Proper Development Plans
The provision of proper facilities and services to support primary production is necessary for the development of the Fisheries Sub-sector. Basic facilities such as proper berthing, gear storage; repair of gears, boats and engines; sanitary conveniences, and ice and fish

storage are a necessity. The plan is to develop a fisheries complex similar to that at Whitehouse, Westmoreland and replicate this model at other strategic fishing beach locations.

vii) Establishment of a Comprehensive Fisheries Database

Further training of staff and expansion of fisheries data collection is critical for proper fisheries management and development.

viii) Security of Tenure of Fishers

A major concern is the security of tenure of fishing beaches to fishers. The management of the day to day operations and maintenance of facilities of fishing beaches will be handed over to competent fisher organizations such as fishermen's co-operatives. This is the main concern of fishers who are constantly being marginalised and displaced to facilitate development in other sectors such as housing and tourism.

1.2 LEGISLATION

The Fishing Industry Act of 1975 and the Regulations of 1976 regulate the Jamaican Fishing Industry. There are a few other related Acts such as the Natural Resources Conservation Authority Act (1995), the Morant and Pedro Cay Act, The Maritime Area Act (1996), the Execulsive Economic Zone (EEZ) Act (1991), the Wildlife Protection Act 1951 which impact on the management of the Fishing Industry.

Under the **Fishing Industry Act,** all vessels and persons must be registered and licensed in order to engage in fishing. The Act provides for the general administration of the Fishing Industry through regulations on registration and licensing, transfer of ownership of boats and vessel, reporting on the loss or destruction of vessels, and the cancellation and suspension of licenses. The Act makes provision for fishery protection in the form of Close Seasons and the Establishment of Fish Sanctuaries. Fishery Management measures currently being employed include:

- **Close Seasons**
  Close Season for Lobster - April 1 - June 30
  Close Season for Conch - August 1 - November 30.
- **Fish Sanctuaries**
  Bogue Lagoon in Montego Bay, St. James
- **Size Restriction**
  The taking of juvenile fish and conch is prohibited
  The catching of undersized and berried lobsters
- **Taking of reproductive fish**
  Taking of "berried' lobsters is prohibited.

The **Wildlife Protection Act** protects the fishery through:

- The prohibition of destructive fishing methods, e.g. dynamiting, toxic chemicals and poisons.
- Discouraging the capture of immature fish and protected species like turtles.

The **Natural Resources Conservation Act** provides for the establishment of Marine Parks and Protected Areas. Some areas which have been declared are as follows:

1. Montego Bay Marine Park
2. Portland Bight Protected Area
3. Port Royal Protected Area
4. Negril Marine Park
5. Ocho Rios Marine Park

2. DESCRIPTION OF THE FISHERIES

The Marine Capture fishery of Jamaica has over 20,000 fishermen, however only 12,706 are registered. Of the registered fisher 96% are males (Table 2.1), 79% work full-time in the fishery (Table 2.2), most fishers are single (Table 2.3) and 43% last school attended as secondary (Table 2.4)

Table 2.1: Number of Fishers by Gender Type

SEX	TOTAL	PERCENT
Males	12,125	96
Females	561	4
TOTAL	12,686	

Table 2.2: Work Time in the Fishery

WORK TIME	TOTAL	PERCENT
Full Time	9,982	79
Part Time	2,624	20
No Time	91	.07
TOTAL	12,697	

Table 2.3: Family Status

	TOTAL	PERCENT
Single	5980	47
Common law	3458	27
Married	2976	24
Separated	35	.03
Divorced	68	.05
Widow/widower	69	.05
N/a	111	.09
TOTAL	12628	

Table 2.4: Level of Education

Educational Level	TOTAL	PERCENT
None	246	2
Elementary/Primary	5,248	41
All-age	1,105	9
High/Secondary	5,522	43
College/University	482	4
Other	94	.07
TOTAL	12,697	

Most of artisanal fishermen operating from open canoe or reinforced fibreglass plastic (FRP) type boats powered by either outboard motors or oars. There are approximately 9,000 boats, of which only 3,952 are registered, ranging from 3.6 to 9 m, which operates from 187 fishing beaches (Appendix 1). The Industry also consists of industrial fishers who utilize motor fishing vessel, 12.3 meter and above, powered by inboard engines. The fishing areas can be divided in two main sections, the inshore fishery (this fishery takes place in the coastal waters of the island and includes nine proximal banks) and the offshore fishery (fishing operations that are based on the offshore cays, as well as deep-sea fishing including the Jamaica/Colombia Joint Regime Area).

There are six principal marine capture fisheries in Jamaica. These are conch, lobster, demersal reef fish, deep-slope fish, coastal and offshore pelagics, shrimps and other molluscs and crustaceans e.g. crabs and oysters. These fisheries are exploited on the island shelf, the inshore and offshore banks.

2.1 Description of Fishing Boats and Vessels

A variety of fishing boats operates in Jamaican waters. They may be mechanised or non-mechanised boats. The non-mechanized boats are generally propelled by oars and are made of wood or a mixture of wood and fibreglass. The mechanised boats are of the open canoe type (Table 2.5). Outboard engines (25 - 75 HP) generally propel them. They are 8.4 x 1.5 x 0.9 m. The decked vessels are generally made of steel with lengths averaging 15 - 30 m (Table 2.6). Ninety - five percent of the fishing fleet is open canoe type boats. Decked vessels account for the other five percent.

Table 2.5: Boat Material

	TOTAL	**PERCENT**
Fiberglass	2,697	70
Fiber/wood	209	5
Wood	860	22
Aluminum	11	.03
Steel Hull	56	1
Other	41	1
TOTAL	3,874	

Table 2.6: Boat Size

	TOTAL	**PERCENT**
< 1M	2	.005
1M - 3.9M	111	3
4M – 8.9M	3,106	79
9M – 25M	689	17
>=26M	7	.02
Other	37	.09
TOTAL	3,952	

2.2 Description of Jamaica's Fishing Grounds

Jamaica's fishing grounds may be described as the inshore and offshore fishing areas (Appendix 2). The inshore area being characterized by the island shelf and the offshore areas by the offshore fishing banks.

2.2.1 The Jamaica Island Shelf.

The island shelf around most of Jamaica is relatively narrow. The 40-meter contour usually lies about 1,000 m from land. On the south coast the island shelf is much larger than on the north coast. The south shelf extends from Kingston in the east to Black River in the west. At its widest, it is 28 km in width and approximately 150 km long.

On the north coast fringing reefs extend with few gaps, from Morant Point in the east to Negril in the West. Here the reefs tend to be small, patchy and often senescent. The north shelf is so restricted that the fringing reef and sill reefs are almost contiguous. On the south coast, large reefs are restricted to the eastern part of the South Jamaica shelf, near Port Royal and the entrance to Portland Bight. The sill reef is well developed along most of the edge of the South Jamaica Shelf.

2.2.2 Oceanic Banks

Most Oceanic Banks rise abruptly from depths of well over 500 m to a submarine plateau with mean depths of 20 - 40m. On some banks, depths of less than 20 m are encountered in areas where reefs, cays and shoals are present.

The oceanic banks may be described as proximal and offshore banks. The proximal banks to the south are New Bank, Blossom Bank, Waltham Bank; Dingle Bank to the Northeast is Grappler Bank, Henry Holmes, Formigas, Albatross, Morant Bank, Bowditch and Salmon Banks.

2.2.4 Offshore Banks

The offshore banks are the Pedro and Morant Banks and Alice Shoal (which is located in the Joint Regime Area). The Joint Regime area is a shared maritime space between the Jamaica and Columbia. The demarcation of which falls between Seranilla and Bajo Nuevo Banks.

2.3 Description of the Pedro bank

The general depth of the Pedro bank ranges from 0 - 10 m to a depth of about 50-m. The mean depth on the bank is 24.5 m and the general circumference of the bank about 590 km. The bank is characterised by westerly currents of about 1.5 knots - 2.5 knots. The bathymetry is characterised by sand flats, sparse coral cover and seagrass beds. The Bank also has three cays Northeast Cay, Middle Cay and South Cay. Approximately 500 to 1000 fishers use the Northeast Cay and Middle Cay as a base from which they fish on the bank. These fishers reside on these cays for up to 11 months of the year.

2.4 Status of the Fishing Industry

In a report done by the Fisheries Division in collaboration with the Zoology Department of U.W.I., 3,760 canoes were recorded in 1981 and 16,000 in 1985. Since 1985, more persons have been attracted to the fishing industry, however, in 1997, 11,169 registered fishers were recorded. This indicates that a large number of unregistered fishers are harvesting the resources and thus contributing to the downward spiral of fish stock. The decline in fish yield, according to Aiken 1985, was due to over exploitation, which saw an increase in fishing effort and a decline in catch per unit effort (Clemetson 1993).

Severe fishing pressure has resulted in the reduction of several families of reef fish, for example, the family Scaridae declined by over 56% between 1981-1992. Also there has been a change in the species composition in respect to catch percentage of “Quality” species, which is declining, and low quality “trash” species which are on an increase, Clemetson et al (1993). In 1997, “trash” fish contributed 36% of the total weight and “quality” fish only 30%. In general, the total landing of fish by market category decreased from 14,495.98 MT in 1996; 7,691.41 MT in 1997; 6,045.18 MT in 1998; and increase slightly in 1999 to 8393.44 MT. (Fisheries Division 1996, 1997 and1998)

The other marine capture fisheries such as lobster and conch are also bordering on exploitation. The shrimp and coastal pelagic fishery seem to be viable and should be carefully watched for any signs of over-exploitation.

2.3 Fishing methods

The most important fishing methods are: fish traps or pots (Antillean Z-trap) used to catch demersal species and accounting for 54% of all fish catches; gill, seine, and throw nets are used mainly to catch oceanic and coastal pelagic species and accounting for 23% of all catches; hand lines, long lines and troll lines, used to catch both demersal and pelagic species and accounting for 17% of the total catch; and diving methods including hand-collection, spearguns and hooks used for demersal and pelagic species and in the capture of conch and spiny lobsters.

2.4 Fisheries Production

During the year 1999, it is estimated that 8393.44 metric tonnes of fish were landed. Of this it is estimated that 1,366 was conch.

Table 2.1: Fisheries Production in Jamaica MT (1996-1999)

	1996	1997	1998	1999
Finfish	12,477.72	5578.75	4160.98	6283.74
Conch	432.00	1821.20	1700.00	1366.00
Lobster	394.14	269.63	169.66	329.90
Shrimp	180.91	67.04	14.54	4.49
Others		10.25		
TOTAL	14,484.77	7,746.87	6045.18	7984.13
% exported				12

Total Production 1999	Preliminary estimates of total production based on the 1999 data collection programme have revealed the following.
Finfish Production 1999	During 1999 it is estimated that finfish production was 6,283.74 MT. This contributed approximately J$1,244,180,520 (US$30,345,866.34) to the local economy.
Conch Production 1999	Conch production was 1366 MT of this 1005.39 MT was exported. Through exports this product contributed US$6.3 M.
Lobster Production 1999	Lobster production was estimated at 329.9 MT, this contributed J$38,514,000 US$1,081,853.93 to the local economy. Of this amount 285.6 MT were exported.
Shrimp Production 1999	Marine shrimp production was estimated at 4.49 MT.

2.4 Problems faced by the Fishery

The predominant problems in the fishery, include:

- loss of habitat due to coastal degradation and pollution,
- use of destructive fishing gear,
- lack of awareness on fisheries management issues,
- Poaching by foreign fishing vessels
- Fishers not respecting close seasons and other fisheries regulations
- Lack of proper enforcement.

3. MANAGEMENT OBJECTIVE BY FISHERIES

The goal to be achieved from proper management of the marine fisheries of Jamaica is the sustainable use of fisheries resources for the maximum benefit of the people of Jamaica.

Shallow-Shelf and Reef Fishery

Objective: To rehabilitate reef fisheries to sustainable levels within the context of coastal zone management and conservation-oriented fishing practices.

Most of the catch is taken by artisanal fishers using mainly Antillean Z-traps. However prohibited fishing practices such as dynamite, poisons, and other noxious substances remain problematic. Fish biomass has already been reduced by up to 80% on the fringing reefs of the north coast, mainly as a result of intensive artisanal fish trapping. It is hoped that fishing activities could be diverted from the reef for a period, which would in effect reduce fishing effort. We have to encourage co-management of the fishery. Increased surveillance and enforcement of legislation is also needed to stop persons destroying the reef.

Deepslope Fishery

Objective: to prohibit fishing effort on spawning aggregations and protect areas where these species normally inhabit during the early life stages.

The deepslope fishing areas within Jamaican waters is relatively small. Catches from the deep slope represent approximately 10% of total annual catch of marine fish. The fishery needs to be better studied. There is also need for increased awareness among fishers of the vulnerability of the stock and the potential for over-fishing.

Coastal Pelagics

Objectives: to ensure the viability of the fishery through maintaining and enhancing habitat, and protection of nursery areas.

The coastal zone where this fishery is based is an area in use by many other interest (water sport, tourist, harbour use). Management strategy must include some arrangement to reduce conflicts, arrangement to control land-based pollution and coastal development and discourage the use any destructive practices in the zone.

Large Pelagics

Objectives: to sustainable development of the fishery, to cooperate with other states (particularly Caribbean states) to assess, protect and conserve the large pelagic resource.

This fishery will need to be studied preferable on a regional basis, and a regional management plan developed.

Lobster

Objective: to restore/rehabilitate the fishery through protection of lobsters and protection and enhancement of their habitat.

There is already legislation in place to prevent the taking of berried lobster, prohibit the landing of lobsters during the close season. There is need for gear restrictions effort reduction and co-management arrangements.

Conch

Objectives: To ensure optimum sustainable yields and develop the fishery in other areas.

The introduction of a large-scale industrial fishery, which has almost totally displaced the artisanal conch fishery of the years prior to 1980, has increased production substantially. Conch is particularly susceptible to over-fishing because it is sedentary and aggregates in specific habitats. Estimated catches (based on export data) increased from 50 MT in 1987 to 2,051 MT in 1994, however actual catches may be much higher due to illegal fishing. The fishery therefore need close supervision and a strong management framework.

New regulations [The Fishing Industry (Amendments Of Schedule) Order 2000] provided for quantity of conch in storage to be declared before the closed season, provides for the inspection of conch in holding areas, establishes minimum size restriction for conch and reserve the coastal shelf for the artisanal fishery.

Shrimp

Objectives: ensure sustainability and full efficient use of the fishery.

Some of the gears used in this fishery, takes excessive by-catch due to the inefficiency of the gear. There is need therefore to introduce by-catch reduction devices to the fishery.

4. HISTORY OF DATA COLLECTION PROGRAMME

In 1962 when a sample survey of the Fishing Industry in Jamaica was conducted by the Division of Economics and Statistics and the Ministry of Agriculture and Lands Jamaica, it was noted that no frame was available for selection of a sample on any basis. In 1970 the Agricultural Planning Unit instituted a continuous survey of the Industry. The main purposes of the continuous survey were (1) to improve the annual estimates of fish production in the island, (2) to improve the estimate of the contribution of the Fishing sector to the gross National Product.

The methodology of the sample survey of the 1960's and 1970's was as follows:

(1) a frame was produced or updated, which is a listing of all boat owners and boats according to beach.
(2) beaches were classified according to number of boats and then a pre determined criteria used to select beaches to be used in the sample.
(3) beaches selected for the sample were visited according to a schedule and a questionnaire completed. Information collected included, type of boat, type of gear, fishing grounds, length of boat, number of crew, fishing hours and catch by species.

Results of Sample Surveys of the Fishing Industry of Jamaica 1962-1981

Year	Survey Conducted by	Estimated Pro. Mil. lbs.
1962	L Chuck	24.2
1968	B. Nembhard	14.6
1970	R. Russell	13.8
1971	R. Russell	15.6
1973	R. Russell	16.1
1981	A. Sahney	15.9

It is to be noted that these surveys did not include landings form the Morant and Pedro Cays or the recreational fishery.

There was no specific data collection system in place for different fisheries. The only record of lobster shrimp and conch was from the Artisanal Inshore. The large industrial catches were not being accounted for. The surveys noted fish by type but there was no systematic biological data collection.

The Fisheries Division, though involved in these surveys was in need of a systemic data collection scheme to provide on a timely basis, the information required to make informed decisions for managing Jamaica's fisheries resources. In 1991 a project aimed at improving management and conservation of the fishery resources of the CARICOM countries, was founded with financial and technical support from the Governments of Canada and of the Caribbean Community. The CARICOM Fisheries Resource Assessment and Management Program (CFRAMP) had as one of its major achievements, the setting up of fisheries management data systems in Member States. The systems would be articulated around two main components: the catch and effort systems and the licensing and registration systems. In 1996 Jamaica working with CFRAMP developed a Jamaica Fisheries Sampling Plan for implementation in the same year. The sampling plan was similar to the ones of former years but with many new components. For example landings from the Industrial sector and the Pedro Banks was included. Also there was to be Biological Data Collection. The plan had two main elements:

(1) Census – catch and effort from processing plants (conch & lobster) and fish processed by packer boats. For the catch and effort census logs were used to capture information as follows:

Processing plants	landing logs	effort & landed wt. by species
Industrial Vessels	fishing logs	catch & effort by species
Packer & Carrier	purchase logs	purchases

(2) Sampling programme from selected landing sites (Manchioneal, Whitehouse (Westmoreland) and Old Harbour Bay)
Fisheries data collectors (including Fisheries Instructors) would collect information at major landing sites. Sampling would be by landing site clusters and the information collected would include catch by species or species group, effort and where possible area fished.

In 1995, the expected system was to be executed by a core of existing Fisheries Division staff based in Kingston (Chief Fisheries Instructor – data collection supervisor, data manager, data entry operator, Fisheries Instructors (12) based at landing sites were to be incorporated. In addition, an educational campaign aimed at the fishermen would be conducted. The Sectors which were included in the sampling plan.

The system was not effective, thus, the Fisheries Division had to restructure the data collection programme in 1996.

5. PRESENT DATA COLLECTION SYSTEM BY FISHERY

5.1 SMALL COASTAL PELAGICS DATA COLLECTION PLAN

5.1.1 Introduction

The Pelagic fishery in Jamaica can be divided into two distinct groups: (1) Coastal fishery for Clupeids, Engraulids, Carangids, Mugulids, and Hemiramphids and (2) Offshore fishery for Scombrids and Istiophorids. The coastal Pelagic fishery is an artisanal nearshore fishery. Fishers use powered fiberglass vessel, using gillnets (mainly sprat nets) and fishing is usually done at nights. The present status of the fishery is unknown.

Harvey (1994), indicated that there are eight (8) clupeid species in Jamaican waters, three (3) of which are commercially exploited for local consumption, Opsitonema oglinum, (Atlantic thread herring, locally known as sprat), H. jaguana (Scaled sardine) and H. heralis (Red-ear sardine, locally known as pinchers). Opistonema oglinum is the most heavily sought after species in Jamaica. Bait fish (eg. Harengulids and Engraulids), caught by trammel and lift nets is very important as it supports the artisanal offshore (line) fishery and the recreational fishery.

5.1.2 Data collection Programme

Certain issues were considered in developing the data collection programme:

- Coastal pelagics are targeted for two reasons: food and bait fish
- Multi-gear fishery: main gear are sprat net and beachseine, others include china net, trammel net, handline and pot.
- Species caught in Jamaica
- Sprat net varies in size (length and width) and mesh size (fishers are constantly adding to existing nets)

The coastal pelagic data collection programme focused on food fish. The extent of the bait fishery is unknown. The main coastal pelagic bait used in Jamaica are Engraulididae (Anchovies and White fry). These are caught by trammel nets and lift nets. Coastal pelagic, food fish, are caught mainly by sprat net and beach seine. The sprat net fishing operations are similar throughout the country.

Stratification was based on gear types (1) sprat net and (2) Beach seine (Table 5.1). Catch & effort (Appendix 3) and biological data (Appendix 4) is collected from two fishing beaches, namely Greenwich Town and Old Harbour Bay. Data collectors visit landing sites twice per month to capture catch & effort and biological data. Fishers are interviewed upon arrival at the landing site, the information is recorded on the data sheets. In cases where fishers were not interviewed, this information is recorded on the summary sheets. Information form both sheets are used to estimate total landings.

Table 5.1 Coastal Pelagic Sampling Programme

GEAR TYPE BEACHES	Number of Vessels	Type of data collected	Fishing Ground
SPRAT NET			
KINGSTON			
Greenwich Town	37	C&E; BIO	South Shelf; KH
Rae Town	15		KH
Hunts Bay	8		Hunts Bay; KH
Port Royal	1		Hunts Bay; KH
ST. ANDREW			
Bull Bay (Seven Miles)	4		South Shelf
Bull Bay (Nine Miles)	2		South Shelf
ST. CATHERINE			
Old Harbour Bay	12	C&E; BIO	Portland Bight
ST. ELIZABETH			
Black River	3		Black River Bay
ST. ANN			
Old Folly	1		Discovery Bay
ST. THOMAS			
Cow Bay	4		South Shelf
Morant Bay	2		South Shelf
Yallahs	6		South Shelf
WESTMORELAND			
Bluefields	3		South Shelf
Negril	6		South Shelf
HANOVER			
Lucea	2		Lucea Bay
BEACH SEINE			
KINGSTON			
Greenwich Town	1	C&E	South Shelf
WESTMORELAND			
Bluefields	1		
Negril	2		
Great Bay	2		

Key: C&E – Catch and effort data collection; BIO – Biological data collection

5.1.3 Limitations and Strength

5.1.3.1 Limitations

- Due to staff limitations, we are unable to increase the number of sampling day
- Need to obtain more information on the beach seine fishery
- Need to perform a selectivity study on the sprat net
- Data collection is focused on *Opsitonema Oglinum*, we need to collect information on the bait fishery.

- Need to collect social and economic information to assist in explaining the biological data (Grant et. al., 2000).

5.1.3.2 Strength

- Available information on the coastal pelagic fishery.

5.1.4 Recommendation

- ✓ The Fisheries Division should continue its coastal pelagic data collection programme.
- ✓ Try to address the limitations to improve information for management
- ✓ Use information generated form assessment to develop a detailed management plan for the fishery

5.2 DEMERSAL AND OFFSHORE PELAGIC DATA COLLECTION PLAN

5.2.1 Introduction

Aiken (1984), Haughton (1988) and Munro (1983) suggested that the fishery is over-exploited, a suggestion was made that the Division needed to monitor the fishery through an on-going data collection programme. Areas of special interest to the Division are: Rosalind Bank, Pedro bank, North Coast, South Coast, Morant Bank, other offshore banks and Alice Shoal.

5.2.2 Catch & Effort Data System

The objective of the data acquisition system is to collect basic fisheries data for the demersal (reef and deepslope) and offshore pelagic fishery by sampling beaches representative of all the landings sites in Jamaica. The monitoring system should provide accurate data on catches, catch per unit of effort, catch by fishing ground, the value of the catch, length frequency and data on fishing gear.

5.2.2.1 Artisanal Inshore

Historically, it has been stated that Jamaica has 187 fishing beaches, including two (2) on the Pedro Bank and one (1) on the Morant Cays. This information, along with data on boats, gear, species and fishers collected by landing sites in 1994, and stored in the Licensing and Registration database (LRS), was analyzed and the result used in developing the present sampling programme for catch and effort and biological data collection for the artisanal component of the offshore pelagic and demersal fishery.

5.2.2.1.2 Sampling Plan

- Fourteen (14) of the 187 beaches will be sampled
- The country was divided into two geographical areas – NORTH and SOUTH coasts, based on the nature of the fishery.
- Landing sites were stratified by:
  - ✓ Fishing ground
  - ✓ Beach size (according to number of boats)
  - ✓ Gears
  - ✓ Fish Types
- Data sheets for catch and effort (Appendix 3 and 5) were developed, and revised with assistance from the NGO's. Example: South Coast Conservation Foundation (S.C.C.F)
- The data is being collected by data collectors from the Fisheries Division

5.2.2.1.2.1 NORTH COAST

The north shelf has a continuous reef system and it is less than one mile from the shore. The distribution of fishers by gear type on the North Coast are: Pots 74%, handline 57%, troll line 37%, other gear<10% (Fisheries Division LRS data, 1996). Percent not equal to 100 as many of the fishers use more than one gear. Boats on the north coast are mainly non-mechanized (Fisheries Division LRS data, 1996). In areas where there are mainly mechanized boats, trolling is done. From this information the following assumptions were made:

1. The reefs on the North Coast are continuous and similar, therefore, productivity will be the same for beaches in the same group.
2. Similar gears among landing sites.
3. Landing sites within each strata are internally homogeneous.

Table 5.2: North Coast sampled beaches by characteristics

CODE	# BEACHES	FISHING BEACHES	FISHING GROUND	MAIN GEAR	FISH TYPE	TYPE OF DC	AGENT
1	6	Rio Bueno	Discovery Bay	P	Reef	C&E; BIO	FIP
2	21	Old Folly Salem Rio Bueno Runaway Bay	Discovery Bay Discovery Bay Discovery Bay Discovery Bay	P P P P	Reef Reef Reef Reef	C&E; BIO C&E; BIO C&E;BIO C&E; BIO	FIP FIP FIP FIP
3	36	Braco	Discovery Bay	P	Reef	C&E; BIO	FIP
4	2	Pagee	Falmouth to Rocky Point	TL	OPelagics	C&E; BIO	FD
5	4	Mo-Bay	Lucea to Discovery Bay	TL	OPelagics	C&E; BIO	FD
6	1	Manchioneal	Formigas, Grappler, Henry Holmes, Albatross, shelf	TL/P	Opelagics Reef	C&E; BIO	FD

Source: LRS
KEY: TL-troll line; P-pot; C&E–catch & effort; BIO-biological data collection; FIP-Fisheries Improvement Project; FD-Fisheries Division; DC-Data Collection

The beaches were also divided into six categories (codes) based on beach size and gear type:
Beach sizes: large (L) – beaches with more than thirty (30) boats; medium (M) – beaches with between 10-30 boats; and small (S) – beaches with less than 10 boats.

- Code 1: Large beach with pot as the main gear (L:P)
- Code 2: Medium beach with pot fishing as main gear (M:P)
- Code 3: Small beach with pot fishing as main gear (S:P)
- Code 4: Large beach with line fishing as main gear (L:L)
- Code 5: Medium Beach with line fishing as main gear (M:L)
- Code 6: Large beach with bank fishing (L:B)

Of the 69 active fishing beaches on the north coast, the beaches were grouped accordingly. At least one beach was chosen from each group for sampling (Table 5.2).

On the north coast, the Fisheries Improvement Project (FIP) provides data collected for their own research, to the Fisheries Division.

5.2.2.1.2.2 SOUTH COAST

The South Coast has a much wider area and larger offshore Bank. The shelf extends to a approximately seven (7) miles (24 km). On the south coast, percentage of fishers by gear type are: handline (35%), pot (32%), china net (23%) and trolling (17%) (Fisheries Division (LRS) data , 1996). The south coast was divided into four (4) categories (Table 5.3):

- Code 7: Large Beach (L) (> 40 boats)
- Code 8: Medium beach (M) (20-40 boats)
- Code 9: Small Beach (S) (<20 boats)
- Code 41: Carrier vessels

Table 5.3: North Coast sampled beaches by characteristics

CODE	# BEACHES	FISHING BEACHES	FISHING GROUND	MAIN GEAR	FISH TYPE	TYPE OF DC	AGENT
7	12	Rocky Point Old Harbour Bay Whitehouse	South Shelf; Pedro Bank South Shelf; Pedro Bank South Shelf; Pedro Bank	M M P;DL	Reef;Opelagics Reef;Opelagics Reef; DS	C&E; BIO C&E C&E	FD FD FD
8	21	Barmouth	South Shelf	M	Reef	C&E	FD
9	27	Welcome	South Shelf	N	Reef	C&E	FD
41	53	Pedro Cays		-	Reef	Landings	FD

Source: LRS
KEY: DL-drop line; P-pot; M-mix fishing; N-net; C&E–catch & effort; BIO-biological data collection; FD-Fisheries Division; DC-Data Collection

5.2.2.1.2.3 PACKER/CARRIER VESSELS

Fishers on the Pedro and Morant Cays send their sorted catch to the mainland via the packer/carrier vessels. The FD has to capture landings from the banks, from the packer boats on the mainland. The main problem is obtaining the effort (average effort - boat days), from the actual fishing vessels. The main landing areas on the mainland are Kingston Fishing Complex, Old Harbour Bay and Rockfort. The main objectives of the packer/carrier vessel data collection are:

- Estimate total landings
- Estimate the level of fish sorting on the Cays
- Determine fish prices by market category
- Understand the dynamics of the fishery on the Cays
- Determine the percentage species composition by market category of fish landed

The LRS system recorded 9 fishing beaches where packer boats are landed (Table 5.3.1). Packer boats are large fiberglass or steel-hull vessels greater than 28ft, powered by outboard (2) or inboard engines. It carries icebox to store the fish. Another code was added to the data collection system, code 41: packer boats.

Table 5.3.2: Code 41, Packer Boats

PARISH	PACKER BOAT LANDING SITES	NUMBER OF BOATS	FISHING GROUND	FISH TYPE

Kingston	Kingston Complex	12	Pedro Bank	Reef
Clarendon	Rocky Point (C)	6	Pedro Bank	Reef, Lobster
St. Catherine	Old Harbour Bay	15	Pedro Bank	Reef, Lobster
St. Elizabeth	Great Bay	2	Pedro Bank	Reef, Lobster
St. Thomas	Yallah	2	Morant Bank	Reef, Lobster
	Rocky Point (T)	2	Morant Bank	Reef
Kingston	Rockfort	5	Pedro Bank	Reef
	Greenwich Town	10	Pedro & Morant Bank	Reef
	Hunts Bay	2	Morant Bank	Reef
TOTAL		**55**		

Source: LRS and personal observation

Vessels were divided into three main categories:

1. **Carrier vessels** – large steel hull vessels, size >60 ft. with inboard engines. Purchase fish from fishers on the Cays, 1-2 days; 4 trips per month; carries large volume of water and fuel in exchange for fish; icebox capacity 14,000lbs.
2. **Packer boats** – large fiberglass boats; carries small volume of water and fuel in exchange for fish; 5-6 trips per month; icebox capacity 7,000-8,000 lbs.
3. **Bighead** – fiberglass boats, size 30ft. with two outboard engines (40-75hp); 1-2 iceboxes, capacity 200-2,000 lbs; one trip per day.

Catch and effort data collection programme is based on the type of vessels and the fish storage capacity of the vessels. The two main assumptions are:

1. similar boat types will carry the same amount of fish
2. capacity of vessel type per trip is similar for all the beaches per category.

Based on these assumptions the following sampling system was developed (Table 5.3.2). Landings data is captured at the Kingston Fishing Complex and Old Harbour Bay. The level of sorting, on the Morant Cays was estimated at 18% discards (Morant Cay Research), this estimate was also used for the Pedro Cays.

Table 5.3.2: Vessel Type by landing site by number of vessels

	LANDING SITES	# VESSELS
CARRIER VESSELS		
Kingston	Kingston complex	7
	Greenwich Town	5
	Rockfort	5
St. Catherine	Old Harbour Bay	1
St. Elizabeth	Great Bay	2
PACKER BOATS		
Kingston	Kingston Complex	5
	Greenwich Town	2
Clarendon	Rocky Point	3
St. Catherine	Old Harbour Bay	7
BIG HEAD		
Clarendon	Rocky Point	3
St. Catherine	Old Harbour Bay	7
St. Thomas	Yallah	2
	Rocky Point	2
Kingston	Greenwich Town	3
	Hunt's Bay	2
TOTAL		**54**

Sampling Schedule
Sites are visited twice per month. The dates are chosen randomly, weekends not included. Schedules are drafted before the beginning of the month, where data collectors and drivers are assigned. The information is added to the Division's data system (hard copy and Trip Interview Program Software (TIP)). Data is entered in the Trip Interview Program Software (TIP.)

5.2.3 Limitations and strengths of sampling plan

Limitations

- The absence of weekend sampling
- Inadequate sample sites within each code
- Need to randomly select landing sites for data collection.
- Resources (human, transport, financial, etc) limited.

Strength

- Trained data collectors
- Ability to estimate total landing

5.2.4 Recommendations

- ✓ The Division should continue its data collection programme and increase resource where necessary
- ✓ Use information from the census to restructure the programme. This will assist to simplify the present system

5.3 LOBSTER DATA COLLECTION

5.3.1 Introduction

The spiny lobster is widely distributed in the coastal waters and the offshore banks around Jamaica. Catch of spiny lobster comes mainly from the Pedro Bank (60%). The stocks particularly on the northern coast have been significantly depleted (Fisheries Division, 1996). Total landings have increased from 260t in 1981 (Sahney, 1983) to 600 t in 1993 (Fisheries Division, 1994). The increase in landings could be due to the changes of the fishery from artisanal (prior to 1982) to an industrial fishery with the introduction of 25-30 m class vessels. Aiken (1984), Haughton (1988) and Munro (1983) suggested that if the effort on Pedro Bank increases the fishery would become over-exploited.

Lobster is a high priced resource and represents an important component of the total value of the landings of the Jamaican commercial fisheries. Its' production supports a local market (mainly the hospitality industry) and an export market. The export market earns an average of US$4-6 million per year.

5.3.2 Catch & Effort Data System

5.3.2.1 Mainland Artisanal Data Collection

Fishers based on the mainland and near shore banks, are defined as mainland artisanal fishers. Most use traps, however, there are many full time fishers for which diving is the main method of fishing. The lobster is sold to the hospitality industry and housewives. Some also goes to small and large processors.

5.3.2.1.2 Catch & Effort

The catch & effort system target catch by gear types, since catch rates and effort differs by gear type. Lobster is caught using many different gear types; antillian Z-traps, SCUBA, Free dive, Hookah and nets (Table 5.4).

Table 5.4 Lobster Sampling Programme

GEAR TYPE/BEACHES	SCUBA	Free dive	Hookah	Net
MANCHESTER				
Alligator Pond	4			
CLARENDON				
Rocky Point	3	6		20
ST. CATHERINE				
Old Harbour Bay	1	3		
Port Henderson (+ Hellshire)	20	3		
KINGSTON				
Hunts Bay	1	1		
Rae Town	1	1		
Greenwich Town		2		
ST. ANDREW				
Bull Bay (7 miles)			14	
ST. THOMAS				
Rocky Point	2	2		
Yallah	1	2		
PORTLAND				
Manchioneal		1		
ST. ANN				
White River	1	3		
Oracabessa		1		
ST MARY				
Pagee		2		
ST. JAMES				
River Bay	1	1		
Whitehouse	1			
WESTMORELAND				
Cook Street Bottom	1	1		
Cox Beach		1		
Negril		2		
St Mary's Beach		1		

Assumptions:

- Catch rates by gear types within stratum are similar
- The catch rates for SCUBA, Hookah and free dive are significantly different, thus the gears should be treated separate.

Catch, effort and biological data are collected by gear type. Old Harbour Bay and Hellshire are visited twice per month. Bull Bay, St.Thomas is also visited twice per month. The FD has been unable to collect landings information from Rocky Point, Clarendon.

5.3.2.2 Offshore Artisanal Data Collection

May be defined as fishers based mainly on Pedro and Morant Cays. The two main gear used are SCUBA gear and traps. The lobster is either transported back to mainland Jamaica, where it is sold to processors or vendors who in turn distribute it locally to the hospitality industry.

5.3.2.2.1 Catch & Effort

Landings of lobster from the offshore artisanal (Pedro and Morant cays) are caught by traps, SCUBA and hookah, supplied to carrier vessels which lands the catch on the mainland, Lobster processors send workers to the landing sites to purchase the lobsters. The Division collects the landings from the packer boats data collection programme. No effort data was collected.

5.3.2.3 **Industrial Data Collection**

Fishers who are based on the mainland but operate on the Pedro and Morant banks in 20 - 35m length vessels are defined as industrial fishers. These fishers are licensed to use lobster (Florida) traps. The operation is sometimes owned by the processor and 90% of the lobster is exported. There are 6 registered industrial vessel using florida traps to fish lobster in 1996.

5.3.2.3.1 **Catch & Effort**

Log sheets/books (Appendix 5) are issued to the captains of industrial vessels. At the end of a trip or fishing season the Fisheries Division collects the log sheets from vessel captains.

5.3.3 Limitations and strengths of sampling plan

Limitation
- Lack of adequate resources (mainly human and transportation
- Lack of observer(s) programme to gather more accurate information on effort.

Strength
- Data collection programme that captures information from all gear type

5.3.4 Recommendations

- ✓ Continue data collection programme
- ✓ Improve accuracy of information from the offshore artisanal and industrial fisheries
- ✓ Improve data collection for hookah gear.
- ✓ Observer programme needed
- ✓ Legislation must be enforced
- ✓ Educational programme needed

5.4 SHRIMP DATA COLLECTION

5.4.1 Introduction

The shrimp fishery of Jamaica is of significant economic importance, and there is the need to acquire accurate data on catch/landings, effort and species composition (Galbraith, 1995). The objective of the data acquisition and monitoring system (Appendix 3 and 6) is to provide accurate data on catches, catch per unit of effort by gear and prices for the shrimp fishery in Jamaica. The data will enable Jamaica to monitor the overall performance of the fishery and the changes in the resource. The data, which will be collected, are basic to other important fishery management activities, in particular stock assessment activities aimed at evaluation resource status and potential (Mahon et. al., 1990). The LRS system recorded 12 fishing beaches, 44 boats (motorized and non-motorized) and 153 fishermen that fish for shrimp.

5.4.2 Catch & Effort

Features of the shrimp fishery that were taken into account in developing the catch & effort system:

- Shrimp is targeted in two ways: (1) target fishery with coastal pelagics as the by-catch or (2) by-catch caught in fisher's net.
- Shrimp is purchased for food fish (consumption) and/or bait.
- It is a multi-gear fishery, thus samples must capture the different gears.
- Species caught by landing site
- Number of fishers engaged in shrimp fishing, its importance to the areas and production

Catch & effort sampling of shrimp is done within two stratum: (1) primary and secondary landing sites and (2) gear type. The landing sites are divided into two stratum based on number of fishing vessels; primary, less than 10 vessels and secondary, more than 10 vessels. Based on the above criteria, only one beach falls within the primary landing site, Hunt's Bay. The remaining beaches falls within the secondary site.

Hunts Bay is the major landing site in Jamaica. All the shrimp vessels in Kingston (Greenwich Town, Hunts Bay, Port Henderson, Hellshire and Port Royal) fish in Kingston Harbour and land their catch at Hunts Bay (Table 5.5). Of the five vessels from Old Harbour Bay one vessel fishes in Kingston Harbour.

Old Harbour Bay is sampled as a secondary landing site. The landings at the other landing sites (St. Mary's Beach, Alligator Pond, Leith Hall, Black River and Farquhar) are estimated based on the assumption that the catch per unit of effort by gear will be the same for the other beaches.

Table 5.5: Shrimp Sampling Programme

Landing Site	Gear Type	# Boats	Species	Catch rate	Use
HUNTS BAY	China Net	41	Ps	0.83lbs/hr	food food bait
	Trawlers	4	mix	0.43lbs/hr	bait
	Shove Net	1	mix		
	Pusher	10	mix		
Port Henderson	Otter Trawl	4	mix		food
Old Harbour Bay	Otter Trawl	1	mix		food
Port Royal	China Net	1	Ps		food
Greenwich Town	China Net	1	Ps		food
OLD HARBOUR BAY	China Net	3	Pn,Pb	1.10lbs/hr	food
	Otter Trawl	1	Pn,Pb		food
ST. MARY'S BEACH		2			food
BROUGHTON	China Net	2			food
ALLIGATOR POND		1			
LEITH HALL		1			bait
BLACK RIVER	Otter Trawl	2	Pn,Pb,Ps		food
FARQUHAR	Beachseine	1	Pn		food

Key: Ps-Penaeus schmitti; Pb-P. brasiliensis; Pn-P. notialis; mix-mixture of shrimp

Hunt's Bay and Old Harbour Bay are sampled twice per month. Catch per unit of effort calculated is based on gear type to determine monthly production. Sampling at Hunt's Bay started in September, 1996. The Division has been unable to collect data from the shove netters and pushers. This will be addressed in the future.

5.4.3 Limitations and strengths of sampling plan

Limitations

- Availability of human and vehicle resources

5.4.4 Recommendations

- ✓ FD continues the data collection programme
- ✓ Publish documents for fishers to present assessment reports
- ✓ Coninue working on the development of the Geographic Information System for the shrimp fishery
- ✓ Legislation needs to be implemented
- ✓ Educational programme for fishers
- ✓ Improve data capture for beach seine. To date little information has been collected.
- ✓ Due to the sporadic nature of this fishery in some areas, the FD needs to devise a way to capture information at other landing sites.

5.5 CONCH DATA COLLECTION

5.5.1 Introduction

The Queen Conch (*Strombus gigas*) fishery is the most valuable foreign exchange fishery in Jamaica. This resource is exploited on the island shelf and offshore banks. The predominant fishery occurs on the Pedro Bank. At present it is estimated that up to 95% of the conch landed in Jamaica originates from the Pedro Bank. However, small amounts are also fished from the Formigas Bank and Morant Banks. The amount of conch landed from the island shelf is so far not quantified but may be significant.

5.5.2 Catch & Effort

The conch industry is divided into an artisanal and industrial fishery.

5.5.2.1 Artisanal Fishery

The artisanal fishery may be described as:

(1) **Mainland artisanal** – these are fishers based on the mainland or island shelf of Jamaica. They were originally free divers who now use SCUBA gear for diving. These fishers are usually part time conch fishers. They sell Conch mainly to processors and the local market.

No catch & effort data is being collected from these fishers

(2) **Offshore artisanal** – these fishers are based on the mainland or island shelf of Jamaica. They use SCUBA or hookah gear for diving. These fishermen sell their catch to packer (small carrier) boats, which ply the route from mainland Jamaica to the Pedro Cays. The packer boats operators sell the conch mean mainly to processing plants.

Catch data is obtained from Processing Plants, however, the Fisheries Division is not able to capture effort information.

5.5.2.2 Industrial Fishery

This fishery is dominated by large producers who harvest conch for export. These fishers are based on the mainland. They fish the Pedro bank using motor fishing vessels of 20-35m. Most of the vessels are leased from countries such as Dominican Republic and Honduras. The vessel crew contingent including fishers averages 30 persons of which most of the divers are foreigners.

A census on all vessels and trips are required. Vessel captains are issued log sheets (Appendix 7). At the end of a trip, Captains return sheets to the Fisheries Division. The data is checked, and entered into Trip Interview Program Software (TIP.)

5.5.3 Limitations and strengths of sampling plan

Limitations
- The effort data on the log forms are not recorded accurately by vessel captain
- Unable to determine the level of poaching on the Pedro Bank

Strength
- Able to estimate total conch landing.
- Able to estimate catch and effort information.

5.5.4 Recommendations
- ✓ Continue the present data collection programme
- ✓ Develop a plan to capture landings from the mainland artisanal fishers
- ✓ Need an observer abroad vessels to (record more accurate and detailed information)

6. DATA MANAGEMENT

6.1 DATA ENTRY

In order to maintain a standardized and accurate database of information, a large part of the Data Collection Units activities has been involved in the standardization of all data including verification and data backups. When application forms for fishermen, boats, data collection sheets, log sheets or any other form of data relating to the Jamaican fishery is collected, it is the responsibility of the Data Entry Operator to see to it that they are all kept in a safe and accessible place until they are ready to be entered in the appropriate computerized software.

Registration forms are first signed by the Director of Fisheries then entered into the official register by parish and by fishing beach. The names, fishers licence number, date of birth , sex and license expiry date is entered in the appropriate Fishermen's Register. An entry number is then written at the top left hand corner, on the application form based on the parish, fishing beach, page number and the row number in the book. For example, (K-112-3). K, which represents the code for the parish of Kingston, 112, represents, the page number and 3, represents the row number. The application forms are then handed to the data entry operator to be entered into the computer. The forms are complied and double checked to ensure that the forms have all been signed and entered in the appropriate registers.

All data is entered in capital letters and codes are created for specific fields. This is done in order to have a standardized data entry system. **Codes** such as: ***Name(s) of Opsite, PortOp, Landing Site, Area Fished, Reporting Area, Sampling Site, Name of Agents, A list of Species; including scientific, common and local name*** are created and stored in report folders.

Throughout each day or at the end of a workweek, a '**Quality Control Report', (QC Report)** is done. The QC Report gives a print out of all the data that has been entered in the LRS and/or TIP software programme for the day. With this, all the application forms are once again checked by comparing what is on the QC report to that on the original application forms.

The purpose of preparing this report is to check and correct any error(s) that have been created while typing in information. Once a mistake has been found, the computerized registration number is then edited and the error(s) is corrected.

6.2 DATA STORAGE SYSTEMS, BACKUPS

In order to secure both the **LRS** and **TIP** Data files, the data files are backed-up on a regular or day to day basis. In order to do this, the following Backup Software is used.

- **PKZIP**
- **1OMEGAWARE –> 1-Step Backup and 1-Step Restore**

The storage of Backup Diskettes and/or Zip Diskettes is very important, for in the event of a fire, flood or hurricane, backups would be stored away in a safe place.
Backup Diskettes and/or Zip Diskettes are stored in a cool, dust-free and safe environment. They should be kept away from the vicinity of the computer, printer and UPS systems.
They are not left in the computer after use.

The Backup Diskettes and/or Zip Diskettes used at the Jamaica, Fisheries Division is stored in a safe and easily accessible place. Our database files (LRS & TIP) are backed up and stored at the following locations:

On Site Locations:

1. On a 32.0 MB RAM, Genuine Intel, Pentium(r) Processor in the Data Assessment and Management Unit (Room 10) at the Fisheries Division
2. a) On a 586DX computer in the computer room (Room 4) at the Fisheries Division
   b) In diskettes holders kept in the filing Cabinet – Room 10, Fisheries Division

Offsite Locations:

1. Ministry of Agriculture, Data Bank
   Old Hope Road, Hope Gardens, Kingston 6.
2. Ministry of Agriculture, Aquaculture Branch
   Twickenham Park, Spanish Town, St.Catherine.
3. The Jamaica Defense Force, Coast Guard office,
   Port Royal, Kingston 1.

6.3 LIMITATIONS AND STRENGTH OF DATA MANAGEMENT SYSTEM

Over the past years, both the ***LRS and TIP software programmes*** have experienced unforeseen problems. Of the two, LRS seemed to have experienced a lot of programming error, most of which have been corrected. However, for both software programmes there is still room for improvement.

STRENGTHS:
1. Both software programs have the ability to create and run specified queries and/or reports.
2. One is able to edit his/her report that has been run, in the format in which he/she desires.
3. The data are kept up to date and are able to be saved both automatically and manually.
4. Data has the ability to be imported and exported from other software programmes into these programmes.

LIMITATIONS:
The following are some of the limitations found in the **LRS** programmes.
1. Unable to perform queries, which contains memo fields.
2. Within the Vessel Database screen under the Renewal/Changes form and the Proof of Registration, if there is more than one owner of a vessel, one is unable to see the name of the second owner.
3. The programme is unable to accommodate all data on fishers when it is exported into Excel. Not all the database are shown. Example: if there are 12,000 fishers in the Fishers.dbf, only 8,000 is shown in Excel.
4. The programme is unable to accommodate a vessel that has three engines. There is only space for two engine types.
5. The Record Filter within the query screen can only accommodate up to eight entries.
6. Unable to add from Fisher, Vessel, Licence, Legal, Aqua, Plant **EDIT SCREEN**
7. Unable to enter the amount of gear within the licence.dbf
8. Unable to select the type of role, e.g. Registered owner from the Vessel screen using the keyboard
9. Vessel screen does not have a date of application
10. Within the **HELP FILE (F1)**, under the heading: **fields in the vessel database** – no field is there for Class, hence no help is given.
11. Within the **BROWSE SCREEN**, the “Quicky” feature runs less than ten times at each given time. When this happens an error message (see below) appears:
    Too many READs in effect
    <Cancel? >   <Ignore>
    In selecting ignore, nothing changes. In selecting cancel, the program exits automatically. One then has to restart the program and allows it to recreate the indexes.
12. Within **Vessel -> Browse**. This screen takes at least 47-50 seconds to appear.
13. Whenever a Fisher fino number is not entered within the **Fishers #** field within the Vessel Screen, the name of the Vessel does not appear within the Vessel Browse Screen. However, that same vessel name appears in the Vessel edit Screen.
    Also, when a “Quicky” and/or a Query is done for that particular vessel, the result equals to zero.
14. Under Utilities, the Backup DBFs only uses one diskette to back up the data. However, when PKZIP is used from the hard drive, three to four diskettes is usually used.
15. From the Main Menu, under the heading “**ADD FISHING LICENCE –> FOR VESSEL OR FISHER**.

When adding a licence for either database (lets say at the start of a new day), the lino (licence number) field (top right hand corner) starts at 00001 and shows data from a previously entered application within the **<Permit/Restrict>** window.
In order to correct the licence number, one has to cancel that entry and select "**ADD FISHING LICENCE** " again from the main menu.

16. Whenever a query is done using fields such as: Landing Site, Gear, Species and Area Fished from the Licpemt.dbf. The result equals to zero.
17. In Appending Data from Drive A or B to a database file in LRS, (example: appending to the Vessel.dbf, it was discovered that:
    - The description field is not completely filled out.
    - The engine HP needs to be justified to the left. Hence when edited, it cannot be seen.
    - The Reg. No. is not appended in a sequential order. It starts from the bottom upward.

The following are some of the limitations found in the **Trip Interview Program (TIP)** program:

1. The date fields need to be adjusted so as to accommodate the year 2000.
   Dates such as:
   - the computer's system date
   - Interview date
   - Reporting Period
   - Date within the Report screen

2. The Record Filter can only accommodate up to eight entries

3. From the Main Menu, under the heading "Data Entry" - >, **Frame Survey,** if the data is entered chronologically (eg. by date)**,** an **<Insert>** option is needed, should in case a date was inadvertently left out.

4. In Section 111, not all species are found in the pick list (F5). Species such as: some specie of the parrotfish, snapper, grunts, some coastal pelagics, species of crabs etc. Whenever specific species cannot be found, the family name of that specie has to be used. This is sometimes quite difficult to enter into the field, as one has to try two to four times before it is accepted. This list is very essential, especially as it relates to the migration of data into TIP.

5. In Section 1V, there are two fields there for weights. The First field represents the total weight of the specie. The second field represents the sample weight of that specific specie. Whenever a query is done using databases Tip11 to Tip 41, the sample weight does not appear although it was entered in section 1V. This information is cruital for the data to be analyzed.

6.4 RECOMMENDATIONS

All Fisheries Divisions/Departments of CFRAMP Member States should develop long-term management plans (these plans could be similar) so that they will know exactly what it is that they need out of these database programmes. Example: Queries, Reports etc., before software programmers begin to write these programmes.

Both the LRS and TIP software should be re-written in a more user-friendly, Windows based environment.

LRS should be re-written in a format similar to that of TIP. That is; an application form should be totally completed before another is added: The term complete, refers to: where a fisher/vessel/aqua/plant, etc. is issued a licence, this information should also be entered right away without having to exit one database to go to the other. (Example: Leaving the Fishers screen to go to the Licence screen. This applies to countries where licences are issued.

Programmers need to check the programme more thoroughly; there should not be a rush to finish these programmes, as this sometimes causes the frequent release of more than one version of the same software.

Data fields, queries and reports need to be tested in stages so as to ensure that all possible linkages within the databases are possible.

Provisions should be made to scan in photograph of a fisherman and or boat in the LRS programme.

There should be an "ADD" option for all the pick list files within the **TIP** software. One should be able to add to all the pick list files. Example: the gears, species etc., where some options are not available. There is also the need for a password for this programme.

A database should be created in the **LRS** software to hold applications such as fishers who have been deceased, destroyed vessels, any vessel or anyone who used to be in the fishery but no longer is involved. This database could be called **HISTORY.dbf**
This database is necessary because whenever a count of vessels or fishers is done, (there is a mis-representation of the data since some of these applications, although not functional are still within the system)

Whenever a file is saved from either LRS or TIP into EXCEL or LOTUS. There needs to be an upgrade of these files (EXCEL and/or LOTUS).

There is a need for a species named "Mixed Fish" be introduced in Section 111, 1V and V of TIP

The Caricom Fisheries Resource and Management Program (CFRAMP) or CARIFORM could assist in the training of Regional Trainers in programming and/or advance programming skills, then allow these trainers to spent some quality time with these Software programmers. The time spent, would be utilized in examining and understanding the documented and practical protocol of these software. This will enable trainers to be better able to manipulate these programmes so as to suit their countries needs, should the need arise.

7. DATA ANALYSIS

7.1 Type of analysis and information generated from catch & effort data

The Trip Interview Program (TIP) fisheries data software has the ability to produce several queries and reports. As the saying goes, "Garbage in, garbage out". Whatever information is entered into these database fields can also be generated. This only depends on the type of information one expects to get from the data entered and how the query/ report is created.
The following is a list of some of the information that can be generated from the software:

1. Target Fishery 2. Fishing Mode 3. Interviews where a specific vessel Id is used 4. Agent (name of person who conducted the interview) 5. Reporting Area 6. Sample Area 7. Total Effort 8. Total number of interviews including a specified landing site 9. Total number of interviews not including a specified landing site 10. Total number of crew members 11. # of Days out and days fished 12. Frame Survey data 13. Landing Type 14. Type of fishing gear used 15. Total number of fishing gears used	16. Gear description 17. Area fished 18. Total hours fished 19. Minimum and Maximum depth fished 20. Type of species caught 21. Total fish quantity for a specific day, month or year 22. Price of fish caught 23. Interviews on a specific day, month, date, year 24. Interviews where troll line, pots and nets were used 25. Interviews related to a specific fishery, e.g.: Spiny lobster 26. Biological data for a specific fishery (this includes, the gender, maturity status and age of the species) 27. Total number of interview taken during a day, month or year

7.2 Estimation of Total Landings

1) Calculations of total landings is based on the following:
   - Percentage of active vessels/gears for sampled site(s)
   - Total fish landings at known site for sampled site(s)
   - Estimate of the CPUE for sampled site(s)
   - Calculate estimate of active vessels/gears that went to sea multiplied by CPUE for un-sampled sites
   - Summation of sampled and un-sampled sites will give total landings.

Calculations are done by stratification e.g. code 61, coastal pelagics.

2) Calculating Co-variance [cv (Y)] within Strata:

Co-variance gives the extent of variability within each strata. This will determine to what extent, if any, the sampling plan needs changing. For example, in the present sampling plan, a number of beaches have been chosen per strata/code. After six months of data collection the variance within strata should be tested to determine if the sample beaches per code should be increased or decreased (to conserve resources).

LET x_i = number of boats at the i^{th} centre
$X = E\, x_i$ (where E = sum all)
$p_i = x_i / X$
$t_i = y_i / p_i$
n = number of site per strata

$$\mathbf{Y = E\, t_i / n}$$
$$\mathbf{v(Y) = 1 / n(n-1)\ [E t_i^2 - (E t_i^2) / n]}$$
$$\mathbf{cv(Y)} = (\sqrt{\mathbf{v(Y) / Y}})\, 100 \text{ (answer as percentage)}$$

Result of 5 - 10% shows good uniformity with a strata. If the cv (Y) is greater than 10% a careful look at the beaches within strata should be looked at.

7.3 Limitations and Strength

7.3.1 **Limitations**

- Method of estimating total landings is complex, the systems needs to be simplified
- Estimation of total landings mixes gear activity and boat activities, there is a need to restructure the data collection plan to sample by gear types only

7.3.2 **Strength**

- Able to obtain estimates of total landings, by species and gear types by landing site

7.3 Recommendations

- Basic and advance statistical training for staff.
- Full analytical procedure developed for estimation of total landings

8. CONCLUSIONS AND RECOMMENDATIONS

Accurate and quality information on the fishing industry of any State (especially of Island States) is a must for national accounts. In the Jamaican context fisheries data is the lifeline of the industry as the data collected provides for stock assessments, the results of which gives guidelines for management of the fisheries.

The major stock assessment studies of Jamaica's fishing grounds have been conducted by Munro (1969 – 1973); Cuba-Jamaica Fisheries Research Project (1977-1978); U.S.S.R. – Jamaica Fisheries Research Project (1979-1980) and Hartsuijker and Nicholson (1979-1981). The Islands of the Caribbean, however, probably share stocks of fishery resources, and a regional approach for fishery resource assessment denotes the way forward.

There is no doubt that the Data collection programme has carried us a long way forward in assessing the fisheries resources of the region. The Fisheries Division through the programme had up to date statistical, economic and social information readily available. The hope is that, as we learn more in the field, we will be able to upgrade and improve the programme to do more.

Greater progress could have been made with the present programme but Jamaica was faced with a number of hindrances, the major of these being inadequate resources. Other problems (some of which are beyond human control), includes personnel problems, logistic problem, transportation, legislation, and weather. The Division tried in every way possible to overcome difficulties, for example, the Division has only one data collector, thus, we have trained and used all available staff in the data collection process. The training process which included fish identification, fisheries laws, completing data sheets, and interviewing fishers, have resulted in improved and new skills of the Division's staff. The programme has also been responsible for fostering meaningful relationships between the Government, fishers, Fisheries (Governmental and none Government Organizations) and other environmental organizations.

From data collected and analyzed, and fieldwork carried out under the project, the following general observations were made. (a) It was possible to see that most of the Jamaican fisheries are either over-exploited or fully exploited and are in need of management. The programme has allowed for proper management decisions to be made. (b) The work carried out under the project have brought to our attention the complexity and dynamic nature of the fishing industry of Jamaica. (c) It has also made it clear that much more work need to be done. For example capturing information on the riverine fishery of the country and setting up research facilities for the un-exploited and under exploited stocks of the country

Recommendations for the future

1 Data collectors for a particular geographical area, should be recruited from the said area. This would facilitate or make absolute the acquaintance period between fishers and data collector.

2 Data collectors must obtain specialist training for the job, and preferably the training should be regional, that is, data collectors across the region should be armed with the same information.

3 Data collectors should be placed on at least 90% of all landing sites so as to eliminate some of the assumption errors.

4 Legislation and new systems must be put in place so that all fish landed must be reported to the authorities. Presently, fishers are sometimes unwilling to give information and sometimes landings have to be visually estimated.

5 Greater efforts must be made to use and make the information gleaned through the programme available to schools, NGOs and government, both nationally and internationally.

6 Systems should be put in place to capture information from the tourist and recreational sectors.

7 Data managers should report on data (catch and effort) and data entry to a regional body at least once quarterly.

8 There should also be at least quarterly review of the catch and effort systems in place to ensure that systems are up to date and if necessary adjusted with supervision to include new developments.

9 More resources must be made available to the data collection programme.

10 Census or frame survey information must be updated yearly with a new census being conducted at least once every four years.

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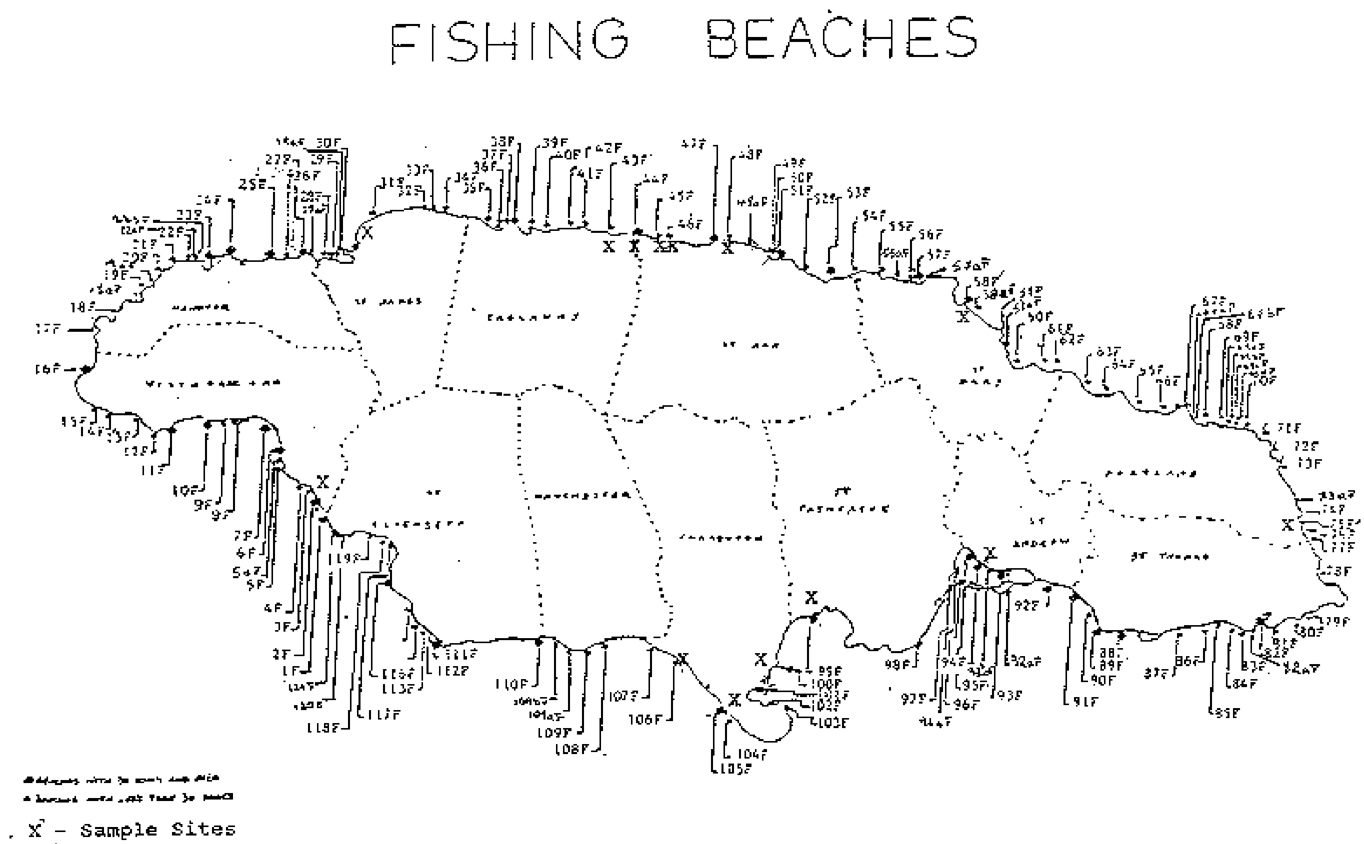
Table 3.1: Fishery Management Objectives

Fishery	Target Fishes	Distribution	Life History	Management Unit	Resource Status
Shallow-Shelf and Reef Fishery	Hinds (Serranidae) Parrotfishes (Scaridae) Triggerfishes (Pamadosydae) Grunts ((Balistidae) Squirrelfishes (Holocentridae) Surgeonfishes (Acanthuridae) Butterflyfishes (Chaetodontidae)	Mangroves (Juveniles) Seagrass Beds (Juveniles) Coral Reefs (Adults)	**Growth** - Up to 50cm for most species **Mortality** – 4-6 years for most species **Spawning** – varies by most species but broadcast eggs into the plankton	Island shelf (incl. Beaches and estuaries) and offshore banks for juveniles and adults; may be wider distribution for early life stages due to larval drift.	Many coral reefs have been degraded through a combination of human (i.e, over-fishing, land based pollution) and natural distrubances (i.e, hurricanes, disease). Unless action is taken immediately, the reefs may not recover sufficiently to restore fish populations to previous levels
Deepslope Fishery	Snappers (Litjanidae) Groupers (Serranidae)	Shallow Water (Juveniles) Deep Water (Adults)	**Growth** – greater than one (1)m, in length for most species are slow growing **Mortality** – long lived **Spawning** – Groupers form large spawning aggregations, several species are hermaphroditic	Deep slope areas around the coastal shelf and oceanic banks for juveniles and adults.	The deepslope resources are probably already close to being fully exploited, a precautionary approach is warranted since foreign effort cannot be quantified and some species (i.e., groupers) are extremely vulnerable to over-exploitation while they aggregate for spawning
Coastal Pelagics	Scaled Sardine (Harengula jaguana) Red-ear Sardine (Harenjula humeralis) Anchovies (Engraulidae) Ballyhoo (Hemiramphus spp) Thread Herring (Opisthonema oglinum)	Near shore area, particularly over seagrass beds, within barrier reef. Principal fishing ground: - Kingston Bight, Kingston Harbour, Portland Bight, Milk River Bay, Black River Bay and Lucea Bay.	**Growth** – short lived **Mortality** – high **Spawning** – major spawning period for Thread Herring is April to July.	Island shelf for juveniles and adults, may be wider distribution for early life stages due to larval drift.	Anecdotal evidence suggests that the thread herring be heavily exploited in many coastal areas. Other species are perceived to be under-exploited because of their migratory nature. Most species are susceptible to coastal pollution.

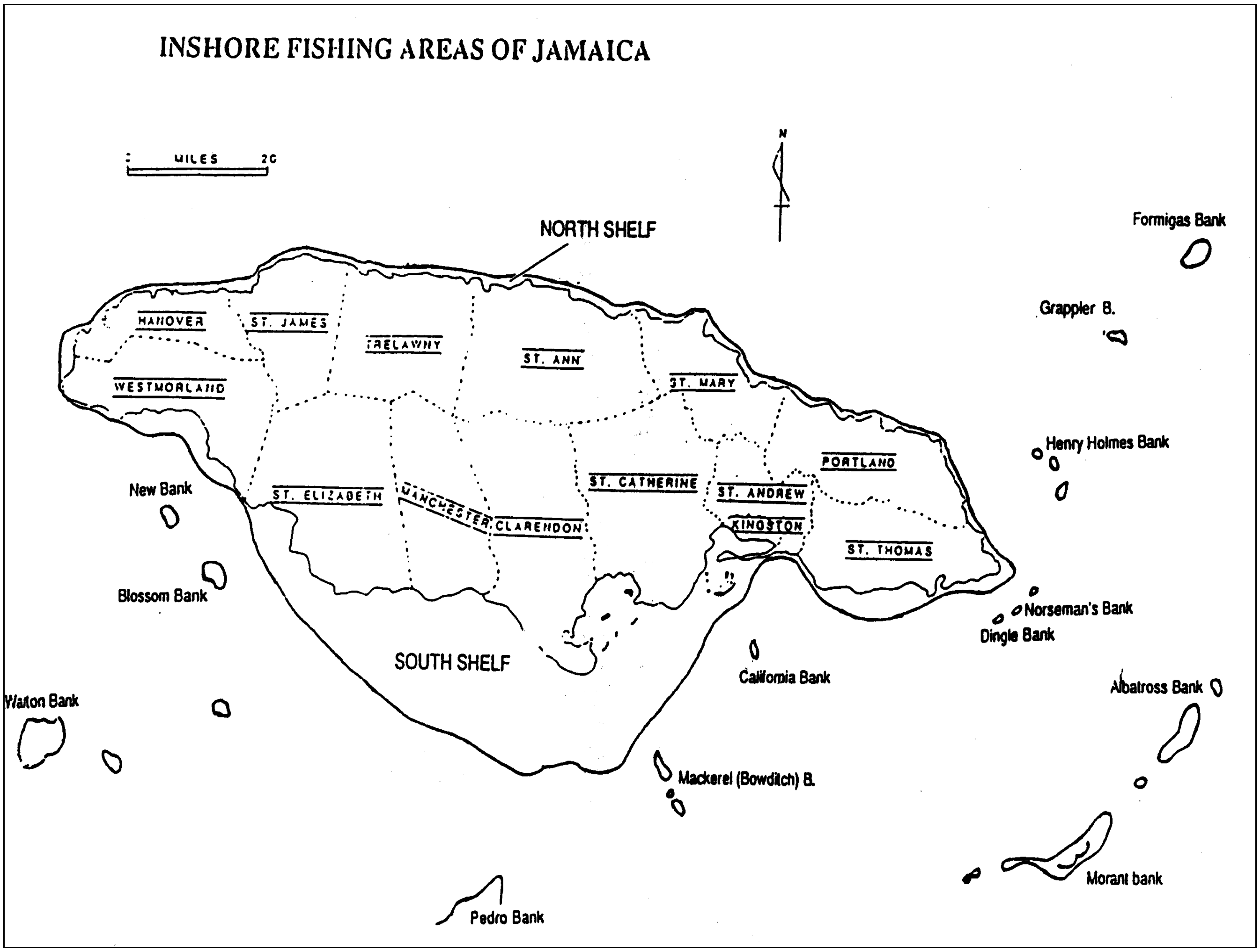
Large Pelagics	Tunas, Wahoo, Bonitos, Mackerels (Scombridae) Dolphinfish (Coryphaena hippurus) Marlins (Istiophoridae) Sharks (Elasmobranchii)	Most species are highly migratory. Stocks which are probably contained within the Caribbean Region are Dolphinfish, Kingfish, Wahoo, Blackfin Tuna, Stocks which extend throughout the Atlantic or at least the western Atlantic are (i.e., yellowtail tuna, skipjack tuna)	**Growth/Mortality** Can grow to several meters in length. Most species are relatively long lived. **Mortality** – Life span is 10 + years **Spawning** – Reproductive behavior is poorly known for most species	For most ocean wide species the entire Atlantic is the Management Unit	The resource status is not fully known but it is believed that it is adequate to allow for the expansion of the fishery.
Lobster	Spiny Lobster (Panulirus argus)	Larvae are planktonic for about six (6) months, Juveniles – shallow coastal habitats such as: seagrass, mangrove and coral rubble in protected bays. Adults – deeper water and offshore reef habitats.	**Growth** – Legal sized reached by males in three (3) years and females in four (4) years. Minimal size at sexual maturity is 80-90mm **Spawning** – Late summer, early fall, spring.	Coastal shelf, offshore bank and coral banks.	Could be over-fished.
Conch	Queen Conch (Strombus gigas)	Larvae are planktonic. Juveniles inhabit shallow coastal habitats, such as seagrass, and sandy bottoms in protected areas. Adults prefer similar habitats in deeper water.	**Growth** – Shell length stops increasing at the onset of sexual maturation typically at an age of about 3-3.5 years. **Mortality** – Maximum life span is about thirty (30) years. **Spawning** – The spawning season in Jamaica is thought to occur between July and November.	Island shelf; nearshore Banks; offshore banks.	The conch fishery is probably fully exploited in fact it could be on the verge of being over-exploited.

Shrimp	White Shrimp (Penaeus schmitti) Pink Shrimp (Penaeus notialis) Red-Spotted shrimp (Penaeus brasiliensis)	Shrimping activity occurs in mangrove areas where fishermen use shove nets, push nets, china nets and along muddy bottoms where trawling is possible.	**Growth** – Food abundance, temperature and salinity are the primary factors affecting growth. **Mortality** – Natural mortality is estimated to be 20-30% per month for adults. **Spawning** – Peck spawning period, February to April.	South shelf, particularly Kingston Harbour.	Potential yield of the fishery is unknown.

APPENDIX 1
MAP OF LANDING SITES



APPENDIX 2
MAP SHOWING FISHING GROUNDS



APPENDIX 3
CATCH & EFFORT DATA COLLECTION FORM

MINISTRY OF AGRICULTURE
FISHERIES DIVISION
CATCH AND EFFORT COLLECTION FORM

Landing Site ____________

Date ____________

Data Collector ____________

Checked Initial/Date ____________

	DATE		DATE		DATE	
BOAT REG. #						
BOAT NAME						
BOAT LENGTH						
CREW SIZE						
TIME/DATE DEPART						
TIME/DATE RETURN						
WEIGHT TYPE (W,F,W)						
GEAR	1	2	1	2	1	2
GEAR TYPE						
SOAK						
DEPTH FISHED						
# GEAR(S) USED						
MESH SIZE						
NET WEIGHT						
FISHING GROUND						

CATCH BY SPECIES	WT(LB)	WT(LB)	PRICE	WT(LB)	WT(LB)	PRICE	WT(LB)	WT(LB)	PRICE

APPENDIX 4
ATLANTIC THREADHERRING BIOLOGICAL FORM

JAMAICA BIOLOGICAL DATA COLLECTION - SPRAT

LANDING SITE:	
DATE:	DATA COLLECTOR:
BOAT NAME BOAT NUMBER:	

Total weight landed:	Area fished:	Fishing gear:
Sample weight:	Sample type:	Weight type:

Atlantic Threadherring (sprat) data

(I - immature; IN - inactive (mature); D - developing; Sp - spawning; S - spent)

	LENGTH	sex	maturity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
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15			
16			
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19			
20			
21			
22			
23			
24			
25			

	LENGTH	sex	maturity
26			
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29			
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APPENDIX 5
LOBSTER – INDUSTRIAL DATA SHEET

FISHERIES DIVISION LANDING LOG - VESSEL

VESSEL ID______________ COUNTRY OF ORIGIN______________ FREEZER / ICE (circle one)

SIZE (FT.)______________ CAPITAN__________________ SCUBA / HOOKAH (circle one)

Date	No. of Divers	No. of Canoes	AREA FISHED LAT.	LONG.	Miles -from anchor -canoe	Total Catch (kilo)	Avg. No. Dive Hrs.	Process Level (%) 50	65	85	100

Return Filled Logs To Processing Plants

APPENDIX 6
SHRIMP BIOLOGICAL DATA SHEET

SHRIMP BIOLOGICAL DATA COLLECTION SHEET

Boat #
Type of Boat
Gear Type
Fishing Ground

weight of catch
weight of sample

in catch
in sample

Species	weight	Sex	total length	rostral length	carapace length	tail length with telson	tail length without telson

APPENDIX 7
CONCH LOG SHEET

JAMAICA CONCH BIOLOGICAL DATA COLLECTION FORM
(Strombus gigas) - Sampling conch in shells

LANDING SITE	DATE	DATA COLLECTOR

Data Entry Only

Entered		Checked	
Date		Date	
By		By	

Boat No.		
Boat name:		
Total Weight (circle one)		g kg oz. lbs
Sample Weight (circle one)		g kg oz. lbs

Area Fished (Fishing ground)			
Sample Type (circle one)	SU	LU	LS

Fishing Gear (circle one)	HOKA SCUB DIVE

For Reference Only

5)Weight Type (WT)	UN PF PS PE PR

Shell Length mm	Lip Thickness Adults only (mm)	Total Weight (gms) (shell & meat)	Meat Weight* gms	WT**	Sex M / F / I / U

Key to Codes
* Meat Weight = Refers to meat that is market ready
1) Indicate recreational fishing boat by R
2) Weight: g=grams; kg=kilograms; lbs=pounds; oz=ounces
3) Sample Type: SU=measured at sea
LU = landed unsorted, LS=landed sorted
4) Fishing Gear: Hoka=Hooks; SCUB=SCUBA; DIVE=Skindiving
5)Weight Type: UN= meat unprocessed,
PF= meat 50%processed
PS= meat 65% processed,
PE = meat 85% processed,
PR = meat 100% processed,
6) Sex: m=male, f=female, U=Unknown
I = Juveniles (immature)

Comments: ____________________

(Form: 1/04/90)

ST. KITTS AND NEVIS - 1. NEVIS

by
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1. INTRODUCTION

Nevis is the sister island of St. Kitts. Together they comprise the federation of St.Kitts - Nevis. Nevis is located at Latitude 17 10' North and Longitude 62 35' West. St. Kitts/Nevis have a combined coastline of 135 km. The area of the exclusive economic zone is 20400 km with a shelf of 845 km.

The primary fisheries legislation is the Fisheries Act of 1984. The act covers the establishment of a fisheries advisory committee, fisheries access agreements, local and foreign fishing licensing, fish processing establishment, fisheries research, fisheries enforcement and registration of fishing vessels. It also specifies conservation measures such as a close season for marine turtles, gear restrictions and the creation of marine resources. The minister responsible for fisheries is given the authority to create new regulations for the management of fisheries when necessary.

Other fisheries -related legislation are:-

1. Maritime areas Act (1984) - Resources Management within the EEZ waters.
2. National Conservation and Environment Protection Act (1987) -Coastal Zone Management.
3. Zoning Ordinance (1991) - Establishment of Maritime Parks in Nevis

2. DESCRIPTION OF THE FISHERY

At present there are approximately 225 persons engaged in the fishing industry. The Department has been encouraging young persons to get involved in the fisheries sector. As a result of this 75% of the fishers are less than 50 years old (Table 1).

Table 1: Number of registered fishers, community distribution and age profile

Community	Age over 50	Age 30 - 49	Age under 30	Totals
St. Pauls	13	11	0	24
St. Thomas	16	39	2	57
St. James	13	19	5	37

St. Georges	8	29	2	39
St. Johns	10	19	1	30
Totals	**60**	**117**	**10**	**187**

Table 2 shows the level of education among the fishers in their respective communities.

Table 2: Level of education by communities

Level of Education	St.Thomas	St. James	St. Georges	St. Johns	St. Pauls	Totals
Primary	37	18	12	14	16	**97**
Secondary	18	16	24	14	8	**80**
College *	2	3	3	2	0	**10**
Totals	**57**	**37**	**39**	**30**	**24**	**187**

*college also represent university

There are a number of registered fishing boat operating from seven landing sites. (Table 3, Fig. 1)

Table 3: Number of registered fishing boats 1997 - 2000

Landing sites	1997	1998	1999	2000
Charlestown	40	37	26	31
Jessups	24	22	19	19
Cotton Ground	5	6	4	6
Jones Bay	22	21	18	13
New Castle	25	16	12	15
Long Haul	12	9	12	6
Indian Castle	15	8	6	6
Total	**143**	**119**	**97**	**96**

Most of the boats are open artisanal dories and pirogue types. Some of these are reinforced with fibre glass. Size range from 12 ft to 40 ft with the largest being sport fishing vessels. The most frequently used engines range from 15 to 225 horse power.

Fishers operate mostly in the coastal waters of St.Kitts /Nevis. Fishing areas are concentrated two to three miles offshore in the north, east and west, whereas in the south the bank extends to approximately twelve miles. Catches are landed at landing sites and sold directly to the consumers or purchased by the Fishermen Cooperative Society Complex. Conch is also landed at the sites and sold mostly to middle-men who process and store the meat for exports. Lobsters are sometimes treated this way, but are mostly sold directly by the fishers to the local hotels, restaurants and the Fishermen Cooperative Society Complex.

The table below indicates the different species targeted by Nevis fishers.

Table 4: Gear used to target different species

Gears	Fishery Type & Target Species
Fish Pots / Traps	Reef and slope species
Trolling	Ocean & coastal species
Scuba	Lobster & Conch
Nets	Coastal Pelagic & Turtles

Trends:

Over the past decade, the Fisheries Division observed a decline in the shallow water and reef resources. This specific resource is affected by over fishing of the reef and shallow areas. It is also affected by the destruction of the Marine habitats by the passage of hurricanes. The landing of some species of reef fishes has declined considerably. Fishers are therefore encouraged to venture offshore to the deeper slopes, targeting the ocean pelagic and deep slope fishes. Fishers are building fish aggregating devices and placing them at sea to attract oceanic pelagic fish for harvesting. Although encouraged by the department, some fishers are unwilling to venture away from the coral reef and shallow areas even though these areas are heavily over-fished and have become unproductive.

Table 5: Estimated landings for Nevis in kg. 1995 - 99

Years	Fish	Lobster	Conch
1995	67,300	6,650	15,700
1996	62,300	5,350	19,850
1997	43,000	3,930	8,900
1998	63,200	4,350	59,200

1999	147,000	14,200	46,000

Table 6: Seafood export for the period 1995 - 99 in kilo		
Years	**Conch**	**Lobster**
1995	13,045.0	5,556.0
1996	16,534.0	1,021.8
1997	7431.8	0
1998	38836.4	1,460.5
1999	43836.4	5,223.2
TOTAL	**119,710.6**	**13,261.5**

3. FISHERIES MANAGEMENT OBJECTIVES

- To ensure that the fishing industry is integrated into a policy and decision-making framework, taking into consideration fisheries and coastal zone management.
- To make use of or utilize the traditional knowledge and interest of local communities, small scale artisanal fisheries, and indigenous people in development and management programs.
- To promote scientific research with respect to fisheries resources.
- To maintain and / or restore populations of Marine species at levels that can produce the maximum sustainable yield as specified by relevant environmental and economic factors, taking into consideration relationships among species.
- To promote the development and use of selective fishing gear and practices which minimize the by-catch of non-target species.
- To ensure effective monitoring and enforcement with respect to fishing activities.
- To co-operate with other nations in the Management of shared or highly migratory stocks.
- To preserve rare or fragile ecosystems, as well as habitat and other ecologically sensitive areas, especially coral reef ecosystems, estuaries, mangroves, sea grass beds and other spawning and nursery areas.

4. HISTORY OF THE DATA COLLECTION PROGRAM

In the infant stage of the Fisheries Division there was only a partial data collection system in place. This system was for the exportation of sea foods. The export licenses were stamped and checked by the division. At the same time the information was compiled on the quantities to be exported.

In 1993 the division employed two trainees who were responsible for data collection. With the assistance of the OECS Fisheries Unit and CFRAMP, the division was able to start a data collection and sampling program. A census was taken of daily landings at Gallows Bay, Charlestown and random sampling at the other landing sites on Nevis. Unfortunately the random sampling was terminated because the officer responsible resigned and the division was unable to recruit a replacement. Sampling is still taking place at Gallows Bay Charlestown three days per week.

In 1995 a biological data collection officer was employed. He was and still is responsible for the sampling of Conch, Lobster, Red Hind, Coney and Red Snapper. Information is also collected on Wahoo, Tuna and Dolphin.

The information collected over the years have enlightened the division on the status of the Fishery resources. In addition, the information will play a significant role in Fisheries' stock assessment, policy and decision making for the future development of the Fisheries Sector.

5. PRESENT DATA SYSTEM

To date there is no detailed sampling plan for all fisheries. The data collector selects randomly, the days to visit Gallows Bay for sampling landings. The data collected (Appendix 1) at Gallows Bay is used to estimate landings for the entire island. The biological data collector on the other hand, samples the landings at the Fisheries Complex when available. In addition, he usually contacts fishers and makes the necessary arrangements for the sampling of their catch; e.g. Lobster and Conch.

Limitations and Strengths of Sampling:

a) **Strengths**

- Species Identification
- Staff in house training and discussion
- Fishers one-on-one consultation with data collector.

b) **Limitations**

- Insufficient data on resources for assessment and analysis
- Fishers are unwilling to provide information
- Under trained staff and Fishers
- Fishers operating patterns.
- Limited funds for the program.

- No set data collection program

Recommendations

1) The program TIP and IRS should be made more user-friendly
2) More staff should be employed to make the sampling program effective and complete.
3) Training of the staff
4) Data collectors should be fully responsible for their duties.

6. DATA MANAGEMENT

The data are collected weekly and entered into LRS and TIP Programs by the data collector. The data are stored on the system and back-ups are usually done once per month. Back-ups were not done for over one year due to software problems and the relocation of the officer.

7. DATA ANALYSIS

An analysis of the data needed by the Department with respect to Fisheries Development and Management has revealed the following:

- The number of registered fishers and boats per landing site and also community
- The age range of fishers
- Estimated catch per landing site per year
- Species that are becoming extinct
- Types of gears used
- Types of engines and horse power
- Size range of boats
- Annual income generated from fisheries.

Estimation of Total Landings

The estimated total landings is done by using the following information:

1) Fishing trip sample per month
2) Number of registered vessel at that landing site
3) Average fishing days per month
4) Total fishing trip per month (#2 x #3)
5) Total landings (fish)
6) Average landing per boat trip (#5 / #1)
7) Total landing, for the month (#4 x # 6)

Limitations and Strengths

a) **Strengths** Providing an estimate of landings
Assist decision-making for policy and legislation
Demonstrate fisheries contribution to the economy

b) **Limitations**
Not enough boats are sampled due to the time of landings
Software constrains data analysis
Inadequate training of staff constrains data analysis.

8. CONCLUSION AND RECOMMENDATIONS FOR THE FUTURE

The lack of basic data on the performance of the fishery sector can be a major constraint to effective fisheries management, and by extension to the general development of Nevis. It is therefore important to devise a plan for organizing and maintaining a sustainable data collection system. This should encompass both the target and non-target fishery resources alike.

The Ministry under which Fisheries falls should make the necessary provisions to employ sufficient data collectors to make the data collection plan both functional and effective.

CFRAMP should assist the countries with guidelines for strengthening the regional capabilities for the collection and management of the data.

LITERATURE CITED

St. Kitts and Nevis Fisheries Management Plan

St.Kitts & Nevis Fisheries Act

Report of the Subproject Specification Workshop for Data and Information System and Licensing and Registration System. Doc. 11

Fisheries Data Collection Systems for Eastern Caribbean Islands. OECS Fishery Report No.2
All in-country reports.

APPENDIX 1
ST KITTS AND NEVIS FISHERIES
FIELD DATA SHEET

Entered Checked

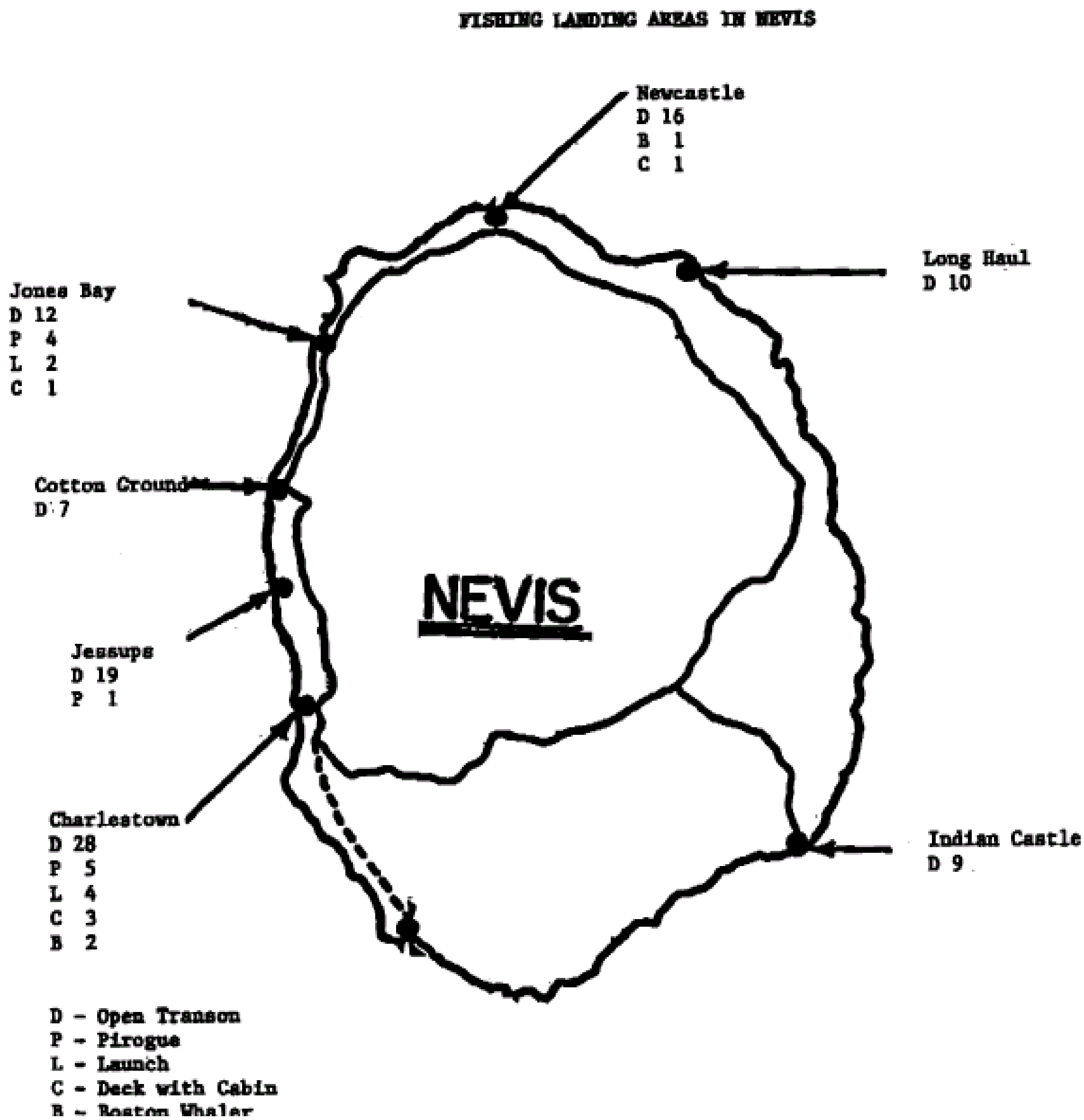
------------------ Landing Site ----------------- Weather ------------------ Date ------------- Date

----------------- Date ------------------ Sea State ------------------- By -------------- By

Landing Number						
Boat I D						
Time Departed						
Time Returned						
Area Fished						
Gear - Primary						
Gear - Secondary						
Number of sets						
Depth Fished						
Weight Type						
Catch by Species						

Comments :

Figure 1: Nevis fish landing sites



Local Fishing Vessel License: Application Form

I .... (first name, surname) hereby apply for a local fishing vessel licence for the vessel described below:

1. Name of Vessel... 2. Registration No. Of Vessel: J6.................
3. Owner: Name .... Age..........yrs. Address ....
   .... Is Owner a Fisher ?: Y / N. Is the Vessel Mainly Used for Fishing?: Y / N
   Other Uses: Water taxi....... Water Sports (tourism)...... Recreation......... Other (specify).....................
4. Charterer of Vessel (if applicable): Name..
   Address..
5. Other Persons having Bonafide Interest in the Vessel (eg. Co-owner; person who purchased vessel on owners behalf:

Name	Address	Interest
....	....	....
....	....	....

6. Captain/Master : Name.. Age.........yrs. Captain's Fisher ID No.:.............................
   Address..
7. Usual Number of Crew (not including captain).............................
8. Gears Operated (tick appropriate ones): Trolling line....... Flying fish net...... Beach Seine..........
   Fillet Net......... Fish pots.......... Harpoon.......... Longline.......... Palange............
   Scuba (for Conch)......... Speargun............ Gillnet............ Handline............ Marine Radio...........
   Other (specify)..
9. Navigational and Safety Equipment Used on Board (tick appropriate ones):
   Bailer....... Compass....... Water Containers......... Oar....... Sail.............. Reflective Mirror.......
   Waterproof flashlight......... Day flares........... Night flares......... Conventional Anchor.......
   Sea Anchor........ Life jackets.........(No. ......) Radar Reflector......... Food Stows..........
   GPS........... Other (specify)...
10. Colours of Vessel: Inside............................ Outside.................................
11. Vessel Info (tick appropriate one):
    Vessel: Pirogue........ Canoe........ Transom......... Longliner........... Other (specify)...............................
    Hull Material: Wooden................. Fiberglass................ Metal....................... Other............................
    Length of Vessel .... (feet/meters)<circle one. Age of Vessel:..................yrs.
    Place of Construction:...
    Fish Storage: Open hull............... Ice Box.................... Other (specify)...
    Engine: None.......... (1) Make.................................. Hp.................... Serial No. ....
    (2) Make.................................. Hp.................... Serial No. ....
12. Berthing Site for Vessel...
13. Fishing Areas Used...

I declare that the vessel described above is a local fishing vessel within the meaning of the Fisheries Act No. 10 of 1984. I understand that I am required to report any changes in the information contained in this form to the Chief Fisheries Officer within seven (7) days of the change.

Caution: Any licence issued on the basis of this application form is liable to cancellation if any of the information given in the is form is incorrect

....
Signature of Applicant Date

ST. VINCENT AND THE GRENADINES

Prepared by:
Cheryl Jardine
Senior Fisheries Assistant/Data

Reviewed by:
Raymond Ryan
Fisheries Officer Biology/Research
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INTRODUCTION

Location

St. Vincent and the Grenadines is a small archipelagic state situated in the southern Caribbean. The island is located north of St. Lucia, South of Grenada and East of Barbados (see Figure 1). St. Vincent and the Grenadines is of a volcanic nature stretching 18 km from east to west, and 29.6 km from north to south with a total land area of 345 km^2. Its coastal shelf is 7,800 km^2, and the coastline of all its islands total 84 km. It has an Exclusive Economic Zone (EEZ) of 27,533 km^2.

St. Vincent, the largest island, is termed the "mainland". The nation's capital Kingstown is located on the southwest coast of St. Vincent and is the most prominent fishing community in the state. The Grenadines consist of thirty-two (32) small islands and cays of which seven are relatively large and inhabited, namely Bequia, Mustique, Canouan, Myreau, Union Island, Petit St. Vincent and Palm Island

The country has a population of approximately 115,339 with a population density of 299 persons/km^2 (July 1998 statistics). The capital Kingstown has a population of approximately 27,000. The average life expectancy is 71 years.

Contribution of the GDP

The Contribution of the fishing industry to the Gross Domestic Product (GDP) from 1990 - 1995 ranged from 1.68% - 1.90% (see Figure 2). The GDP contribution of the fishing industry is dependent not only on earnings from fish landings, but on the performance of other sector's in the economy.

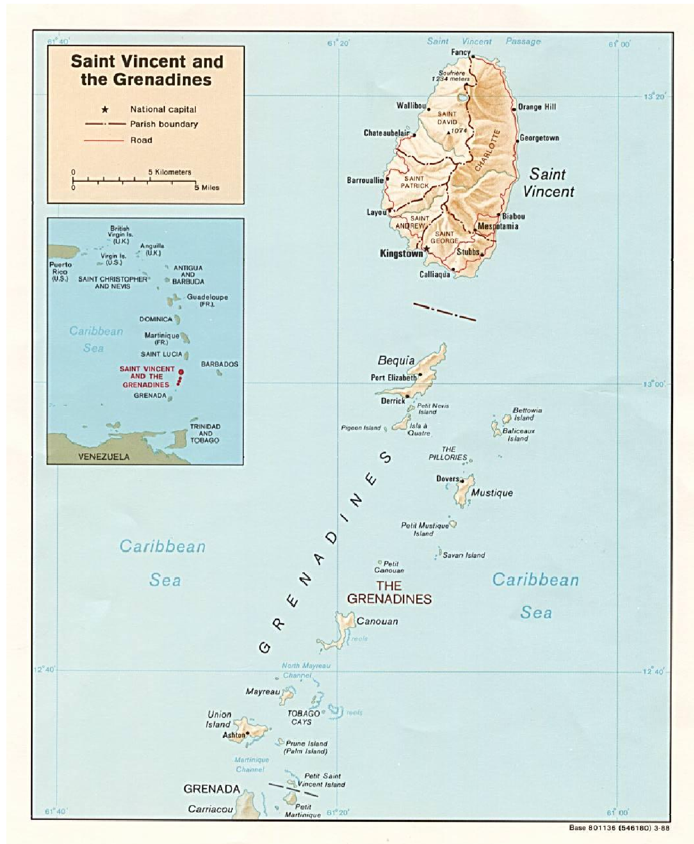


Figure 1 Map of St Vincent and The Grenadines

Policy

The policy framework for the fisheries sector is the expansion of fish production on a sustainable basis to provide a key source of protein for the Vincentian population at a competitive price. In order to support the increased production of fish, it is essential that the marine environment is adequately protected. In order to address its diverse tasks and responsibilities, the Fisheries Division mission is

To effectively manage and develop the fisheries sector, in consultation with all stake-holders and within the context of economic diversification, through the sustainable utilisation of available aquatic resources, by research, technology transfer and training, in order to optimise the sector's contribution to the national economy.

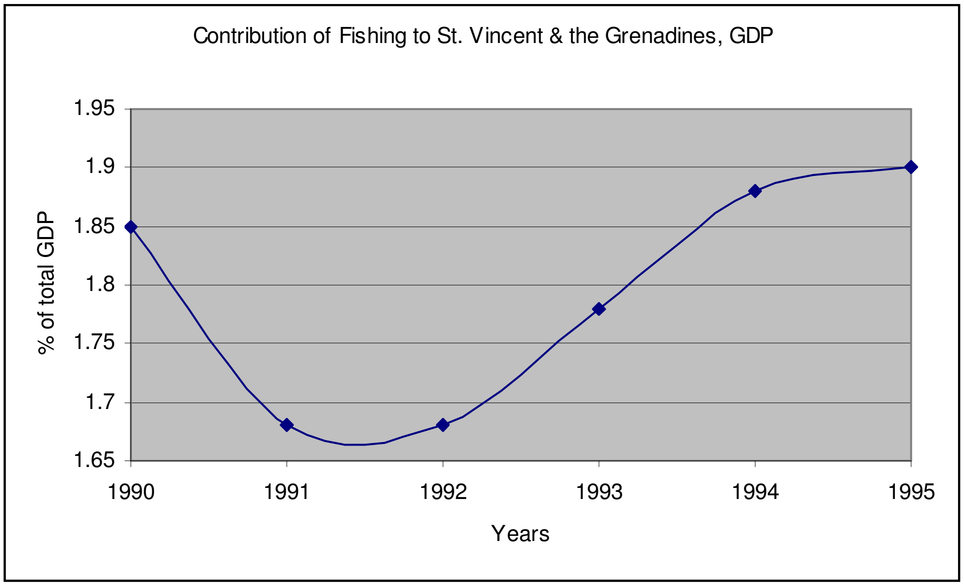


Figure 2. Contribution of fishing to the GDP

Legislation

The Fisheries Division operates under the Ministry of Agriculture and Labour (see Organization Chart, Appendix 1) and is responsible for the overall management and development of the fisheries sector. The Division has the following pieces of legislation to assist in its task:

The Fisheries Act (1986) and Regulation (1987), which form part of the OECS harmonized legislation, covers: fisheries access agreements, local and foreign fishing licensing, fish processing establishments, fisheries research, fisheries enforcement and the registration of fishing vessels. The legislation also specifies conservation measures such as prohibiting the use of any explosive, poison or other noxious substance for the purpose of killing, stunning, disabling, or catching fish; closed seasons, gear restrictions, creation of marine reserves. The legislation gives the Minister responsible for fisheries the authority to create new regulations for the management of fisheries when necessary.

The Maritime areas Act (1982) - Declares the maritime areas of St. Vincent and the Grenadines . These maritime areas are internal waters, archipelagic waters, territorial sea, contiguous zones, Exclusive Economic Zones.

Other Legislation

Town and Country Planning Act (1992) - Coastal Zone Management

Forestry Act (1945) - Mangrove Protection

Mustique Conservation Act (1989) _ Management of the Conservation areas on and around Mustique

Central Water and Sewage Authority Act (1978) - Control of land-based Pollution

Public Health Act (1977) - Waste Management

DESCRIPTION OF THE FISHERY

Vessels and fishers

There are approximately 2,500 full and part-time fishermen in St. Vincent and the Grenadines, however, there are approximately 1550 fishermen estimated from the Licencing and Registration System (LRS). Fish vendors, traders, gutters and handlers make up an additional 500 persons.

Information gathered from the Licencing and Registration Program (LRS) indicate that there are over 600 vessels operating at various landing sites in St. Vincent and the Grenadines, given that an estimated 90 % of fishing vessels are registered (558 vessels to date). Pirogues, bow & stern and double enders dominate the fishing fleet (see Figure 3). Most of these vessels are below 32 ft in length (see Table 1 and Figure 4) and are constructed mainly from wood and fibreglass.

Table 1: Number of Vessels by Size Class in St.Vincent And the Grenadines

SIZE	SIZE CLASS	NUMBER OF VESSELS	PERCENT-AGE (%)
12ft & under	Class I	59	11.2
>12ft - 20ft	Class II	274	52.1
>20ft - 30ft	Class III	175	33.3
>30ft - 40ft	Class IV	10	2
>40ft - 66ft	Class V	8	1.5
TOTAL		526	

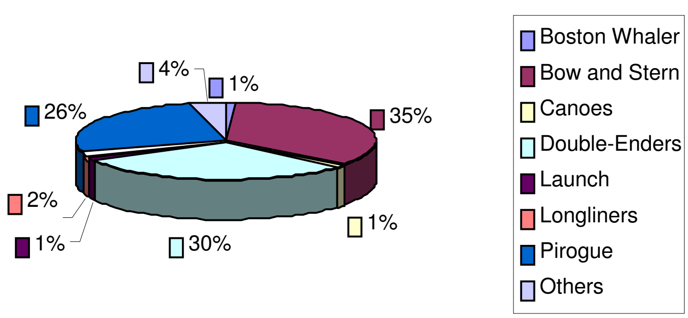


Figure 3. Registered fishing vessels by description class

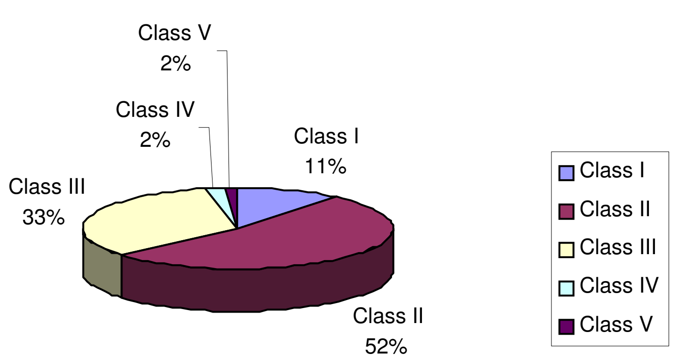


Figure 4. Registered fishing vessels by size class (see Table 1)

Description of vessels

Flat Transoms (Bow and Sterns)
Flat transoms boats, commonly called bow and stern boats or dories are open boats 3 - 6 m (11 - 27 ft) in length with a beam of 0.9 - 2.1 m (3 - 7 ft). They are constructed from wood or marine plywood. The wood or plywood in many cases is covered by epoxy or fibreglass, which provides a waterproof covering. Flat transom boats have a pointed bow and flat stern or transom and are often powered by one or two outboard gasoline engines ranging from 14 - 115 horsepower. On rare occasions, oars may be the only form of propulsion.

Pirogues
Pirogues are also open boats with a pointed bow and flat transom, however, the bow is much higher than the flat transom boats and they tend to be slightly larger, ranging from 7 - 10 m (19 - 30 ft) in length with a beam of 1 - 2.8 m (4 - 10 ft). They are constructed from fibreglass and powered by one or two outboard gasoline engines ranging from 40 - 75 horsepower. The pirogues have a similar function to the wooden flat transom boats described above, and have replaced the flat transom boats in some fishing units.

Double enders
Double enders or two bows are open wooden boats ranging from 3 - 9 m (10 - 29 ft) in length with beams ranging from 1.2 - 2.4 m (4 - 8 ft). Both ends of the boat are shaped like the bow of a boat, hence the name two bows. In most cases the only means of propulsion are oars, but occasionally, they may be powered by a small outboard gasoline engine specially rigged at one end of the boat. These engines range from 6 - 48 horsepower, but a horsepower of 15 is typical.

Canoes
Canoes are hallowed out of cotton or gommier trees. Planks are added along the sides to keep the waves out. These canoes range from 22 - 25ft in length with beams of 5 - 6 ft and are used for fishing demersals and small offshore pelagics. They may be outfitted with an outboard gasolene engines with horsepower ranging from 25 - 65. A single fibre glass Yanmar canoe (retained by the Fisheries Division for test fishing operations by fishermen in seine fishing communities) is 39ft in length with a beam of 6ft. It is powered by a 20 hp inboard diesel engine and outfitted with fish finder for locating pelagic fish schools. This vessel has been modified for fishing deep slope demersals by installing a hydraulic line hauler.

Longliners
Longliners are decked vessels powered by inboard marine diesel engines ranging from 90 - 475 hp, and are outfitted with modern navigational and fishing equipment. In St. Vincent and the Grenadines, these vessels range from 34.7ft - 48.5ft in length, with beams ranging from 9.7ft - 15.9ft. The main type of longliner is a Yanmar chine type made of glass reinforced plastic (GRP) powered by inboard diesel engines ranging from 90 - 190 hp. These Yanmar vessels range from 34.7ft to 42ft in length with beams 9 to 11 ft. They are multi-purpose in nature and designed to operate up to 150 nautical miles from the islands with a 3 to 5 day stay at sea. These multi-purpose vessels are used primarily for tuna longline fishing, but may also be utilised for trolling, bottom longline fishing, bottom angling. In most cases, they are able to sleep 4 - 5 persons, below the hull superstructure. The other longliners used are standard American built longline vessels purchased in the United States.

Launches
Launches are of the standard varieties, including cabin cruisers and boston whalers, constructed from fibreglass ranging from 16 - 34 ft with beams from 5 - 10ft. They are powered either by outboard engines ranging from 55 - 500 horse power or inboard engines up to 600 hp. These vessels are generally imported

from Trinidad and Tobago or the United States and are used primarily for recreational fishing. They are used occasionally for commercial fishing after the engine power is modified (lowered) to make fishing a viable operation.

Others

Sloops are decked vessels constructed from wood and powered by inboard engines and sails. These large boats can travel along great distances, often more than 20 miles, to fishing grounds, however, they are operated primarily on the Grenadines shelf 3 - 5 miles from shore.

A single *dinghy* is registered as a fishing craft. It is 11ft in length with a beam of 5ft, constructed from firbeglass and powered by a 25 horsepower outboard gasolene engine.

Fishing Gears

A significant number of traditional gears are utilised in St. Vincent and the Grenadines. These include trolling lines, bottom handlines and beach seines. In many cases the trolling line as well as bottom lines and in some cases palangs are gear types utilised by a single fishing unit. Many artisanal vessels fish for demersals during the low/off season for the small offshore pelagics (see pictures, Appendix 2).

Beach Seining

Seine fishing is used to catch inshore pelagics which usually shelter in bays. The seine is set to surround the school of fish. The catch comprises mainly jacks, robin, dodger and other inshore pelagics. It is illegal for the mesh size of any seine to be less than one inch (1") square.

Gill Netting

Gill netting uses a net to catch pelagic fish by trapping them by their gill covers (operculum). The net can be set fixed or left to drift while the fish are lured into them. The net is usually made of nylon monofilament or fine twine, making it difficult for the fish to detect. The catch composition is usually determined by the size of the mesh. A ballahoo net should not be less than one half inch square mesh (Fisheries Regulations 1987).

Trolling

Trolling is an active type of line fishing used in catching offshore pelagics. A line with bait is placed in the water and pulled by a slow moving boat. The catch comprises mainly kingfish, dolphin, tuna and billfish.

Handlining

Handlining is a simple method of placing live or dead bait on one or several hooks attached to a line and waiting for the fish to bite. This method is used for catching bottom fish along reefs and banks.

Bottom longlining

This method of fishing targets the demersals. The gear is not allowed to drift floating close to the surface but instead it is anchored at the bottom using anchors and sinkers. Buoys and sinkers along with the baited branch lines are attached to the mainline at selected intervals to minimize snarling on the bottom and maximizing the area covered while maintaining symmetry. This method is practiced on the shelves and deep water areas of St. Vincent and the Grenadines. Species caught include groupers, snappers, sharks and amberfish.

Fishing Areas

Fishermen in St. Vincent and the Grenadines utilise the fishing area within the EEZ as shown in Appendix 3. The small coastal pelagics and reef fish are caught close to shore, while the larger pelagics can be found in deeper waters (see Appendix 4).

Types of Fishery

GROUP	DESCRIPTION
Off-Shore Pelagics	Fast swimming migratory fish that inhabit the deep sea; e.g tuna, billfish, dolphin, kingfish
In-Shore Pelagics	Near shore fish found in mid water of surface water in beach areas, often smaller than off-shore pelagics, e.g jacks, robin, dodger
Demersals	Marine organisms dwelling at the sea bottom, e.g rock hind, blem, groupers, parrotfish.
Shell-fish	Marine species living at the sea bottom and protected by a shell, e.g lobster, conch, whelks
Sharks	Fast swimming migratory fish that inhabit the deep sea and have a cartilaginous structure
Turtles	Reptiles that live in the sea but come on land to lay their eggs.
Whales	Migratory marine mammals that give suckle to their young. E.g. humpback, blackfish

Trends in Catch and Effort

The trends in catch and effort over a 5 year period (1994 - 1999) were analysed using data from the TIP database. The catch per unit effort (CPUE) was calculated using the sample weight for each year by gear and the number of trips by year (see Table 2).

CPUE = Sample weight / number of trips

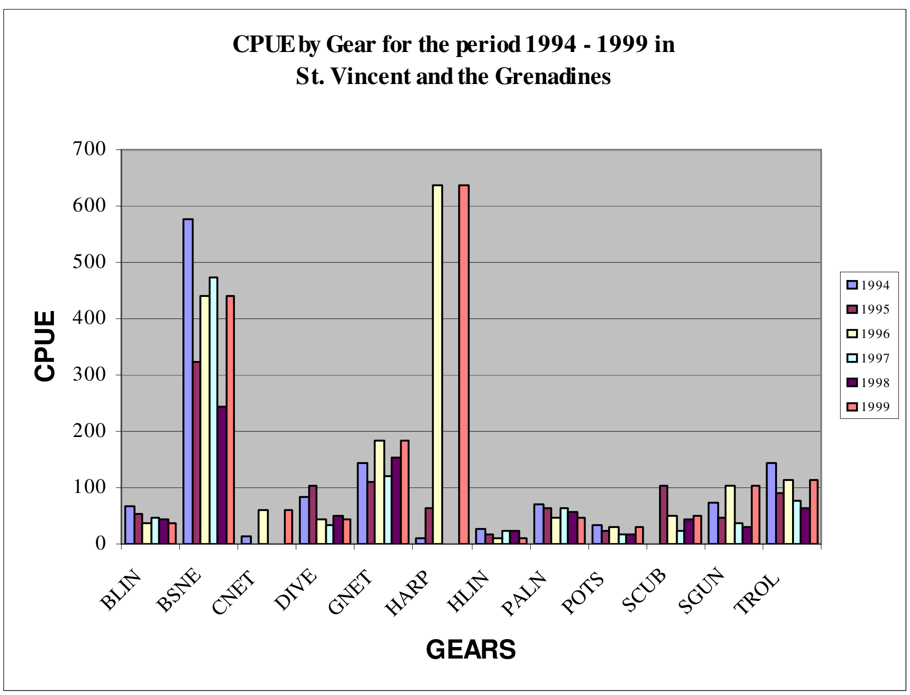
Table 2: Calculations of catch per unit effort by gear

Gear	1994			1995			1996		
	# of Trips	Sample Weight	CPUE	# of Trips	Sample Weight	CPUE	# of Trips	Sample Weight	CPUE
Bottom Line (BLIN)	305	20620	68	192	10603	55	260	9978	38
Beach Seine (BSNE)	184	106110	577	139	45129	325	205	90496	441
Cast Net (CNET)	2	25	13	0	0	0	1	60	60
Dive (DIVE)	167	14125	85	213	22259	105	9	378	42
Gill Net (GNET)	27	3876	144	32	3501	109	43	7954	185
Harpoon (HARP)	9	80	9	9	557	62	3	1910	637
Hand Line (HLIN)	210	5555	26	241	4014	17	305	3465	11
Palangue (PALN)	26	1811	70	28	1815	65	104	5022	48
Fish pots (POTS)	27	882	33	29	669	23	81	2517	31
Scuba Dive (SCUB)	0	0	0	54	5613	104	136	6979	51
Spear Gun (SGUN)	23	1699	74	31	1454	47	24	2477	103

Troll (TROL)	194	10202	53	183	7889	43	210	26721	127
TOTAL	1174	164985	141	1151	103503	90	1381	157957	114

Table 2 Cont□d

Gear	1994			1995			1996		
	# of Trips	Sample Weight	CPUE	# of Trips	Sample Weight	CPUE	# of Trips	Sample Weight	CPU E
Bottom Line (BLN)	265	12749	48	125	5376	43	260	9978	38
Beach Seine (BSNE)	194	92018	474	157	37928	242	205	90496	441
Cast Net (CNET)	0	0	0	0	0	0	1	60	60
Dive (DIVE)	42	1444	34	18	889	49	9	378	42
Gill Net (GNET)	50	5999	120	40	6089	152	43	7954	185
Harpoon (HARP)	0	0	0	0	0	0	3	1910	637
Hand Line (HLIN)	872	21243	24	634	15683	25	305	3465	11
Palangue (PALN)	268	17048	64	124	7208	58	104	5022	48
Fish pots (POTS)	75	1257	17	58	935	16	81	2517	31
Scuba Dive	34	865	25	5	212	42	136	6979	51
Spear Gun (SGUN)	605	23292	38	125	3903	31	24	2477	103
Troll(TROL)	267	33031	124	207	17482	84	210	26721	127
TOTAL	2672	208946	78	1493	95703	64	1381	157957	114



In St. Vincent and the Grenadines although several types of gear are employed in most fisheries, one or two types of gear is/are predominantly utilised. For the years 1994 - 1999 the CPUE for the demersal fishery (CNET, PALN,BLIN, POTS) was constantly low while that of the pelagics fishery show signs of fluctuation with the Beach Seine fishery maintaining a fairly high CPUE throughout the years (see Figure 5). Although demersal fishing is carried out all year round, the fishing effort and landings increased in the later half of the year during the low season for the large pelagics (dolphin and wahoo) season (Morris, 1991). The overall CPUE has decline rapidly from 1994 to 1998 but has increased reasonably in 1999 although not to the level of 1994 (see Figure 6).

Figure 5. CPUE by gear type and year

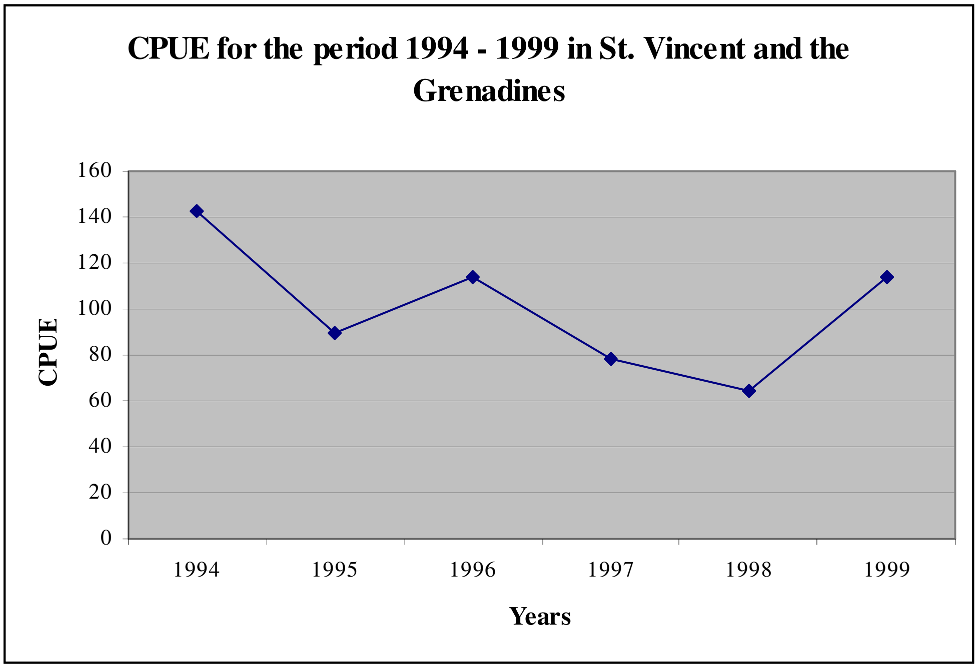


Figure 5. Overall CPUE for the period 1994 to 1997

Present Status of the Fishery

The fishing industry in St. Vincent and the Grenadines is predominantly small scale and artisanal, employing traditional gears, methods and vessels. The majority of fishing vessels are open and powered by outboard engines. These vessels exploit both the oceanic and inshore pelagics as well as the shelf and deep slope demersals. Most fishermen are daily operators, going out to sea in the morning and returning to land in the late afternoon or evening.

Fish landings in St. Vincent and the Grenadines account for an estimated 2.5 million pounds of fish annually, generating an estimated $EC 7 million (*see Table 3*). The Small inshore pelagics which include primarily robin (*Decapturus macarellus*), Jacks (*Selar crumenophthalmus*), Dodger (*Decapturus punctatus*) and Spratt (*Harengula pensacola*) accounted for approximately 45% of the total fish landings. Off-shore pelagics 25%, demersals 20% , shellfish 5%, and others 5%. Fish caught locally make up about 70% of the per capita consumption of fish and fish products.

The average annual fish export amounts to an estimated 390,000 lbs, realizing values of approximately $EC 2 million dollars (see Table 4). Tuna and lobsters account for more than 75% of fish exports.

Approximately 660,000 lbs of fish and fish products amounting to $EC 2.7 million dollars are imported annually.

TABLE 3: Estimates of landings and values of fish landed in St. Vincent and the Grenadines (Source: Fisheries Division, SVG)

YEAR	LANDINGS (LBS)	VALUE ($EC)	AVERAGE PRICE PER LB ($EC)
1999	1649809	6803801	4.12
1998	2038670	7745240	3.8
1997	1831432	6267517	3.42
1996	1637487	5638876	3.44
1995	1693747	6957491	4.11
1994	2897112	6613615	2.28
1993	2689106	6904119	2.58
1992	2845650	8136000	2.86
1991	2972485	8110210	2.73
Average (1991 - 1999)	2250611	7019652	3.11

TABLE 4: Estimates of fish and fish products exported from St. Vincent and the Grenadines (Source: Fisheries Division, SVG)

YEAR	EXPORTS (LBS)	VALUE ($EC)	AVERAGE VALUE PER LB ($EC)
1999	423795	2415597	5.7
1998	236337	1271272	5.37
1997	284062	1761416	6.2
1996	515704	2438162	4.73
1995	548806	3041104	5.54
1994	544516	2984997	5.48
1993	444333	1904545	4.29
1992	318927	883927	2.78
1991	214648	722900	3.37
Average (1991 - 1999)	392348	1935991	4.83

MANAGEMENT

Fisheries Management Objectives

Develop and increase the potential of marine living resources to meet human nutritional needs, as well as social, economic, and development goals.

Ensure that the fishing industry is integrated into the policy and decision-making process concerning fisheries and coastal zone management

Take into account traditional knowledge and interests of local communities, small-scale artisanal fisheries and indigenous people in development and management programmes.

Maintain or restore populations of marine species at levels that can produce the maximum sustainable yield as qualified by relevant environmental and economic factors, taking into consideration relationships among species.

Promote the development and use of selective fishing gear and practises that minimize waste in the catch of target species and minimize by-catch of non-target species.

Ensure effective monitoring and enforcement with respect to fishing activities

Protect and restore endangered marine species

Preserve rare or fragile ecosystems, as well as habitats and other ecologically sensitive areas, especially coral reef ecosystems, estuaries, mangroves, seagrass beds and other spawning and nursery areas.

Promote scientific research with respect to fisheries resources.

Cooperate with other nations in the management of shared or highly migratory stocks

Management Objectives by Fishery

Shallow Reef Fishes

Target Species:
- Hinds (Serranidae)
- Parrotfishes (Scaridae)
- Squirrelfishes (Holocentridae)
- Grunts (Pamadosydae)
- Surgeonfishes (Acanthuridae)
- Triggerfishes (Balistidae)

Objective: To Promote stock recovery

Deep Slope Fishes

Target Species:
- Snappers (Lutjanidae)
- Groupers (Serranidae)

Objective: Maximize catches within the limits of the potential yield

Coastal Pelagics

Target Species:
- Jacks (Carangidae)
- Herrings (Clupeidae)
- Silversides (Atherinidae)
- Anchovies (Engraulidae)
- Ballyhoo (Hemiramphus spp)
- Robins or Scads (Decapterus spp)
- Small tunas

Objectives: Encourage co-management of the fishery
Maintain artisanal nature of the fishery

Large Pelagics

Target Species
- Tunas (Scombroidei)
- Billfishes (Istiophoridae)
- Dolphinfish (Coryphaena hippurus)
- Wahoo (Acanthocybium solandri)
- Sharks (Elasmobranchii)
- Swordfish (Xiphius gladius)
- Whales, porpoises (Cetacea)

Objectives: Cooperate with members of ICCAT particularly Caribbean states to assess, protect and conserve the large pelagic resources
Promote development of the commercial and sport fisheries.

Lobster

Target Species
- Spiny Lobster (Panulirus argus)

Objectives: Rebuild stocks in depleted areas

Conch

Target Species
- Queen conch (Strombus gigas)

Objectives: Rebuild stocks in depleted areas

HISTORY OF THE DATA COLLECTION PROGRAMME IN ST. VINCENT AND THE GRENADINES

Overview

Prior to 1991, data collection was primarily limited to fish exports and landings at the Kingstown Fish Market. Landing toll receipts were issued by the market which indicated catch and price by species or species categories and effectively provide a census of fish landed at the market. There were some limitations however, since fish landed after market hours (07:00 - 15:00), on Sundays and public holidays were not recorded but were sold directly to consumers by the fishermen, small pelagics weighing less that 50 lbs were not recorded, and the catch per unit effort and biological characteristics were not captured.

The exports of lobster, conch and fin fish were compiled from permits issued by the Ministry of Trade and health certificates issued by the Fisheries Division. Before each trip the traders had to acquire an export permit stating the quantity and price of each species to be exported. A tariff of 50¢ was charged per pound of fish. Export figures were not based on actual weights but on eye estimation. Consequently, inaccuracies were great, as fishermen had a tendency to underestimate weights since fewer pounds of fish meant less tariff to pay.

Implementation of a Data Collection System

In 1988 plans were formulated under the Organisation of Eastern Caribbean States (OECS) for a revised data collection system (Morris 1988). Path diagrams detailing the flow or movement of all local fish and fishery products from fishermen to the consumer were used as background information during the development of a plan for a data collection system. A sampling program for estimating catch and fishing effort was designed for twenty-one (21) landing sites on mainland St. Vincent, Twelve (12) landing sites in the Grenadines along with thirteen (13) trading vessels. A total census was to be continued at the Kingstown Market. The use of summarised data sheets was discontinued at the Kingstown market and individual toll receipts used to estimate catch per unit effort as well as total catch .

Export permits by trading vessels were modified to provide precise information on species composition. Hotels, restaurants, supermarkets and charter boats were to be requested to provide purchase slips for estimation of catches sold directly to the agencies.

In 1992, a revised data collection system was implemented under the CARICOM Fisheries Resource Assessment and Management Program (CFRAMP). A system of stratified cluster sampling was introduced. Landing sites were divided into seven geographical zones (see Landing site map, Appendix 5). In each sampling zone, landing sites were to be selected at random to be visited on particular days and species composition and catch and effort data collected from all vessels landed during the sampling period.

The Sampling Program

In 1992 a sampling programme for estimating catch and fishing effort was designed to cover all missing categories of data. During this period the level of infrastructural development was low at many landing sites, therefore the status of each landing site was determined by the number of vessels operating at a particular site.

Primary sites = 40 or more vessels
Secondary sites = 10 to 40 vessels
Tertiary sites = less than 10 vessels

The general objective of this plan was:

to provide data and scientific analyses necessary to assist resource managers to make resource management decisions.

The specific objective were:

to implement a fish sampling programme which would provide catch effort data, length frequencies, individual weight (size frequency), sex ratio and age composition.

In order to accomplish this specific objective it was necessary to:

obtain equipment for implementation of sampling programme; and
train data collectors to take unbiased samples, measure different types of lengths, distinguish sexes, learn

species code and general usage of the data collection forms.

As part of the development of data management and the related stock assessment, six data collectors were recruited. Each of these six persons, was given the responsibility for data collection in a given zone. In each cluster, landing sites were to be stratified according to status, and selected at random from each stratum for sampling on a particular day.

Achievements

- More than five (5) years of consistent data have been collected and can now be used for statistical analysis
- Information collected from the Licensing and Registration Programme (LRS), have been accumulated, and provide the socio-economic support for the scientific information provided by the biological and catch and effort programmes.
- The successful training of data collectors not only to take accurate and unbiased data from fishermen but also to give support in other Fisheries related fields (engine maintenance, gear technology, processing).
- The level of infrastructural development at the various landing sites throughout the state has improved significantly during the last six (6) years.
- Logbooks for vessels that have the capacity to stay up to several days at sea is still in its preliminary stage. A draft copy of these forms are already in use by the Fisheries Division□s longline vessel □Black Jack□.
- Improvement of health certificates to provide precise information on the composition and weight of species exported, as well as the countries fish are being exported to(See forms, Appendix 6).
- Improvement of landing toll slips at the Kingstown market to capture species composition and catch and effort data (See form, Appendix 7).
- Involvement in new projects such as the Coastal Zone Mapping Project. The project entails the mapping of coastal habitats from St. Vincent to Union Island. It is being funded by the British Development Division in the Caribbean (BDDC) through the Natural Resource Management Unit (NRMU) of the Organization of Eastern Caribbean States (OECS). This information will further complement other data collected by providing a spatial element to the data resource.
- More detailed information as to the area fished on each fishing trip is being captured. These information can add a spatial element to variety of data collected.

PRESENT CATCH & EFFORT DATA SYSTEM IN SVG

The Sampling Plan

There has been significant infra-structural development at the various landing sites throughout the state during the last six years or so. In 1992 the New Kingstown Fish Market (NKFM) was the only landing site with marketing facilities such as, vending stalls, ice machines, chillers, etcetera. Today, similar facilities now exist in Paget Farm, Bequia; Britannia Bay, Mustique; Friendship, Canouan; Clifton, Union Island; Calliaqua, Barrouallie and Chateaubelair, St. Vincent.

Landing sites in St. Vincent and The Grenadines are zoned (cluster) and categorized (stratified). There are seven zones and thirty six (36) landing sites. Categorically, a site is designated as either primary, secondary or tertiary. The assignment into any one of these categories is based on the number of fishing boats that regularly land fish at the site. In the near future the level of infra-structural development and the amount of fish landed at each site will be taken into consideration. There are two (2) primary sites (Kingstown and Barrouallie); fourteen (14) secondary and twenty (20) tertiary sites (see landing site map Appendix 5). In addition to these on-shore landing sites, several trading vessels take fish directly from the fishermen and they are also classified as landing sites.

Data are collected from all landing sites using a cluster-stratified random sampling methodology. That is, all landing sites are clustered into zones depending on their geographical location. Within each zone, landing sites are then divided according to their status of importance (i.e primary, secondary and tertiary) and the status determines the frequency of sampling, such that primary sites are most frequently, and tertiary sites least frequently sampled. To avoid possible bias caused by the unequal sampling regime resulting in distorted spatial differences in catch composition; all species-specific landings data were raised on a monthly basis to estimate total landings weight per month (Ryan,1999).

Kingstown is still the only site at which a total census is conducted. This is easily taken since the fishermen must pay a landing toll for fish landed at this market. This additional information is used to compliment data obtained from the sampling programme.

The biological data collection only involves length measurements of a few selected species at selected landing sites. On mainland St. Vincent, length measurements are carried out at Kingstown, Greathead and Calliaqua. These sites are chosen in accordance with the stratified sampling system that is applied to the catch and effort data. In the northern Grenadines, the sampling is carried out on the three (3) trading vessels that operate in the area. Sampling is carried out on deck randomly, as the fishermen land their fish.

Sampling Schedule

There are currently six (6) data collectors, collecting biological and catch and effort data throughout the state. Each data collector is responsible for a given landing site zone (see Landing Site map Appendix 5) and is expected to work for a period of 24 days in any given month A sampling schedule is planned prior to the beginning of a particular month (See Time Table, Appendix 8). This schedule allocates sampling days to landing sites for each data collector by using the techniques of simple random sampling (see Allocation Table, Appendix 9). Sampling is not carried out on Sundays and major holidays, nevertheless, every day is considered as a potential fishing day. This simplifies data analysis and the error is negligible since fishermen fish whenever they can regardless of what day it is.

Information is taken from all boats at random eight hour periods between the hours of 6:00 am and 7:00 p.m. These eight hour periods are divided into two four-hour periods with a one hour break for lunch. At the landing site, sampling is done for the first available vessel after the data collector arrives and then the next available vessel given the length of time spent conducting the interview. At the end of each month completed data forms are submitted to be reviewed and entered into the TIP program.

Limitations and strengths

Limitations

Sale of fish to hotels and some sale at sea are not presently captured by the data collection system.

There are possibilities of double sampling, since fish after being tied at sea for some time may be taken out periodically, and send to other locations, hence one catch may be sampled several times. This is more prominent in the beach seine fishery.

Sample coverage rates are not sufficient for sampling at the different landing sites

The seasonality of certain species (dolphin, wahoo) makes it difficult to reach the target for biological sampling

Data on sex and maturity of fish have not been captured by the present sampling plan.

Strengths

The level of activity at each landing site can now be determined

Information can now be recorded by individual species and weight rather than species groups.

Some analysis have been done since more than 5 years of consistent data have been collected.

Recommendations

Continue to enhance and upgrade the data collection programme so that it will take into effect current fishing practices.

Implement sampling plan for the beach seine fishery, to keep track of fish distribution from a particular tie.

Carry out frame surveys on an intermittent basis, to provide additional information that is beyond the scope of the present sampling plan and enable dis-aggregation of data to assist in the interpretation of analyses.

Give consideration to the revision of effort units used in data collection. This should be coordinated at the regional level.

Increase sampling effort by a further sampling rate of 30%.

Sample reproductive information from selected species

Implement hotel purchase slips to capture sales of fish made directly to them.

DATA MANAGEMENT

Introduction

The importance of a proper data collection programme for any harvested fishery resource can never be overemphasized but in order to have a fully functioning data collection system, the proper equipment and skilled manpower must be put in place to ensure that data is stored securely and is easily available for analysis.

Data Entry

Data forms along with the daily summary sheets are submitted at the end of each month by the data collectors. The daily summary sheets give information on the number of vessels landed and how many were sampled on that day. (See daily summary, Appendix 10). The Data Officer or Assistant Data Officer review each data sheet to ensure that there are no discrepancies. In the case of any discrepancies, queries are made at data collector□s meeting at the end of each month. The forms are then sorted by zones and placed into file folders. The information is then entered on the computer. (see data entry forms, Appendix 11).

At present the Fisheries Division of St. Vincent and the Grenadines has registered an estimated 90% of fishing vessels. The registration of Fishers and vessels is a continuous process ensuring that the registration database/information is up-to-date. Fishermen who wish to be registered visit the Fisheries Office and give the relevant information which is entered on appropriate forms (see vessel and fisher forms appendices 12 and 13). Information is then transferred to the computer. All Fishing vessels must be inspected before a unique vessel registration number is given such as J8-00001-KI. J8 is the international call sign for St. Vincent and the Grenadines, 000001 is a sequentially assigned number and KI is the operating site of the vessel.

Data Storage

The Trip Interview Program (TIP) software was initially *developed for the U.S. National Marine Fisheries Services South East Fisheries Center and adapted for use in the CARICOM region with input from the OECS Fisheries Unit, CFRAMP* and member states. This database is use for the entry and storage of catch and effort and biological data. The Licensing and Registration System (LRS) software *developed by CFRAMP* and member countries is used for the entry and storage of licencing and registration information. Census data from landing toll books issued by the New Kingstown fish market (Appendix 7) and export data gathered from Health Certificates issued by the Fisheries Division (Appendix 6) are entered in Microsoft Excel workbooks.

Backup

Data are backed up twice per week in quadruplicate using the PKZIP software. They are stored on 3 □ □ 1.44 MB floppy diskettes and 3 □ □ 120MB floppy diskettes. Occasionally data will be copied onto a compact disc. Copies of these diskettes are stored at the office and by the Data Officer and Assistant Data Officer.

Limitation and Strengths of Data Management System

Limitations

- Inadequate human resource to effectively manage the gathering, inputting and storage of data flowing in at the end of each month.
- Databases used (TIP and LRS) are not compatible with windows and have become cumbersome relative to other programs.

Strengths

- Data can now be stored electronically rather than manually.
- All related information are stored in one database, hence simplification of data queries.
- Database files can be linked to other database programs, hence making it easier for data analysis.

Recommendations

- Upgrading the TIP and LRS programmmes to be compatible with windows.
- Employment of additional personnel to assist in data input and quality control.

DATA ANALYSIS

Type of analysis and information generated from catch & effort data

Analysis of data was conducted mainly for two species in St. Vincent and the Grenadines, namely Red Hind (*Epinephelus guttatus*) and Coney (*Epinephelus fulvus*). The data analysis of the Western Atlantic Wahoo and of dolphinfish were done using data from all the Eastern Caribbean states.

Statistical analysis was done using the catch and effort data in conjunction with the length frequency data generated from the TIP program (see e.g. report on the Assessment of Red Hind, not appended). Statistical analyses include:

1. Estimation of Growth Parameters using length frequency data to conduct Modal progression Analysis (MPA). The growth parameters L_∞ and K were estimated to be 72 cm and 0.51 y^{-1} respectively.
2. Estimation of Mortalities using means of the linearised length converted catch curve method, using an average of data over two years 1997 and 1998. Total mortality (Z) was estimated to be 2.78 y^{-1}.
3. Estimation of selectivity was estimated assuming a sigmoid-type selection ogive given the multi-gear nature of the fishery. Lc was estimated to be 42.9 cm with a 95% CI.
4. Cohort Analysis and Yield and Biomass Prediction: The cohort generated F-at-size matrix and the population size of the first length group were used as input information for the Thompson and Bell Yield and biomass prediction analysis. MSY was estimated to be 252,810 lbs with F_{MSY} estimated to be 1.89 y^{-1} and $F_{0.1} = 0.64$ y^{-1}.

CPUE

A simple CPUE analysis was conducted for the beach seine fishery using three years of data (Ryan 1999). The overall CPUE was found to be 335kg/haul.

Estimation of Total Landings

An estimate of the total amount of fish landed in St. Vincent and the Grenadines is obtained by summing the totals of all the estimates for the individual landing zones as well as the census information collected at the New Kingstown Fish Market (see Estimation by Landing sites for 1999, Appendix 14).

Total landings = Census + Estimates (zone1 + Zone2 + Zone3 + ...Zone 7)

To calculate an estimate of the amount of fish landed at a particular landing site the sample weight and the raising factor (rf) must be taken into consideration.

Raising factor (rf) = (# of days in month / # of days sampled)

Estimate for any site = sampled weight x (# of days in month / # of days sampled)

Then,

Estimate for any site = sampled weight x (rf)

Limitations and Strengths

<u>Limitations</u>

- Little or no effort data is being captured to determine the trends in catch per unit effort (CPUE) for certain species
- There is no formal way of capturing or estimating what percentage of data is being missed over a particular period, due to activities such as sale at sea etc.
- Difficulties in the estimation of landing when data collectors are absent from work due to vacation or otherwise.
- Inadequate human resources limit analysis to only a few species
- Information on underutilized species is limited, so proper analysis cannot be conducted to aid development.
- Limited information on growth and sex of species

<u>Strengths</u>

- Data can be analysed to determine whether stocks are depleting or not
- The growth parameters of a particular species can be determined using length frequency data
- Estimate of maximum sustainable yield (MSY) for any species can be calculated
- Mortality rates can be estimated.

Recommendations

- Conduct surveys at landing zones where data are being missed so that more reliable estimates can be made.
- Conduct analysis on other species
- The length frequency data should be corrected for gear selectivity prior to analyses.
- Fisheries independent surveys, particularly for underutilized species should be considered.
- Otoliths of selected species should be collected and send to IMA for analysis.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The data collection system in St. Vincent has made tremendous strides and continues to do so. More than five years of consistent data have been collected. This information can now be used and have been used in some aspects to formalize useful and up-to-date scientific analyses that can replace old hypotheses and obsolete anecdotal statistics.

The significant infrastructural development at landing sites in St. Vincent and the Grenadines, training of fisherfolks in the utilisation of new gears and methods, fish processing, the introduction of longline vessels and the training of fisheries personnel in geographical information systems (GIS) etc will facilitate the collection of more accurate data. This increases confidence in the assessments conducted using such data. However, the collection of socio-economic information continues to hinder a comprehensive economic evaluation of the fishing industry.

Recommendations

- Look at the abundance and distribution of coastal pelagics - tagging, stock identification by DNA analysis.
- Reallocate time among landing site zones, taking into consideration the infra-structural development at landing sites.
- Upgrade landing site status
- Enhance the present data collection system and analysis capabilities to provide necessary information for fisheries management and development, taking into consideration the expansion of biological sampling to other landing sites.
- Promote the development and use of selective fishing gear practices that minimise waste in the catch of target species and the by-catch of non-target species causing habitat degradation.
- Promote increased utilisation of aquatic resources through product development (salting, canning, etc) and technology transfer, so as the lesser the import of canned fish products and increase exports.

- Promote increase collection of socio-economic data.
- Improve legislative support of data collection.

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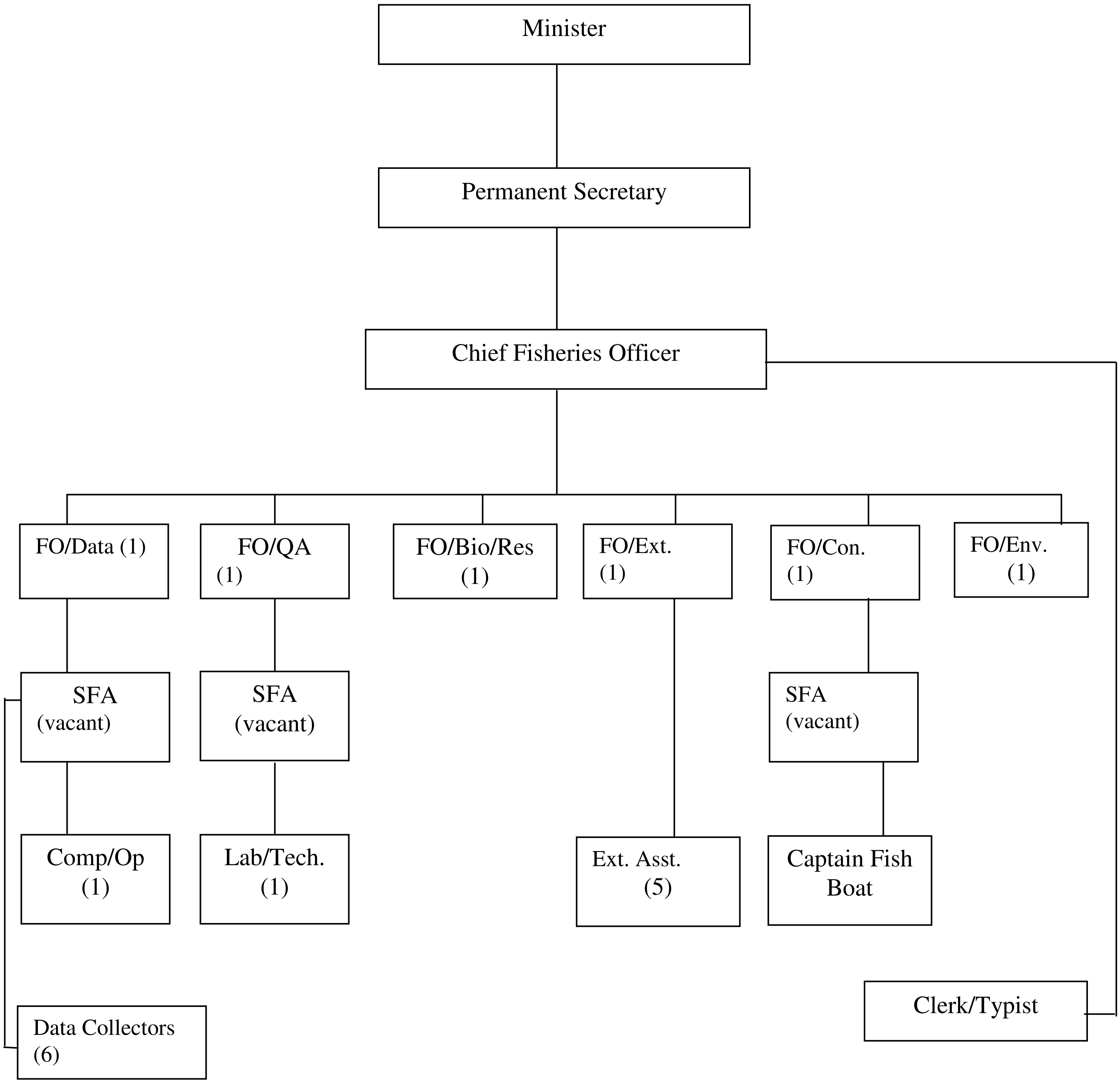
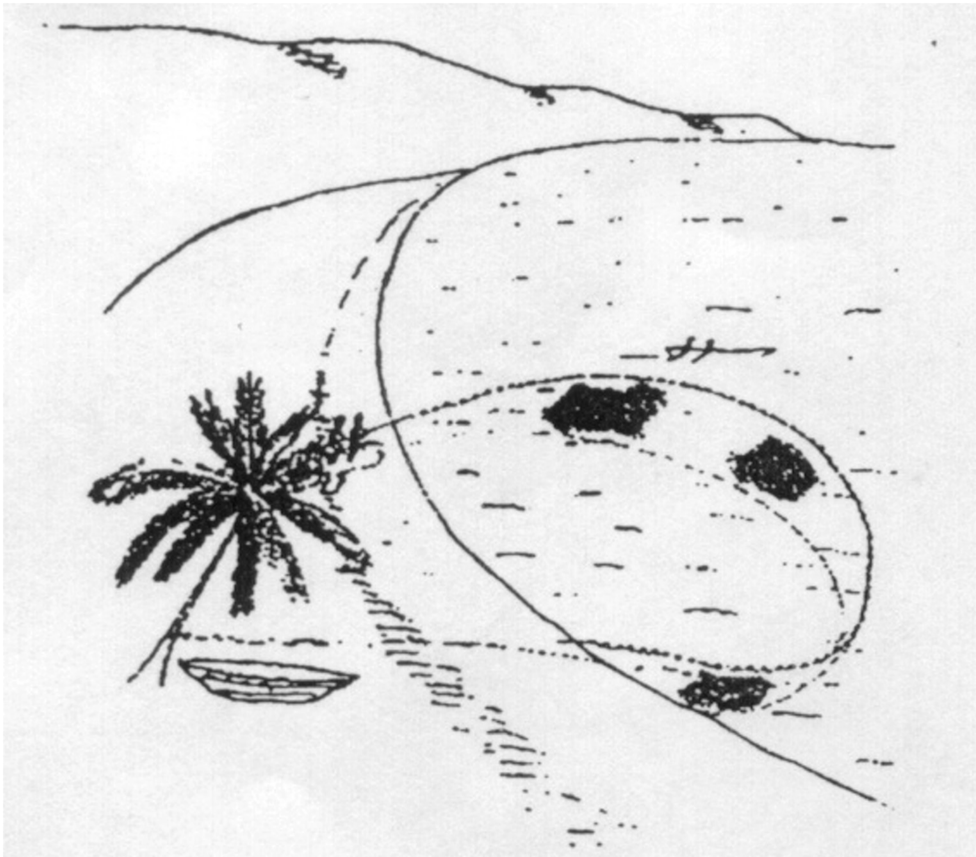
APPENDIX I
ORGANIZATION CHART, FISHERIES DIVISION SVG



APPENDIX 2
FISHING GEARS



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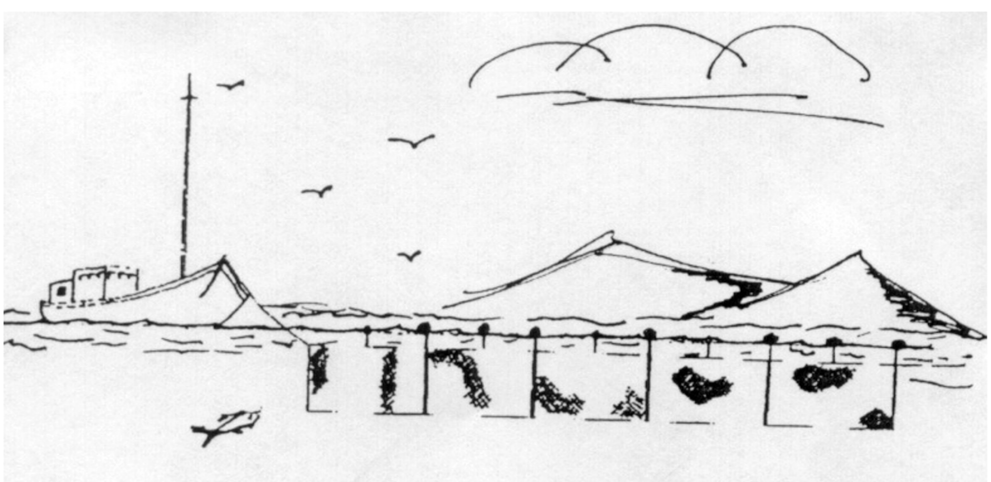
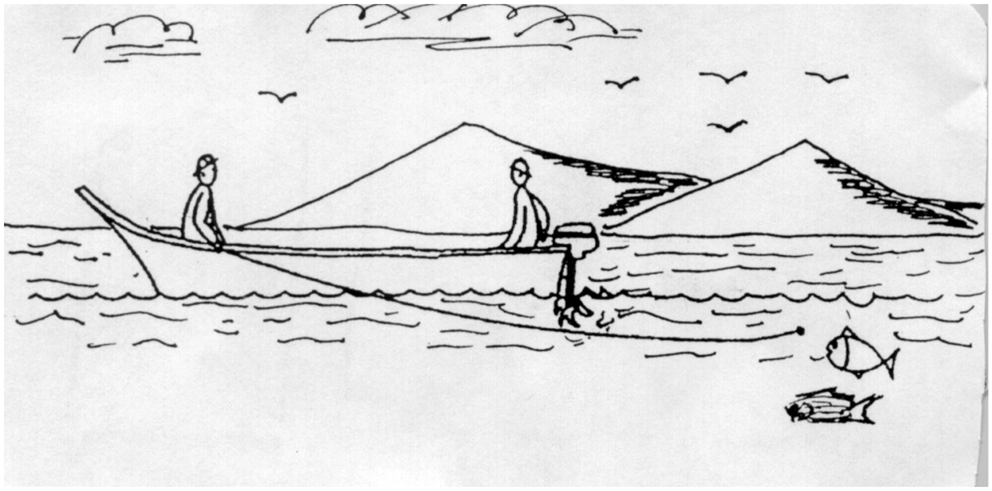
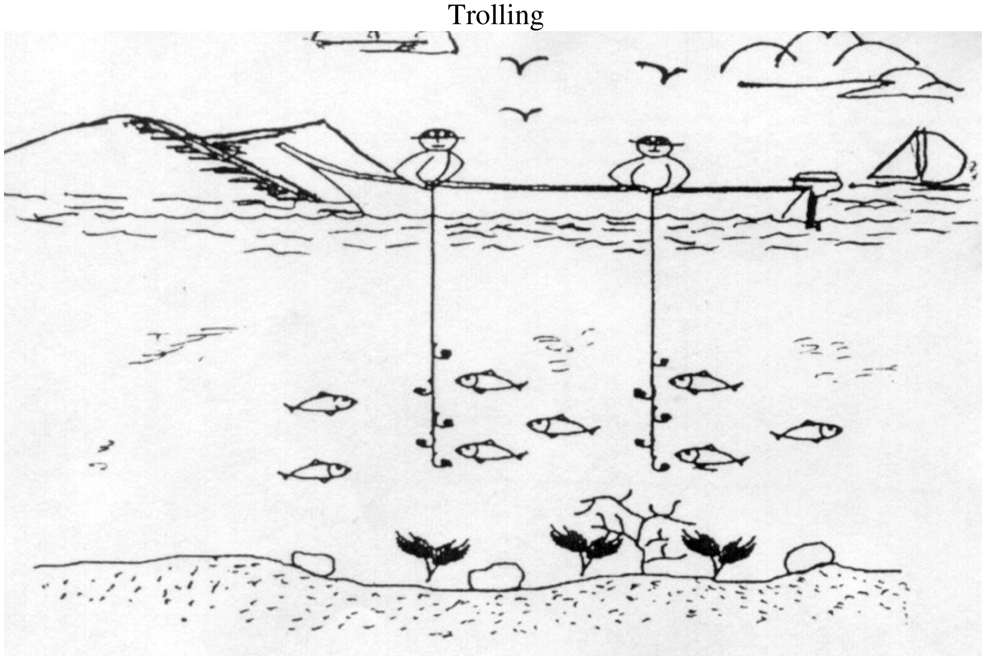


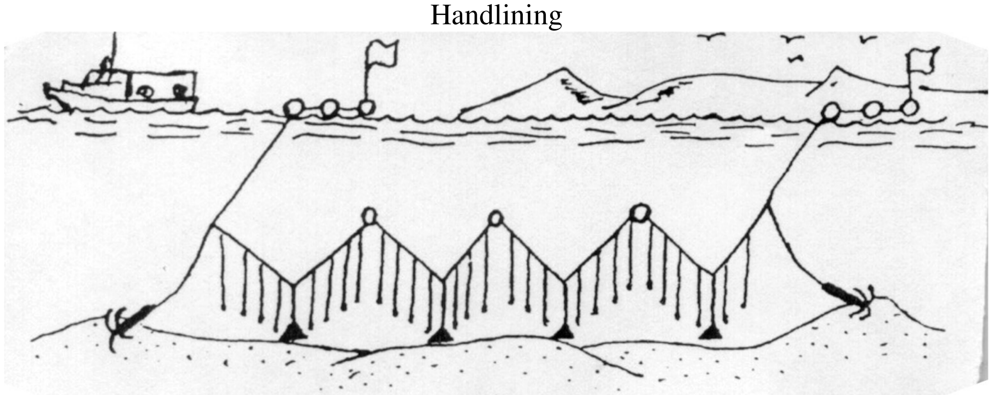
Gill Netting



Trolling

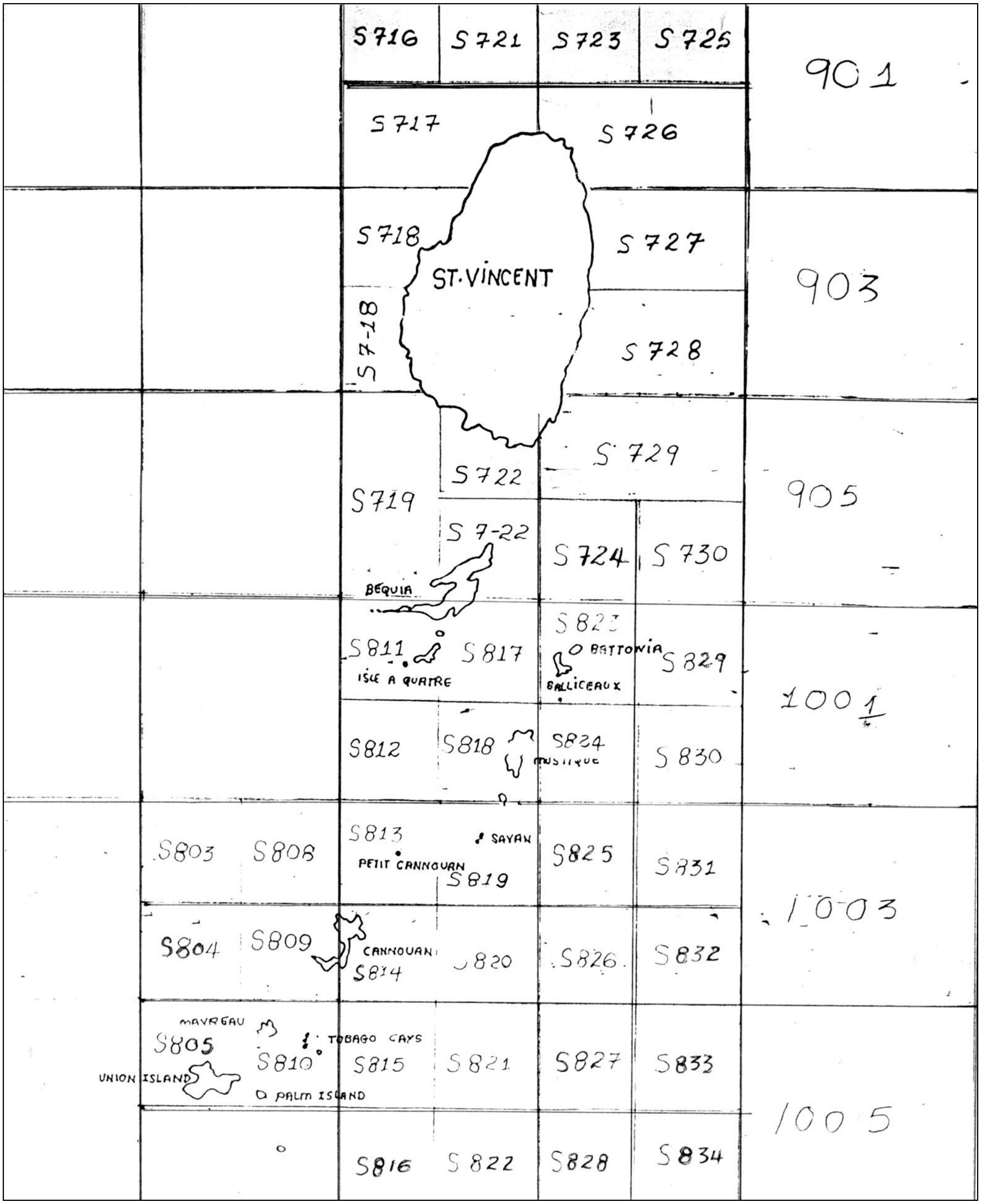


Handlining

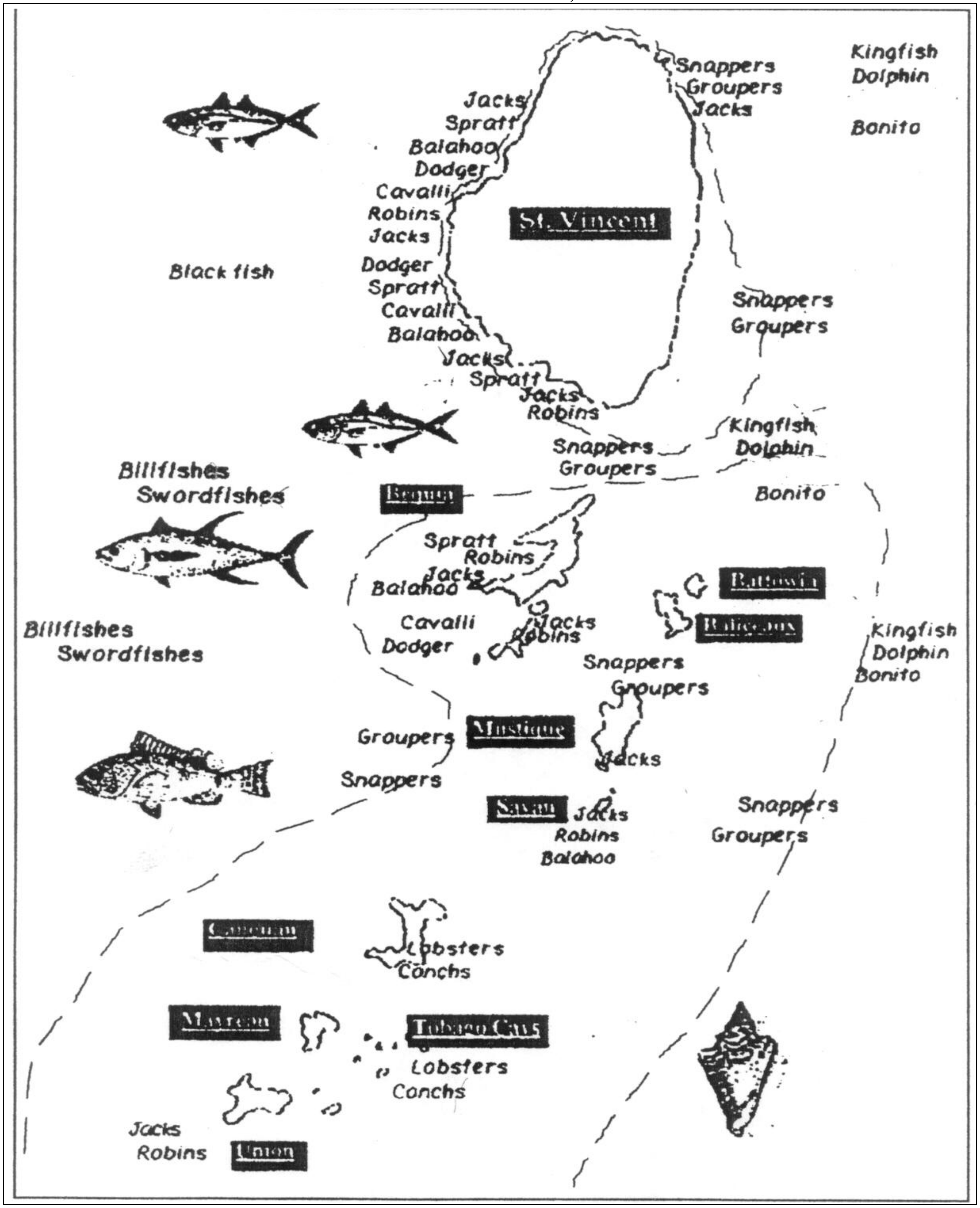


Bottom Handling

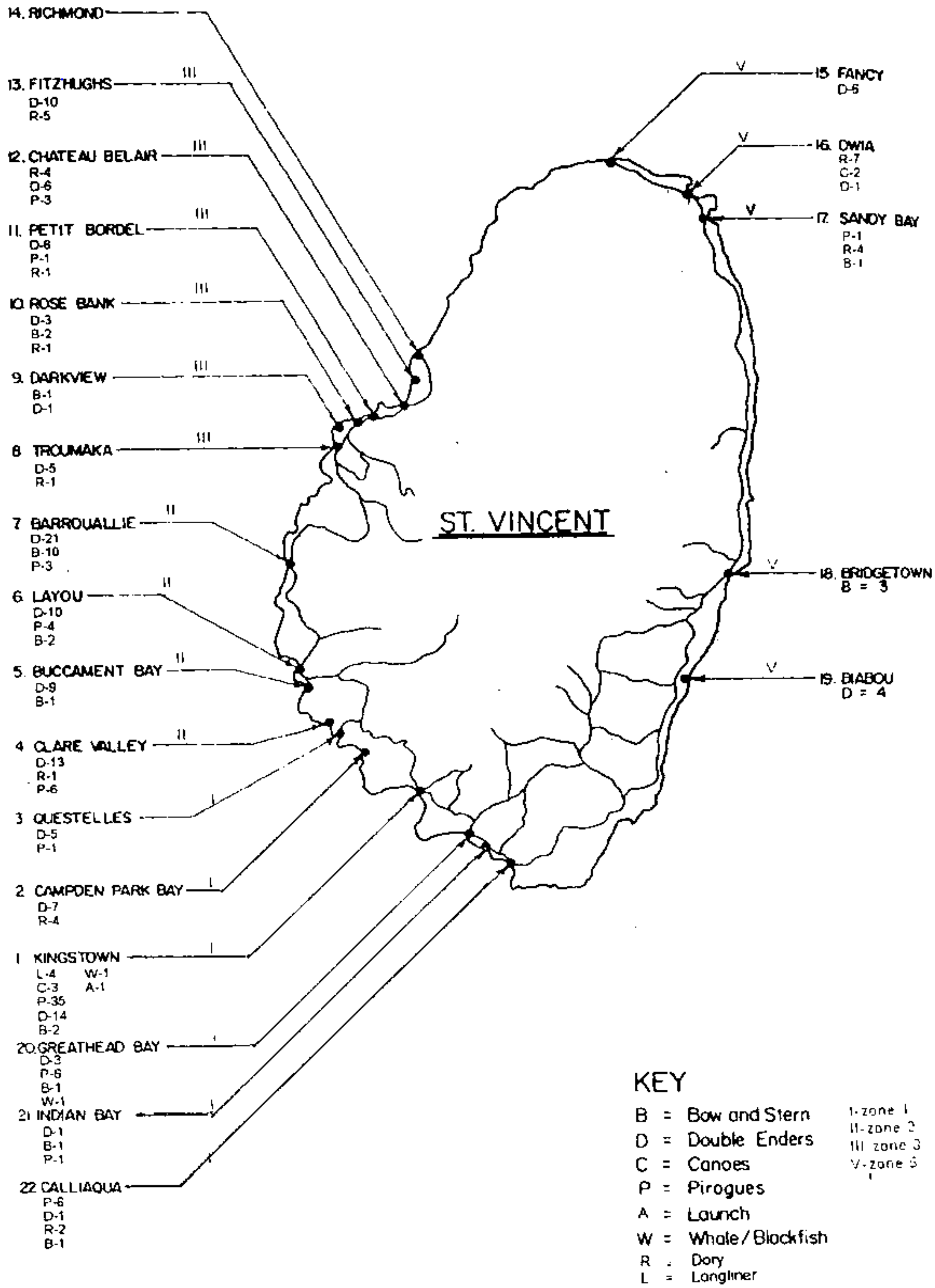
APPENDIX 3
FISHING AREAS



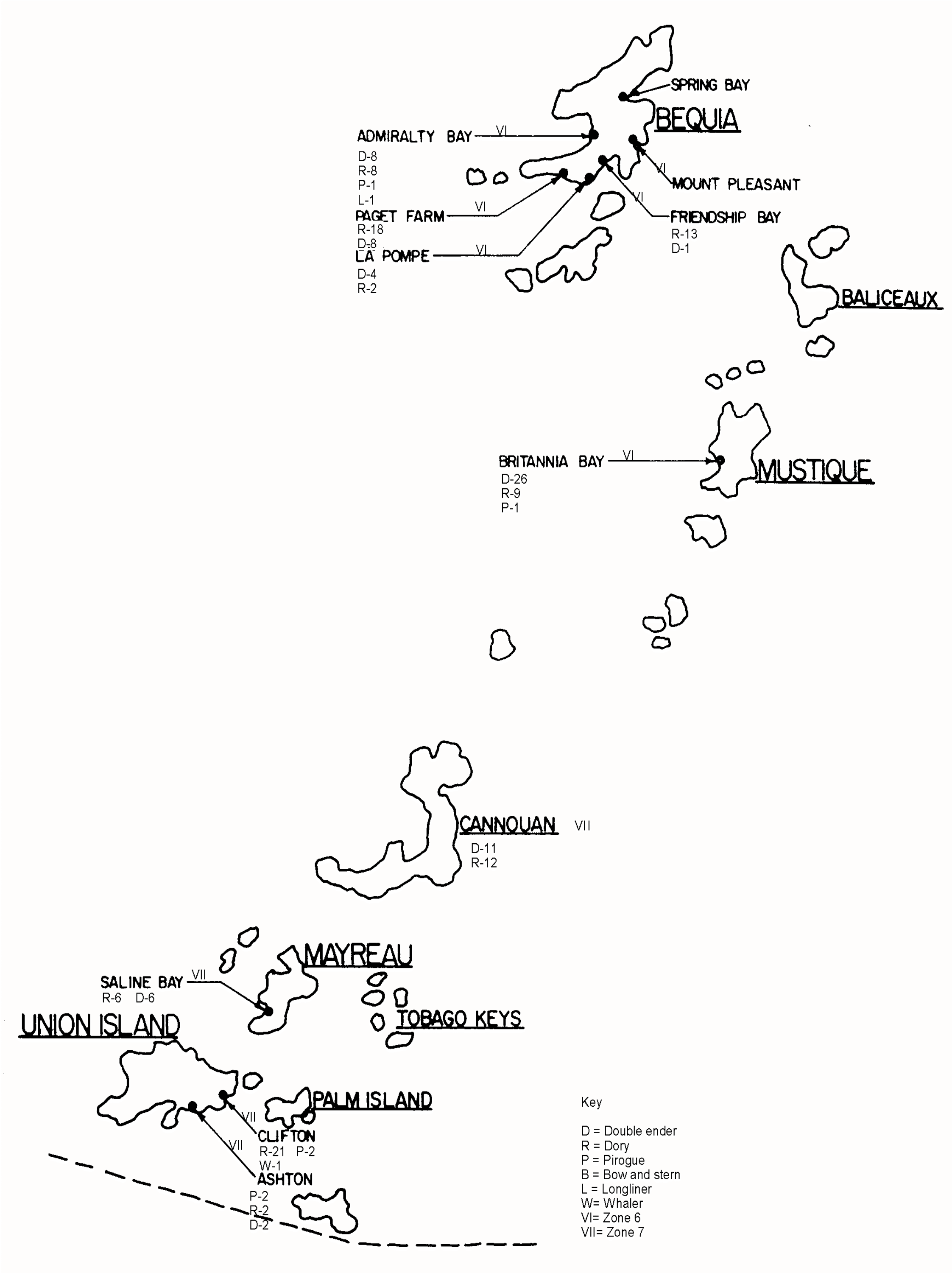
APPENDIX 4
FISHING GROUNDS, SVG



APPENDIX 5
DESIGNATED LANDING SITES IN SVG



APPENDIX 5 (continued)
DESIGNATED LANDING SITES IN SVG



APPENDIX 6
ST. VINCENT AND THE GRENADINES
FISHERIES DIVISION
MINISTRY OF AGRICULTURE AND LABOUR

HEALTH CERTIFICATE FOR THE EXPORTATION OF FISH, CRUSTACEANS, MOLLUSCS, ECHINODERMS AND OTHER SEA FOODS.

COMMERCIAL NAME(S)	SCIENTIFIC NAME (S)	WEIGHT KG/LB	VALUE	PRES. METHOD
TOTAL:				

NAME OF EXPORTER:...
ADDRESS OF EXPORTER:..
COUNTRY EXPORTED TO:.. Date........../............/19......................
NAME OF CARRIER/REG. NO:...
FLIGHT/VOYAGE NO. (if any):...
NAME OF CONSIGNEE:...
ADDRESS OF CONSIGNEE:...

I.. the exporter/agent of the above mentioned sea foods, do hereby declare that the information given above is correct. DATE: ..../.........../19...........

The above mentioned sea foods have been examined by .... of the Fisheries Division of the Ministry of Agriculture and Labour and found to:

a) Be fit for human consumption.
b) Contain no additive such as dyes, preservatives, or any chemical agent prohibited from use in this country by legislation.
c) Be free of salmonella in 25 G.
d) Contain acceptable levels of clostridium (less than 1,000 spores/g).
e) Free of Vibrio comma (Cholera bacteria).

....
CHIEF FISHERIES OFFICER

APPENDIX 7
TYPICAL MARKET LANDING TOLL DATA FORM

Captains Name:	Boat Name:

Vessel Registration No.:	Date: / /

Hours Fished:	Area Fished:	Gear(s) used:

SPECIES	NO. OF FISH	WEIGHT	PRICE ($E.C)
Blackfin Snapper			
Blem			
Bonito			
Butterfish			
Dolphin			
Blue Marlin			
Kingfish			
Red Hind			
Red Snapper			
Swordfish			
Lobster			
Conch			
TOTALS			

Certified correct

------------------------------ ----------------------------------
Fisherman Hotel Superintendent

APPENDIX 8
TIME SCHEDULE
NOV 2000
ZONE 1

LANDING SITE	COMMENTS	DATE
CALL		1ST
CALL		2ND
GRBA		3RD
LOWM		4TH
INBA		6TH
QUES		7TH
CAPA		8TH
GRBA		9TH
LOWM		10TH
GRBA		13TH
GRBA		14TH
GRBA		15TH
CALL		16TH
LOWM		17TH
INBA		18TH
GRBA		20TH
INBA		21ST
CALL		22ND
CALL		23RD
CAPA		24TH
QUES		27TH
GRBA		28TH
GRBA		29TH
OFFICE		30TH

APPENDIX 9
ALLOCATION OF TIME AMONG LANDING SITE ZONES FOR ST. VINCENT AND THE GRENADINES (ASSUMING 24 SAMPLING DAYS)

LANDING SITE ZONES	LANDING SITES	CATEGORY	DAYS/MONTHS	PERCENTAGE SAMPLING
ZONE 1	KINGSTOWN	1	*12 / CENSUS	50 / CENSUS
	GREATHEAD	2	6	25
	CALLIAQUA	2	6	25
	INDIAN BAY	3	3	12.5
	LOWMAN'S	3	3	12.5
	QUESTELLES	3	3	12.5
	CAMPDEN PARK	2	3	12.5
ZONE 2	CLARE VALLEY	2	4	16.7
	BUCCAMENT	2	4	16.7
	LAYOU	2	4	16.7
	BARROUALLIE	1	12	50
ZONE 3	TROUMACA	3	3	12.5
	DARKVIEW	3	3	12.5
	ROSEBANK	2	3	12.5
	CHATEAUBELAIR	2	10	41.7
	FITZHUGHES	3	3	12.5
	PETIT BORDEL	3	2	8.3
ZONE 5	BIABOU	3	6	25
	SANDY BAY	3	6	25
	OWIA	3	6	25
	FANCY	3	6	25
ZONE 6	FRIENDSHIP BAY	3	ESTIMATED	
	PAGET FARM	3	ESTIMATED	
	ADMIRALITY BAY	3	ESTIMATED	
	LOWERBAY	3	ESTIMATED	
	LA POMPE	3	ESTIMATED	
	TRADING VESSELS	2	RANDOMLY SAMPLED 24 DAYS/MONTH	
	BRITANNIA BAY	2	CENSUS	
ZONE 7	CANOUAN	2	CENSUS	
	CLIFTON	3	CENSUS	
	ASHTON	3	CENSUS	

APPENDIX 10
ST. VINCENT AND THE GRENADINES
FISHERIES DIVISION
DATA COLLECTORS DAILY SUMMARY

Data Collector:				*Date*		
Site:				*Start time:*	*End time:*	
SUMMARY OF LANDINGS						
Land No.	*Boat Name*	*Reg. No.*	*Fisherman Name*	*Reg. No.*	*Sampled Y/N*	*Comments*
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Comments on Day

Weather: *Sea State:*
Other:

APPENDIX 11
FISHERIES DIVISION
DATA COLLECTION SHEET

Data Collectors Initial __________________

DATE ________________

Vessel Reg. No.:			
Vessel Name:			
Fisherman's Name:			
Area Fished:		*Site Code:*	
Crew Size:		*Fuel Used:*	*Q'ty Bait Used:*
ETD: *Date:*		*ETA:* *Date:*	*Hours Fished:*
Fishing Gear (Circle one)		*EPOT HLIN TROL BLIN GNET BSNE* *SCUB SGUN PALN*	
Total Weight			*g Kg Lbs*
SPECIES BREAKDOWN			
Common Names	*Weight*	*LS*	*Price/lb*

ETD - Estimated Time of Departure; ETA - Estimated Time of Return;
LS (Landed Status) - W (Whole) H (Headed) G (Gutted)

APPENDIX 12

Saint Vincent and the Grenadines

Application for REGISTRATION OF VESSELS

For Official Use:
Registration No. ________

Vessel ______________________ Radio Call ________

Registered Owner ______________________ Fishers No. ________

Port of:
Registration ______________
Operations ______________

Vessel Type ______________
Material ______________
Description ______________
____

Captain ______________
Fishers No. ______________

L.O.A. ______________
B.O.A. ______________
Draught ______________
Tonnage ______________

Partner ______________
Fishers No. ______________

Engines: Make and Type H.P.
1. ______________ ____
2. ______________ ____

Partner ______________
Fishers No. ______________

(Attach details of other stakeholders)

Investments & Concessions Granted:
1. ______________
2. ______________
3. ______________

Fishery Type ______________
Storage Cap. ______________
Ice: [ ] Yes [ ] No
No. of Crew ______________

Date format: dd/mm/yy (For Official Use)

Inspection: Date ________ Expiry ________ Registration Expiry ________

Date format: dd/mm/yy

Signature ______________________ Date ______________

Approved by ______________________ F.O. Date ______________

APPENDIX 13

Saint Vincent and the Grenadines

Application for REGISTRATION OF FISHERS

For Official Use
Registration No.:_____

Last Name:______________ First Name: ____________ Nickname: ____________

Address: __________________________________ Village: ______________

Phone No.:________________ Date of Birth: ______________ Sex: ________

ID: National [ ] Social Security [ ] Drivers License [ ]

Passport [ ] Other:[________________] ID Number:__________

Contact Information

Name: ____________________________________ Phone No.:________________

Address: ____

Role in Fishery

[ ] Registered Owner
[ ] Owner
[ ] Captain
[ ] Crew
[ ] Vendor
Other:__________

Education

[ ] Elementary
[ ] "O" Level
[ ] "A" Level
[ ] Post Secondary
[ ] College/University

Qualification in Fishery

1.________________
2.________________
3.________________
4.________________

Operating Site: ________________

Cooperative Affiliation

1. ____________________________________
2. ____________________________________
None: [ ]

Time Working

[ ] Full Time
[ ] Part Time
[ ] Weekend Only
[ ] None

Family Status: ____________________

No. of Dependants: ____________

No. of Children: ____________

No. of Girls: ________ No. of Boys: ______

Date of Application:

____
(dd/mm/yy)

Date of Registration:

____

APPENDIX 14
ESTIMATED DATA ON FISH BY LANDING SITES LANDED AND MARKETED IN ST. VINCENT AND THE GRENADINES FOR THE YEAR 1999 (JAN - DEC)
Weight in lbs

NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	**AUG	*SEP	*OCT***	*NOV	****DEC	TOTAL
ZONE 1													
**NKFM	96,477	97,711	125,817	87,975	68,141	79,958	69,490	73,350	46,790	24,032	34,437	54,506	858,684
CALLIAQUA	3,289	11,703	4,642	2,608	2,561	2,633	1,686	3,174	989	1,349	2,158	424	37,214
CAMDEN PARK	10,220	23,193	145	5,050	345	250	0	322	250	1,106	0	0	40,880
GREAT HEAD BAY	820	2,389	1,993	3,399	2,651	2,338	3,192	3,345	734	390	1,520	1,832	24,602
INDIAN BAY	796	537	775	1,388	718	760	1,302	1,408	735	240	0	196	8,854
LOWMANS	17,298	196	0	0	0	0	1,651	258	0	542	0	0	19,945
QUESTELLES	2,480	44,800	2,888	308	0	0	424	1,932	383	1,489	0	558	55,261
SUB-TOTAL	**131,379**	**180,529**	**136,259**	**100,726**	**74,416**	**85,939**	**77,745**	**83,789**	**49,880**	**29,148**	**38,115**	**57,516**	**1,045,440**
ZONE 2													
BARROUALLIE	5,811	2,856	620	8,550	5,597	5,277	6,251	7,183	14,574	9,422	6,820	4,095	77,056
BUCCAMENT	620	1,120	0	36	0	3,000	31	0	24	0	0	80	4,911
CLARE VALLEY	4,921	2,078	1,531	4,800	2,306	5,355	395	1,062	1,458	163	1,725	755	26,549
LAYOU	233	1,890	808	0	0	4,800	70	0	0	0	0	129	7,930
SUB-TOTAL	**11,585**	**7,944**	**2,959**	**13,386**	**7,904**	**18,432**	**6,747**	**8,245**	**16,056**	**9,585**	**8,545**	**5,059**	**116,446**
ZONE 3													
CHATEAUBELAIR	2,083	2,517	6,991	1,317	2,019	1,863	3,150	3,524	3,768	885	2,890	1,423	32,429
DARK VIEW	0	686	217	135	0	90	403	134	0	47	60	0	1,772
FITZ HUGHES	1,054	700	3,689	30	1,436	320	2,945	3,633	75	385	0	0	14,267
PETIT BORDEL	4,371	3,276	186	1,290	465	645	827	1,003	750	375	225	419	13,832
ROSE BANK	4,557	2,361	4,526	1,320	1,550	5,588	1,705	1,988	1,245	770	620	2,248	28,478
TROUMACA	2,403	0	827	0	0	400	0	369	120	143	1,050	0	5,311
SUB-TOTAL	**14,468**	**9,541**	**16,435**	**4,092**	**5,470**	**8,906**	**9,030**	**10,651**	**5,958**	**2,605**	**4,845**	**4,089**	**96,089**
ZONE 5													
BIABOU	1,790	775	1,245	420	1,374	673	2,857	4,331	798	184	826	651	15,926
FANCY	0	0	439	0	298	0	0	78	0	0	0	0	814
OWIA	222	504	9,424	6,651	0	0	326	155	78	81	0	155	17,596
SANDY BAY	0	0	0	0	0	0	0	0	0	0	0	0	0
SUB-TOTAL	**2,012**	**1,279**	**11,108**	**7,071**	**1,672**	**673**	**3,183**	**4,564**	**876**	**265**	**826**	**806**	**34,337**
ZONE 6 BEQUIA													
TRADING VESSELS	15,070	18,434	28,912	18,881	26,780	18,004	36,780	38,500	19,800	1,500	3,063	16,162	241,885
SUB-TOTAL	**15,070**	**18,434**	**28,912**	**18,881**	**26,780**	**18,004**	**36,780**	**38,500**	**19,800**	**1,500**	**3,063**	**16,162**	**241,885**
ZONE 7													
UNION ISLAND	11,553	4,343	4,299	6,440	0	0	0	0	4,255	3,115	880	0	34,884
PETIT MARTINIQUE		7,295	11,440		8,800	8,800	13,860	10,040	15,400	0	0	0	75,635
CANOUAN	1,982	1,478	668	429	537	0	0	0	0	0	0	0	5,094
SUB-TOTAL	**13,535**	**13,115**	**16,407**	**6,869**	**9,337**	**8,800**	**13,860**	**10,040**	**19,655**	**3,115**	**880**	**0**	**115,612**
GRAND TOTAL	**188,049**	**230,841**	**212,081**	**151,024**	**125,579**	**140,754**	**147,345**	**155,789**	**112,225**	**46,217**	**56,274**	**83,631**	**1,649,809**

* Months of Fish Kill
** Guesstimation of data for Zone 3 (Data collector was on vacation)
*** Guesstimation of data for Campden Park, Indian Bay, Lowmans and Ques for Zone 1 and all sites for Zone 3 (Data collectors were out of the state.
**** Guesstimation of data for Zone 2 (Data collector was on vacation)

REPUBLIC OF SURINAME

by

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Ministry of Agriculture, Animal Husbandry and Fisheries
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1. INTRODUCTION

1.1 GENERAL INFORMATION

Geography and Economy		
Area	:	163,265 sq. km
Length of coastline	:	380 km
Shelf area (to 200 miles)	:	54,550 sq. km
Terrain	:	Varies from coastal swamps to savanna to hills
Climate	:	Tropical
Population (1997)	:	422,175
Annual growth rate	:	1.55 %
Languages	:	Dutch (official), English, Sranan Tongo (lingua franca)
Workforce (1998)	:	37,727 (government)
Unemployment rate (1998)	:	11%
GDP (1998)	:	890.3 million US$
GDP growth rate (1998)	:	23.4 %
GDP per capita (1998)	:	2,109 US$
Currency unit (1998)	:	SF 406 = US$ 1
Agriculture	:	9.1 % of GDP (1998). Products: rice, bananas, timber, shrimp & fish, and citrus fruits.

The capital is Paramaribo; about 50% of the population live in Paramaribo. Another 100,000 live in semi-urban areas close to the capital. About 15% live in the southern Interior Rainforest, which accounts for 80% of the country's total area.

1.2 THE OVERALL FISHERIES POLICY

The overall policy of the Suriname Fisheries Department is to increase fish landings through the expansion and modernization of the artisanal fleet without over-exploiting the fishery resources. This will be achieved through:

- A step by step policy on inputs - increase in the replacement and expansion investments for the fishery sector. This will be done primarily for the artisanal fishery and secondarily for the industrial fishery, because the former has more expansion potentials. These however surpass the absorption capacity of the local market and therefore the artisanal fishery can only become fully developed if it can break through on the export market.

- A responsible license system should have an effect on the regulation of fish supplies in relation to the market possibilities.

- Gradually make substitution in the artisanal fleet from foreign crews to local ones. The government initiate and coordinate the boat building program and is seeking for funds for the training of fishermen.

- Concentrate on the improvement of infra structural supplies all over the country in order to improve the development and the control on fishery activities (ship building yards, maintenance and repairing facilities of wooden boats, ice production and storage, cooling and freezing storage, landing places, dry storage, fish auctioning places, conform the catch and the number of boats).

- Surveillance and control in the national waters, joint activities are set up between the Ministry of Agriculture, Animal Husbandry and Fisheries and the Ministry of Justice and Defense. Regular control should lead to a safe zone for fishermen and minimization of illegal practices. This should lead to a higher output of this economic activity.

- Institutional and financial supplies should be made ready, in a bridging period of 2 to 3 years, in order to assign the fisheries infrastructure to interested communities and co-operatives, which from then on will be fully responsible for the exploitation.

- Development of the export sector shall be stimulated by making a detailed marketing study of the export markets for fish and fish products. The department of fisheries is also training personnel in quality management aspects.

- To guarantee the continuity of fish and shrimp exports in Suriname, fishery policy promotes the responsible use of natural resources. The fishery policy concentrates on:
    - Expansion of the laboratory facilities for research, inspection and certification;
    - Continuation of the training program for quality managers (e.g.HACCP)
    - Research on the stock biomass, in order to avoid overexploitation.

- In order to expand the earnings from the aquaculture sector, more support will be given to the culture of shrimp and fish species.

1.3 LEGISLATION

<u>Registration</u>
For trawlers and snapper vessels, boat registration is compulsory, according to nationality and status. For the artisanal fishery the distinction is made between coastal fishing units, inland fishing unit, sport fishing and fishing units without boats.

Annual fees

Since 1986 license fees of foreign companies / owners are cashed in US $ and in Surinamese guilders for local fishermen.

Reporting

Each vessel captain has to report his position daily to his base. In addition, logbooks used to be filled out and submitted to the Fisheries Department within three days after completion of the trip. Nowadays these logbooks are not used any more, due to the inconsistent quality of the information. Landings reports are submitted through the Processing plant for shrimp trawlers and snapper boats of each trip. For the finfish trawlers the landing reports are collected at each company/ owner by Fisheries staff. For all other fishing units the landing is collected through a sampling system at the various landing sites.

Closed areas

All trawlers are forbidden to operate under the 10 fathoms water depth. Shrimp trawling is forbidden in areas shallower than:
- 12 fathoms from January to June;
- 15 fathoms from July to December

Destination of the catch

The entire catch has to be landed in Suriname. Transshipment at sea is prohibited, as well as delivering part of the catch in neighboring countries.

1.3.1 LICENSING POLICY

Until now there was no attempt made to limit the size of the fleet, but now this matter is being considered for the Industrial fishing units and the Coastal gillnet fleet. However no action has yet been taken.

I.3.2 ENFORCEMENT

Regulations on registration and license fees are effectively enforced. Enforcement of regulation at sea is being improved in 1999, with a small aircraft and 4 patrol vessels. The responsibility for enforcement of fishery regulation lies with the Ministry of Defense.

2. DESCRIPTION OF THE FISHERIES

2.1 The Fishery

The fishery of Suriname is geographically divided into industrial (offshore), coastal, brackish water, fresh water fisheries and aquaculture.

2.1.1 Industrial fisheries

The industrial fishing activities take place at depths from about 18m and are considered capital intensive. They include the shrimp-trawling fishery, which has brought the bulk of the fisheries output since the early sixties, finfish trawls, snapper fisheries and seabob trawls. The number of trawlers have been fluctuating between 100 and 170 since 1978 (proclamation of the 200 nautic miles E.E.Z. by Suriname) but in 1998, 268 trawlers were registered, of which 109 shrimp, 21 seabob and 12 finfish and 126 snapper handliners. Penaeid prawns vessels undertake trips of 50 to 100 days' duration. Seabob fleets make shorter trips, 4 to 10 days and finfish vessels make trips of 14 days to 30 days.

There is no reliable estimate of the amounts of finfish caught as by-catch by shrimp trawlers. It seems that fish are caught towards the end of a trip, and that bycatches may be high up to this point. The species composition of the real catch differs significantly from the species composition of the landed by-catch.

Trawling is prohibited at depths of less than 12 fathoms from January to June and 15 fathoms from July to December. In the second period shrimp recruitment is expected to take place.

The seabob trawlers are targeting *Xiphopenaeus kroyeri*. This fishery has operated since late 1995 and started with 5 vessels. Generally they fish in depths between 13 meters and 24 meters. The duration of a trip is about 8 - 10 days.

In the second half of the eighties a number of shrimp trawlers were converted into finfish trawlers because there was a market for the fish. In 1993 a new finfish fleet enters our water, North Sea trawlers. These vessels introduce a lot of pelagic fish species to the common market, such as baracuda and mackerels.

The snapper hook and line boats operating offshore were not registered until 1982. In 1985 an agreement was signed to permit a maximum of 100 vessels every year operating in our waters. In 1997 this maximum has been exceeded.

2.1.2 Coastal Fishing

Fishing operations in depths less than 10m are considered artisanal. In coastal waters two main fishing gears are used. About 230 boats fish with drifting gillnets of a length up to 4,000m in the 3 to 10m depth contour and catch primarily Sciaenidae and Ariidae. The pin seine, or banket fishing is exercised on the mud flats of seabanks , by some 25 boats. In some seasons, part of these fishermen switch to bottom longline, for marine catfishes. The coastal fishing crafts are "V-shaped" wooden plank boats, of two types. The " open Guyana type" boats are not decked, 8 to 14m long. powered by a 25- 50 HP outboard engine. The " closed Guyana type" boats are decked, 15m long, with a 45-80 Hp diesel inboard engine. The crew members are mostly Guyanese and a few Surinamese. Both type of boats keep the catch on ice .

2.1.3 Brackish water

In the estuaries of the main rivers chinese seines are primarily used, for small shrimp, and secondarily for small fishes (partly juveniles of marine species). These fishermen use flat bottomed wooden pirogues, (about 200 units) 6-10m long, with 15 to 35 HP outboard engines, and set also bottom longlines, for catfishes.

There exists also a small drifting gillnet fishery in the estuaries and lower part of the main river, and a seine fishery for fresh water Sciaenidae. Smaller gillnets are set in the brackish water lagoons. Juveniles of marine species make up the bulk of the catch there. Some times of the year, small seines are dragged for Penaeid juveniles.

2.1.4 Fresh water

Suriname has an extensive waterway network. Fresh water fish contributes an important part in the diet of the population of the interior where it is often, the only source of protein. Few of these species are occasionally supplied to the populated coastal areas. Freshwater swamp fish are traditionally prefered by the consumers. The most wanted and expensive fish in Suriname, the armoured catfish, is actively searched for and is disappearing from the accessible places (*Hoplosternum littorale*). The water reservoir, van Blommenstein Lake, is presently lightly exploited for *Cichla ocellaris*. The presence of dead trees and piranhas makes working with nets difficult in this lake.

2.2 FISHERIES DATA

Table 1 Commodity (1998)

	Production (1)	**Import**	**Export (2)**	**Total supply**	**Per caput supply (kg/yr)**
Fish for human consumption (tons)	16,000	1,482	10,333	7,149	16.9

Estimated employment (1998)
Primary Sector: 4283 (including foreigners)
Secondary Sector: unknown

Gross Value of Fisheries Output (ex vessel value)
1998 = 58.7 million Suriname guilders

Trade (1998): (total of fish, shrimp and crustaceans)

Value of Imports: 2.7 million US$
Value of Exports: 38.6 million US$

Table 2 Number of registered fishing units 1994 - July 2000 in Suriname

	1994	1995	1996	1997	1998	1999	2000
Shrimptrawlers	119	101	107	109	109	104	99
Seabobtrawlers		5	5	18	21	24	24
Fishtrawlers	22	21	13	13	12	13	11
Snapperliners	55	97	73	103	126	-	-
Total industrial fleet :	***196***	***224***	***198***	***243***	***268***	***275***	***216***
Decked Guyana boats (inboard engines)	70	75	56	63	54	44	49
Open Guyana boats (outboard engines)	219	189	124	209	231	263	309
Total coastal fleet	***289***	***264***	***180***	***272***	***285***	***307***	***358***
Chinese seine (BV)	357	351	277	291	248	237	250
Longline (BV)	89	99	77	68	33	36	38
Drifting gillnet (BV) :	137	145	107	134	103	113	108
Sport (BV) :	30	32	28	41	39	33	35
Fixed gillnet (BV) :	50	49	24	30	23	22	14
Dragnet (BV) :	9	11	7	8	8	4	7
Riverseine (BV)	19	21	9	12	12	14	7
Lagoon gillnet (lagoon)	162	148	84	84	50	38	52
Aquarium					1		
Total inland and estuary fleet (BV)	***691***	***708***	***613***	***668***	***517***	***497***	***511***
Total artisanal fleet (Coastal, inland and estuary)	***1115***	***1120***	***793***	***940***	***802***	***804***	***869***
Source : Fisheries Department							

* The number of licenses set for 1999 by the Fisheries Department are the limits for number of licenses to be issued for that year. See licencing form, appendix 2.

Table 3 Classification of fishing fleets operating in Suriname

FLEET CATEGORY	TYPE OF VESSEL	TYPE OF GEAR
Industrial fleet	Outrigger trawlers	Shrimp trawl Fin-fish trawl Sea-bob trawl
	Stern trawlers	High-opening trawl
Small-scale fleet	Snapper boats	Hook and line
	Guyana boats	Drifting gillnet Njawarie (banknet) Longline (bottom)
	Korjaal (canoes)	Large fuiknet (chinese seine) Medium fuiknet (chinese seine) Small fuiknet (chinese seine) Drifting gillnet Longline (bottom) Kieuwnet (fixed gillnet) Haritete (river seine)
	Small or no canoes	Drag net Spannet (fixed gillnet) Chastnet

Table 4 The fishery resources of Suriname

MANAGEMENT UNIT		MAIN SPECIES	OTHER SPECIES
01	Large demersal fish	Cynoscion acoupa Cynoscion steindachneri Arius parkeri, Arius proops	Megalops atlanticus Epinephelus itajara Lobotes surinamensis
02	Small soft-bottom demersal fish	Macrodon ancylodon, Cynoscion virescens, Nebris microps,	Larimus breviceps Arius spp. Bagre spp.
03	Small sandy-bottom demersal fish	Lutjanus synagris	Haemulon spp. Calamus spp.
04	Red snapper & deep sea fish	Lutjanus purpureus	Rhomboplites aurorubens Serranidae
05	Rays & sharks		
06	Large pelagic fish	Scombridae	Sphyraenidae, Caranx hippos
07	Small pelagic fish	Engraulidae, Clupeidae	Carangidae
08	Brackish water fish	Mugilidae, Centropomidae Tilapia mossambica	Arius passany, Arius couma, Elops saurus
09	River fish	Plagioscion surinamensis	
10	Fresh water fish	Callichthydae, Erithrinidae	Aequidens spp.
11	Estuarine shrimp	Xyphopenaeus kroyeri	Nematopalaemon schmitti
12	Penaeid shrimp	Penaeus subtilis Penaeus brasiliensis	Penaeus schmitti Penaeus notialis
13	Deep sea shrimp		
14	Crabs	Ucides cordatus	Other crabs
15	Cephalopods		
16	Sea turtles		

Table 5. Main and secondary target stocks (T,t), main and secondary by-catch (B,b) by fleet.

Gear \ Resource	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Shrimp trawl	b	B	b	b	B	b	b	b			b	T		b	b	?
Fish trawl	t	T	T	b	B	b	B				b	b		b	b	?
Stern trawl	b	T	T	b	b	t	B					b		b	b	?
Sea-bob trawl	b	B			B		b				T	t		b	b	?
Hook & line				T	b	t										
Drifting	T	t			B	b		b								?
Njawarie	T	T			B			t								?
Longline	T	t			b											
Large fuiknet	t	T														
Medium		t					t				T	b				
Small fuiknet		b					b				T	b				
Kieuwnet								T		t						
Haritete									T							
Lagoon drag								t			t					
Estuary drag								t			t					
Spannet								t	T	t						
Chast-net								t		t						

Note: The codes 01 to 16 in this table correspond to those in table 4.

3. MANAGEMENT OBJECTIVES BY FISHERY

3.1 Large Demersal Fish:

Resource status

These predatory species are not expected to reach very high densities. Their abundance has not been measured directly, though they are part of the biomass of demersal fish estimated by different surveys. According to these results, and to data found in the literature on densities of large demersal, predatory species observed in other (tropical) parts of the world, their MSY should be around 5,000 tons a year.

Exploitation level has been low until the beginning of the 1980's. The drifting gillnet fleet, however, has known a very sustained growth in that decade. Estimates by the Fisheries Information System (F.I.S.) suggested that production was already close to or above the MSY in 1991-93. In 1998, declining catch rates indicate that the resource is probably overfished. Large, long-lived fish species are particularly vulnerable to overexploitation, and the effects of excessive fishing pressure on these species may only become apparent after several years.

Objectives:

- Given the high prices of these species on the export markets, production of foreign currency is de facto the main objective.
- Bringing the effort back to a level corresponding to MSY.
- On the longer term MEY, either in foreign or local currency or both, should supplant MSY as a management objective.

Tools:

- Heavy penalties should be provided by the law, in the absence of a continuous surveillance at sea.
- Definition of a maximum number of boats by fleet (norms for fishing vessels and gears).
- Establishment of zones closed to particular types of gears, especially in the shallower waters.
- Definition of minimal mesh sizes for gears capturing juveniles, in accordance with their selectivity.
- Prohibition for certain types of gears, once their harmfulness to the stocks has been manifested by investigations including socio- economic aspects.
- Rules for the compensation of gear damage.
- General measures related to the economic situation, liberalization, simplification of the procedures for export, suppression of subsidies.

3.2 Small Soft Bottom Demersal Fish

Resource status

This resource has been the main object of biomass surveys carried out during the last 30 years. Biomass estimates obtained by these surveys varied widely, however. An average MSY value, derived from these biomass estimates, can be tentatively put at 11,000 tons.

Because of the (presumably large) amounts discarded, it is impossible to safely assess the actual extraction, and the state of exploitation. It was assumed that the resource was lightly exploited, until the admission of the stern trawler fleet. Nowadays, it may be close to full exploitation.

Objectives:

- Supplying the domestic market is the first management objective of this resource. In relation to this an objective is to keep prices down and guarantee the availability of affordable protein rich aliments.
- In the future generation of foreign currency.
- The situation of the small scale industries (indirect employment) is an element to be considered in the management of this resource.

Tools:

- A plan is required for monitoring the different fleets involved in exploitation of this resource, including the collection of catch and effort statistics and an observers program.
- Depth limits and closed areas/seasons by type of gear, mesh size and other restrictions regulations required to reduce wastes and juvenile catch.
- Enforcement of the regulation on banning trawlers from the inshore waters.

3.3 Small Sandy Bottom Demersal Fish

Resource status
There is no estimate of the potential yield or the biomass of this resource. The yields of red snappers have been declining after two years of exploitation by stern trawlers, indicating that the fishing effort on this species is considerable, may be already beyond MSY level.

Objectives:

- Generation of foreign currency is the main objective (primarily export orientated).

Tools:

- Management of this resource starts with a control of fishing effort, most practically accomplished through a restrictive licensing policy.
- Since it's a developing fishery, priority should be given to data collection from this fleet.

3.4 Red Snapper and Deep Sea Demersals

Resource status
The red snapper stocks are more or less continuous from Trinidad to Northern Brazil (mouth of Amazon) and are exploited all along by Venezuelan fishermen. There is no estimate of the biomass or potential yield for the entire region. In Suriname waters, the MSY has been estimated at some 3,000 tons. The current harvest is believed to be at least 3,000 tons, meaning that the resource is fully exploited, if not overexploited.

Objectives:

- Red snapper is an excellent export commodity and therefore generation of foreign currency is the main objective.
- Development of associated industries for processing and export.

Tools:

- It will be appropriate to concentrate on control at sea, collection of license fees, provision of high fines against illegal fishing, incentives to developing the fleet and investments in the harvesting sector.

3.5 Sharks and Rays

Resource status

Suriname waters used to be considered rich shark grounds. The stocks seem to have declined quickly in the period of directed fishing (1981-83) and these vessels did not apply for license after 1983 (until 1992). Sharks stocks are known to collapse easily under fishing pressure, due to their slow reproductive process. The only estimate available (probably an underestimate) is a biomass of 5,000 tons (sharks only), given by R/V Fridtjof Nansen in 1988.

Objectives:

- The main issue is the conservation of endangered shark species and rays discarded by trawlers, which form a significant, unutilized biomass.
- Sharks should be considered a potential foreign currency contributor, if stocks ever recover to sustain a fishery (interest is shown in exploiting shark fins).

Tools:

- There is no directed fishery for this resource, so the only tool for preservation is to reduce the by-catch of trawlers affecting these resources.

3.6 Large Pelagic Fish

Resource status

A MSY of some 10,000 tons has been derived from the Fridtjof Nansen biomass estimates. The resource can be considered as largely underexploited.

Objectives:

- These fish should be seen as potential export commodities and development should therefore be directed towards the generation of foreign currency.

Tools:

- Support should be given to experiments of innovative fishing technologies and these operations should be exempted from fishing rights.

3.7 Small Pelagic Fish

Resource status

Small pelagic fish constitute by far the largest fish biomass (400 to 500,000 tons, according to 1988 Fridtjof Nansen results) present in Suriname waters. Given these quantities, the stock must be considered as almost untouched, even though the amounts destroyed by the trawlers could be sizeable.

Objectives:

- This resource should be seen as an important potential source of protein for industrial use; the main objective should be to identify ways to exploit and develop products of commercial value.

Tools:
- The government should look for the appropriate expertise to eventually carry out the first steps in investigating possibilities to exploit this resource.
- Experimental operations should be exempted from fishing rights.

3.8 Brackish water fish

Resource status
There is no estimate of the potential or biomass. The level of exploitation is substantial, but it is impossible to say how it compares with the potential of the resource. Some species seem to have become scarcer than they were 15 years ago (*Mugilidae*).

Objectives:
- Given the social and cultural importance of this resource, preservation of the employment and means of subsistence this resource provides, should be the first objective.
- Supplies to the local market.
- Brackish water fisheries should be handled in the broader framework of integrated coastal zone management.

Tools:
- Attribution of a protective status to certain areas
- Limited access to these areas.

3.9 River fish

Resource status
The stocks are unknown.

Objectives:
- Preserving the employment and subsistence of Koebi (*Plagioscion surinamensis*) fishing to a part of the population.
- Earning of foreign currency via supply of this species to the hotel sector and the domestic market.

Tools:
- Appropriate tools would be limiting the fishing mortality and the size at first capture, by introducing a minimal mesh size.

3.10 Fresh-water Fish

Resource status
The level of exploitation varies from a place to another. The stock units, for each species, are difficult to define, and no research has been carried out in this direction.

Objectives:

- Preserve this secondary source of income.
- Recreational and cultural aspects for the tourism industry
- Conservation of natural zones.

Tools:

- Policy on fishing concessions
- Minimal sizes, specification of authorized gears, closed seasons.

3.11 Estuarine Shrimp

Resource status

There is no estimate available of the potential yield of either sea-bob or witi-bere. As long as exploitation was confined to estuaries, using passive gear, it was assumed that overexploitation was very unlikely. The introduction of trawls, able to catch sea-bob efficiently year round, makes it necessary to monitor closely the state of this resource.

Objectives:

- Preservation of this source of income and of the living standards of the population involved are important objectives.
- Fresh and dried shrimp are traditional commodities for the local market and a contributor to the domestic protein supply.
- Production at MEY level for the seabob trawler fleet.
- Generation of foreign currency (frozen seabob).

Tools:

- Practical measures: minimal distance between sets of nets, number of nets per fishermen, dimensions of the stucture, admission of new fishermen.
- Regulation of the total number of nets in a given area (estuary).
- Control of the number of seabob boats.
- Depth limits.

3.12 Penaeid Shrimp

Resource status

According to the results of the workshop held in 1998 in Guyana, this fishery is fully exploited in the entire region and overcapitalized in several countries, also in Suriname (economic overexploitation).

Even though dramatic yield variations are observed from year to year, the shrimp biomass does not show a decreasing trend in the longer term, however, and there is no indication that the stocks are endangered. This annual variability is not fully understood yet, but is thought to be closely related to recruitment, itself dependent on environmental conditions.

Objectives:
- Management should be seen in a regional perspective; management decisions are however still made at national level.
- Economic optimization is the main goal; maximization of the net foreign currency and the protection of the shrimp dependent industries receive top priority.

Tools:
- Fishing effort could be reduced most efficiently by reduction of the fleet.
- Increasing the license fee would help to decrease the fleet by encouraging vessels to leave and would compensate the loss of foreign currency.
- A closed season can be suggested at the recruitment peak(s).
- Depth limits can help to pursue a combination of objectives: minimization of interactions with other fleets, global reduction of by-catch, reduction of the juveniles of finfish species in the by-catch.

3.13 Deep water shrimp

Resource status
MSY estimates were not provided. Based on the yields obtained during experimental operations, JAMARC offered the conclusion that exploitation by a very small fleet would be feasible. The long-term sustainability was not guaranteed.

Objectives:
- This fishery should be seen as a potential minor, foreign currency contributor.

Tools:
- Experimental operations with exemption from the fishing rights.

3.14 Crabs

Resource status
Available stocks are unknown.

Objectives:
- Maintain this resource as a supplier of a traditional product to the local market and as a subsidiary source of revenue for a group of citizens.
- They have an export potential and may contribute to the earning of foreign currency.

Tools:
- Accurate measures could be applied to prevent depletion: size limits, seasons, protection of berried females.

4. DATA COLLECTION PROGRAMME

The Fisheries Information System (FIS) was established in 1990 through a UNDP/FAO project. It operated optimally until 1994. The main features of the data collection programme are:

1. The data collection programme is based on stratification of the landing sites (Appendix 1) by gear type and boat type.
2. Effort is expressed either in number of landings or in number of days at sea (depending on the type of fishing unit, is recorded at all landing places). At important landing places, a complete census is taken. At other places, a sampling procedure is implemented, and effort is recorded during a given number of days per month (Appendix 3).
3. At places where effort is taken everyday, lpue are recorded for all or for part of the landing vessels. At the other places , lpue are recorded for all vessels on the same days effort is recorded.
4. Effort is computed by landing place. An effort raising Factor is used in the case of places which are not covered every day.
5. Average lpue's per month are computed both by landing site and stratum.
6. The system produces two estimates of the landings by month by landing site, one by multiplying effort for the landing site by the average lpue for the stratum.
7. Data on vessels landing at processing plants are reported by those plants.
8. All the above is done seperately for each combination of gear and boat.
9. There are primary landings (fish landed for the first time) and secondary landings (fish that has been already landed once, and then transported , either by road or by boat, to another landing place). Secondary landings are not included in the total landings. They are recorded by the system in order to keep track of the circulation of the products.

Data collection is done by:

- Statistical sampling; there is a different scheme for the various landing sites
- Biological sampling:
  1. Shrimp: processing plants and from individual companies (Appendix 5 & 6)
  2. Fish: processing plants and samples from the observers (Appendix 4)
  3. Observer programme

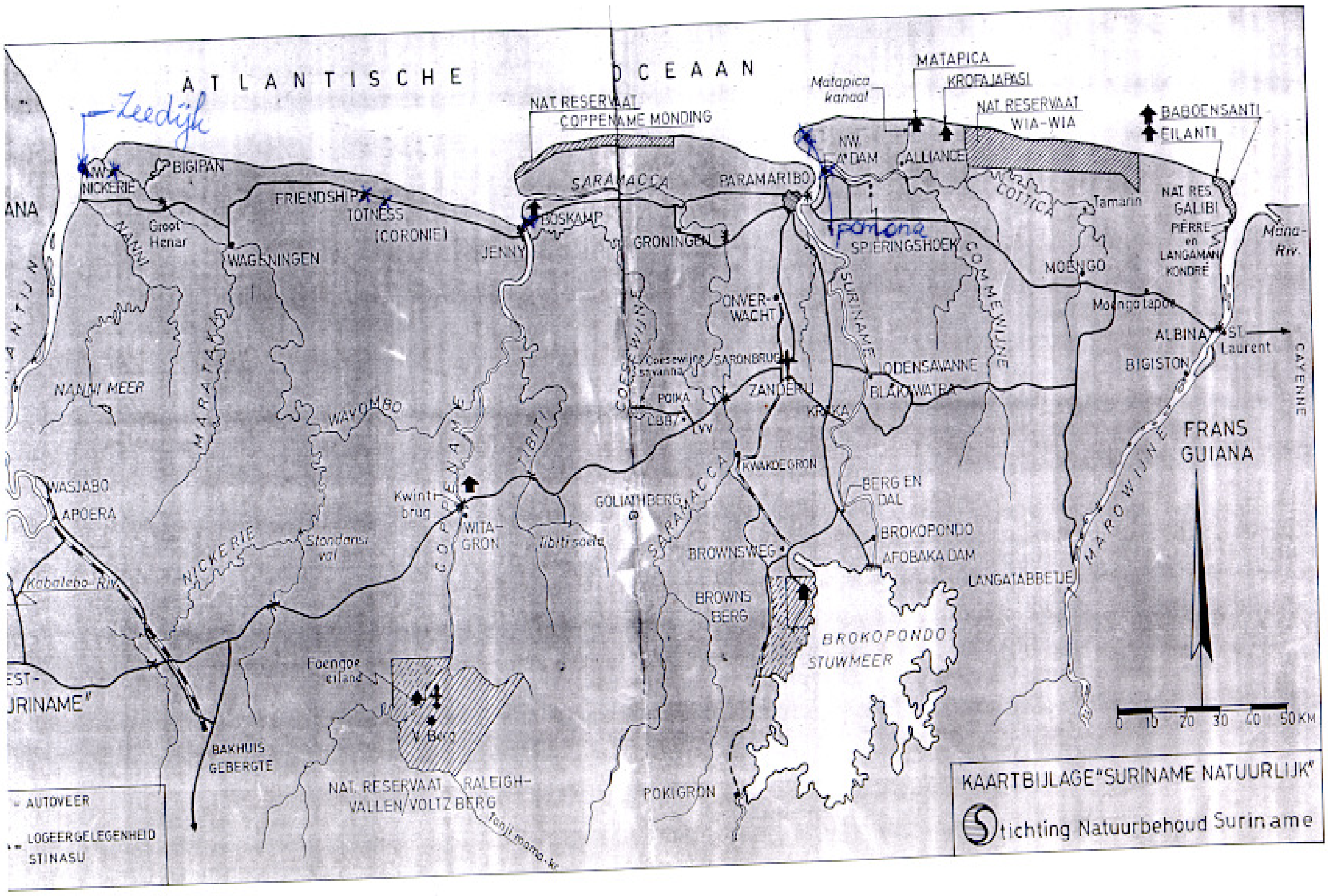
5. DATA MANAGEMENT

- **Data analysis:** data entry is done in Excel spreadsheets. Analysis is done in exel and if needed transfered to other programmes for analyses. Excel is a very flexible programme in terms of importing data and transfering data.

- **Data management:** decree C-14 and inland fisheries law (legislation) and there is a draft fisheries management plan, since 1998. The updating of this plan is being finalized at the moment.

- **Constraints**
  1. Shortage of data collectors.
  2. A flexible database is needed; we are thinking about MS Acess.
  3. There are a lot of data available which need to be analysed (since 1993).

APPENDIX 1
MAP OF SURINAME SHOWING LANDING SITES



APPENDIX 2
LICENCE - COASTAL FISHERY

licence coastal fishery
Vergunning - Kustvisserij
Republiek Suriname
Republic of Suriname
As issued in art. 14 of the decree C4 on rules for sea fishery
(Als bedoeid in artikel 14 van decreet C-14 houdende regelen op het gebied van zeevisserij (SRS 144 .31 december 1980) voor het bedrijven van de zeevisserij in de economische zone van de Republiek Suriname)
for the activities of sea fishery in the economic zone of the republic of Suriname.

199.......

category
CATEGORIE .... NO. ....

Issued to
Verstrekt aan: ....
adress
Adres: ....
district
District: ....
name & adress captain
Naam en adres van gezagvoerder: ....

Handtekening van de houder: ....
signature boat owner

vessel name
Naam van het vaartuig ....
vessel type
Type vaartuig ....
harbour & country of registration
Haven en land van registratie ....
registration characteristics
Registratie kenmerken ....
size and gross tonnage of the vessel
Atmeting en Brutotonnage van het vaartuig ....
characteristics of the motor
Beschrijving v/d motor (merk, type, vermogen, aantal) ....
brand, type, capacity, number
engine no.
Serie No. ....
number of crew incl. captain
Aantal bemanningsleden incl. gezagvoerder ....
type of fishgear
Type visgerei, lengte, diepte, maaswijdte ....
length depth mesh

Plaats en datum van afgifte
place & date of issue

The Minister of Agric. Animal Husb. & Fisheries
De Minister van Landbouw, Veeteelt en Visserij

Paid
Betaalde
Fish licence fee
Visvergunningsrechten
Kwitantienummer en datum
receipt number & date

zegel
stamp

APPENDIX 3

LANDING FORM

VISSERIJDIENST SURINAME

VESSEL NAME ____________ DEPARTURE DATE ____________ COMPANY NAME ____________

REG.No. ____________ LANDING DATE: ____________ CAPTAIN'S NAME ____________

No.	Date	Fishing Time		Position		Depth (m)	Fish	Catch
	Day month	Hour start	Hour stop	Start	Stop		Fish name	kg

APPENDIX 4
FISH BIOLOGICAL DATA SHEETS

FISH LENGTH MEASUREMENTS
FISHERIES DEPARTMENT, SURINAME

Type of vessel : **Fishing gear :** **Sampling on board/shore**
Vessel name : **Mesh size :** **Place :** **Date :**
Fishing ground / depth (m) : **Samplers :**

APPENDIX 5

INDUSTRIAL SHRIMP BIOLOGICAL

SHRIMP PORT SAMPLING (INDUSTRIAL SHRIMP FISHERY)
FISHERIES DEPARTMENT, SURINAME

FACTORY : [illegible] DATE : [illegible] BOAT : SAMPLERS :

GRADE		BROWN				HOPPER				PINK				WHITE	
		♀ A	♀ B	♀ C	♂	♀ A	♀ B	♀ C	♂	♀A	♀B	♀C	♂	♀	♂
U 10	1														
	2														
	3														
	4														
10/15	1														
	2														
	3														
	4														
16/20	1														
	2														
	3														
	4														
21/25	1														
	2														
	3														
26/30	1														
	2														
	3														
31/40	1														
	2														
41/50	1														
51/60	1														
61/70	1														
P/O L	1														
	2														
	3														
	4														
	5														
P/O M	1														
	2														
	3														
	4														
P/O S	1														
	2														
	3														
Culls	1														
	2														

TRINIDAD

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1. INTRODUCTION

Trinidad is located between 10°00' and 11°00' north latitude and 61°00' and 62°00' west longitude and is situated on the continental shelf off north east South America at the mouth of the Orinoco River, downstream of 17 South American rivers including the Amazon River. It is bounded on the north by the Caribbean Sea, on the east by the Atlantic Ocean, on the south by the Columbus Channel, and on the west by the Gulf of Paria. The marine environment can be described as "mixed" due to the freshwater and estuarine influences of the northeast South American rivers and the saline, oceanic influences of the North and South Equatorial currents. Trinidad thus possesses a diversity of marine species typical not only of continental coastal South America but also of the Caribbean island chain.

Fisheries contributed TT$74 million to the Gross Domestic Product (GDP) in 1998. This represented approximately 9% of the agriculture GDP and 0.2% of the national GDP.

1.1 POLICY DIRECTIONS

An overview of the resource status of the marine fishery sector indicates annual production of landings of approximately 14,000 tonnes, with two fishing methods, gillnetting and trawling, accounting for approximately 80% of the landings. Most of the traditional coastal species are either close to full exploitation, fully-exploited or over-exploited (overfished) from a conservation (biological) sense (Fabres and Kuruvilla, 1992). In order to ensure that resources are used as efficiently as possible to maximise benefits to the fishing industry, fishing communities and the country, it is necessary for fisheries to be managed by Government in co-operation with fishing communities. The management of coastal fisheries in Trinidad and Tobago is complicated by the multisectoral use of the coastal zone for non-fishing activities. Success at fisheries management therefore must be based on an integrated approach recognising the other users of the coastal zone and the marine areas, and their impact on the fisheries.

Because some stocks are shared by neighbouring countries (due in part to the migratory habits of some species), management regimes for these species need to be co-ordinated at the sub-regional or regional level. In addition, the growing number of international conventions, treaties and agreements to which Trinidad and Tobago is signatory and which have the status of international conservation or trade law, define operational parameters for the conduct of the local fishing industry. The operations of the marine fisheries of Trinidad and Tobago must also therefore be viewed in this context and development of management practices must be consistent with this international environment.

The principles of co-management and integrated management therefore embrace local fishing communities, non-fishing coastal communities, coastal zone users and international communities. Within this context, a comprehensive marine fisheries policy was developed (Fisheries Division and FAO 1994). The management objectives and main policy directions are outlined below.

The Government's objectives for management are to:

- Implement efficient and cost-effective management;
- Ensure through proper conservation and management that fisheries resources are not endangered by overfishing;
- Ensure that the exploitation of the fisheries resources and the conduct of related activities are consistent with ecological sustainability;
- Maximise economic efficiency of commercial fisheries;
- Ensure accountability to the fishing industry and the community at large for fisheries management;
- Achieve appropriate cost-sharing arrangements between all the beneficiaries of sound fisheries management.

The Government recognises that a major factor contributing to over-fishing and over-capitalisation is the present “Open Access” regime which allows unregulated fishing effort. The Government in association with the fishing industry will attempt to manage fishing effort on the resources by controlling the number and type of local vessels within a given limit, and by implementing time and area closures, and fishing gear changes. With regard to financial assistance to the fishing industry, the Government intends to phase out many elements of the concessions, rebates and incentives since increased fishing activity is not to be encouraged. Bearing in mind the stability fishing has traditionally provided to rural communities, the Government will give priority to the maximisation of employment opportunities through the development of projects for those displaced from the fishery due to effort limitations. The Government will also, through negotiation with neighboring countries, aim to reduce levels of fishing effort on shared fishing grounds.

The Government will increase its capacity for fisheries surveillance to prevent unauthorised fishing operations in the waters of Trinidad and Tobago. It will also embark on a licensing programme for all commercial fishing vessels as a means of monitoring the effort applied to the fisheries. In 1998 Trinidad and Tobago became a member of the International Commission for the Conservation of Atlantic Tunas (ICCAT) and this has placed additional responsibilities on this country to put in place a comprehensive monitoring programme to report on the catch and effort; export and transshipment of large migratory pelagics (for eg. tunas and swordfish) from its ports, as well as use of port facilities by foreign entities.

The high proportion of finfish by-catch in the trawl and gillnet fisheries and its negative impact on the coastal ecosystem, as well as on the resources harvested by other fisheries, also influences policy decisions on these fisheries. The Government therefore favours methods which minimise the amount of by-catch taken, and will accordingly, monitor international developments and undertake local studies to investigate the most effective approach, including the use of alternative gear and the introduction of by-catch reduction devices.

In its policy directions, the Government will continue to protect domestic fishing interests by supporting the regional initiatives under CARICOM, participation in the international fora such as ICCAT that address these issues and co-operate in regional and international data exchange, assessment and management of commercially important species.

1.2 LEGISLATION

The principal legislation governing domestic fishing in Trinidad and Tobago is the *Fisheries Act 1916* and the subsequent amendments to the Act, the *Fisheries (Amendment) Act 1966*, and the *Fisheries (Amendment) Act 1975*. The Act applies to all rivers and tidal waters in Trinidad and Tobago and to the 12-mile territorial sea, and empowers the Minister responsible for fisheries to make regulations to prescribe mesh size of nets; to restrict the size of fish, shrimp, crabs and turtles caught, and prohibit their sale or prevent the catching of these species either absolutely or by season or area. These regulations are effected through the *Fisheries Regulations* made under Section 4 of this Act.

Under Section 4 of the *Fisheries Act*, the *Fisheries [Control of Demersal (Bottom) Trawling Activities] Regulations 1996* and the *Fisheries [Control of Demersal (Bottom) Trawling Activities] (Amendment) Regulations 1998* specify restrictions on the areas of operation of the different trawler fleets according to a depth zoning regime. The regulations also prescribe a minimum stretched mesh size for the cod end of the trawl nets. Also with regard to trawling, a 1988 decision of the Cabinet restricts entry of new vessels, both artisanal and industrial, to the fishery (The *Fisheries Act of 1916* does not provide a legal basis for controlling access by nationals of Trinidad and Tobago to fisheries resources under the national jurisdiction.)

The *Fisheries (Conservation of Marine Turtles) Regulations, 1994* (also under Section 4 of the *Fisheries Act*) requires the semi-industrial and industrial trawl fleets to use Turtle Excluder Devices (TEDs) on their nets. These regulations were drafted in accordance with trade requirements for the export of shrimp to the United States and the stipulations under Section 609 of United States Public Law 101 – 162.

A Monitoring and Advisory Committee (MAC), comprising members of the Fisheries Division, fishing industry, research and non-governmental organisations and other stakeholders, was formed in 1997 to advise the Government of Trinidad and Tobago on the implementation and operation of an "Agreement to promote the sustainable management and optimal utilization of the inshore fisheries resources on the North and South Coasts of Trinidad and in the Gulf of Paria" (Fisheries Division 1997). This committee directed the drafting of the *Fisheries (Amendment) Regulations, 1998* under Section 4 of the Fisheries Act. These regulations defined the increase in mesh size for multifilament gillnets and the restriction on the importation and operation of monofilament gillnets. Based on the lack of support from the fishing industry, a moratorium has been placed on the implementation of these regulations pending further investigation.

The *Fishing Industry (Assistance) Act, 1955*, makes provisions for the granting of financial assistance to the fishing industry by such means as fuel rebates, tax waivers and subsidies on fishing equipment.

The *Marine Areas (Preservation and Enhancement) Act 1970*, provides for the designation of restricted areas, and the *Marine Areas (Preservation and Enhancement) Regulations 1973*, require the permission of the Minister to enter and remove fauna from the restricted area. The Act is currently applied only to the management of coral reefs.

In the 1980s, Trinidad and Tobago became signatory to the United Nations Convention on the Law of the Sea (UNCLOS III, 1982) thus acquiring wide-ranging, legal responsibility for the management and conservation of the living marine resources and the associated habitat, as well as control of the activities of foreign fishing fleets in the ocean space under its jurisdiction. In implementing the UN Convention on the Law of the Sea, Trinidad and Tobago was declared an Archipelagic State in 1986. The *Archipelagic Waters and Exclusive Economic Zone Act of 1986* provides for the declaration of archipelagic waters and the establishment of a 200-mile exclusive economic zone (EEZ). The Act charges the Minister with responsibility for the conservation and management of living resources. Within this context, it provides for the determination of the allowable catch in respect of each fishery in the EEZ, and the determination of the proportion to be harvested by citizens of Trinidad and Tobago. Access of foreign fishing vessels to the archipelagic waters, territorial sea or EEZ is allowed only through licences issued by the Minister who also provides the authority for surveillance and enforcement of regulations pertaining to foreign fishing.

In 1997 the European Union restricted imports of fish and fish products from countries, including Trinidad and Tobago, which did not have an acceptable regulatory procedure in place for implementing and monitoring phytosanitary standards for fish handling. This resulted in the adoption of the *Fish and Fishery Products Regulations, 1998* which come under Section 25 of the *Food and Drugs Act Chapter 30:01.* Under these regulations the Minister with responsibility for health has the authority to grant licences for the import and export of fish which have been handled and packed under conditions conforming to health and safety standards prescribed under the Act. The Regulations specify the requirements for handling fish, the general and specific operating requirements for establishments handling or processing fish, the requirements for vessels used for fishing or transporting fish and, for vehicles and equipment used for unloading, handling, holding and transporting fresh fish for processing.

The existing legislation discussed above is inadequate as a legal basis for a modern national fisheries management system (Moore 1992). The *Fisheries Act 1916* does not provide any legal basis for the licensing of fishing vessels or for the present administrative practice of registering fishermen and fishing engines. It is also incomplete as to its geographical coverage since it does not include the EEZ. The *Archipelagic Waters and Exclusive Economic Zone Act of 1986*, covering the EEZ as well as the territorial sea and archipelagic waters applies only to foreign fishing operations. There are therefore no controls over local fishing operations in the EEZ and beyond.

In recognition of the inadequacies in the existing legislation, a Fisheries Management Bill prepared in 1995, to be known on finalisation as the *Marine Fisheries Management Act*, will repeal the *Fisheries Act of 1916* and the relevant sections of the *Archipelagic Waters and Exclusive Economic Zone Act of 1986*. The *Marine Fisheries Management Act* will provide for the preparation of fishery management plans and will, in accordance with these plans, control and limit access to fish resources through the establishment of a licensing system for both local and foreign fishing vessels.

2. DESCRIPTION OF THE FISHERY

The fishing industry in Trinidad is largely artisanal, but includes some multi-purpose vessels and semi-industrial and industrial trawlers and is characterised by multi-species and multi-gear fisheries. The total number of vessels recorded for Trinidad is 1,251 (Chan A Shing 1999). Most vessels (62%) operate out of the West Coast of the island, while only 76 vessels, 6% of the total number of vessels, operate on the East Coast, with the north and south coasts being home port to 12% and 20% of the vessels respectively.

The total number of fishermen is estimated at 8,040 (1998 estimate). It has been estimated that 13,000 persons are directly involved in the fishing industry with 50,000 persons indirectly involved.

The following section, compiled largely from Chan A Shing (2000), provides further details on the characteristics of these vessels as well as the gear used, fishing areas and species exploited.

2.1 TYPES OF FISHERIES: COMMERCIALLY IMPORTANT SPECIES, VESSEL AND GEAR CHARACTERISTICS AND FISHING AREAS

2.1.1 The Coastal Pelagic Fishery

The principal species targeted by this fishery are Scomberomorus brasiliensis *(carite),* Scomberomorus cavalla *(kingfish), and Elasmobranchii (*Sphyrna tudes, Rhizoprionodon lalandii, Carcharhinus porosus, *and* C. limbatus). *Many other associated species are exploited by this fishery, but may not be specifically targeted. These include* Selene vomer, Oligoplites saurus, Diapterus rhombeus, Selene spixii, Caranx hippos, *and* Caranx crysos *(Henry and Martin 1992b).*

The vessel most commonly used in the coastal pelagic fishery is the pirogue. These are wooden, fibreglass, or fibreglass-coated, open boats 7-9 m in length, propelled by outboard engines from 15-235 hp, commonly 45-75 hp. They are used for both commercial and sport day fishing. Major fishing gears are gill nets, handlines, trolling or towing.

The coastal pelagic fishery is also known as the gillnet fishery, as this is the principal gear used in this fishery. Artisanal Gillnets are either multifilament (fillet) or monofilament nets. The latter are made of transparent nylon, and when deployed the activity is referred to locally as "transparing" or "monoflemming" depending on the area where they are used. The former is a heavier net made of cotton, but nylon and other synthetic twines are now more common than cotton nets.
These nets are fished in different ways. Monofilament nets are used either by day or night. They are set below the surface of the water and anchored at both ends, or at one end with the other attached to the boat by the cork or float line. Multifilament nets are generally fished at night at the surface of the water, supported by a float line. They are generally attached to the boat at one end. One (1) or two (2) net sets are made per trip (Hodgekinson-Clarke, 1990).

Gillnets are fished more in the latter part of the year during the rainy season. Carite landings are generally higher at this time. Gillnet specifications are presented below.

NET TYPE	MESH SIZE	TWINE GAUGE	WEIGHT	MESH DEPTH	LENGTH
Nylon Mono-filament	4.5" 4.25"	No. 9, 10, 12, 15, 18 (10 most popular)	50 or 25lb bales (5-8 bales per net)	100 mesh/50lb 50 mesh/25lb	450-1098m
Nylon Multi-filament	4.5" 4.25" 3.75"*	12, 15	50 or 25lb bales (3-6 bales per net)	100 mesh/50lb	732-1190m

*Source: Hodgkinson-Clarke (1990); Fisheries Division Unpubl.; D. Mankee and Son Gear Supplier (P.O.S.,Trinidad). *Soomai et al, 2000 (for mullet).*

The gillnetting areas are depicted in Figure 1.

Line methods include "**A-La-Vive**", which refers to fishing with live bait using hooks and nylon twine line. Kingfish is targeted but carite and other species are also caught. Generally, the larger size ranges of carite are captured by this method. The gear can be described as shown in the following table.

MATERIAL	TEST/STRAIN (LB)	HOOK SIZE
Nylon Twine	10 - 27	No. 1/0, 2/0, 3/0
Steel Wire (Black or White)	22 - 32	No. 1/0, 2/0, 3/0

Source: Fisheries Division North Coast Survey (Rec. Fishery) Unpubl. data.

Switchering is a line method commonly used on the south coast at sites such as Erin and Moruga. It is essentially a handline with baited hooks, generally deployed while the boat is stationary. Bait is often acquired from shrimp trawlers, and comprise fish, which would otherwise have been discarded, and/or small shrimp.

Trolling or Towing is the method where four (4) to six (6) lines are towed from bamboo outriggers off pirogues. Leader lines vary between 20m and 90m in length and usually there is one (1) hook per line. Gear materials are outlined in the following table.

MATERIAL	LINE SIZE	HOOK SIZES	LEADER
Steel Lines	No. 24, 25	No. 2, 3, 4, 5	30 - 90m
Bronze Lines	No. 22-23, 20, 19, 18 (strongest)	No. 2, 3, 4, 5	35 - 45m
Nylon Twine	200lb strain	No. 2, 3, 4, 5	90m
Nylon Cord	-	No. 2, 3, 4, 5	20m

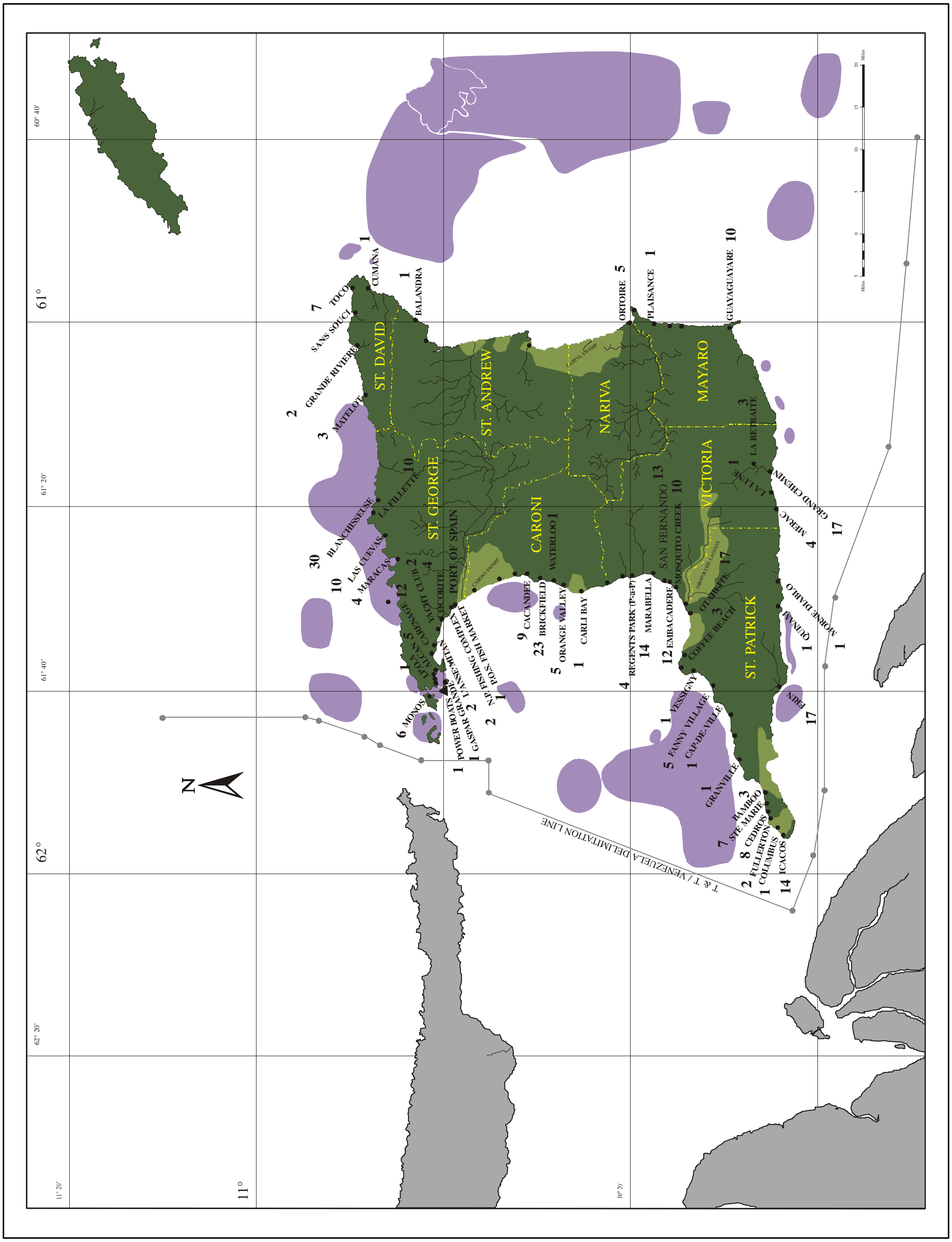
Source: Fisheries Division Unpubl.

Areas where line methods are used are shown in Figure 2.

Figure 1: Gilnetting areas (Chan A Shing 2000).


ST. DAVID
ST. ANDREW
NARIVA
MAYARO
ST. GEORGE
CARONI
VICTORIA
ST. PATRICK
PORT OF SPAIN
SAN FERNANDO
TOCO
CUMANA
BALANDRA
SALYBIA
MANZANILLA
ORTOIRE
RADIX
PLAISANCE
GUAYAGUAYARE
GRANDE RIVIERE
MATELOT
LA RETRAITE
LA LUNE
GRAND CHEMIN
LAS CUEVAS
MARACAS
MORNE DIABLO
MONOS
COCORITE
CARENAGE
P.O.S. FISH MARKET
CACANDEE
ORANGE VALLEY
CARLI BAY
CLAXTON BAY
ST MARGARET
MARABELLA
COFFEE BEACH
VESSIGNY
ERIN
BAMBOO
STE MARIE
CEDROS
FULLERTON
ICACOS
T & T / VENEZUELA DELIMITATION LINE
N
61°
62°
11°

Figure 2: Line areas (Chan A Shing 2000).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SAN FERNANDO
TOCO
CUMANA
BALANDRA
SANS SOUCI
GRANDE RIVIERE
MATELOT
LA FILLETTE
BLANCHISSEUSE
LAS CUEVAS
MARACAS
YACHT CLUB
CARENAGE
COCORITE
MONOS
CACANDEE
BRICKFIELD
WATERLOO
ORANGE VALLEY
CARLI BAY
MARABELLA
EMBACADERE
MOSQUITO CREEK
OTAHEITE
COFFEE BEACH
VESSIGNY
FANNY VILLAGE
CAP-DE-VILLE
GRANVILLE
BAMBOO
STE MARIE
CEDROS
FULLERTON
COLUMBUS
ICACOS
ERIN
QUINAM
MORNE DIABLO
MERAC
GRAND CHEMIN
LA LUNE
LA RETRAITE
GUAYAGUAYARE
PLAISANCE
ORTOIRE
T. & T. / VENEZUELA DELIMITATION LINE
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62°
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Seine methods include Italian seines, beach or land seines and bait seines. The Italian seine is used mainly in the Gulf of Paria. Tuck seines once used at certain sites are no longer popular. However, in some places the name "Italian seine" may be used to describe tuck seines. This gear is fished from the vessel during the day and it takes up to seven (7) men to deploy and retrieve it (Sturm and Julien, 1984). Below are the gear specifications:

GEAR TYPE	WINGS	BAG LENGTH	BAG MESH	WING MESH
Italian Seine	80m Length	20-40m	25mm	305mm

Source: Sturm and Julien (1984).

Beach seines are fished in the day and are used at Mayaro on the South East Coast and on the South West Coast. The seine is placed on a boat and one end of it is anchored on shore. The boat is taken out to sea in a wide arc during which the seine is deployed. The free end of the seine is then brought to shore and the net is hauled by the two ends. Between 10 to 40 persons are needed to haul the seine (Sturm and Julien, 1983).

LENGTH	MESH SIZE
340 – 660m	13mm Cod End 152mm Wings

Source: Sturm and Julien (1983).

Smaller seines (bait seines), generally operated by 3-4 people, are used to capture bait species nearshore. The seines used on the north are primarily bait seines.

Popular seining areas are shown in Figure 3.

2.1.2 Soft-Bottom Demersal (Shrimp and Groundfish) Fishery

This fishery targets mainly shrimp species: *Penaeus schmitti, P. subtilis, P. notialis, P. brasiliensis, Xiphopenaeus kroyeri* and associated groundfish: *Micropogonias furneri and Cynoscion jamaicensis. A* list of target and by-catch species is given in Appendix 1.

Trawlers have been categorized into four types according to length, engine horsepower and degree of mechanization.

- Type I vessels are 6.7-9.8m in length with two 56-hp outboard engines. They manually deploy one stern trawl and number 13 vessels (Chan A Shing 1999).
- Type II vessels are 7.9 -11.6 m in length with a 129-hp inboard diesel engine. They also deploy a manually operated net. They total 71 vessels (Chan A Shing 1999).
- Type III trawlers are larger at 10.4 -12.2 m in length with usually 176-hp inboard diesel engines. These use a single net operated by a hydraulic winch. They are also equipped with electronic fishing aids and communication equipment. There are currently 9 Type III trawlers.
- Type IV vessels are considered industrial vessels and use two (2) nets attached to twin outriggers. The nets are set and retrieved using a hydraulic (double-drum) winch. All local trawlers use four-seamed, flat nets. The vessels are 17.1 -22.9 m in length, have 365 hp inboard diesel engines and are equipped with electronic fishing aids and communication equipment as well as some refrigeration. Currently 19 Type IV vessels operate out of Trinidad.

Figure 3: Seining areas (Chan A Shing 2000).


ST. DAVID
ST. ANDREW
NARIVA
MAYARO
ST. GEORGE
CARONI
VICTORIA
ST. PATRICK
PORT OF SPAIN
SAN FERNANDO
PLAISANCE
ST MARGARET
GUAYAGUAYARE
LA FILLETTE
LAS CUEVAS
SAUT D'EAU
MONOS
GASPAR GRANDE
CARLI BAY
PT. D'OR
OTAHEITE
COFFEE BEACH
ERIN
CEDROS
ICACOS
T & T / VENEZUELA DELIMITATION LINE
61°
62°
11°

Some of the important trawl-gear dimensions are given in the following table.

VESSEL TYPE	MINIMUM HEADROPE LENGTH (M)	MAXIMUM HEADROPE LENGTH (M)	AVERAGE HEADROPE LENGTH (M)	AVERAGE STRETCHED LENGTH (M)
I	7	14	10.4	3.8
II	9.2	12.5	10.6	2.45
III	10.1	15.2	11.6	3.5
IV	13.7	13.7	13.7	3.5
Bait Trawlers	6.8	9.75	7.9	2.47

Source: Fisheries Division, 1990

All trawlers operate in the Gulf of Paria. The Industrial, double-rigged trawlers also operate west of Saut D'eau on the north coast and in the Columbus Channel. Trawling off the east coast is prohibited by law. The trawling areas are given in Figure 4.

Groundfish are also exploited by gillnets (depending on how they are deployed), banking, and palangue (bottom set longline). The latter two (2) methods are discussed in the following section.

2.1.3 Hard Bottom Demersal Fishery

This fishery includes those fish caught by several gear, namely fishpots, bank lines and other demersal lines. The species targeted by this fishery are mainly snappers: *Lutjanus* spp., *Rhomboplites aurorubens*, and groupers: *Epinehelus* spp. and *Mycterperca* spp. Bycatch normally includes Lobsters: *Panuliris* and Grunts: *Haemulon* sp.

Fishermen exploiting these species artisanally use pirogues (described in the Section 2.1.1). Also used in this fishery are semi-industrial multi-purpose commercial vessels, and recreational vessels. The fleet is composed of vessels 14-23 m in length. These vessels target snappers and groupers using pots or/and demersal handlines. They stay at sea for periods between 7 and 15 days.

The palangue is a demersal longline used by both the artisanal and non-artisanal fisheries. It consists of a mainline, which carries a number of branch lines with hooks. There are two (2) types of palangue: a "small palangue" used for small snappers and sharks and a "large palangue" generally for sharks. The difference between the two is based on the number of hooks and size of hooks. Between 200 - 500 hooks are used on the large palangue. The small palangue may carry 1000 - 5000 hooks. Number and size of hooks vary depending on the species being targeted.

Fishpots are used to target primarily snappers and groupers. A variety of fish pots are used in the local fishing Industry. A survey of fish pots in use in 1998 yielded the following data.

SHAPE	DIMENSION (LxWxH)	WALLS (and frame)	AREA OF OPERATION; VESSEL TYPE
"Square"	40" x 40" x 18"	2" x 2" sq BRC wire (steel rod 5/8")	East, South East Coast; Mostly Artisanal
Arrowhead	60" x 40" x 20"	2" Chicken wire (steel rod 5/8")	East South East Coast; Mostly Artisanal
Arrowhead	64" - 66" x 38" - 42" x 22 - 24"	Hexagonal Plastic (polyethylene) 2" diagonal mesh (steel rod 5/8")	West Coast; Mostly Non-artisanal
Arrowhead	48" x 48" x 20"	18 gauge 1½" diagonal mesh	North Coast; Artisanal
	60" x 48" x 36"	Hexagonal chicken wire (wooden)	
Arrowhead	36" x 36" x 18"	Chicken wire	North Coast; Artisanal
	60" x 60" x 18"	Steel chicken wire (wooden)	
Arrowhead	42" x 42" x 12"	18" gauge 1.½" diagonal mesh	South and South West Coast; Artisanal
		Chicken wire (wooden)	

SHAPE	DIMENSION (LxWxH)	WALLS (and frame)	AREA OF OPERATION; VESSEL TYPE
Arrowhead	48" x 42" x 12"	18" gauge 1½" diagonal mesh	South and South West Coast; Artisanal
		Chicken wire (wooden)	

Source: Mohammed, 1998.

Figure 4: Trawling areas (Chan A Shing 2000).


ST. DAVID
ST. ANDREW
NARIVA
MAYARO
ST. GEORGE
CARONI
VICTORIA
ST. PATRICK
PORT OF SPAIN
SAN FERNANDO
LA RETRAITE
CACANDEE
WATERLOO
ORANGE VALLEY
ST MARGARET
OTAHEITE
STE MARIE
ICACOS
N.P. FISHING COMPLEX
P.O.S. FISH MARKET
T & T / VENEZUELA DELIMITATION LINE
N
61°
62°
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Pots generally have one opening and the numbers of pots set are as variable as the dimensions of the pots used. However, for the non-artisanal vessels which make trips of 12 - 18 days, between 40 - 60 pots are carried per trip.

Heileman and Phillips (1992) described the fishpots used in the Tobago fishpot fishery. The pots are the typical Z-shaped Antillean design with a steel frame of approximate measurements 2 m x 1.5 m x 0.6 m. Each pot is covered with 30 mm hexagonal wire mesh and carries two funnels with 180 x 360 mm openings. A wire basket and hook for carrying bait are suspended from the top of each pot.

The pots are baited with flying fish, bonito, herring or sardines and set in depths of 37 - 128 m. They are set on one-day fishing trips from 9 - 10 m fiberglass or wooden pirogues fitted with hydraulic winches. A surface buoy, which serves as a marker, is attached to each pot by rope. Soak time averages 24 hours with the pots being re-set on a daily basis.

Commercial use of fishpots started around the late 1940's at most west coast sites, with the assistance of the Fisheries Administration. In 1955 the use of fishpot was extended to Matelot on the north coast where there was a vibrant and innovative inshore artisanal fishing community. Use of fishpots in the inshore artisanal fishery is the primary activity at Ortoire on the East Coast. Fishpotting areas are shown in Figure 5.

Banking uses a weighted main line, with one (1) to several hooks attached, set demersally in an area shallower than its surroundings.

2.1.4 Oceanic (Highly Migratory) Pelagic Fishery

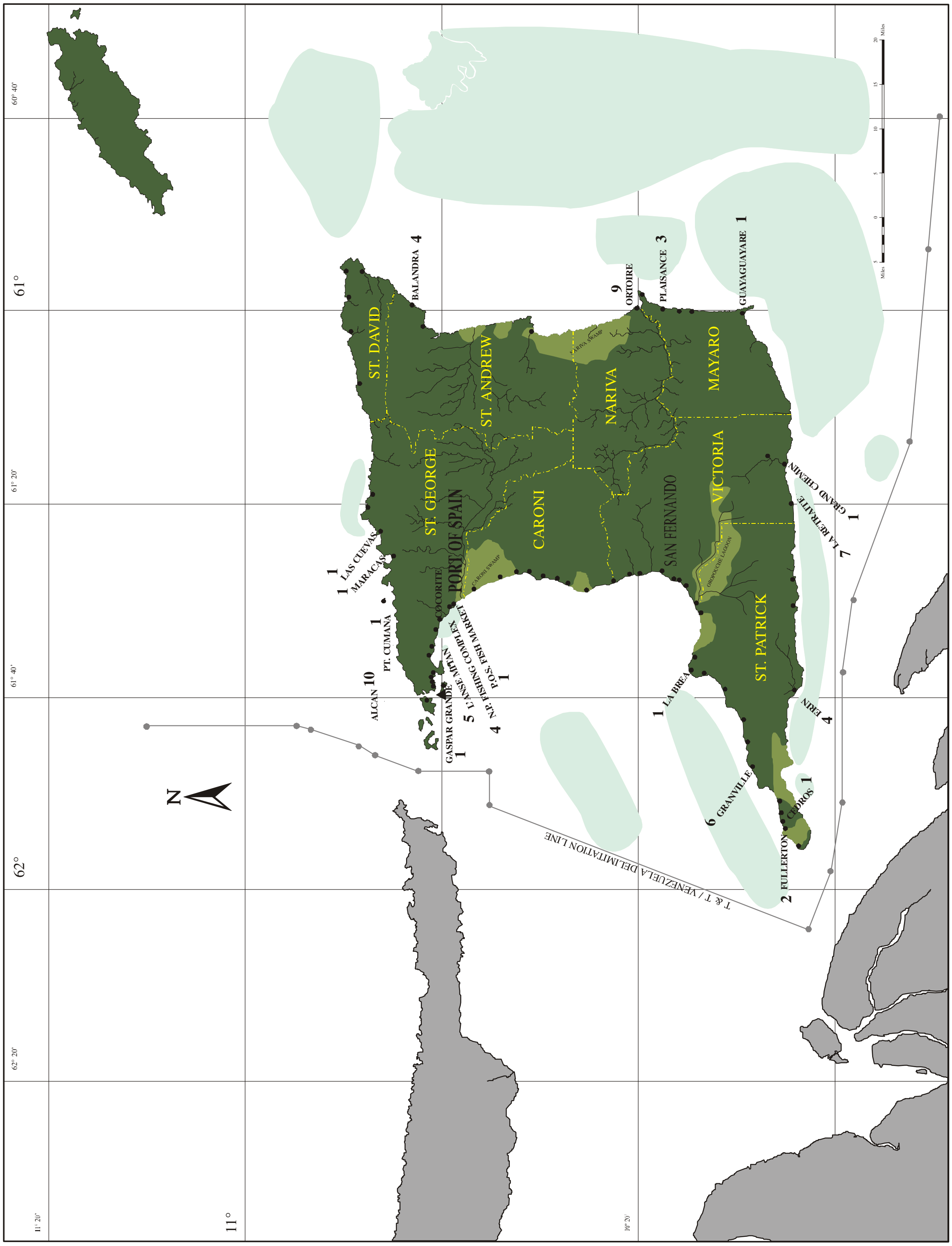
This is the fishery targeting tunas: *Thunnus albacares*, *T. obesus*, *T. alalunga*, *T. atlanticus*, swordfish: *Xiphias gladius*, dolphinfish: *Coryphaena hippurus*, with sharks and carite, being considered bycatch.

Involved in this fishery are industrial longline vessels, semi-industrial multi-purpose commercial vessels, and recreational vessels. The fleet is composed of vessels 14-23 m in length. They stay at sea for periods between 7 and 15 days.

Pelagic longline gear comprises between 300 - 1000 hooks attached to a mainline set at about 30m - 50 m below the surface of the water. The mainline is about 6 mm in diameter and about 1300lb. test. Baited hooks are attached to the monofilament leader lines (30 m - 60 m in length and 700lb. test) which are snapped onto the main line at about 100 m - 150 m intervals. The line is about 15 - 55 miles long. Buoys are attached to the main line after every 3 - 10 hooks. High flyers and buoys are attached to the end of each section of approximately 50 hooks. "Cyalume" light sticks may be attached to every 3 - 7 hooks when targeting swordfish.

Artisanal line methods are most popular off the north and east coasts, and around offshore structures such as rigs. These methods include a-la-vive, trolling/ towing, switchering, and pelagic longline.

Figure 5: Fishpotting areas (Chan A Shing 2000).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NARIVA
MAYARO
ST. GEORGE
PORT OF SPAIN
CARONI
SAN FERNANDO
VICTORIA
ST. PATRICK
BALANDRA 4
ORTOIRE 9
PLAISANCE 3
GUAYAGUAYARE 1
GRAND CHEMIN 1
LA RETRAITE 7
ERIN 4
CEDROS 1
FULLERTON 2
GRANVILLE 6
LA BREA 1
LAS CUEVAS 1
MARACAS 1
PT. CUMANA 1
ALCAN 10
COCORITE
GASPAR GRANDE 1
T. & T. / VENEZUELA DELIMITATION LINE
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61°
62°
11°

2.2 TRENDS IN CATCH AND EFFORT

2.2.1 Catch

Figure 6 shows the annual total landings from the Trinidad fishing fleet for the period 1908 to 1997. In general, over the 87-year period, total landings increased with 10 to 12-year cyclical reductions in landings since 1959 (Chan A Shing and Mohammed 2000). The increase in landings since the late 1940s was the result of several factors including: the Government's Fishing Incentive programme; introduction of new gear types including trawl and fish pots; increased mechanization of boats and gear. The cyclical nature of the landings may be the result of variations in the landings of such pelagic species as mackerels, herrings and jacks. Figure 7 shows the landings for a few of the major species/species groups, namely carite, kingfish, sharks, shrimp, snappers, and croakers, while Figure 8 shows the species composition of the artisanal landings for 1996.

Figure 6: Annual total landings for 1908-1997 (Chan A Shing and Mohammed 2000).

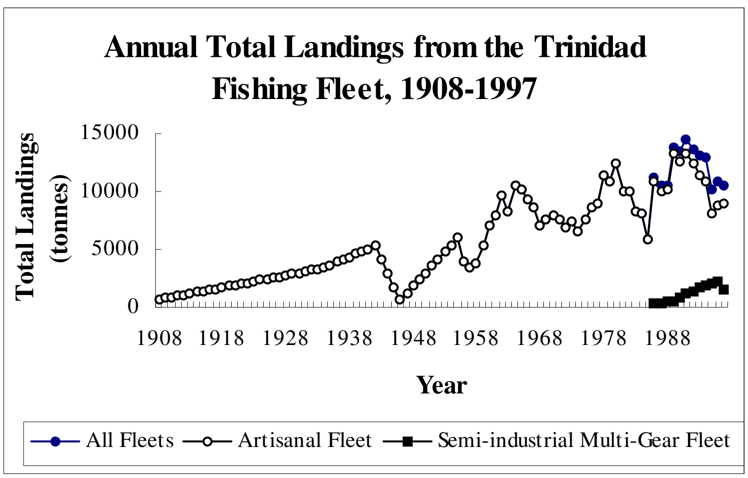


Figure 7: Landings for a few of the major species for 1908-1997 (Chan A Shing and Mohammed 2000)..

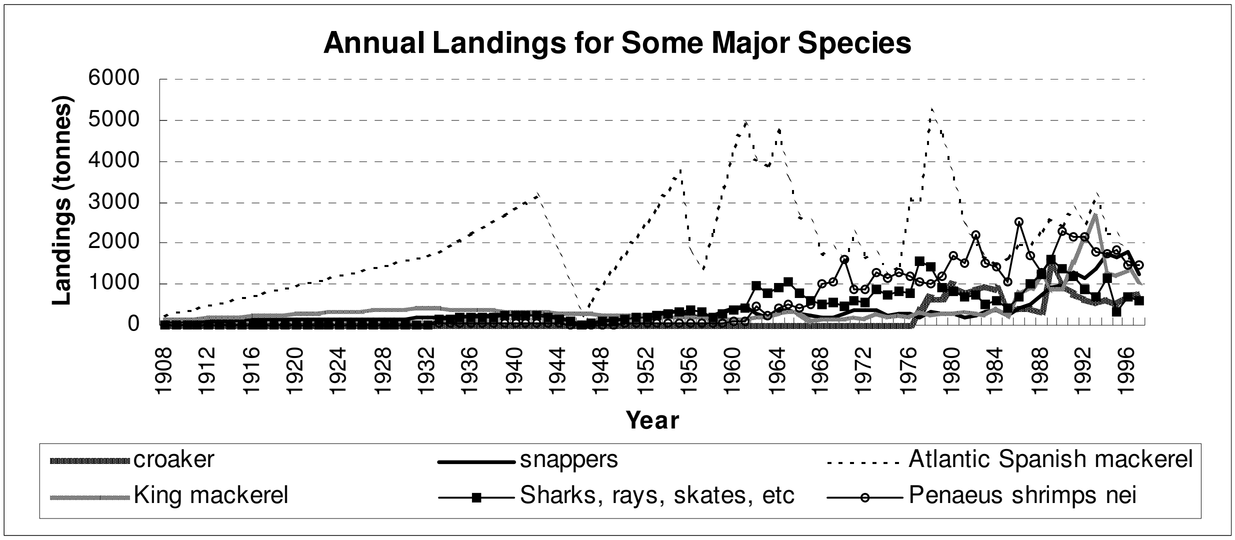
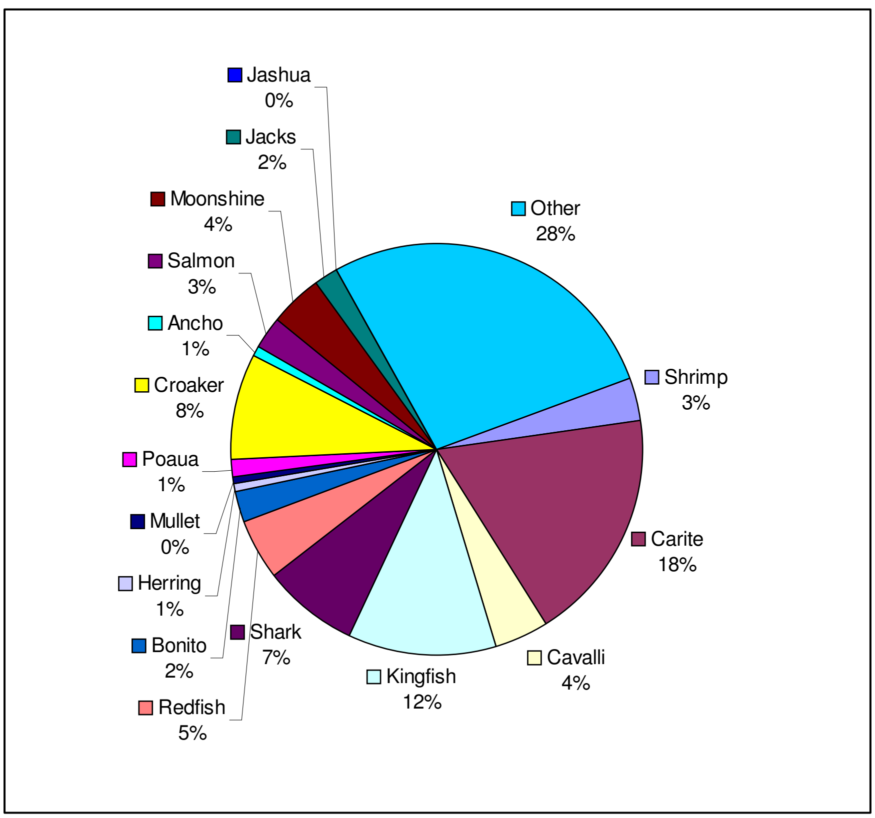


Figure 8: Species composition of artisanal landings (1996).



(Source http://www.cep.unep.org/trini_tbgo/fisheries/statistics.htm)

2.2.2 Effort

Fishing effort data is presented for two (2) major fishing methods, namely gillnetting and trawling. Effort data for the artisanal gillnet and line fisheries are available for the period 1995 to 1997. Data for the artisanal gillnet fishery includes number of trips for monofilament and multifilament gillnets. Data for the line fishery includes handlines known locally as banking, and a-la-vive lines which are handlines using live bait. Effort data for palangue, an artisanal demersal long-line is also represented. Over this period number of trips using monofilament gillnets were higher ranging from 4000-14000 compared to an average of 3000 trips for multifilament nets (Figure 9) (Fisheries Division unpublised data).

With regard to trawling, over the period 1992 to 1999 the total number of days spent at sea per year was on average 16,000 for the artisanal fleet, in the region of 2,000 for the semi-industrial fleet, and 4,000 for the industrial fleet. This is equivalent to approximately 120,000 net hours (hours spent in dragging a net) for the artisanal fleet, 31,000 net hours for the semi-industrial, and 90,000 for the industrial per year. (Figure 10) (Ferreira and Soomai 2000).

Figure 9: Gillnet effort.

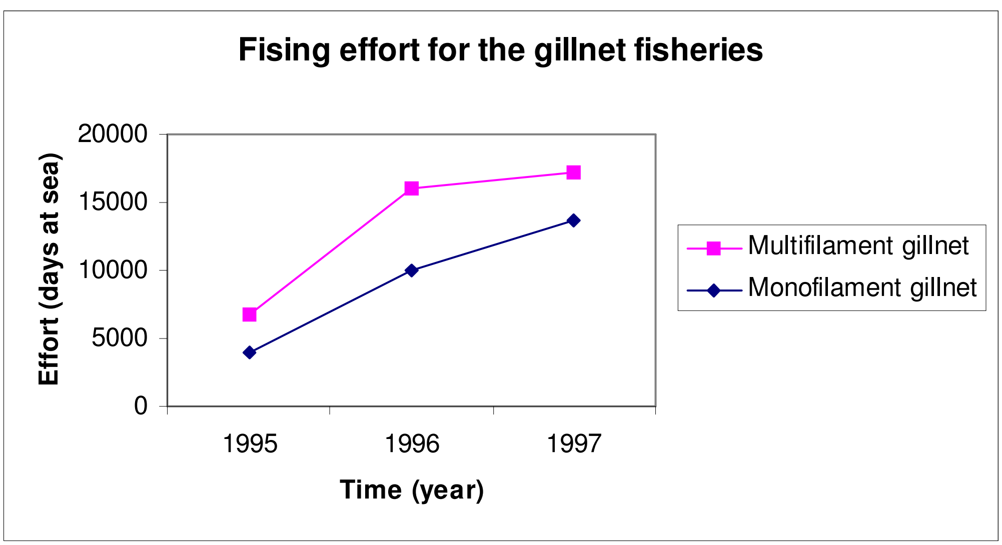
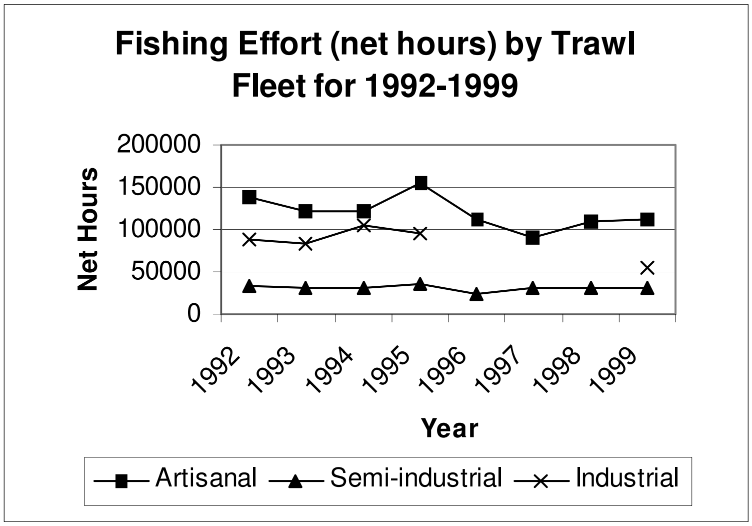


Figure 10: Trawling effort (Ferreira and Soomai 2000).



3. PRESENT STATUS OF THE FISHERY INCLUDING MANAGEMENT RECOMMENDATIONS BY FISHERY

Table 1 gives a summary of the status of the main commercial species and management recommendations for the inshore gillnet fishery, the trawl fishery, fishpot and line fishery and the pelagic longline fisheries.

Table 1: **Present status of the fishery including management recommendations by fishery.**

FISHERY	SPECIES	DATA USED IN STUDY	ASSESSMENT TYPE	STATUS OF STOCK	MANAGEMENT RECOMMENDATIONS	REFERENCE
Coastal Pelagics: carite, flying fish, sharks, kingfish, sardines, anchovies, herrings.						
Inshore, artisanal gillnet and line fishery	Carite (*Scomberomorus brasiliensis*)	1991-1992	Thompson and Bell(1934) length based model	Fully exploited	No increase in fishing effort; gillnet mesh size should not be less than 4 3/4" stretched mesh; line fishing to be encouraged over the use of gillnets.	Henry and Martin 1992a
	Kingfish (*Scomberomorus cavalla*)	1987	Beverton and Holt (1957) yield per recruit	Fully exploited	No increase in fishing effort; gillnet mesh size should not be less than 4 3/4" stretched mesh; line fishing to be encouraged over the use of gillnets.	Sturm et al 1987
	Sharks (*Carcharinus porosus*)	1992	For one species using model developed for the Australian gummy	Underexploited		Walker 1992
Inshore artisanal bait fishery using nets	Herrings, anchovies, sardines	1988	Study of potential yield using hydro acoustic methods for similar species aggregated inshore on the east coast.		Harvesting of sardines as foodfish is prohibited by law.	Institute of Marine Research, Bergen, Norway, 1989.
Coastal Demersals Associated with Soft Muddy Substrates: shrimp and associated groundfish (croakers, salmon, grunt, catfish)						
The trawl fishery/artisanal, semi-industrial and industrial fleets)	White shrimp (*Penaeus schmitti*) Brown shrimp (*P. subtilis*)	1991	Length-based Thompson and Bell model applied to the artisanal trawl fishery in the Orinoco Delta of Venezuela	Fully to overfished	No increase in fishing effort for all species. Trinidad and Tobago trawlers not allowed access to Orinoco Delta since 1995. A management regime is in place for the trawl fishery involving zoning of the operations of the different trawl fleets, a limit on the effort of the semi-industrial and industrial fleets and the use of TEDs by these two fleets.	Lum Young et al 1992
	Brown shrimp (*P. subtilis*)	1973-1996	Biodynamic production model applied to trawl fisheries of Trinidad and Tobago and Venezuela.	Overfished		Alio et al 1999
	Croaker (*Micropogonias furnieri*)	1987, 1989-1997	Yield per recruit (Y/R) analysis. Depletion modeling	Fully to overfished		Manickchand-Heileman and Kenny 1990. Soomai 1999
	Salmon (*Cynoscion jamaicensis*)	1989-1997		Fully to overfished		Soomai 1999
	Shrimp fishery	1995-1998 (Venezuela) 1995-1996 (Trinidad and Tobago)	Joint Bioeconomic analysis using data from Venezuela and Trinidad	Fully to overfished, over-capitalised	Profits to this shared fishery could be maximised by reducing effort of the Trinidad fleet to 61% of the current effort and 82% of the current effort of the Venezuelan fleet.	Seijo et al 2000

FISHERY	SPECIES	DATA USED IN STUDY	ASSESSMENT TYPE	STATUS OF STOCK	MANAGEMENT RECOMMENDATIONS	REFERENCE
	Groundfish fishery	1989-1997	Bio-economic analysis	Fully to overfished	Limit effort for all fleets since this option maximises the minimum final biomass attainable as well as minimises the loss of opportunity	Soomai and Seijo 2000
Coastal Demersals Associated with Hard Bottom Substrates: snappers and groupers						
The fishpot and line fishery	Snapper Plumhead (*Rhomboplites aurorubens*)	1992	Beverton and Holt (1957) equilibrium yield per recruit analyses of the fishpot fishery of the North and east coast.	Fully exploited	Restrict fishing	Manickchand-Heileman and Philip, 1992
	Lane snapper (*Lutjanus synagris)*	1980-1981		Underutilised but the species may be currently fully to overexploited	Increase the age of first capture of species	Manickchand-Heileman and Philip, 1992
	Redfish (*L. purpureus*)	1992		Fully exploited	Limit effort and increase mesh size of fishpots	Manickchand-Heileman and Philip, 1992
	Yellowedge Grouper (*Epinephelus flavolimbatus*) Sweetlip (*Mycteroperca interstitialis*)	1992		Fully exploited or over exploited	Restrict effort, increase mesh size of fish traps, impact of illegal fishing by fleets of other countries on these resources needs to be established	Manickchand-Heileman and Philip, 1992
Oceanic (Highly Migratory) Pelagics: tunas, swordfish and sailfish						
The pelagic longline fishery	Yellowfin tuna (*Thunnus albacores*)	Reviewed annually			3.2kg minimum size limit on individual fish caught; fishing effort not to exceed 1992 level.	ICCAT 1995
	Bigeye tuna (*Thunnus obesus*)	Reviewed annually		Overexploited	Catch reduction to 80,000MT; 3.2kg minimum size limit on individual fish caught; 25% of vessels using FADs; provide list of all vessels(780 GRT) fishing bigeye in the Atlantic; limit number of Atlantic vessels (> 24m LOA) to average number in 1991-1992 (except countries catching< 2,000MT average over recent 5 years; limit number of Chinese Taipei bigeye tuna vessels to 125; catch limit of 16,000mt for Chinese Taipei.	

FISHERY	SPECIES	DATA USED IN STUDY	ASSESSMENT TYPE	STATUS OF STOCK	MANAGEMENT RECOMMENDATIONS	REFERENCE
	Skipjack tuna (Katsuwanus pelamis)			Stable	No management recommendations	
	Albacore (north Atlantic stock) (*Thunnus alalunga)*			Fully exploited		
	Albacore (south Atlantic stock) (*Thunnus alalunga)*			Close to fully exploited		
	Swordfish (north Atlantic stock)(*Xiphias gladius)*			Fully exploited		
	Swordfish (south Atlantic stock) (*Xiphias gladius)*			Close to fully exploited		
	Atlantic sailfish (*Istiophorus albicans*)					

4. HISTORY OF THE DATA COLLECTION PROGRAMME

Efficient monitoring, assessment and management of the marine fisheries require a data collection system which covers the diverse inputs into the fisheries management process. These include: information on fishermen, fishing vessels, engines and gear; fish landings and fishing effort data; fisheries biological data including species, length, weight, maturity, sex, age, location/time/depth of capture, associated physical and chemical parameters; fish exports and imports; fisheries economic data including costs and earnings data on fishing activities; information on applications for government fishing incentives; bibliographic references on relevant publications on commercially important species, stock assessment and management, related oceanography, research cruises in the region, database development, data processing, and information management in marine fisheries; and documentation on institutions, and individuals of relevance to regional fisheries. This paper focuses on one of the most fundamental components of any fisheries management data collection programme, namely the collection of landings and effort data. The following description of the history of this programme is compiled from Fabres (1993), Chan A Shing (2000), Mc Clure (1991), and Fisheries Division and FAO (1991).

Fisheries catch and effort statistics have been collected in Trinidad from 1954. By the end of 1956 data were collected principally through the two wholesale fish markets, one located at Port of Spain and the other at San Fernando. The market data collected included quantities, species, prices and places of origin. Recognising the usefulness of this type of information and the need for more complete statistics the government in 1957 established a special statistical branch of the Fisheries Division and provided funds to extend fisheries statistical services. In 1957 and 1958 it was therefore possible for the Division to obtain market returns from 15 retail markets in Trinidad and Tobago. In 1959, a formal on-shore collection programme at specific beaches was launched. In 1960, the Division employed full-time enumerators at the three most important fishing centres: Port of Spain, San Fernando and Bonasse; and part-time enumerators at six smaller centres. By 1991 data collection was conducted at 15 sites in Trinidad (five of these half-time). By the end of 1999 there were full-time enumerators at 17 landing sites.

The system has remained basically intact over the years in terms of the nature of data recorded and process by which it is recorded. The Statistical Collector employed at each beach/landing site records the landings by species group, fishing method, area fished, and landing prices for individual fishing vessels. Over the years until 1992, these forms were manually processed to produce hand-written monthly and annual summaries of aggregated data for each fishing beach showing total landings by gear type, number of fishing trips, hours spent at sea, and ex-vessel value by gear type and "species". For sites sampled half-time, monthly/annual estimates were extrapolated by multiplying by two. Besides this, however, landings on days when the data collector was absent were not accounted for at these sites nor those covered fulltime. A single raising factor was used to estimate total landings based on a Census taken in 1985/1986 (the reliability and completeness of which was unknown) of numbers of vessels in the country. Prior to this the recorded data were used as the national statistic for marine landings in Trinidad and Tobago.

In 1991under a United Nations (Food and Agriculture Organization) project on the “Establishment of Data Collection Systems and Assessment of the Fisheries Resources” a suite of programmes was written in dBASE III+ language to provide for computerized data entry, processing and reporting. Estimation of the un-recorded landings and fishing effort on secondary fishing beaches was based on a national fisheries census of vessels conducted in 1991 which provided information on vessel distribution, gear type, species composition of landings (census form attached as Appendix 2), and the division of the coastline of Trinidad into statistical sampling regions such that fisheries within a region were similar (discussed further in Section 5.1).

Also under the UNDP/FAO project, as a complement to the beach landings catch and effort system, logbooks were introduced for the semi-industrial and industrial shrimp trawlers in November 1991. In these, the captains recorded catch data for each of the shrimp and fish components of the catch (including quantities discarded) by haul (logbook form attached as Appendix 3). These data were entered and analysed in Dbase IV. By May 1992, however, owners stopped submitting logbook returns due to a number of commercial developments in the industry.

A technical co-operation project with the International Development Research Centre (IDRC) of Canada which began in 1991 led to the system being conceptually re-designed, with its incorporation within a general fisheries management information system. Development of the Fisheries Management Database (FISMIS) began with the Commercial Landings component of the Harvest Module. This module will also comprise components for the Recreational Landings, and Observer/Logbook Records. The other two modules of FISMIS are: Socio-Economic Module comprising Fisherman Registrations, Vessel Registrations, Beach Facility Profiles, Imports/Exports, and Financial Incentives; and Stock Assessment Module comprising Ageing Data, Resource Survey Data, Catch Sampling Data, Oceanographic Data, and Remote Sensing Data. Figure 11 shows the concept of FISMIS.

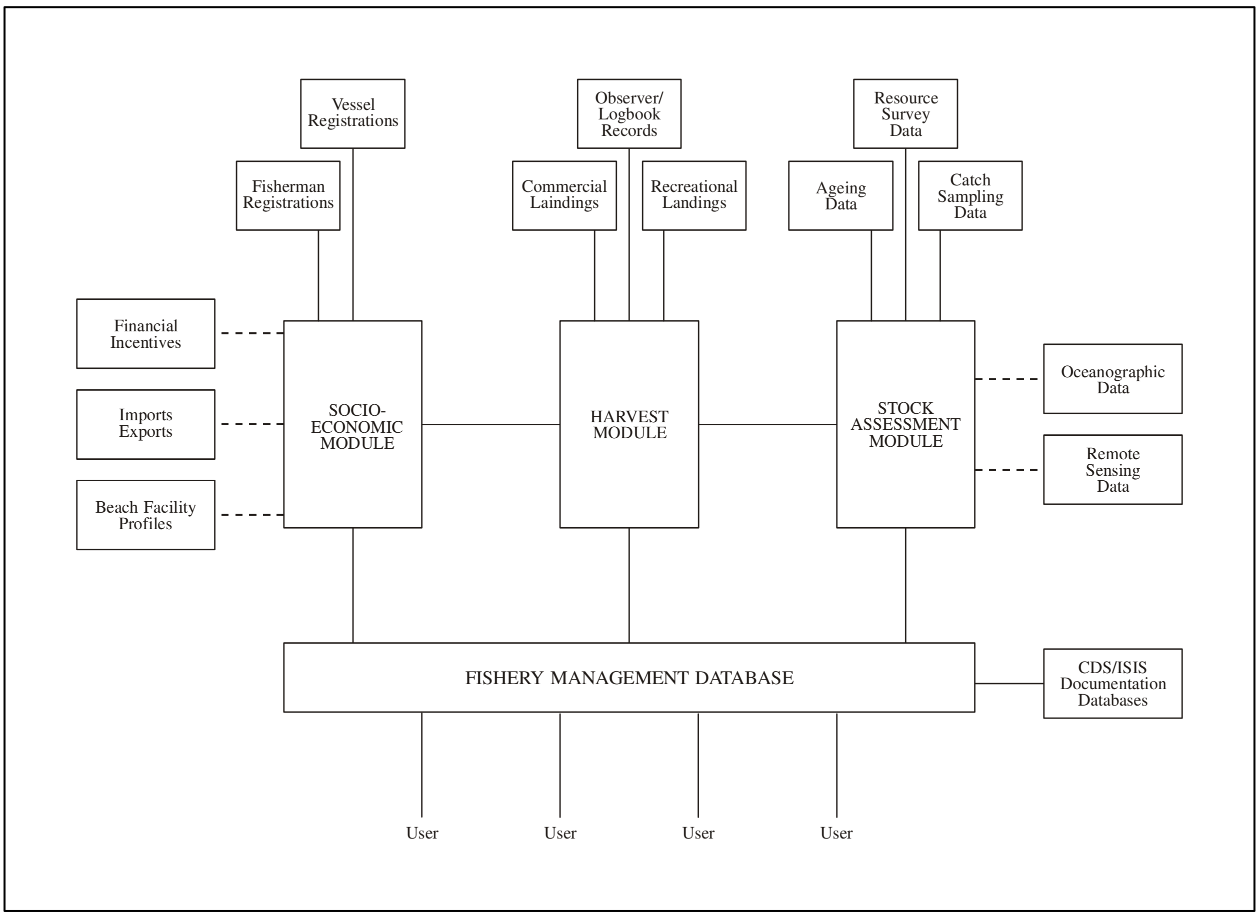


Figure 11: Fishery management database chart (MIS 1991a).

In the mid-1990s, under the CARICOM Fisheries Resource Assessment and Management Programme (CFRAMP), an enhanced supervisory mechanism for field data collectors was implemented which contributed to improved precision in reporting. A Data Collection Supervisor was hired to monitor the activities of the field data collectors, and annual training workshops were held to ensure consistency in recording data and address problems arising. Under CFRAMP a frame survey was also conducted in 1998 to update the one conducted in 1991.

5. PRESENT CATCH AND EFFORT DATA SYSTEMS

5.1 DESCRIPTION OF THE SAMPLING PLAN

Statistical Collectors employed by the Ministry live close to the beaches and record fishing vessels landing daily, as they come in from fishing. The main document used for collection purposes is the "Return of Fish Landed" form (Figure 12). Data are collected for each vessel on: Vessel Registration Number; Times departed and returned; Number of crew; Gear type used; Weights of "species" landed (grouped by "Local Names" as given in Appendix 4); Ex-Vessel price per "species", and Area Fished. These data, obtained on the beach either from fishermen directly or from the vendors who meet the fishermen on the beach to purchase catches, are recorded by the Collector in a notebook and later transcribed onto the "Return of Fish Landed Forms". Both the notebooks and forms are submitted to the Fisheries Division Statistical Unit. The data entry staff of this Unit check back the forms with the notebooks and return the latter to the Collector.

Collectors record the above data for at least 20 days (selected at random by the Collector himself) in a month. A Boat Activity Sheet is also used by the Collector to record the numbers of boats active by fishing method on each day of the month (Appendix 5). This sheet can thus be used to determine: whether or not the Collector was able to record data from all the fishing vessels on each of the days on which he worked; and the total number of fishing days at a particular site. These forms are submitted by the Collectors to the Fisheries Division together with the notebooks and landings form. Staff of the Statistical Unit conduct trips to the beaches to clarify any queries with the Collectors. In addition they interview the Collector each month to establish the total number of fishing days on the beach (questionnaire attached as Appendix 6).

The existing system of data collection targets only the artisanal inshore fleet such that each enumerated site is assumed to be representative of artisanal fishing activity within a zone. Trinidad is sectioned into nine (9) sample zones (Figure 13). Data collected at an enumerated site are raised to obtain estimates of landings at the site for all fishing days in the month (including non-enumerated fishing days). These raised data are then used to estimate the total artisanal landings for enumerated as well as non-enumerated sites in a zone. This second raising is based on results of a census of fishing vessels conducted every few years to determine the number of boats at each landing site.

Figure 12: "Return of Fish Landed" form.

DATE:			BEACH:						COLLECTOR:						
BOAT REGISTRATION #	TF		TF		TF		TF		TF		TF		TF		COMMENTS
NO. OF CREW															
TIME DEPARTED															
TIME RETURNED															
TYPE OF FISHING															
FISHING AREA															
SPECIES	Weight	Price	Weight	Price	Weight	Price	Weight	Price	Weight	Price	Weight	Price	Weight	Price	

RETURN OF FISH LANDED
Fisheries-B1

Figure 13: Map of Trinidad showing landing sites and catch and effort sample zones.

5.2 STRENGTHS AND LIMITATIONS OF SAMPLING PLAN

5.2.1 Strengths

1. More reliable estimation of total landings and effort of the artisanal fleet, based on designation of homogenous sampling Regions/Zones around the coastline, useful for stock assessment and management.

5.2.2 Limitations

1. This system does not cover the semi-industrial and industrial as well as the recreational fisheries. When the catch and effort data collection programme was first established in 1959 there was only an artisanal inshore fishery. Towards the end of the 1960s and into the 1970s, development of the offshore sector was promoted. The Government in 1972 acquired ten shrimp trawlers (Gulf-of-Mexico type), and during the mid to late 1980s non-artisanal, offshore longliners and multigear boats were introduced which land catches in non-traditional places. Recreational boats are also known to land significant catches using commercial-type gear. Unfortunately, the catch and effort system was not expanded to cater for these new developments in the fisheries.

2. This system does not cover discards. For some fisheries there are no discards so that the recorded landing data is equivalent to catch data. However in the case of the trawl fishery for example large quantities of unwanted catch are discarded at sea and not recorded.

3. Landings recorded by broad species groups in some cases rather than by species. Only in a few cases are the Data Collectors capable of identifying catch down to species. In all other cases landings are recorded in broad species groupings which cannot be used directly (without further investigation and analysis) in stock assessment analysis.

4. Inadequate coverage of artisanal vessels due largely to budget constraints. Data Collectors have been traditionally employed at specific sites. In general these sites have remained major landing sites throughout the years and can still be considered to be representative of fishing activity within the zone. However, in some cases coverage of additional landing sites within a zone would result in more refined estimates of landings. For example, under the current sampling plan, the landings of Type II artisanal trawlers operating in the northern Gulf of Paria (22 boats) are estimated based on only four Type II boats operating out of Orange Valley. Waterloo represents a major landing site for Type II artisanal trawlers (12 boats) in the Northern Gulf of Paria. Hence, coverage of this site would result in more acccurate estimates of landings. In addition, budget constraints also result in the absence of replacement staff when Data Collectors go on vacation leave.

5.3 RECOMMENDATIONS

1. Introduce Vessel Logbooks for the Semi-Industrial and Industrial Trawlers, Offshore longliners, Offshore Multi-Gear Boats, and Recreational Boats. The system of logbooks for trawlers was implemented in 1991 as mentioned in Section 4. These logbooks covered the total catch (landings as well as discards). There are plans to re-implement the logbook system for this fleet in the coming year. Estimates of landings for this trawl fleet are being determined, in the interim, from data collected by the biological sampling team.

2. Implement Observer/At-Sea Sampling Programmes to capture discards and verify logbook returns. An at-sea sampling programme was initiated for the artisanal and semi-industrial trawl fishery in 1999. There are plans to extend this programme to the industrial fleet in the coming year.

3. Ongoing monitoring of fishing activity around Trinidad to determine appropriateness of existing enumerated sites. Where coverage of a zone is determined to be inadequate a case should be made to employ Data Collectors at additional sites.

6. DATA MANAGEMENT

6.1 DATA ENTRY

The current catch and effort system has been developed for the UNIX version of ORACLE Relational Database Management System (RDBMS). The Fisheries Division maintains one SCO UNIX operating system server on which the ORACLE RDBMS resides, and thus the catch and effort application. UNIX is a multi-user operating system and as such the Division connects six terminals via multiplexing hardware and software. A staff of six persons comprising the Statistical Unit insert, update, delete, and retrieve data from the database via Data Entry Screens/Forms. These have context-sensitive help and controls incorporated to prevent invalid data entry. The "Return of Fish Landed" forms have been computerized from 1995 to the present, while landings from trawling have been entered since 1991. The Data Entry/Editing Screen is shown in Figure 14.

Figure 14: Return of Fish Landed Form.

F I S M I S	RETURN OF FISH LANDED - DATA ENTRY

Date landed INFORMATION was received by Fisheries: [redacted]

BEACH: [redacted] DATE LANDED: [redacted] COLLECTOR: [redacted]

Vessel Registration: TF[redacted] Number of crew: [redacted]

TIME DEPARTED: [redacted] DATE DEPARTED: [redacted] TIME RETURNED: [redacted]

TYPE OF FISHING: [redacted] FISHING AREA: [redacted]

Species	Local name(s)	Weight	Price	Kg/Lb
[redacted]	[redacted]	[redacted]	[redacted]	L
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

The Division also maintains a small Intranet connecting eight Windows-based computers through a network hub to which the server is also routed. This increases the potential for data maintenance as each networked computer, with existing software, can connect to the ORACLE application.

6.2 DATA STORAGE SYSTEMS, BACKUPS

The entire database including operating system and application resides on the server's four (4) gigabyte hard disk. The current size of the disk is adequate and if more storage space is required as the database grows additional hard drives can be incorporated into the system.

For the purpose of data archiving and backup there is an eight (8) gigabyte internal tape drive. Unfortunately this tape drive is yet to be completely configured. Regardless, offline storage and backup of data is maintained over the network. The process is manual whereby the ORACLE system is shutdown, the application's data exported and then transferred to the Intranet server where it is backed up to disk (Iomega Zip and Jaz) and/or compact disk, along with all other network data, during the scheduled weekly backup routine.

6.3 STRENGTHS AND LIMITATIONS OF DATA MANAGEMENT SYSTEM

6.3.1 Strengths

1. Secure, efficient, and effective storage of landings data that can be readily retrieved.

There are approximately 30 years worth of landings data collected on "Return of Fish Landed" forms. However, these forms are deteriorating every day and sooner or later may not be in a usable condition. Hence it is desirable to have the data computerized. Data could be queried in a real-time situation as opposed to manually searching through hundreds or thousands of paper forms.

2. Multi-user enabled environment facilitates simultaneous data entry, data analysis, system maintenance etc.

3. UNIX (operating system) guarantees an almost faultless operating system thus creating a robust computing environment providing uninterrupted processing.

4. Oracle (relational database management system) is currently the industry's leader with years of experience and numerous support resources.
5. The combined strengths of both the operating system and RDBMS allow for extensive data collection, i.e. there is no limitation as to the amount of data entered.
6. Low maintenance due to high durability
7. Local, technical and Internet-based support via maintenance contract

6.3.2 Limitations

1. No in-house UNIX and ORACLE support
2. Costly maintenance
3. No application maintenance contract. The system lacks an application maintenance contract i.e. support for the catch and effort system specifically designed and built for the Division.
4. Human error during data entry

6.4 RECOMMENDATIONS

1. Develop an Application Support Contract. Due to the lack of in-house UNIX and ORACLE support, an Application Support Contract specifically for the catch and effort system should be instituted to supplement the existing ORACLE RDBMS Maintenance Support Contract.

2. Incorporate further controls against invalid data entry. Error trapping for data entry is desirable to maintain data quality. One such example which could be incorporated is the check of vessel registration numbers being entered against a list of valid boat numbers to prevent invalid data entry.

3. Implement a more robust system of quality control. A more robust system of quality checks during and after data entry and editing should be implemented. Up until a few months ago, data entry clerks checked data entered for the same enumerated beaches assigned to them for data entry. In order to increase the likelihood of identifying errors made in data entry, the clerks are now assigned to check data for beaches other than those for which they have entered data.

7. DATA ANALYSIS

7.1 TYPE OF ANALYSIS (INCLUDING ESTIMATION OF TOTAL LANDINGS) AND INFORMATION GENERATED FROM CATCH AND EFFORT DATA

1. Artisanal Nominal Landings Reports

This section has been compiled after MIS 1991a. Raw Landings Data Output Reports are printed for the purpose of quality control of data entered from the "Return of Fish Landed" forms. In addition, the following reports are generated from the nominal statistics. In all cases the appropriate totals are also calculated.

i) BEACH LANDINGS REPORT

This two-part report (Figure 15) is generated for a user-specified beach and time period:

- Part (1): For each fishing method, the following statistics are calculated with respect to all species combined: Hours; Men; Trips; Number of Vessels Fishing; Landings (lbs); Value; Landing/Trip; Value/Trip.
- Part (2): For each Fishing Method and Species Group, the following statistics are calculated: Landings (lbs); Value.

Figure 35: Beach Landings Report

FISHERIES DIVISION

BEACH LANDINGS REPORT

FOR THE PERIOD: ____________________ TO: ____________________ BEACH: ____________________

FISHING METHOD	HOURS	TOTAL MEN	# TRIPS	# VESSELS	TOTAL LANDINGS	TOTAL VALUE	LANDINGS/ TRIP	VALUE/TRIP
. . . .	. . .							
TOTALS	xx	xx	xx	xx	xx	xx	xx	xx

FISHING METHOD		"SPECIES 1"	"SPECIES 2"	. . .	OTHERS	TOTAL
Xx	LANDINGS	xx	xx			xx
	VALUE	xx	xx			xx
	. .			. . .		
TOTALS	LANDINGS	xx	xx			xx
	VALUE	xx	xx			xx

ii) BEACH/MONTH LANDINGS REPORT

This report (Figure 16) is generated for the Year and Beaches specified by the user. For each Beach and Month, the following statistics are calculated with respect to all species combined: Landings (lbs); Value; Trips; Landings/Trip; Value/Trip.

iii) BEACH/SPECIES SELECTED BY GROUP LANDINGS REPORT

This report (Figure 17) is generated for the Beaches, Year and Species Groups specified by the user. For each Beach and Species Group, the following statistics are calculated: Landings (lbs); Value; Trips; Landings/Trip; Value/Trip.

Figure 16: Beach/Month Landings Report

FISHERIES DIVISION

BEACH/MONTH LANDINGS REPORT

FOR THE YEAR: ____________________

BEACH		JAN	FEB	MAR	. . .	DEC	TOTALS
Xx	LANDINGS	xx	xx	. . .			xx
	VALUE	xx	xx	. .			xx
	TRIPS	xx	xx				xx
	LANDINGS/TRIP	xx	. .				
	VALUE/TRIP						
.	.	.	.		.		.
.	.	.	.		.		.
.	.	.	.		.		.
Xx	LANDINGS	xx					
	VALUE	xx					
	TRIPS	xx					
	LANDINGS/TRIP						
	VALUE/TRIP						
TOTALS	LANDINGS	xx					
	VALUE	xx					
	TRIPS	xx					
	LANDINGS/TRIP						
	VALUE/TRIP						

Figure 17: Beach/Species Landings Report

FISHERIES DIVISION

BEACH/SPECIES LANDINGS REPORT

FOR THE YEAR: ____________________

SPECIES		BEACH 1	BEACH 2	….	. . .	OTHER	TOTALS
SPECIES GROUP 1	LANDINGS	xx	xx				xx
	VALUE	xx	xx				xx
	TRIPS	xx	. .				xx
	LANDINGS/TRIP	xx	.				
	VALUE/TRIP	xx					
.	.	.			.		
.	.	.			.		
.	.	.					
OTHER	LANDINGS						
	VALUE						
	TRIPS						
	LANDINGS/TRIP						
	VALUE/TRIP						
TOTALS	LANDINGS	xx					
	VALUE	xx					
	TRIPS	xx					
	LANDINGS/TRIP						
	VALUE/TRIP						

iv) BEACH/FISHING METHOD LANDINGS REPORT

This report (Figure 18) is generated for the Time Period, Beaches and Fishing Methods specified by the user. For each Beach and Fishing Method, the following statistics are calculated with respect to all species combined: Landings (lbs); Value; Trips; Landings/Trip; Value/Trip.

Figure 18: Beach/Fishing Method Landings Report

```
                                   FISHERIES DIVISION

                            BEACH/FISHING METHOD LANDINGS REPORT

                    FOR THE PERIOD: ____________________      TO: ____________________
------------------------------------------------------------------------------------------
BEACH                              "METHOD 1"          "METHOD 2"        . . .          TOTALS
------------------------------------------------------------------------------------------
xx                 LANDINGS        xx                  . . .                            xx
                   VALUE           xx                  . .                              xx
                   TRIPS           xx                  .                                xx

                   LANDINGS/TRIP   xx                  .
                   VALUE/TRIP      xx

.                  .               .                                                    .
.                  .               .                                                    .
.                  .

xx                 LANDINGS
                   VALUE
                   TRIPS

                   LANDINGS/TRIP
                   VALUE/TRIP
------------------------------------------------------------------------------------------
TOTALS             LANDINGS        xx
                   VALUE           xx
                   TRIPS           xx

                   LANDINGS/TRIP   . .
                   VALUE/TRIP
```

v) STATISTICS COLLECTOR PERFORMANCE REPORT

This report (Figure 19), used in monitoring statistics collectors' coverage of landings, is generated for the Collector, Beach, and Time Period specified by the user, and consists of two parts:

- Part (1):For each landing that the collector recorded but omitted data on, the following details are printed: date of landing and vessel number to identify landing; all missing items (Number of Crew, Date Departed, Time Departed, Time Returned, Fishing Method, Fishing Area, Species Weight and Species Price) indicated by an "X".
- Part (2):Days on which the Collector did not report any landings.

Figure 19: Statistics Collector Performance Report

FISHERIES DIVISION

STATISTICS COLLECTOR PERFORMANCE REPORT

COLLECTOR NAME: ____________________

BEACH NAME: ____________________

REPORTING PERIOD: ____________________ TO: ____________________

MISSING LANDINGS DATA

DATE	VESSEL #	# CREW	DATE DEPARTED	TIME DEPARTED	TIME RETURNED	FISHING METHOD	FISHING AREA	SPECIES WEIGHT	SPECIES PRICE
. . .	. .								
. .	.								
.									
TOTALS	xx	xx	xx	xx	xx	xx	. .	.	

DATES WHEN NO FISHING WAS REPORTED

xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
xx	xx	xx	xx	xx	. . .	. .	.		

TOTALS MISSING DAYS: xx DAYS IN PERIOD: xx

7.1.1 Estimation of Total Artisanal Landings

The above nominal landings and effort statistics collected on major (enumerated) beaches are used to generate data for secondary (non-enumerated) beaches, where it is assumed similar fishing occurs, at the same intensity. The nominal catch landings and fishing effort data are raised by two factors (MIS 1996). The First Raising Factor (1^{st} RF) adjusts the nominal statistics to account for the non-enumerated fishing days at each enumerated beach, that is, fishing days on which the Field Data Collector did not collect information. This factor is determined as the ratio of the Total Number of Fishing Days to Total Number of Enumerated Fishing Days. This is a monthly ratio obtained for each of the 15 enumerated beaches. The Second Raising Factor (2^{nd} RF) adjusts the first raised statistics to account for non-enumerated vessels, that is, vessels which fished but for which no data were recorded. This factor is determined as the ratio of the Total Number of Boats to Total Number of Enumerated Boats and is applicable to a zone. The totals are obtained from an annual fishing vessel census. The totals obtained from the 1991 census were used to estimate total landings for 1992 to 1997, and the totals obtained from the 1998 census for 1998 to 2000.

Nominal catch landings and effort data are thus raised initially by the 1^{st} RF. This first set of raised statistics is then raised by the 2^{nd} RF. The first and second raised reports generated are described below. The value of landings each month is determined as the product of the raised landings and the average price. Totals for the year are estimated as well as the mean (x), variance (S^2), and standard deviation (S) for the landings such that: x is the ratio of the sum of observations or raised estimates of landings for each month to the number of observations or months; S is the square root of S^2; and S^2 is given by the equation:

$S^2 = [1/(n-1)] * [\Sigma(x_i-x)^2]$ where n is the sample size.

2. First Raised Artisanal Statistics Reports

i) BEACH/MONTH RAISED LANDING REPORT

This report (Figure 20) is generated for the Year and Beaches specified by the user. For each Beach and Month, the following statistics are calculated with respect to all species combined: Landings (kg); Value; Trips; Landings/Trip; Value/Trip.

Figure 20: Beach/Month Raised Landing Report

```
                                           FISHERIES DIVISION
                 BEACH/MONTH RAISED LANDING REPORT TO ACCOUNT FOR NONENUMERATED FISHING DAYS FOR YEAR XXX

BEACH           JAN     FEB     MAR     APR     ...     ...     DEC     TOTAL     MEAN     VAR     STD DEV
XXX     LAN     XXX     XXX     XXX     ...     ...                     XXX       XXX      XXX     XXX
        VAL     XXX     XXX                                             XXX
        TRP     XXX
        L/T
        V/T
TOTAL   LAN     XXX     XXX                                             XXX       XXX      XXX     XXX
        VAL     XXX                                                     XXX
        TRP
        L/T
        V/T
```

ii) GEAR/SPECIES/MONTH RAISED LANDING REPORT

This report (Figure 21) is generated for the Year and Beach specified by the user. For each Species Group captured by each Fishing Method separately, the following statistics are calculated for each Month: Landings (kg); Value; Trips; Landings/Trip. Totals are determined for all species combined for each Fishing Method.

Figure 21: Gear/Species/Month Raised Landing Report

```
                                           FISHERIES DIVISION
      GEAR/SPECIES/MONTH RAISED LANDING REPORT FOR NONENUMERATED FISHING DAYS FOR YEAR XXX FOR ENUMERATED BEACH XXX

   GEAR     SPECIES          JAN     FEB     MAR     APR     ...     ...     DEC     TOTAL     MEAN     VAR     STD DEV
    XXX      XXX       LAN     XXX     XXX     XXX     ...     ...                     XXX       XXX      XXX     XXX
                                  VAL     XXX     XXX                                                  XXX
                                                            TRP     XXX
                                                                L/T
             TOTAL     LAN     XXX     XXX                                             XXX       XXX      XXX     XXX
                                  VAL     XXX                                                          XXX
                                                                TRP
                                                                L/T
     TOTAL             LAN     XXX     XXX                                             XXX       XXX      XXX     XXX
                                  VAL     XXX                                                          XXX
                                                                TRP
                                                                L/T
```

iii) SPECIES/MONTH RAISED LANDING REPORT

This report (Figure 22) is generated for the Year and Beach specified by the user. For each Species Group captured, the following statistics are calculated for each Month: Landings (kg); Value; Trips; Landings/Trip.

Figure 22: Species/Month Raised Landing Report

```
                                              FISHERIES DIVISION
  SPECIES/MONTH RAISED LANDING REPORT TO ACCOUNT FOR NONENUMERATED FISHING DAYS FOR YEAR XXX FOR ALL GEARS COMBINED AT ENUMERATED
                                                  BEACH XXX

          SPECIES          JAN     FEB     MAR     APR     ...     ...     DEC     TOTAL     MEAN     VAR     STD DEV
            XXX      LAN     XXX     XXX     XXX     ...     ...                     XXX       XXX      XXX     XXX
                                  VAL     XXX     XXX                                              XXX
                                                        TRP     XXX
                                                            L/T
            TOTAL    LAN     XXX     XXX                                             XXX       XXX      XXX     XXX
                                  VAL     XXX                                                      XXX
                                                            TRP
                                                            L/T
```

3. Second Raised Artisanal Statistics Reports

i) ZONE/MONTH SUMMARY REPORT

This report (Figure 23) is generated for the Year specified by the user. For each of the nine zones, the following statistics are calculated for each Month: Landings (kg); Value; Trips; Landings/Trip.

Figure 23: Zone/Month Summary Report

```
                                              FISHERIES DIVISION
                       ZONE/MONTH SUMMARY OF TOTAL ESTIMATED LANDINGS FOR ALL ZONES FOR YEAR XXX

          ZONE             JAN     FEB     MAR     APR     ...     ...     DEC     TOTAL     MEAN     VAR     STD DEV
           1         LAN     XXX     XXX     XXX     ...     ...                     XXX       XXX      XXX     XXX
                                  VAL     XXX     XXX                                              XXX
                                                        TRP     XXX
                                                            L/T
                                                        2
                                                       ...
                                                       ...
                                                        9
            TOTAL    LAN     XXX     XXX                                             XXX       XXX      XXX     XXX
                                  VAL     XXX                                                      XXX
                                                            TRP
                                                            L/T
```

ii) ZONE/SPECIES/MONTH SUMMARY REPORT

This report (Figure 24) is generated for the Year specified by the user for all zones combined. For each Species Group captured, the following statistics are calculated for each Month: Landings (kg); Value; Trips; Landings/Trip.

Figure 24: Zone/Species/Month Summary Report

```
                                   FISHERIES DIVISION
               ZONE/SPECIES/MONTH SUMMARY OF TOTAL ESTIMATED LANDINGS FOR ALL ZONES FOR YEAR XXX

SPECIES          JAN     FEB     MAR     APR     ...     ...     DEC     TOTAL     MEAN     VAR     STD DEV
  XXX     LAN     XXX     XXX     XXX     ...     ...                     XXX       XXX      XXX      XXX
                       VAL     XXX     XXX                                              XXX
                                              TRP     XXX
                                                  L/T
  TOTAL   LAN     XXX     XXX                                             XXX       XXX      XXX      XXX
                       VAL     XXX                                                      XXX
                                                  TRP
                                                  L/T
```

iii) ZONE/GEAR/MONTH SUMMARY REPORT

This report (Figure 25) is generated for the Year specified by the user for all zones combined. For each Fishing Method, the following statistics are calculated for each Month: Landings (kg); Value; Trips; Landings/Trip.

Figure 25: Zone/Gear/Month Summary Report

```
                                   FISHERIES DIVISION
                    ZONE/GEAR/MONTH SUMMARY OF TOTAL ESTIMATED LANDINGS FOR YEAR XXX

GEAR             JAN     FEB     MAR     APR     ...     ...     DEC     TOTAL     MEAN     VAR     STD DEV
  XXX     LAN     XXX     XXX     XXX     ...     ...                     XXX       XXX      XXX      XXX
                       VAL     XXX     XXX                                              XXX
                                              TRP     XXX
                                                  L/T
  TOTAL   LAN     XXX     XXX                                             XXX       XXX      XXX      XXX
                       VAL     XXX                                                      XXX
                                                  TRP
                                                  L/T
```

iv) ZONE/GEAR/SPECIES/MONTH SUMMARY REPORT

This report (Figure 26) is generated for the Year specified by the user for all zones combined. For each Species Group captured by each Fishing Method separately, the following statistics are calculated for each Month: Landings (kg); Value; Trips; Landings/Trip.

Figure 26: Zone/Gear/Species/Month Summary Report

```
                                        FISHERIES DIVISION
                     ZONE/GEAR/SPECIES/MONTH SUMMARY OF TOTAL ESTIMATED LANDINGS FOR YEAR XXX

GEAR     SPECIES          JAN     FEB     MAR     APR     ...     ...     DEC     TOTAL     MEAN     VAR     STD DEV
  XXX      XXX      LAN     XXX     XXX     XXX     ...     ...                     XXX       XXX      XXX     XXX
                                 VAL     XXX     XXX                                           XXX
                                                            TRP     XXX
                                                                L/T
         TOTAL      LAN     XXX     XXX                                               XXX       XXX      XXX     XXX
                                 VAL     XXX                                                   XXX
                                                                TRP
                                                                L/T
  TOTAL             LAN     XXX     XXX                                               XXX       XXX      XXX     XXX
                                 VAL     XXX                                                   XXX
                                                                TRP
                                                                L/T
```

4. Trawling Raised Statistics Reports

The trawling raised landings reports use a subset of the overall landings data: only the landings for which the fishing method is trawling. The trawl data extracted are summarized for each beach by gear (trawler type), and fishing area. The application of the 1st RF adjusts the nominal statistics to account for non-enumerated days and is identical to the one used for landings from other methods. The total trawl landings and effort are thus estimated for each enumerated beach by fleet type (artisanal Type I and II, semi-industrial Type III, and industrial Type IV) and fishing area (North Gulf of Paria, South Gulf of Paria, South coast, Venezuela) (Shim 1997). The reports generated are as follows.

i) FIRST RAISED LANDINGS BY GEAR/FISHING AREA/SPECIES REPORT

This report (Figure 27) is generated for the Year and Beach specified by the user. For each Species Group captured by each combination of trawler fleet and fishing area, the following statistics are calculated for each Month: Landings (kg); Value; Trips; Landings/Trip.

Figure 27: First Raised Landings by Gear/Fishing Area/Species Report

```
                                    FISHERIES DIVISION
       TRAWLING 1ST RAISED LANDINGS BY GEAR/FISHING AREA/SPECIES AT ENUMERATED BEACH XXX FOR YEAR XXX

                JAN    FEB    MAR    APR    ...    ...    DEC    TOTAL    MEAN    VAR    STD DEV
S:XXX    LAN    XXX    XXX    XXX    ...    ...                   XXX     XXX     XXX    XXX
          V:XXX    VAL    XXX    XXX                                         XXX
                                G:XXX    TRP    XXX
                                   F:XXX    L/T
TOTAL    LAN    XXX    XXX                                        XXX     XXX     XXX    XXX
                   VAL    XXX                                                XXX
                                            TRP
                                            L/T
               S=SPECIES GROUP; V=TRAWLER TYPE; G=SHRIMP/BY-CATCH; F=FISHING AREA
```

ii) FIRST RAISED LANDINGS BY GEAR/FISHING AREA/BEACH REPORT

This report (Figure 28) is similar to (i) except that statistics are generated, not by individual species groups, but for all shrimp species combined and for all bycatch species combined by trawler type and fishing area.

Figure 28: First Raised Landings by Gear/Fishing Area/Beach Report

```
                                    FISHERIES DIVISION
        TRAWLING 1ST RAISED LANDINGS BY GEAR/FISHING AREA/BEACH AT ENUMERATED BEACH XXX FOR YEAR XXX

                JAN    FEB    MAR    APR    ...    ...    DEC    TOTAL    MEAN    VAR    STD DEV
V:XXX    LAN    XXX    XXX    XXX    ...    ...                   XXX     XXX     XXX    XXX
          G:XXX    VAL    XXX    XXX                                         XXX
                                F:XXX    TRP    XXX
                                            L/T
TOTAL    LAN    XXX    XXX                                        XXX     XXX     XXX    XXX
                   VAL    XXX                                                XXX
                                            TRP
                                            L/T
                     V=TRAWLER TYPE; G=SHRIMP/BY-CATCH; F=FISHING AREA
```

iii) FIRST RAISED LANDINGS BY BEACH REPORT

This is similar to (ii) but all fleet types and areas are combined.

iv) FIRST RAISED FISHING EFFORT BY GEAR/FISHING AREA/BEACH REPORT

This report (Figure 29) is generated for the Year and Beach specified by the user. For each fleet type and fishing area the following fishing effort statistics are calculated for each Month: number of hours at sea, men (average number of crew per trip), number of boats, trips, hours/trip, days/trip. The 1st RF is applied to the hours, and trips. A similar report is also generated by fleet type and provides a grand total for all trawl fleets.

Figure 29: First Raised Fishing Effort by Gear/Fishing Area/Beach Report

```
                                              FISHERIES DIVISION
                   TRAWLING 1ST RAISED EFFORT BY GEAR/FISHING AREA/BEACH AT ENUMERATED BEACH XXX FOR YEAR XXX

                              JAN     FEB     MAR     APR      ...      ...      DEC      TOTAL     MEAN     VAR     STD DEV
 V:XXX      HRS                 XXX     XXX     XXX     ...      ...                        XXX       XXX      XXX      XXX
               F:XXX     MEN              XXX                                                               XXX
                                                   BOATS        XXX
                                                        TRIPS
                                                      HRS/TRIP
                                                      DYS/TRIP
 TOTAL      HRS                 XXX     XXX                                                 XXX       XXX      XXX      XXX
                         MEN              XXX                                                               XXX
                                                   BOATS        XXX
                                                      HRS/TRIP
                                                      DYS/TRIP
                                    V=TRAWLER TYPE; G=SHRIMP/BY-CATCH; F=FISHING AREA
```

v) FIRST RAISED UNCLASSIFIED LANDINGS BY FISHING AREA/BEACH

Landings from vessels which are unclassified are summarized by area and beach and are raised to account for non-enumerated days. Because the Trawl Reports are summarized by fleet type and fishing area, landings will not be included in the analyses in two instances: if the trawler type is unknown (unclassified), i.e. it is not on the vessel master list in the database which identifies the trawler type; and if the Fishing Area was not entered by the Data Collector for a vessel landing on the “Return of Fish Landed” forms. Two reports can thus be generated as follows: Unclassified Vessels for all fishing methods by beach, which prints the registration numbers of vessels for which landings have been reported but which do not exist on the vessel master list; and Blank Fishing Area Summary which prints a summary of landings for which the Fishing Area is not entered. If the latter landings are significant, and if the number of unclassified trawlers is unacceptable then: the option “Assign default fishing areas” is run and default values are assigned according to the Default Fishing Area set for each beach; and efforts are made to classify the unknown trawlers and update the vessel master list. The Trawl Reports can then be re-generated and these landings will be included.

The first raised trawler landings by fleet type and fishing area are then used to estimate total trawler landings by fleet type and fishing area. This process is conducted in a spreadsheet application and has not been programmed in ORACLE since user input is necessary throughout the procedure.

5. Trinidad and Tobago/Venezuela Fishing Agreement Reports

During the period 1977 to 1995, under a fishing agreement between Trinidad and Tobago and Venezuela, a number of permits were given to artisanal trawler owners allowing them to shrimp within the Orinoco Delta of Venezuela during a specific season, 01 DEC-XX to 30-JUN-XX + 1. Since 1991, specific reports were generated each year based on statistics from the previous season in order to monitor shrimp landings as well as determine which boat owners would receive a permit for the coming season (MIS 1991a).

i) FISHING SEASON REPORT (RANKING REPORT)

For each fishing vessel, identified by Boat Number, Boat Owner, Permit Status (Y/N) and Beach, the following statistics were calculated for the entire season: Landings; Value; Trips; Landings/Trip; Value/Trip; Standard Deviation of Landings / Trip; and Standard Deviation of Value / Trip. The following values were then ranked individually with a rank of 1 being the highest, and an average rank is then calculated from the 5 ranks: Landings; Value; Trips; Landings/Trip; Value/Trip. Appropriate Totals and Averages are also presented (Figure 30).

Figure 30: Seasonal Report

FISHERIES DIVISION
TRINIDAD AND TOBAGO/VENEZUELA FISHING AGREEMENT
SEASONAL REPORT
FOR THE SEASON: ____________________ TO: ____________________

BT#	BOAT OWNR	PER-MIT	BCH	TOT LDG (lbs)	TOT VAL $TT	# TPS	LDG /TPS	VAL /TPS	STD DEV LDG /TPS	STD DEV VAL /TPS	RANKING					
											LDG	VAL	TPS	LDG /TPS	VAL /TPS	AV
TOT				xx	xx	xx										
AVE							xx	xx								

ii) BOAT PROFILE REPORT (ALL BOATS OR A SPECIFIED BOAT)

For each fishing vessel, identified by Boat Number, Boat Name, Boat Owner and Fishing Beach, the following statistics are calculated for each month in the season: Trips; Hours Distant from port; Landings; Weight of Shrimp - Large, Medium, Small Shrimp; Percentage by Weight - Large, Medium, Small Shrimp; Value; Landings/Trip; Value/Trip. Appropriate Totals are also presented (Figure 31).

Figure 31: Boat Profile Report

FISHERIES DIVISION
TRINIDAD AND TOBAGO/VENEZUELA FISHING AGREEMENT
BOAT PROFILE REPORT
FOR THE SEASON: ____________________ TO: ____________________

BOAT NUMBER: ____________________

BOAT NAME: ____

BOAT OWNER: ____

FISHING BEACH: ____

MONTH	# TRIPS	HRS DISTANT FROM PORT	TOT LDG (lbs)	WEIGHT OF SHRIMP			% BY WEIGHT			TOTAL VALUE ($TT)	LDG /TRIPS	VALUE /TRIP
				LG	MED	SM	LG	MED	SM			
TOTAL	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx		
AVE											xx	xx

iii) BEACH PROFILE REPORT

For each Beach individually (Bonasse, Fullerton, Icacos) as well as for these beaches combined, the following statistics are calculated for each month in the season: Landings; Percentage by Weight - Large, Medium, Small Shrimp; Value; Trips; Number Distinct Vessels Fishing. Appropriate Totals are also presented (Figure 32).

Figure 32: Beach Profile Report

FISHERIES DIVISION
TRINIDAD AND TOBAGO/VENEZUELA FISHING AGREEMENT
BEACH PROFILE REPORT
FOR THE SEASON: ____________________ TO: ____________________ BEACH: ____________________

MONTH	TOT LDG (lbs)	% BY WEIGHT			TOT VAL ($TT)	# TRIPS	DISTINCT VESSELS FISHING
		LG	MED	SM			
JAN							
FEB							
...							
..							
.							
DEC							
TOTALS	xx	xx	xx	xx	xx	xx	xx

iv) WHOLESALE SHRIMP PRICES ($TT/LB) REPORT

This report presents the same statistics in two different formats

1. For each beach individually (Bonasse, Fullerton, Icacos) as well as for all combined, the following statistics are calculated for each month in the season; and for each of the size categories of shrimp (Large, Medium, Small): Number of Samples; Average Price; Minimum Price; Maximum Price; Price Standard Deviation. Appropriate Totals are also presented (Figure 33).

Figure 33: Wholesale Shrimp Prices (TT$/lb) Report

FISHERIES DIVISION
TT/VENEZUELA FISHING AGREEMENT
WHOLESALE SHRIMP PRICES ($TT/LB) REPORT
FOR THE SEASON: ____________________ TO: ____________________
BEACH: ____________________

MONTH	LARGE SHRIMP					MEDIUM SHRIMP					SMALL SHRIMP				
	NO.	AVG $$	MIN $$	MAX $$	$$ STD DEV	NO.	AVG $$	MIN $$	MAX $$	$$ STD DEV	NO.	AVG $$	MIN $$	MAX $$	$$ STD DEV
DEC															
JAN															
.															
.															
.															
JUN															
SEASONAL BEACH VALUES	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX

2. For each Month in the season and for each of the size categories of shrimp (Large, Medium, Small), the following statistics are calculated for each beach individually (Bonasse, Fullerton, Icacos) and then collectively as a unit: Number of Samples; Average Price; Minimum Price; Maximum Price; Price Standard Deviation. Appropriate Totals are also presented (Figure 34).

Figure 34: Wholesale Shrimp Prices (TT$/lb) Report

FISHERIES DIVISION
TT/VENEZUELA FISHING AGREEMENT
WHOLESALE SHRIMP PRICES ($TT/LB) REPORT
FOR THE SEASON: ____________________ TO: ____________________

MTH	BEACH	LARGE SHRIMP					MEDIUM SHRIMP					SMALL SHRIMP				
		NO.	AVG $$	MIN $$	MAX $$	$$ STD DEV	NO.	AVG $$	MIN $$	MAX $$	$$ STD DEV	NO.	AVG $$	MIN $$	MAX $$	$$ STD DEV
DEC	BONASSE															
	FULLERTON															
	ICACOS															
	ALL															
JAN	. . .															
.	. . .															
.	. .															
JUN	BONASSE															
	FULLERTON															
	ICACOS															
	ALL															

7.2 STRENGTHS AND LIMITATIONS OF DATA ANALYSIS

7.2.1 Strengths

The following strengths of the Data Analysis System have been identified by MIS (1991a).

1. Analytical procedures are standardized and less error-prone. Computerization of the analytical procedures results in a reduction in possible errors likely in manual data processing and transcription.

2. Efficient Data Processing. Specific reports required monthly and annually are programmed. Data can thus be processed more efficiently and in a timely manner.

3. Flexibility of reporting procedures. In addition to the standard programmed reports, the system allows the conduct of "ad-hoc" queries and the generation of customised reports, e.g. generation of fishing activity profiles of individual fishing vessels for performance analysis.

4. Multi-user enabled environment. This facilitates simultaneous access to the database by several users for data entry, editing, quality control, data analysis, system maintenance, and generation of reports.

7.2.2 Limitations

1. No in-house ORACLE programming expertise.

2. Contracted programming is extremely costly.

7.3 RECOMMENDATIONS

1. Training in a Report Writing Tool. The Division's Systems Manager and at least one Fisheries Officer should be trained in a reporting tool, for example (Structured Query Language) SQL*ReportWriter, ORACLE Discoverer. SQL*ReportWriter lets you create a wide variety of reports using any number of database queries, selecting data from ORACLE and even non-ORACLE databases. SQL*ReportWriter is an excellent tool for generating ad hoc and batch reports. ORACLE Discoverer allows for analysis of data by non-programmers.

2. Review Boat Activity Sheets and modify Raising procedure if appropriate. Boat Activity Sheets should be reviewed to determine whether the vessel landings not recorded (due to time constraints) by the Data Collectors on enumerated days are significant enough to warrant modification of the raising procedure. If they are significant then the first raising would account for non-enumerated vessels on enumerated fishing days at enumerated sites. The other two raisings would be as discussed in section 7.1.1.

8. CONCLUSION AND RECOMMENDATIONS FOR THE FUTURE

The Fisheries Management Information System (FISMIS) is visualized as a suite of database systems (Figure 11) covering the range of inputs into the day-to-day operations of a Fisheries administration to enhance its organization capability and performance. As mentioned in Section 4, these inputs required for effective assessment and management of fisheries include Catch and Effort data, Fishermen and Vessel Registrations, Bibliographic databases, Registers of experts/consultants, Listings of Institutions and Technical Co-operation agencies, Import/Export databases, etc. Such an integrated database system should be of use not only to scientists, but also to fisheries extension staff, fisheries administrators, managers, and key officials in the Public Service involved in the administration, planning, and development of marine fisheries, and would serve as an instrument to improve efficiency and effectiveness to the benefit of clients - the fishing communities.

Continued development of the Harvest Module, and development and integration of the Stock Assessment and Socio-Economic Modules with the Harvest Module is thus recommended. The Harvest Module is currently being expanded to incorporate Trawler Logbook Records and this will be followed by the initiation of the Stock Assessment Module through the development of the Catch Sampling Data Component for the trawl fishery.

The need for exchange of data and research information between countries where fishing fleets interact, or where the life-history of particular fish species demands it, must also be highlighted. The formalisation of this through the concept of "Regional Databases" (Stamatopoulos 1986) demonstrates the added value each country gets by contributing its data, documentation etc., and drawing on the entire database. At the same time it is realised that such an objective will probably be realised in stages, due to the technical complexities, and diversity of data collection systems in the various countries.

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APPENDIX 1: SPECIES COMPOSITION OF DEMERSAL TRAWL CATCHES

FAMILY	SPECIES	LOCAL NAME
TARGET SPECIES		
Penaeidae	*Penaeus brasiliensis* *Penaeus notialis* *Penaeus schmitti* *Penaeus subtilis* *Xiphopenaeus kroyeri*	Hopper shrimp Pink shrimp White shrimp Brown shrimp Sea bobs, Honey-shrimp
MOST ABUNDANT AND COMMERCIALLY IMPORTANT BY-CATCH SPECIES		
Ariidae	*Arius spp.*	Cacamato, Catfish
Bothidae	*Cyclopsetta spp.*	
Carangidae	*Caranx spp.* *Chloroscombrus chrysurus* *Selene spixii* *Selene vomer* *Trachinotus carolinus*	Cavalli Plato Lookdown, Moonshine Moonshine Pampano
Carcharinidae		Shark
Centropomidae	*Centropomus ensiferus*	Snook/Brochet
Clupeidae	*Harengula clupeola* *Opisthonema oglinum*	Hardback sardine Thread herring
Cynoglossidae	*Symphurus spp.*	Tongue fish
Engraulidae	*Anchoa spp.* *Cetengraulis edentulus*	Sardine Sardine
Ephippidae	*Chaetodipterus faber*	Paoua
Gerreidae	*Diapterus rhombeus* *Eucinostomus argenteus*	Blinch Blinch
Haemulidae	*Haemulon spp.*	Grunt
Lutjanidae	*Lutjanus spp.*	Redfish
Polynemidae	*Polydactylus virginicus*	Barbe
Pomatomidae	*Pomatomus saltator*	Ancho
Portunidae	*Callinectes spp.*	Cirri crab
Sciaenidae	*Cynoscion spp.* *Macrodon ancylodon* *icropogonias furnieri* *Ophioscion spp.*	Salmon German, Rock salmon Croaker
Scombridae	*Scomberomorus brasiliensis*	Carite
Trichiuridae	*Trichiurus lepturus*	Cutlass fish
Triglidae	*Prionotus punctatus*	Fowl fish

APPENDIX 2: 1998 CENSUS DATA NTRY FORM

CENSUS OF FISHING UNITS

11/95

FISHERMAN NAME: (in charge)

FISHERMAN NAME: (owner)

VESSEL NAME:

TYPE:

LENGTH: [ft] [m]

VESSEL REGISTRATION:

USUAL NUMBER OF CREW (including skipper):

HOME PORT:

LANDING SITE:

ENGINE(s):
inboard [ ] outboard [ ] horsepower:
inboard [ ] outboard [ ] horsepower:
inboard [ ] outboard [ ] horsepower:

GEAR:
primary [ ]
secondary [ ]
tertiary [ ]
other [ ]

type: number:
dimension [ ] hooks [ ] mesh [ ] length [ ] width :
months used: J F M A M J J A S O N D
area fished (see map):
species caught::
discards:
disposal of catch:

GEAR:
primary [ ]
secondary [ ]
tertiary [ ]
other [ ]

type: number:
dimension [ ] hooks [ ] mesh [ ] length [ ] width :
months used: J F M A M J J A S O N D
area fished (see map):
species caught::
discards:
disposal of catch:

GEAR:
primary [ ]
secondary [ ]
tertiary [ ]
other [ ]

type: number:
dimension [ ] hooks [ ] mesh [ ] length [ ] width :
months used: J F M A M J J A S O N D
area fished (see map):
species caught::
discards:
disposal of catch:

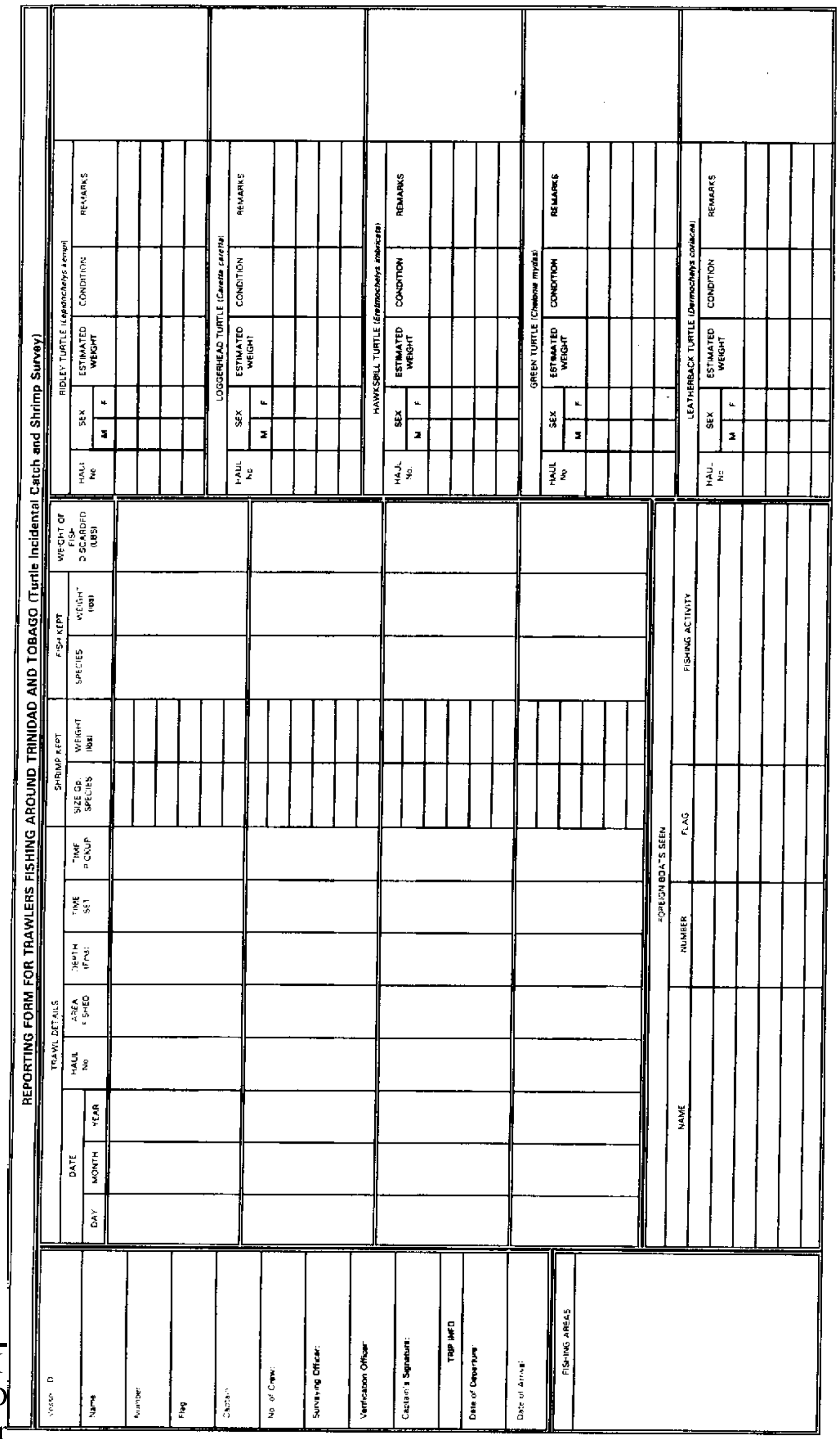
INFORMATION GATHERED FROM:

DATA COLLECTOR:

COMMENTS:

MAP:

APPENDIX 3: TRAWL LOGBOOK DATA ENTRY FORM



APPENDIX 4: LIST OF SPECIES COMMON NAMES USED IN DATA ENTRY

ACOUPA WEAKFISH
AFRICAN POMPANO
ALASKA SALMON
ALBACORE
AMERICAN HARVESTFISH
ANCHO
ANCHOVY (SARDINE)
ANGELFISH (QUEEN ANGEL)
ATLANTIC BIGEYE
ATLANTIC BUMPER (PLATO)
ATLANTIC CUTLASSFISH
ATLANTIC SPADEFISH (PAOUA)
ATLANTIC TRIPLETAIL
BACHIN
BACHIN, SMALL
BAR JACK
BAR JACK (SMALL)
BARRACUDA
BERMUDA SEA CHUB
BLACK CRO CRO
BLINCH
BLINCH (SMALL)
BLUE RUNNER (BLACK CAVALLI)
BONEFISH (BANAAN)
BONITO
CENTER FIN
CHOICE FISH
COBIA (CODFISH)
CONCH
CREVALLE JACK (CAVALLI)
CREVALLE JACK (SMALL)
CRO-CRO AND WEAKFISH
DOG SALMON
DOLPHIN (BOTTLENOSE)
DOLPHINFISH
DRUM (BOKUM)
EEL
FLOUNDER (SOALFISH)
FLYINGFISH
GAR (NEEDLEFISH)
GERMAN SALMON AND CRO-CRO
GREAT NORTHERN TILEFISH
GROUPER
GROUPER (SMALL)
GRUNT
HALFBEAK
HERRING
JACK (PALOMET)
JACKS
JASHUA
KING WEAKFISH (GERMAN SALMON)
KING WEAKFISH (GERMAN SALMON) (SMALL)
KINGFISH
LEATHERJACK (SAPATE)
LIPPE
LOBSTER
MARLIN (BLACK)
MARLIN (BLUE), (OCEAN GUARD)
MARLIN (RED)
MISC (SMALL WHITEFISH)
MIX FISH
MOJARRA (SMALL)
MOONSHINE (LEAN)
MOONSHINE, SMALL
MULLET
MUTTON SNAPPER
OILFISH (YU-KUM)
PACUMA TOADFISH
PARROTFISH
PARROTFISH (PORGY)
PERMIT (SOFT PAMP)
POMPANO (ZELWON)
RED MOUTH GRUNT
ROCK SALMON
SAILFISH
SALMON & CRO CRO
SALMON, SMALL
SEA CATFISH
SEA CATFISH (SMALL)
SEA ROBIN
SEA/SWIMMING CRAB
SHARK
SHARK (BLACKTIP)
SHARK (BLUE DOG)
SHARK (BULL)
SHARK (FINS)
SHARK (GUMMY)
SHARK (HAMMERHEAD)
SHARK (MAKO)
SHARK (SAND)
SHARK (SAW)
SHARK (THRESHER/MORO)
SHARK (TIGER)
SHARK, SMALL
SHRIMP
SHRIMP (EXTRA LARGE)
SHRIMP (FINEY)
SHRIMP (LARGE EXTRA LARGE)
SHRIMP (LARGE MEDIUM)
SHRIMP (LARGE)

SHRIMP (MEDIUM)
SHRIMP (SMALL MEDIUM)
SHRIMP (SMALL)
SHRIMP, BROWN (LARGE)
SHRIMP, BROWN (MEDIUM)
SHRIMP, BROWN (SMALL)
SHRIMP, HONEY
SHRIMP, HOPPERS
SHRIMP, RED (LARGE)
SHRIMP, RED (MEDIUM)
SHRIMP, RED (SMALL)
SHRIMP, WHITE (LARGE)
SHRIMP, WHITE (MEDIUM)
SHRIMP, WHITE (SMALL)
SIERRA MACKAREL (SMALL)
SIERRA MACKEREL (CARITE)
SMALL KINGFISH
SMALL TOOTH WEAKFISH
SMOOTH WEAKFISH
SMOOTH WEAKFISH (SILV.SALMON) (MEDIUM)
SMOOTH WEAKFISH (SMALL)
SNAPPER (BARBADOS RED)
SNAPPER (BLACK PARGUE)
SNAPPER (DOG)
SNAPPER (KOLA)
SNAPPER (LARGE RED)
SNAPPER (MEDIUM RED)
SNAPPER (PARGUE)
SNAPPER (PLUMHEAD)
SNAPPER (RED)
SNAPPER (SMALL RED)
SNAPPER (SMALL)
SNAPPER (WALLIAC)
SNOOK
SNOOK (LARGE)
SNOOK (SMALL)
SNOOK AND SALMON
SOUTHERN KING CROAKER
SPEARFISH
SQUID
SQUIRRELFISH (MARIE ANN)
SQUIRRELFISH (OLDWIFE)
SURGEONFISH
SURGEONFISH (SHOEMAKER)
SWORDFISH
TARPON (GRANT-TE-CYE)
TARPON (SMALL)
THREADFIN (BA BAY)
TORROTO GRUNT
TUNA
TUNA (BIGEYE)
TUNA (BLUEFIN)
TUNA (MACKEREL)
TUNA (MACRIO)
TUNA (SKIPJACK)
TUNA (YELLOWFIN)
TURTLE
WAHOO
WEAKFISH (SALMON LARGE)
WEAKFISH (SALMON)
WHITEFISH
WHITEMOUTH CROAKER (CRO-CRO)
WHITEMOUTH CROAKER (LARGE)
WHITEMOUTH CROAKER (MEDIUM)
WHITEMOUTH CROAKER (SMALL)

APPENDIX 5: BOAT ACTIVITY FORM

BOAT ACTIVITY SHEET

BEACH:

DATE (month, year):

DATE	ARTISANAL TRAWLER	SEMI-INDUSTRIAL TRAWLER	INDUSTRIAL TRAWLER	A-LA-VIVE	FILLET	TRANSPEARING	BANKING	PALANGUE	FISHPOT		# BOATS FISHING	# BOATS NOT FISHING	TOTAL BOATS
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
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21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													

APPENDIX 6: QUESTIONNAIRE ON FISHING DAYS

Marine Fishery Analysis Unit Fisheries Division, Ministry of Agriculture, Land and Marine Resources	
QUESTIONNAIRE TO ESTABLISH NUMBER OF FISHING DAYS ON ENUMERATED BEACHES	
Interview Date:	Interviewer:
Beach:	Reporting Month:

Did fishermen on this beach fish on weekends during the reporting month?
SATURDAY [ ]   SUNDAY [ ]   BOTH [ ]

Did fishermen fish on Public or other holidays in the reporting month? If not, how many days did they not fish? (public and religious holidays e.g. New Year's Day, Carnival, Eid, Easter, Divali, Kartik, Hosay, Corpus Christi)

During the reporting month, did fishermen not fish due to bad weather or other factors (poor catches etc.)?
YES [ ]   NO [ ]
For how many days?

Is there any specific activity or factor which affected fishing activity in this area during the reporting month (alternative employment – URP, road/bridge construction, estate labour)?

Give details of movement of fishermen into and out of this port during the reporting month.

NUMBER	IN/OUT	TO/FROM LOCATION

3. TECHNICAL REPORTS

3.1 Regional Overview of Fish Catch and Effort in CARICOM Countries

3.2 National Data Management System Software Systems (TIP and LRS)

National Data Management Software Systems
(Trip Interview Program and Licensing and Registration Software)

by

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Introduction

The Fisheries Management and Data collection System consisted of two major components. The Trip Interview Program (TIP) and the Licensing and Registration Software (LRS) were adapted/developed to enhance the efficiency of the establishment of these components:

1. Catch and Effort Data Collection Systems with the main objective being: To establish operational systems at the national level to collect, analyze and report on quantities of catch by species, and the effort (human and technical) made to obtain this catch; and to enhance the capabilities of the National Fisheries Divisions to analyze their data and report on the performance of their fisheries sector.

2. Licensing and Registration System, with the main objectives being: To establish national systems to monitor and manage the fisheries by tracking changes in the numbers of fishermen, fishing boats, fishing gear etc.; enhance the national and regional capability to design and manage their licensing and registration system (LRS); and computerize the LRS function of Fisheries Department and improve on their ability to analyze and report on the data.

This report speaks to:

- The goals and objectives of the CFRAMP supported software
- The development of the TIP and LRS
- Installation tips
- An introduction to the upgraded TIP and LRS
- Querying capabilities
- Data management tips
- The strengths and weaknesses of TIP and LRS

- A Summary of some of the technical aspects of the Present and the Future of TIP and LRS.

Goals and Objectives of the CFRAMP supported software:
The Trip Interview Program (TIP) and the Licensing and Registration Software (LRS)

"In order to rationally manage a fishery, the responsible agency must have adequate data to make informed and meaningful decisions." This statement essentially defines the overall objective of the software developed and/or supported by CFRAMP's Fisheries Management Data System subproject.

The Trip Interview Program (TIP) of data collection was initially designed for collecting interview and other fishery-dependent biological and socio-economic data, and adapted for the CFRAMP participating countries. The purpose of TIP was to collect fishery information by individual trip in order to obtain more detailed catch and effort data. The stated objectives of TIP are to:

- Obtain and maintain a site activity file to estimate numbers of fishing trips by fishery and/or major gear type
- Obtain size frequency samples on a species priority basis
- Obtain information on species composition in mixed catches, and
- Obtain representative samples of landings, areas of fishing, effort, catch per unit effort, and prices by size of fish

The TIP software stores trip, landings, sample, measurement, and age and sex data. These data can be presented in the form of an inverted pyramid indicating that the amount, complexity and cost of information increases in relation to that at the next lower level

Registration in the context of fisheries management simply means the addition to a list (the register) of the name of the person, boat or gear that will either be engaged or be used in fishing activities. Licensing regulates the legally permitted activities of persons or vessels engaged in fishing or fishing-related activities. The purpose of the LRS software is to store registration and licensing information on the countries' fisheries.

Development of the TIP and the LRS

The subproject initiation mission for the CFRAMP Fisheries Data and Information, and Licensing and Registration systems subprojects took place in September and October of 1991. The mission founds that fisheries data collection systems were in a relatively preliminary state and that while some countries had designed systems, for the most part implementation had been minimal primarily due to insufficient staff numbers and training. Where some data was being collected, complete information was not being captured or some of the import product pathways were missed. With regard to licensing and registration, it was found that only Barbados had an operational, computerized system in place. Other countries had paper-based registers of fishing vessels, fisherpersons or both.

In all instances the most frequently anticipated difficulty in improving the systems was the lack of resources, especially personnel, to take on an expanded role in data collection and management of the relevant data systems. Additionally, it was thought that obtaining compliance of fisherpersons with any new registration or licensing requirements would be problematical.

CFRAMP brought two officers from each participating country to a combined Subproject Specification Workshop (SSW) in the latter part of June 1992. The participants at the workshop further developed and approved the activities to be carried out under the two subprojects. Earlier that same year, CFRAMP and OECS Fisheries Unit staff met and negotiated with officials of the Southeast Fisheries Center (SEFC) of the US Department of Commerce National Oceanographic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS), on the use and adaptation of the Trip Information Program (TIP) package, which was being used by that agency to store, on desktop personal computers, data collected by "port agents" along the southeast coast of the United States. The software package seemed ideally suited to the capture and storage of both present and future data needs. However, the software had been utilized in conjunction with the SEFC's mainframe computer via which medium data analysis and reporting was carried out. Given the inaccessibility of mainframe computers to regional fisheries divisions, and with the steadily improving capacity and versatility of personal computers, it was felt that the TIP should be adapted both to eliminate the complex data coding system which had developed consistent with mainframe use, and to provide querying and reporting capability within the software. The SEFC gave CFRAMP permission to adapt TIP accordingly, with the proviso that all adaptations had to be done with the consent and input of the Agency's senior programmer. In fact, it was an initial requirement that all programming to facilitate CFRAMP needs be done by the NMFS staff to the specifications determined by CFRAMP. The TIP package was presented to the SSW, which approved the adaptation of the software.

Simultaneously, CFRAMP and OECS/FU staff designed a Registration and Licensing software based on the OECS Fishing Vessel marking scheme (OFVMS) which had in turn evolved out of the FAO standardized vessel marking system. It was thought that the OFVMS and its attendant procedures provided a basis for a comprehensive Registration and Licensing system which could and would be adapted to meet ever changing needs of countries which were at different levels of registration and licensing system development.

A 1994 review of CFRAMP endorsed the approach taken to that point in time and made recommendations for refining the implementation plans of the two subprojects. The activities of the subprojects were further reviewed and refined based on recommendations made at a statistical training workshop held in 1995.

To date both systems have undergone numerous modifications/upgrades that were requested and influenced by the Member States. Programming support and technical assistance have been provided by CFRAMP and the OECS.

General Installation Tips

The first general rule that should be practiced before the re-installation of TIP or LRS, is to back-up (or copy) the existing data (and application if necessary). Any available backup facility could be used, providing that the user understands clearly how the result is achieved, and also how a successful restoration is done. For example, if PKZIP or WINZIP is applied, not only must the user understand how these application process a back-up, but must also be able to comfortably manipulate the software to achieve the desired end (backup or restoration). Today, various medium and back-up applications are easily available and quite affordable. To name a few that are in use among us are: the usual 3.5" floppy disks, super disks like the Zip and Recordable/Rewritable Compact Discs, and Tape cartridges. These, in most instances are distributed with Back-up and Restore applications.

It is necessary that one is aware of the software requirements for a successful installation and be sure that it can be accommodated by your hardware (memory, hard disk space available) and operating system. Become familiar with the installation instructions, options/choices, and appreciate how the new installation will affect the existing system.

All attempts should be made to produce a working/disk copy of the software, and have the original safely stored.

During installation, the process should be closely monitored so that the best response is provided when prompted. Upon completion, start the software, examine the end product and confirm the successful importation of data etc.

Introducing the upgraded Trip Interview Program (TIP) and the Licensing and Registration Software (LRS)

TIP 4.0

The purpose for the modification of the Trip Interview Software was to make it operable after the January 1, 2000 roll-over. This was particularly important since the date values play a mandatory role in capturing TIP "Interview Date", generating "Sequence Numbers", and capturing date data where applicable.

The following gives a general account of the modifications:

- The date was displayed on TIP Entry, Modify, Delete, Defaults, Lists, etc screens in the format MM/DD/YY. This date field has been edited to reflect the format MM/DD/YYYY.

- The "Interview Date, and "Reporting Period" (Start and End dates) fields are formatted to MM/DD/YYYY.

- On occasions where the user is prompted to input a date value, the entry field has now been modified to accommodate the century as well as the year value.

- Each record is identified by a unique Sequence number. This number is generated every time a new Interview is entered, and is partly created by attaching the year value to the front of the number. This number is also the key to accessing, querying, and reporting data from TIP databases. The process used to generate a new Sequence number has now been programmed to include the century as part of the Sequence number.

LRS 3.0 (and 3.1)

The modifications to LRS came about as a result of needs expressed by Member States. The following gives a general account of the upgrade.

- **The Pick** option located on the Help Menu updates without having to exit and re-enter LRS. A number of new fields (Sex, VeClass, PortReg, PlfType, PondSize, FarmType, PlantGear, ProdLevel, PlfType, and Sources) have been defined and values are to be added, especially for new database files.

- **Fisher Registration database:** Contact and Gender Information is captured. Port of Registry values have been moved to the PICK file. This is an attempt to accommodate those Member States whose registration is implemented by Areas or Zones.

- **Vessels and Fishers Licence:** a new database and fields were added to support the detail side of adding Restrictions or Permissions, thus replacing some fields in the existing database.

- **Aquaculture registry: a** new database and fields were added to support the detail side of adding Production Information, removing some fields from the existing form.

- **Processing Plant** registry: A new database and fields were added to support the detail side of adding Processing information, removing some fields from the existing form.

- **Utilities** Menu: Standard Reports - A facility whereby Standard Reports may be appended, after they are created.

- **Browse** menu: A browser been added to the browse menu pad, named **Quiky**. This is available for all Registries.

Querying capabilities

As a result of attempting to deal with the various types of data in a single data system, TIP and LRS data structures are somewhat complex. The options available in the reporting menu, and specifically the querying module, are designed to make the retrieval of data less laborious than it could be. TIP and LRS data are stored in several files, and a single file must be created to reduce the complexity of the data retrieval process. Since the FoxPro querying module is not distributable, a customised application was adapted to accomplish the same result. This is achieved using FoxPro's Relational Query By Example (RQBE) Structured Query Language (SQL) Select statement. Additionally, extractions can be used to create files that can be used with other programs such as MS Excel, Lotus 123, Dbase, MS Access etc. The second part of the process is the use of FoxPro Report Writer to create/customise reports .

Data Management Tips

General good data management practices involve:

- Execution of a security system where data (hard and electronic copies) is stored.
- Implementation of a sound data collection system.
- Scheduled regular backup of data, having a set stored off site.
- Quality control measures that would allow the data manager to determine whether recently entered data has been entered as required.
- On-going analysis/review of the system, making adjustments/modifications where necessary.

Strengths and Weaknesses of TIP and LRS

Since the introduction of TIP and LRS, a number of measures/activities have been carried out with the intention of bringing the applications to a level where they fully support national Catch and Effort, and Registration and Licensing data systems. To date, ongoing monitoring activities have led to the granting of various kinds of assistance to member states, as a means of achieving the highest level of efficiency from these applications. One can sum up the general strengths and weaknesses of the applications as follows:

Strengths

- Querying and Reporting facilities provide flexibility to achieve desired outputs.
- Systems can be customised to support the culture of national data systems.
- Both applications have the capacity to hold all the data the region possibly needs in fisheries.
- Support is readily available within the region.
- TIP and LRS do not demand much of the system's (computer) resources in order to operate smoothly.

Weaknesses

- TIP more than LRS, has a long learning curve.
- Because they are both dependant on certain type of data that feed the "linking" fields, when this data is not accessible (not inputted), the operations of the applications become very unstable.
- TIP and LRS do not compete very nicely with a number of other like packages, simply because they operate in the DOS environment. Although they were designed to closely resemble the graphical user interface, there are still some attributes lacking, resulting in the appearance of "not-so-user-friendly".

A Summary of the technical aspects of the Present and the Future of TIP and LRS

TIP and LRS evolved in the CFRAMP participating countries at a period when the development and implementation of automated fisheries management tools were recognized as a mechanism that would facilitate the identification of the strategy for bringing about optimum utilization of the available human and physical resources in our small countries. Also, at that time, the availability and use of personal computers (PC) as standard office equipment were increasing in our region. It was also the period of the Disk Operating System (DOS). Some computers did not need a hard disk drive to host the operating system, in order for them to become operable, and, in instances where a hard disk drive was installed on the computer, the capacity was significantly small when compared to what is the standard hard disk size today.

Ideally, TIP was designed to operate on any IBM compatible PC with a hard drive with at least 4 megabytes of free space and a minimum of 640K of main memory. It was designed and compiled using FoxPro version 1.01(DOS based), and did not require that FoxPro be resident on the computer.

It is important that we are reminded that TIP was adapted from the Southeast Fisheries Centre (SEFC) of NOAA's National Marine Fisheries Service, and that the package was mainly designed for catch and effort data storage, in conjunction with the analysis and reporting capability provided for on their mainframe computer. The software package seemed ideal for our present and future needs in relation to the capture and storage of catch and effort data. However if we were to apply the software to our situation, it would have had to also address our querying and reporting needs. Equally, since mainframe computers were not accessible to our region's fisheries divisions, the structure of the software must be modified to facilitate full manipulation of the software on personal computers.

Since FoxPro was now introduced as a database management software, it seemed logical to have the LRS designed using this software as well.

The CFRAMP took the necessary steps to facilitate/accommodate the introduction of FoxPro programming language to our lead agencies (CFRAMP and OECS). I.e., they aided the procurement of FoxPro software and the training of individuals, strengthening the institutions that would subsequently provide technical assistance to the member states. Consequently, the inclusion of the querying and reporting capability became a very extended, constantly frustrating, and tedious process, especially since the outputs were informed by the member states. Some of us may remember when an extraction took overnight to process. At present it is almost instant!

To date these software have undergone numerous modification, with the objective to achieve maximum compatibility and efficiency. FoxPro 2.5b facilitates their operation. Over the past years as the culture of the standard operating changed, the need was felt to migrate the software to an environment compatible with the existing norm. This would not have only granted a level of comfort that would ease the manipulation of the software, but also aid the inclusion of OLE objects to represent data. However, the factors facilitating this goal were all never favorable at the same time. For example, at one point the "uncertainty" of the extension of CFRAMP seemed problematic. The ideal situation would be to have in place, a working tool than one that was halfway complete. At another point, financial constraints and limited human resources did not encourage the commencement of this activity.

We have come to the place where this issue could be addressed. Considering a number of elements, for example available technical support for operating systems, programming and maintenance support (both financial and technical) for the outputs during and after the CFRAMP, our first step would be to decide on the database management software that would facilitate this long awaited goal. Of course a consultative process would better inform the final decisions taken. The result may be a collection of a number of outcomes. For example the names of the TIP and the LRS may change, the operating system under which they are designed would change, but, the content would remain.

Today, a number of Microsoft (MS) Windows driven database programming software and associated training are widely available. The following are a few recommendations that could be considered during the consultative/review/ analysis process:

- MS Visual Foxpro
- MS SQL (server/database)
- MS Visual Basic

APPENDIX 6
SHRIMP PORT BIOLOGICAL FORMS

HEAD-ON SHRIMP PORT SAMPLING (SUJAFI)
FISHERIES DEPARTMENT, SURINAME

Company :
Landing date :
Size category :
Vessel :
Sampling date :
Samplers :

No.	Species ([illegible]P,W)	Maturity & sex (A,B,C,M)	Total weight (gr)	Carapace length (mm)	Abdomen weight (gr)	Abdomen length (mm)
1						
2						
3						
4						
5						
6						
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3.3 National Data Management Software System (Proposed Way Forward)

National Data management Software Systems 2
(Proposed Way Forward)

by

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Objective

To develop a new software (taking portions of TIP/LRS and create a new database using a database development tool) or upgrade TIP and LRS (decision need to be made by member states)

Activities

In developing a new software or upgrading TIP and LRS the following will be done:

- Thorough review of the TIP and LRS data fields
- Design the new database or upgrade TIP and LRS
- Develop the database
- Test and debug software
- Prepare User manuals
- Train Fisheries Departments staff
- Deploy and configure software

Approach

- Consultant in collaboration with Fisheries staff and CFU will conduct review
- Workshop-to present review findings and database design
- Consultant will refine design based on Workshop recommendations
- Consultant will then proceed to develop database/upgrade TIP & LRS
- Consultant will develop user manual, train staff and deploy and configure database.

Expected Outputs

- A reliable, effective, accurate, functional and user-friendly database software.
- Simple end-user manuals.
- Fisheries Department staff trained.

Proposed Database Software Development Tools

- Microsoft Access
- Microsoft SQL Server
- POSTGRES

Microsoft Access

Advantages

- Simple
- Readily available
- Excellent for small simple databases
- Easy to learn
- To develop/change database structure can be done quickly
- Good for short-term solutions

Disadvantages

- Stability, reliability, efficiency and functionality questionable – complex databases.
- Too easy to change the structure of the database.
- Networking and security capabilities may not be adequate for the Regional Database connectivity.

Microsoft SQL Server

Advantages

- High-level reliability, consistency and functionality
- System not too complicated and does not require high level computer expertise
- Caribbean expertise available
- Allow the development of complex databases

Disadvantages

- Fisheries staff will need training
- More expensive than Microsoft Access

POSGRESS-Linux based

Advantages

- Cheap-actually it is free
- Excellent for developing complex systems
- Networking security capabilities excellent

- Very stable system

Disadvantages

- Requires Linux operating system
- Availability of experts limited

3.4 ALTERNATIVES TO CONVENTIONAL DATA SYSTEMS

Alternatives to Conventional Data Systems
By
Stephen Willoughby

This document is based on the methodologies and approaches expressed in
"Alternative Directions for Small-Scale Fisheries Management", (Berkes *et al*, 2000),
"Introduction to tropical fish stock assessment. Part 1-manual", (FAO 1992).
"Guidelines for the routine collection of capture fishery data", (FAO 1999).

Conventional Data Collection Methods

Fisheries managers and policy-makers need to understand the dynamics of the fisheries sector and its linkages with other sectors to set policy, manage fisheries, evaluate and monitor the performance of management measures. Data collection and analysis are essential to provide the information necessary to inform decision-making by fisheries policy-makers, planners and managers. There are several data collection methods available to fisheries managers. The choice of method will depend on the data collection strategy, cost, type of data, accuracy required, collection site, fishery, and the skill of the data collector. The main data collection methods are:

1. **Examination of available records**. Written information may be found in studies done by local and international agencies, and Universities, statistical reports, government files, newspapers, sales receipts, tax records and records kept by wholesalers, retailers, importers, exporters, landing site records, processing plants, fishing boat and licence registers. This data collection is used to provide information on past and present operations in the fisheries.
   Note of caution**:** *The data found in records may have been generated by the use of inadequate data collection methods; statistics may have been inflated or in some way biased, especially by the attitudes and values of the authors.*

2. **Interviews**. Interviews involve questioning persons who can provide reliable information on the topic being investigated. Interviews are done either by:
   (i) Structured interviews using survey forms or questionnaires that are filled in by either the researcher or informant – the questionnaires should be pre-tested, questions should be simple and as clear as possible.
   (ii) Open interviews where notes are taken while talking to the informant. This needs well-trained interviewers, as they are often required to interpret and analyze information while conducting interviews.

Interviews can be used to obtain almost any information, for example, background information of fisheries, socio-economic information and information to develop questionnaires for sample surveys. Questions may be blanks to be filled in, multiple choice or open-ended.

<u>Note of caution</u>***:*** *The information obtained from a structured interview represents an opinion and therefore may not be accurate; interviews require high level of literacy among the respondents; and could be expensive.*

3. **Surveys**. Surveys enumerate fisheries units that can be observed and counted. The enumeration may be done as either a census or a sample survey.
   (I). A census survey is designed to determine the total number of variety units in the fishery. For example, landing sites, boats, fishers, buyers and gear.

   (II). Sample surveys are done in situations where complete enumeration is expensive and time consuming. Data should be collected by random sampling.

<u>Note of caution</u>***:*** *Data from sample surveys may contain systematic errors and biases if data were not collected by random sampling..*

4. **Direct Observation:** Direct observation involves taking measurements on fishing vessels, at landing sites, processing plants, or in markets (FAO, 1999). The information that can be collected by this method includes catch (landings and discards), effort, gear, operations, environmental variables (sea temperature, and stare), biological variables (length, weight, age), the value and quantities of the landing and sales (FAO, 1999).
   <u>Note of caution</u>***:*** *Observers should not be involved in other fisheries activities such as enforcement, licensing or tax collection. The involvement of observers in other activities*

will increase the possibility of biases and unwillingness of target individuals to cooperate.

5. **Reporting:** Fishers and stakeholders report their activities. Reporting reduces administrative cost to fisheries departments since data are complied by persons other than fisheries staff. These reports include logbooks completed by fishermen, and forms completed by companies, processors, markets officials, processors, fishers and custom officers. These provide valuable data of the harvest and post harvest sectors, fish sale and trade.
   Note of caution**:** *This method requires literacy and the cooperation of target individuals, may need to be supported by registration, risk of under reporting and distortion of data. Therefore data need to be validated.*

Conventional Approached to the Analysis of Fisheries Data

Conventional approaches to the analysis of fisheries data focused on the use of mathematical models along with various assumptions to predict the future yield, biomass and value of the catch under varying conditions. The two main groups of mathematical models are the "holistic models" and the "analytical models" (FAO, 1992). The holistic models consider a fish stock as a homogeneous biomass and utilize catch and effort data to estimate the maximum sustainable yield (MSY), see Appendix A. Holistic models are used in situations where stock data are limited. The surplus production methods and swept area method are commonly used holistic models. The surplus production model uses time series catch per unit of effort, usually for at least year, from sampling the commercial fisheries. The swept area method is based on research trawl survey catches per unit of area.

The "analytical models" are "age-structured" models. They require a detailed description of the stock in terms of the age or length composition and mortality rates to estimate MSY, see Appendix B. Analytical models require large quantities of quality data on the length, age and mortality of the stock.

The mathematical models require inputs of growth and mortality parameters that are obtained from by preliminary analysis of the field data - catch and effort, age or length frequencies. Appendix C shows a flow chart of the steps in analyzing the data to provide estimates of MSY.

New Approaches to Data Collection

Conventional data collection has focused on collecting data to estimate parameters required for stock assessment models which predict future catches, stock biomass and value of large, single-stock fisheries that use a single type of fishing gear. These stocks are typical of commercial-scale fisheries in temperate areas. Conventional fisheries manager and fisheries scientists felt that both the problems and solutions could be clearly specified once sufficient data were plugged into the right stock assessment model. These approaches require extensive research, sophisticated models, large amounts of quality data and highly trained experts. They have not adequately served the needs of many small-scale fisheries that are characterized by coastal multi-species stocks, multiple types fishing gears and limited resources for data collection.

There is a need to move towards fisheries management and data collection approaches that are cost-efficient and can work with less data inputs than the data demanding conventional approaches. They should also be simple and practical so that they can be developed and implemented by generalists with a broad working knowledge of the fisheries. The new approaches must:

- Address multiple-species fisheries and ecosystem health
- Pay greater attention to the social issues and people's use and misuse of marine resources.
- Consider economics variables that emphasize the benefits and costs of not only individual fishing boats and fishing fleets, but also fishing households and communities.
- Contain management regimes that go beyond command-and-control measures. The new regimes should be creative, innovative and involve new concepts, approaches, tools, methods, and management and conservation strategies, some of which will require significant changes in the conventional approaches.

Several new or revised approaches have emerged in recent years and are now available for the use of fishery managers and scientists (Berkes, *et al*, 2000). The new approaches use a wider variety of information types, sources and methodologies than may be typical for conventional fisheries assessment. These new approaches include (see Appendix D for definitions and further explanations of the concepts used below):

- Wider range of methodologies. Methodological approaches with broader emphasis on fishery management objectives. This is a more holistic approach that represents a shift in focus from assessment of the resource to assessment of the whole fishery including the fishers and their communities and the ecosystem of which the fishery is part. For example:
  - use of experts' judgement (a fisheries officer, researcher or fisherman of many years experience) to give initial assessment of trends and identify critical areas requiring immediate attention; experts' judgement may be both equally useful and more affordable than conventional data collection methods;
  - adaptive management is a learn-by-doing approach that relies on feedback learning to inform future policy; past failures are taken into consideration when developing future policies;
  - use of the best available information;
  - use of knowledge held by the indigenous people and the resource users.

- Participation. Participatory decision processes, rather than the usual primary focus upon fish stock assessment. The key elements are stakeholder participation in all aspects of the fishery and precautionary approaches to err on the side of conservation. Sharing of power and responsibilities between resource users and managers is essential. This collaboration is based on the principle of transparency and accountability.

- Population dynamics. Population dynamics with a secondary focus on the human dimensions of the fishery. The linkages between human and natural systems should be recognised and approaches developed to address them.

- New governance regimes. New governance regimes such as community-based management and co-management with the potential of addressing community development as an integral part of fishery resource management. Conventional approaches have focused on biology and, to some extent, economics without adequately addressing the socio-economic needs of fisher populations and the potential benefits of collaborative governance.

- Interdisciplinary approaches. Interdisciplinary and social science methodologies including
  - logical framework analysis - a tool for the conceptualization, design and execution of projects. It consists of a series of processes of stakeholder analysis, problem analysis, objective analysis. analysis of alternatives, logical framework matrix, execution plan, monitoring and evaluation plan and project reports.
  - technology of participation (Spenser,1998) - a group process designed to help groups think, talk and work together, it involves individual and group brainstorming and clusters the group's ideas into categories, and focused conversation for group reflection.
  - rapid appraisal survey - rapid appraisal techniques are useful in acquiring a wide variety of information including social, economic, institutional, organizational, technological, habitat, environmental and biological; rapid appraisal methods may range from interviews with key informants to scaled-down versions of conventional sampling.
  - fisheries management planning - involves data collection, analyses, and setting specified achievable goals, objectives and management measures,
  - fisheries ecosystem planning - addressing the problems and needs of fisheries at the ecosystem level
  - marine protected area planning - protect target species from exploitation to allow their populations to recover

- Incorporating fisheries issues. Incorporating fisheries issues in integrated coastal area planning and management and the use of a geographic information system (GIS) to provide visual tool for decision-making and conflict resolution.

- Use of low-cost journals. The use of no-cost or low-cost journals and grey literature reports that address tropical small-scale fisheries are invaluable information assets for the small-scale fisheries manager.

- Use of Internet. Cost-effective use of Internet resources to bring the fishery manager in easy access to global data resources, resource personnel, information exchanges, and information on funding opportunities.

- Use of computers. Increased accessibility to computers and user-friendly software provides tools to efficiently manage and rapidly analyse data and information.

- New focus. A people and objectives oriented approach, combining common sense and ecological knowledge about fisheries with the specialised analytical knowledge of fisheries science and management, (McConney 1998).

The first steps in utilizing the new approach is to identify the stakeholders and agree through multi-stakeholder processes on a shared vision of the fisheries, setting out clearly a picture of what the fishing industry of the future should look like if fisheries management were successful. The next step is to identify the issues that have to be addressed in order to realize the vision. There must be clear objectives, strategies and implementation plans using the most appropriate fisheries management approaches and tools, to deal with these issues. The path towards the vision can have a surprising array of obstacles and pitfalls. Among these are:

- Politics. Decision-making is directed by what is politically appropriate, rather than scientifically appropriate (Ludwig *et al.*1993).

- Lack of knowledge**.** Knowledge of fishery science and management is lacking among most fishers, some decision-makers and the general public (McConney 1997). It is necessary to convince all stakeholders that fisheries science and management are worthwhile in order to try to achieve consensus and make decisions for the industry.

- Stakeholders unwilling to collaborate. Stakeholders may not be willing to collaborate or participate in the consultative fisheries management planning process designed to give all stakeholders an opportunity to exchange information in order to try to achieve consensus and make decisions.

- Scarce resources. In Small Island developing states, the capacity for state management is severely constrained by scarce financial, human and physical resources.

- Limited access to research literature. Small-scale fisheries managers in developing countries cannot afford subscriptions to mainstream fisheries science and management journals. Even if they could afford it, small-scale fisheries are poorly represented in the mainstream literature that generally focuses on large-scale fisheries or temperate small-scale fisheries (Pauly, 1994).

- Data, time and finance demanding. Existing conventional methods developed for small-scale fisheries are still relatively data, time and finance demanding, compared to existing institutional capability.

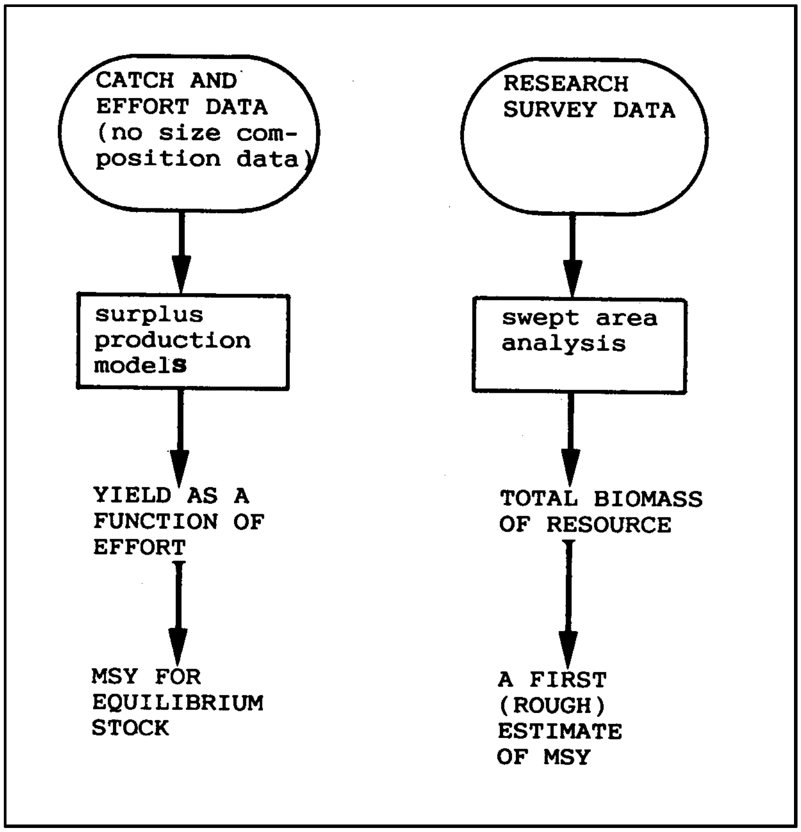
Conclusion

The conventional data collection approaches were focused on stock assessment and obtaining the data prediction models. There was little consideration of either the wider body of knowledge resident in the fishing industry, stakeholders and the fisheries' linkages to other sectors of the economy. The alternative approaches combine all parts of the fisheries system by involving, *inter alia*, a wider range of methodological approaches, stakeholder participation and consensus, cost efficient procedures, consideration all fisheries linkages, use local and traditional knowledge in decision making, empowerment of resource users. The way forward is not to abandon the conventional approaches, but to use them in conjunction with the new approaches to ensure food security and livelihood of fishers, and conserve the biodiversity of the resources on which the fishers depend.

Appendix A

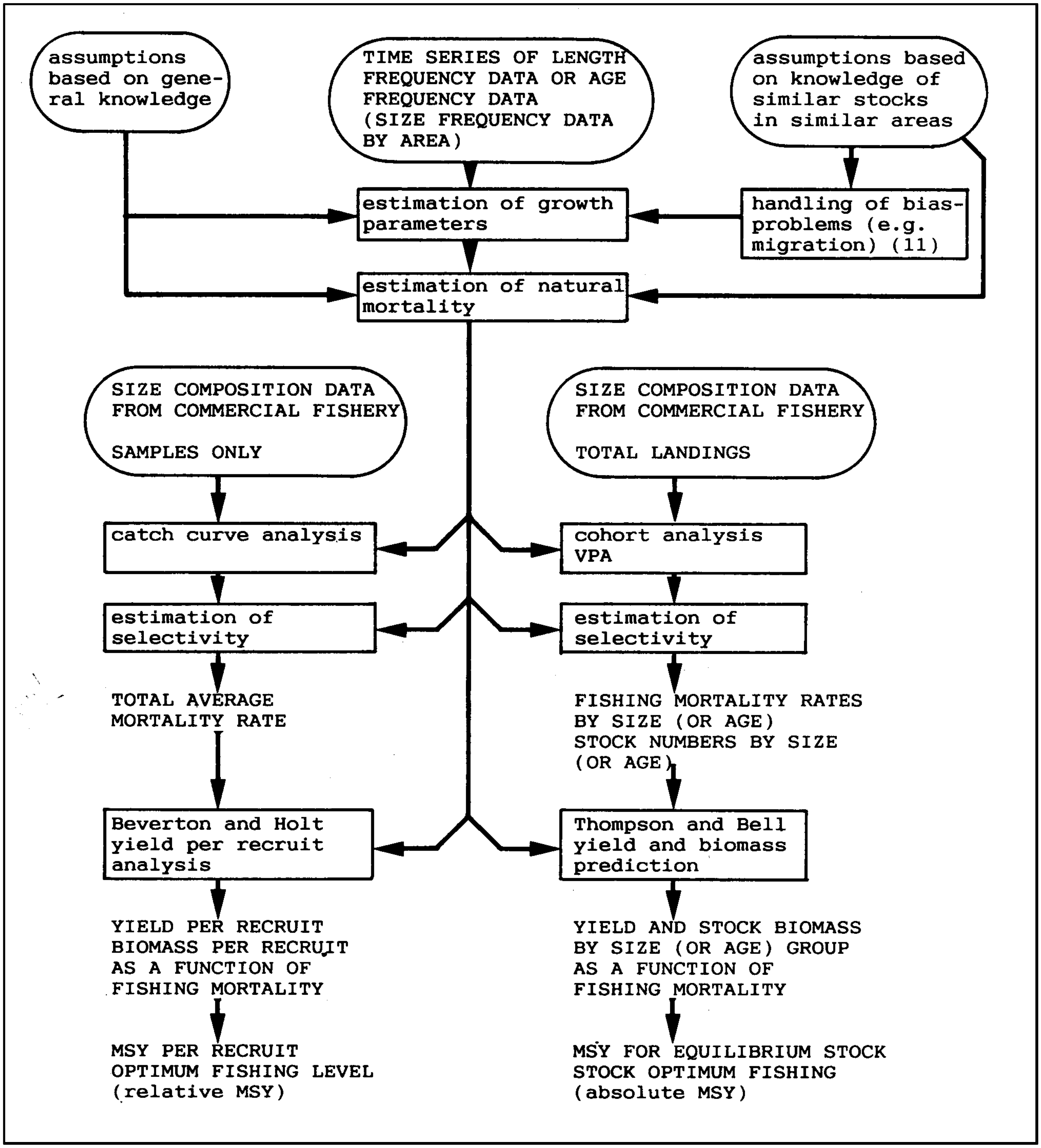
Flow-chart the "holistic model" of stock assessment

(FAO, 1992)


CATCH AND EFFORT DATA (no size com-position data)
RESEARCH SURVEY DATA
surplus production models
swept area analysis
YIELD AS A FUNCTION OF EFFORT
TOTAL BIOMASS OF RESOURCE
MSY FOR EQUILIBRIUM STOCK
A FIRST (ROUGH) ESTIMATE OF MSY

Appendix B

Flow-chart for the "analytical model" of stock assessment
(FAO, 1992)



Appendix C

General flow-chart for fish stock assessment

(FAO, 1992)

INPUT

FISHERIES DATA (+ ASSUMPTIONS)
(Data preferably by stock or species)
- Catch/effort of total commercial catch.
- Length- or age-frequency data from commercial fisheries or surveys with research vessels.
- Biological data (maturity stage, length/ weight etc) from research vessel surveys and/or from sampling commercial fisheries
- General knowledge of the biology of the species

↓

PROCESS

Analyses of historical data
- Estimation of growth parameters
- Catch curve analysis
- Virtual population or cohort analyses
- Surplus production models

↓

INTERMEDIATE OUTPUT
(used as input for the next process)

ESTIMATES OF POPULATION PARAMETERS
- Von Bertalanffy growth parameters
- Length-weight relationship
- Total mortality
- Fishing mortality and natural mortality
- Stock size (size composition of stock)

↓

PROCESS

Predictions of yield
- Beverton and Holt's yield/recruit model
- Thompson and Bell's model (for single stock or for mixed fisheries)
- Surplus production model
- Swept area method combined with a
- Gulland-type of model

↓

FINAL OUTPUT

OPTIMUM FISHING LEVEL
(the optimum level of fishing mortality)
- MAXIMUM SUSTAINABLE YIELD OR VALUE and present position with respect to optima

Appendix D

Definitions and explanations of terms and concepts used in the text
(The source of this Glossary is Berkes, *et al,* 2000)

Adaptive management: Often applied to systems on which there is insufficient information, adaptive management relies on feedback learning or learning-by-doing. Typically, experiments are designed to accelerate learning; policies may be used as experiments; and the distinction between the scientist, the manager and the resource user are broken down.

Co-management: A partnership arrangement in which government, the community of local resource users (fishers), external agents (non-governmental organizations, academic and research institutions), and other fisheries and coastal resource stakeholders (boat owners, fish traders, money lenders, tourism establishments, etc.) share the responsibility and authority for decision making over the management of a fishery.

Community: A social group possessing shared beliefs and values, stable membership, and the expectation of continued interaction. It can be bounded geographically, by political or resource boundaries, or socially as a community of individuals with common interests.

Community-based resource management (CBRM): This is a central element of co-management. CBRM is people-centered and community-focused, having a narrower scope and scale than co-management. Government most often plays a minor role in CBRM, providing mainly legitimacy and accountability, since only government can legally establish and defend user rights and security of tenure at the community level.

Community-centred co-management (CCCM): Includes both the characteristics of CBRM and co-management, i.e., people-centered, community-oriented, resource-based, and partnership-based. It has the community as its focus, but recognizes that to sustain such action, horizontal and vertical links are necessary, and meaningful partnerships can only occur when the community is empowered and organized.

Dataless management: This term describes a fishery management approach prescribed by R. Johannes in which management proceeds using available information from a variety of sources, and does not delay due to lack of technical information.

Ecosystem-based management: Resource management that takes account of interactions of a given resource with other components in the ecosystem in which it is a part.

Empowerment: Having the power and responsibility to do something; the ability of a person or a group of people to control or to have an input into decisions that affect their livelihoods.

Fisheries Management Plan (FMP): A plan to achieve specified management goals and objectives for a fishery or set of fisheries. It includes data collection, analyses, and management measures for the fishery.

Fishery Ecosystem Plan (FEP): This is a plan that addresses the problems and needs of fisheries at the ecosystem level. This differs from the usual management plan that deals specifically with the exploited resource. In the USA an FEP is required under the Sustainable Fisheries Act.

Geographic Information System (GIS): An information system that stores and manipulates data which is referenced to locations on the earth's surface, such as digital maps and sample locations.

Household: A basic unit for socio-cultural and economic analysis. It includes all persons, kin and non-kin, who live in the same dwelling and share income, expenses and daily subsistence tasks. The concept of household is based on the arrangements made by persons, individually or in groups, for providing themselves with food or other essentials for living.

Indigenous knowledge: Local knowledge held by a group of indigenous people, or local knowledge unique to a given culture or society; traditional ecological knowledge is a subset of indigenous knowledge.

Local knowledge: Knowledge based on local observations by resource users themselves; differs from traditional knowledge in not being multigenerational or culturally transmitted.

Management objective driven (MOD): This is an approach to fishery management in which research, assessment and management measures are based primarily upon the desired management objectives.

Marine protected area (MPA): A spatially defined area in which all populations are free of exploitation.

Maximum economic yield (MEY): This is the level of overall yield from a fishery that provides the maximum economic return as defined by the difference between the monetary cost of fishing and the monetary value of the yield.

Maximum sustainable yield (MSY): The largest average catch that can be taken continuously (sustained) from a stock under average environmental conditions. MSY is often used synonymously with the term Potential Yield as the target reference point to guide fisheries managers in resource utilization.

Optimum sustainable yield (OSY): This is a level of yield that is defined based on a combination and rationalisation all of the outputs that are considered to be important for the fishery in question, provided that these outputs are sustainable.

Precautionary approach: Set of measures taken to implement the precautionary principle. That is, a set of agreed cost-effective measures and actions, including future courses of action, which ensures prudent foresight, reduces or avoids risk to the resource, the environment, and the people, to the extent possible, taking explicitly into account existing uncertainties and the potential consequences of being wrong.

Social-ecological system: A term used to emphasize the point that social and ecological systems are in fact linked, and that the delineation between social and ecological (and between nature and culture) is artificial and arbitrary. The integrated concept of humans-in-nature.

Stakeholders: Individuals or groups (including governmental and non-governmental institutions, traditional communities, universities, research institutions, development agencies and banks, donors, etc.) with an interest or claim.

Stakeholder analysis: This is a process that seeks to identify, and to describe the interests of, all of the stakeholders in a fishery. It is considered to be a necessary precursor to participatory management.

Stock assessment: The process of collecting and analyzing biological and statistical information to determine the changes in the abundance of fishery stocks in response to fishing, and, to the extent possible, to predict future trends of stock abundance.

Stock assessment driven (SAD): This is an approach to fishery management in which conventional quantitative stock assessment aimed at estimating present and desired levels of fishing mortality, is considered to be a prerequisite to management, and becomes the top priority activity.

Stock: A grouping of fish usually based on genetic relationship, geographic distribution and movement patterns that can be considered a discrete entity for management purposes.

Technology of Participation is design and problem-solving tool that generates creativity and consensus from a group by having all participants involved focused discussion.

Traditional ecological knowledge: A cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment.

Traditional knowledge: A cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission.

Yield: Catch in weight. Catch and yield are often used interchangeably.

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3.5 THE IMPORTANCE OF COLLECTING OTOLITH INFORMATION IN FISH STOCK ASSESSMENT

Age and Growth Studies at the CFRAMP/IMA Regional Age and Growth Laboratory. The importance of collecting otolith information in fish stock assessment – Suggestions for a way forward.

by

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1.0 Introduction

Information on growth (length and weight), mortality (both fishing and natural mortality) and maturity are examples of time related processes which are key items in the analytical assessments of fish stocks (Eltink et al. 2000). Due to Age readings of calcified structures these processes can be related to time e.g. weights (lengths) at age, fishing mortality by year, maturity at age etc (Ibid.).

Fisheries managers should be acutely aware of the quality of their data as it impacts not only on the fish resources (managers often use their biological advice, for example, to set Total Allowable Catches (TAC's) and mesh size regulations), but also on the livelihood of fishers, the linkages in related sectors of the economy as well as regional and international obligations. The end users of fisheries management advice are far-ranging, therefore fisheries scientists have an ethical responsibility for the quality of their data.

The fisheries scientists involved in stock assessment are the users of age readings. Errors in age readings will especially affect the estimates of recruitment but also, to a lesser extent, the estimated fishing mortality and spawning biomass (Ibid), therefore it is important to exclude inconsistent age determination as a factor in the evaluation of stock assessment problems. Consequently the responsibility for good quality data must also be shared by the age and growth expert.

Under the CFRAMP Subproject "Large Pelagics, Deep-Slope and Reef Fishes Resource Assessment", the capabilities for providing age and growth information through age reading of calcified structures was enhanced by strengthening the institutional capabilities present at the Institute of Marine Affairs (IMA) through the recruitment of staff, the procurement of equipment and a training consultancy.

This document attempts to advertise the development of the Laboratory since its inception from 1995 and to highlight the progress of the Laboratory in the following areas such as sample preparation, image processing, age determination, data analysis and quality assurance (QA). The authors of this report also identify some of the existing problems and offer some reasons for them as well as attempt to suggest a way forward for the Age and Growth Laboratory in the context of regional fisheries management.

2.0 RESULTS

Laboratory Protocol

The assignment of an age to a particular growth pattern on a calcified structure is not an exact science as there is understandable drift between readers and within readers over time and some species present more problems than others. Therefore much attention must or should be spent on ensuring the quality of the age readings and hence the reliability of the outputs from any Laboratory. The concept of age determination as not being an exact science should be taken within the context of similarly assigning age groups based on the identification of modes from length frequency samples.

It should be noted that many of the procedures and ideas outlined here have been developed by the Laboratory during the course of the age determination process and have resulted from numerous re-iterations as issues and difficulties arose with each species. Figure 1 outlines the basic protocol established by the CFRAMP/IMA Age and Growth Laboratory. Note that quality assurance assumes the best practice possible at each stage of the protocol given the Laboratory capabilities. The experience gained by the staff of the Laboratory is inherently incorporated into the Laboratory protocol.

Receipt of hard-parts

Otoliths samples received by the Laboratory are assigned a unique sample number and an inventory of the status of the hard parts (number, type and condition) is done for each species. This data, together with biological information sent by the country, is stored in a database specific for each species. The integrity of the links between the data is maintained through this specific sample number. Checks by the data collectors in the countries and re-checks by their respective fisheries officers to ensure that all the information is collected is critical as otoliths sent to the Laboratory minus the associated length information, for example, is meaningless and invariably at a cost. Information on the fishing gear, fishing ground/area and the type of length measurement is also sometimes omitted. Sex data is especially important for a species when the sexes exhibit differential growth rates e.g. *Acanthocybium solandri* (wahoo).

Hard-part Preparation

Detailed accounts of hard-part preparation by the Laboratory are found in Kishore (1998) and Kishore and Chin (2000). The Laboratory's procedure for hard-part preparation has evolved with the assistance of a training consultancy (Campana 1996). Transverse sectioned of otoliths and spines are routinely used for ageing. A standardised format for this preparation has been established, however, it is flexible enough to deal with species that have been not been aged previously. For example, *Caranx hippos*, the black cavali from Trinidad has not been previously aged using hard-parts. To determine the best choice of hard-parts the Fisheries Division in Trinidad collected the three pairs of otoliths, dorsal spines and vertebrae. These hard-parts were evaluated using the Laboratory's standard protocol but also included staining techniques adapted from ageing procedures used for sharks. In this manner staff outside of the Laboratory played a key role in the development of this evaluation procedure of the Laboratory.

This process can be adapted for any new species to be aged by the Laboratory. Apart from establishing the best hard-part of choice, it also establishes and fosters linkages between the Laboratory and other resource personnel in the countries who are involved in the assessment of the fishery. Linkages may be formal and informal all of which contributes to the continued dialogue among users that is needed in the age determination process.

Age Reading Equipment

The age reading equipment of the Laboratory comprises of a computer linked to the OLYMPUS SCT stereomicroscope via a video camera. The image analysis software is OPTIMAS 5.1. The Laboratory has received a new computer and image software system OPTIMAS 6.5. While not functional as yet it is expected to help considerably in improving the quality of images captured, improve storage space, training in the age determination process and the role of digitised images in the development of reference collections.

One of the drawbacks of the reading equipment is the lack of training that the resource personnel working in the Laboratory have had with the image analysis software OPTIMAS. This reduces the degree of confidence in operating the equipment and reduces the benefits of the image system.

Annulus Interpretation

Many of the annular patterns observed on the sectioned otoliths and spines were first determined with the assistance of the CFRAMP age and growth consultant Dr. Steven Campana during a two-week training session held during April-May 1996. Some of these interpretations were adjusted and refined by the Laboratory as the receipt of samples, particularly those of larger individuals, increased. Some issues related to annulus determination are the criteria for genuine versus false rings, number and locations of reading axes, potential age reading problems such as the presence of double rings, juvenile growth and edge patterns.

The Laboratory is continually refining its approaches to deal with problems that may arise for a given species. Previous annular assessment of *Acanthocybium solandri* (wahoo) by Campana (1996) indicated that this species could not be aged using otoliths and recommended the examination of sectioned fin rays, vertebrae or opercula for annular patterns. This recommendation was based on the limited samples available at that time and particularly the number of large individuals. Subsequent examination of both pectoral and dorsal spines by the Laboratory of wahoo collected at a Hard-part Removal Workshop in St. Lucia revealed unclear banding patterns. However the lack of associated length data for these samples made this examination inconclusive.

The Laboratory staff was able to obtain samples from large individuals for annulus determination because of the availability of samples from the Gamefishing tournaments in Trinidad. In the routine examination of *A. solandri* (wahoo), interpreting any annular patterns on the cross-section of the otolith was very difficult and it necessitated the examination of the whole otoliths, which proved to be easier, Figure 2 and Figure 3 (images of whole and sectioned otoliths of wahoo).

Each annulus for a given species was interpreted as comprising an opaque (white under reflected light) zone and a translucent (dark under reflected light) zone. Annuli for the reef species were counted using the opaque zones, whilst for the pelagic species translucent zones were counted. Annuli at the margins of the otoliths were included for age determination. To date the Laboratory has been able to interpret annular banding patterns on 24 species sent to the Laboratory, inclusive of CFRAMP and non-CFRAMP species, Table 1. Figures 4 to 8 (*Lutjanus synagris*, *Holocentrus rufus, Epinephelus guttatus, Balistes vetula, Acanthurus chirurgus*) illustrate some of the annular banding patterns on the sectioned otoliths and sectioned spines of *B. vetula*. The images show that the patterns vary considerably with some exhibiting broad banding patterns to narrow bands on the edge indicating several types of growth patterns. For some of the species aged by the Laboratory it represents the first ageing for that particular species in the Caribbean. In the cases of the wahoo and *Lutjanus synagris* (lane snapper) they show presumed annular patterns with exceptional clarity.

Implicit in this range of annular patterns is the degree of difficulty that the readers have to work with. Given the level of experience of the reader and the quality of the image analysis tools available it is unwise to expect any given reader to carry out age readings for all specie as is currently the case. It is suggested that an increase in personnel would allow for some degree of groupings or specialisation for a particular reader (e.g. pelagics versus reef species).

Growth Parameters and Growth Curves

Observed mean length-at-age data from the age determinations were used to generate the following growth parameter estimates using FAO-ICLARM Stock Assessment Tools (FiSAT) computer program. Preliminary growth parameter estimates for 9 species have determined because of the limited data sets received by the Laboratory, Table 1.

Balistes vetula

The growth parameter estimates for *Balistes vetula* (queen triggerfish) based on the von Bertalanffy growth model, are L_∞ = 75.0 cm, K = 0.07 yr^{-1} and t_0 = - 4.33 yr, Table 1. The resulting growth curve (Kishore and Chin 2000) shows that while there is a good spread of age groups, presence of small samples and the absence of age I fish, contributed to the high t_0 value. For this species more samples of the younger age groups are needed to refine the growth parameter estimates. Generally growth parameters are determined by the size of the sample, the length of the largest fish, the age of the oldest fish, the separation or lack of separation of sexes and methods of back-calculation.

Lutjanids

Despite the very clear annular banding patterns for *Lutjanus synagris* (lane snapper) from Belize, Figure 4, the resulting growth curve in Kishore (2000) reflected by the growth parameter estimates of L_∞ = 26.5

cm, $K = 0.13$ yr^{-1} and $t_0 = -10.0$ yr, demonstrates how the lack of representative sampling can affect the generation of good results. Several reasons could have caused these results such as the small sample size (n = 88), general absence of Age I and II fish, under representation of samples at extreme ends of the size range and small number of samples within the age groups.

When the growth parameters from this study (Kishore 2000) are compared with other studies for the Caribbean (Rodriguez Pino 1962, Claro and Reshenikov 1981, Manooch and Mason 1984, Manickchand-Dass 1987, Pedroso and Pozo 1991, Pozo *et al* 1991 and Johnson *et al* 1995), the growth parameters particularly the L_∞, values are lower than expected. However with the exception of Manooch and Mason (1984) and Johnson *et al* (1995), all other studies for the Caribbean are based on annular interpretations using whole otoliths. However ages determined for the lane snapper by this Laboratory are comparable to Johnson et al (1995) for lane snapper for the northern Gulf of Mexico whose 9 years olds range from approximately 30 to 50 cm and whose oldest fish was 17 years at a length of 50 cm.

Important additional factor which can results in major differences are the type of interpretation applied to the banding patterns seen on the hard-parts and the methods of preparation and the imaging tools available for age analysis. Therefore before any conclusion can be drawn on the growth pattern determined by the Laboratory for the lane snapper from Belize, more samples covering the entire size range and adequate sample number within an age groups are needed to confirm this growth pattern. If this growth pattern is confirmed, then the obvious implication is for a slow growing rather than a fast growing stock and with the resultant implications for management of this stock.

Ages determined from samples of *Lutjanus vivanus* (silk snapper) from Dominica ranged from 2 to 8 years. The resulting growth parameter estimates derived from these samples are $L_\infty = 58.5$ cm (TL), K = - 0.133 yr^{-1} and $t_0 = -0.342$ yr, Table 1. Comparison with other growth estimates from Cuba (Richardson-Drakes et al, in press) using hard-parts show lower values for L_∞. Small sample size (n=56 for Dominica versus n=727 for Cuba), the absence of young fish, and the interpretation of annulus formation (whole versus sectioned otolith) and imaging tools and techniques are factors, which may have resulted in the differences. Again it is recommended that a larger number of samples more representative of the size range be obtained to add to the present data set to refine the growth parameter estimates of *L. vivanus*.

Doctor fish

The limited size range again affected the growth curve (Kishore and Chin 2000) and generating growth parameter estimates of $L_\infty = 39.0$cm, $K = 0.083$ yr^{-1} and $t_0 = -4.307$ yr, Table 1. The length range was from 10 – 26 cm (TL) spanning the 7 age groups. Of the 167 samples received by the Laboratory, 153 were in the 11 – 20 cm size range.

Craig (1999) noted that for the surgeonfish *Acanthurus lineatus* in Samoa, equally good but very different fit to the same data when the youngest fish were excluded, resulting in different growth parameter estimates based on the von Bertalanffy growth model. This occurs because K and L_∞ are strongly age-dependent. He also noted that the sliding scale of K and L_∞ values introduces considerable subjectivity into the analyses. This uncertainty is amplified when the values are used to estimate natural mortality or total mortality from length-converted catch curves. A stock might erroneously be managed as fast-growing, short-lived species. One suggestion from Craig (1999) is the recognition of two separate growth phases in the growth curve. The data for *A. chirurgus* from Montserrat also suggests that this fish exhibits very fast growth in the first few years of life followed by a long period of asymptotic growth. This type of growth pattern was also noted by Choat and Axe (1996) for 10 species of acanthurids from eastern Australia, which exhibited 80% of linear growth in the initial 15% of the life span with life spans ranging from 30 to 45 years.

It is recommended that a better representative sample of the age groups be obtained to refine the growth parameters and to provide a more confident estimation of the growth pattern for this species. The growth curve and growth parameter estimates developed by this Laboratory represent the first description of age and growth information for this species for the region using hard-parts.

Squirrelfishes

For both of these species *Holocentrus adscensionis* and *H. rufus*, the size range was again narrow. For *H adscensionis*, of the 106 samples received, 101 were from the 16 – 25 cm size range while for *H. rufus*, of the 166 samples, 155 were from the 16 – 20 cm size range.

Despite the relatively good fit of the data to the von Bertalanffy growth model (Kishore and Chin 2000), the absence of young fish and the small size (length) of the oldest fish has produced for *H adscensionis* the following growth parameter estimates, $L_\infty = 24.9$ cm, $K = 0.252$ yr^{-1} and $t_0 = -1.625$ yr, Table 1. This growth pattern is similarly seen for *H. rufus*, producing the growth parameter estimates $L_\infty = 19.55$ cm, $K = 0.16$ yr^{-1} and $t_0 = -10$ yr, Table 1. The presence of one fast growing Age I fish and small (length) but old fish of *H. rufus* has produced a high t_o value and low L_∞ value. Again it recommended that for both species young fish less than 15 cm be collected to aid in the refinement of the growth curve and growth parameters estimates.

Groupers

The two grouper species for which growth parameter estmates have been derived are the coney, *Cephalopholis fulva* (=*Epinephelus fulvus*) and the red hind, *Epinephelus guttatus* from Dominica and Grenada respectively. The samples of groupers received again were narrow in their size range. Although the data also fit well the von Bertalanffy growth model (Chin 2000), the small sample numbers of 30 and 56 for the coney and red hind respectively and the absence of young fish, affected the growth parameter estimates for the coney $L_\infty = 46.5$ cm, $K = 0.15$ yr^{-1}, $t_0 = -2.409$ yr and for the red hind $L_\infty = 47.26$ cm, $K = 0.133$ yr^{-1}, $t_0 = -2.409$ yr, Table 1.

However, despite small sample size, comparison of the growth parameter estimates for *E. guttatus* with those in the literature (Burnette-Herkes 1975, Sadovy 1992) are similar.

Wahoo

Ages for the wahoo range from young of the year to 10 years and the resulting growth parameter estimates, $L_\infty = 153.97$ cm, $K = 0.34$ yr^{-1}, $t_0 = -1.544$ yr, are seen in Table 1. This data shows a very good fit of the von Bertalanffy growth model, and shows good coverage of samples across the size range. Differentiation of half-years was noted for some samples of young fish late in the age determination process and was factored into the generation of these growth parameters. Re-aging of some samples therefore has to be done and the growth parameters refined. However this growth curve should be used with caution despite the good fit to the von Bertalanffy growth model because it uses data from several fishing areas across different countries. If the ongoing genetic studies on the stock composition (H. Oxenford pers. comm.) confirms the singular nature of the stock from these fishing areas then these growth parameter estimates can be used more confidently.

The difficulty in getting representative samples across the size range for a good estimation of growth cannot be understated. Sample collection for this species shows how the collective effort of users of the data can make the difference between good parameter estimates and poor ones. It included data collection from three fishing areas/countries (St. Vincent, Trinidad and Tobago), which were not previously part of the data collection program and required the collaboration of the CFRAMP co-ordinator, the staff of the Age and growth Laboratory and Gamefishers in Trinidad and Tobago. This interaction created an environment in which all end users of age determination accepted that they genuinely have shared ownership of the complete process from sample collection to age estimations. This interaction and consequent harmonising of efforts resulted in rapid collection of samples to permit an age interpretation, which gave a reference point for growth information.

Interactions with the gamefishers allowed the Laboratory to gain information about fishing grounds, peculiarities to fishing tournament and historical changes seen through the eyes of the fishers. Most importantly the Laboratory was able to obtain historical data for a ten-year period for the Carib Gamefishing Tournament held in Tobago. This information has been given to the Fisheries Division in Trinidad and Tobago for incorporation into their data collection. The benefits gained show the importance of meaningful interaction among all the stakeholders of this fishery. This type of data collection was important as it can be used to fill in data gaps for a commercially exploited fishery involving several countries. Additional information on sex means that the possibility of differential growth rates between the sexes can now be examined. It also emphasises that ageing involving hard-parts cannot be done in isolation from other activities within the stock assessment process.

Length/weight relationship of wahoo was determined from data gathered from the Gamefish Tournaments in Trinidad/Tobago and from the commercial catch from St. Lucia. Regression of the log transformed data revealed a very good fit $\lg y = 3.862 \lg x - 7.050$ (r^2adj = 0.9614). However the residual plot of this data showed two distinct groupings, which may indicate two separate populations. Additional samples of young fish from both fishing areas have to be obtained before this assessment can be used to complement the genetic research on stock separation.

<u>Quality Assurance</u>

There has been increasing pressure to provide a better and more reliable basis for assessments, and the age and growth aspect has been included in this repeated criticism that assessments of marine stocks are insufficiently reliable. The principal goal of this quality assurance (QA) process is the development of methods applicable to the range and scope of the fish age determination activities carried out within any institute, and that it is possible to clearly evidence the mechanisms which transparently sustain the precision and accuracy of the results (Mc Curdy et al 2000). The importance for such reliability in age determination lead to, in 1997, to the formation of the EU funded European Fish Ageing Network (EFAN) which now involves approximately 50 institutions.

Quality assurance in age reading is a cyclical process involving the development of procedures and protocol, the application of these protocols the inspection of the process and its outputs to ensure that an acceptable level of quality is being achieved and the revision of the process to improve where the required quality is not attained (Ibid).

The needs of the customer of the outputs of age and growth data are outside of the quality assurance process. However, it is the responsibility of the Laboratory to address these concerns and it is important to the end users to be aware of these needs and how it may ultimately affect the assessment of fish stocks in the Caribbean.

The various procedures outlined in the preceding sections and summarised in Figure 1, documented methodologies that have been developed and for which checks and balances have been introduced given the capabilities of the Laboratory in terms of its equipment and experience of resource personnel. Some of these checks and balances have been alluded to in the above discussion, however the following section will deal specifically the development of errors in age readings reference collections, and data management.

Because of the degree of subjectivity in age readings, tools such as age bias plots and coeffecient of variation (C.V) plots have been introduced to test the precision and accuracy of the readers. The Laboratory in its quality control currently uses these techniques together with comparison of annular measurements.

Many marks exist on the otolith however their pattern of formation is not consistent, suggesting that they might be reflecting something other than annuli. Therefore, a consistent and/or experienced reader is not necessarily an accurate age reader. To confirm accuracy, validation is required, i.e., the confirmation of the temporal nature of these presumed annuli. It is important to note that the appearance of these annuli change substantially in different environments, and annuli, which are valid in one area, may not necessarily apply in another area.

The Laboratory employs two validation techniques, which are tractable to the operations of the Laboratory. Marginal increment analysis which involves determining the temporal nature of the deposition of either the opaque or translucent zones by following the frequency of the edge types (opaque or translucent) of the sagitta with time. This was possible only for *C. hippos* and *Scomberomorus cavalla* as the data collected for these two species were collected monthly over a minimum of one year.

Microstructure analysis, another validation technique, was performed on the Spanish mackerel, *Scomberomorus brasiliensis* (carite). Lapilli of young-of-the-year (YOY) carite, up to and including the size of presumed first annulus formation (in the corresponding sectioned sagitta), were used to enumerate presumed daily increments.

The embedded lapillus of carite after polishing showed very clear presumed daily increments typical for species in temperate countries, Figure 9. These increments on the lapillus were extremely clear and regular, and while the increments were not validated (through chemical marking experiments) as daily, they can be safely assumed to be such (Campana 1996). Each presumed daily increment consists of a light and dark zone or band. A second order polynomial curve through the origin of the daily increments plotted against fish length fitted extremely well, suggesting a length of 47.0 cm (Kishore and Martin 1998). This data compares favourably with mean-length-at-age I of 47.1 cm and 49.1 cm for males and females respectively based on annular interpretations of sectioned sagittae. Validating the position of the first annulus on the sectioned sagitta was very important given the discrepancies of the mean length-at-age I present in the literature. Such a procedure can be similarly applied to other species for which the position of the first annuls is difficult to determine.

Critical to the integrity of the Laboratory operations is the development of reference collections. These are used to check age bias and precision of readers with time and among themselves. EFAN recognised three different types of reference collections (Eltink et al. 2000); sets of calcified structures of fish whose ages are either unknown or agreed or known.

The Laboratory has the capacity to develop a collection of unknown ages i.e. control collection. These are sets of calcified structures of unknown age, which are re-aged at regular time intervals by experienced age readers to estimate changes in the precision and relative bias at age over time. This collection should contain calcified structures, which are representative of the population at that point in time and not selected because of their quality. For the other type of reference collection, the agreed collection that may comprise of selected specimens from various workshops or otolith exchange.

Campana (1996) recommended about 100 to 200 samples be used for what can be described as a control collection. Because of the small sample sizes only collections for *B. vetula, C. hippos, S. cavalla H. adscensionsis*, *H. rufus, A. chirurgus* and a provisional one for *A. solandri* are possible.

Maintenance of these collections is extremely important, as deterioration of hard-parts is not acceptable. Proper methods for storing samples still need to be refined as the recommended adhesive glue used to fixed sectioned otoliths and spines unto plates (4” x 6”) of Plexiglass causes the sections to peel off after a period of time.

The reference collections can facilitate otolith exchanges between ageing laboratories. The objective of an exchange of calcified structures is to estimate the precision and bias in the age readings from age readers of different age reading laboratories (Eltink et al. 2000). This is extremely important to ensure that that the integrity of the Laboratory is not lost as result of ‘drift’ in age readings. The differences might not only be caused by age reading methods, but might also be due to different preparation methods of the calcified structures or the use of different calcified structures (Ibid). In addition the imaging tools and techniques available to the laboratories might also be different. It is essential therefore that there be compatibility between laboratories involved in such an exchange program.

The QA process is also dependent on the level of expertise of the staff based on their training in age determination. The staff of the Laboratory is very committed and highly motivated however more training in the use of the image analysis system and more experience in fisheries stock assessments is needed.

It is understandable that large amounts of data are used, generated and manipulated in the age determination process. This requires a great deal of quality control and is time consuming to ensure that the appropriate linkages between the databases are maintained at all time. The role of the data manager is a crucial one for this the person who is responsible for the effective operations of the Laboratory and the reliability of the outputs. Also the age readers are very important as they form the backbone of the Laboratory. Changes in age readers compromise the age determination process as it interferes with estimation of precision and bias among readers.

The demands for quality assurance increase the cost of age readings and these additional costs will have to be funded. Therefore the outputs of this Laboratory must be development within a framework of age versus length based approach to stock assessments. For example currently some of the parameters such as L_∞ cannot be used because the assumption of the length-based approach requires an L_∞ value higher than the L_{max} value. Whereas L_∞ values determined from hard-parts need not necessarily be higher, a general rule of thumb as indicated by Sparre and Venema (1992), the L_∞ value is approximately three-quarter of the L_{max} value. The integrity of the growth parameter estimates using hard-parts must be understood by the end users of this data.

<u>The way forward</u>

The results of the Laboratory have indicated its potential to function as a regional Laboratory for the ageing of commercial fish species for the Caribbean. It has demonstrated, during the period 1995 to 2001, the ability to interpret annuli patterns on both whole and sections of otoliths and spines and have attempted validation of these patterns through the use of marginal increment analysis and microstructure analysis using the best procedural practices available to it.

Some of the problems identified were the lack of adequate samples across size ranges, technical problems related to imaging software and changes in staff, which affected the age determination process.

Inherent in some of these problems is the relationship of the Laboratory to other activities within CFRAMP. The provisions of age and growth information must be seen as a collective exercise involving all end users of the data not just the Age and Growth Laboratory. To deal with some of the problems a methodology and assessment framework is shown in Figure 10 to help increase the proficiency of the age determination process.

With the evolution of CFRAMP into the Caribbean Regional Fisheries Mechanism (RFM), the conceptual framework for the role of the Age and Growth Laboratory must be re-designed. All stakeholders must decide this framework and the required outputs tailored to suit the demands of the uses of fish stock assessments. It must be borne in mind that quality assurance is an integral part of the age determination process and increases the cost of the age readings. These costs will have to be funded. Examples are the validation experiments and otolith exchange programs. Quality assurance in an on going process with the evolution of new methods and procedures which will increase accuracy and precision, the scientific development also requires funding for the training of staff and update of equipment.

The continued refinement of the age determination protocol and the research development to parallel developments in stock assessment of fish species to include other environmental aspects, can also be incorporated in the Laboratory's terms of references such as new techniques to answer questions such as the impact of pollution on fish stocks and fishing, nursery and breeding areas.

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Table 1. Preliminary Growth Parameter Estimates determined by the CFRAMP/IMA Age and Growth Laboratory for 9 species of fish.

Species	Country	L_∞ (cm)	K (yr^{-1})	t_0 (yr)	ϕ'
Lutjanus synagris	Belize	26.53 TL)	0.13	-10.0	1.96
Epinephelus guttatus	Grenada	47.3 (TL)	0.13	-3.972	2.474
Cephalopholis fulva	Dominica	46.5 (TL)	0.15	-2.409	
Lutjanus vivanus	Dominica	58.5 (TL)	0.13	-0.342	
Holocentrus adscensionis	Dominica	24.9 (TL)	0.25	-1.675	
Holocentrus rufus	Dominica	19.5 (TL)	0.16	-10.0	
Acanthurus chirurgus	Montserrat	37.5 (TL)	0.09	-3.925	2.103
Balistes vetula	Montserrat	75.0 (TL)	0.07	-4.437	
Acanthocybium solandri	*Combined samples	153.9 (FL)	0.34	-1.544	

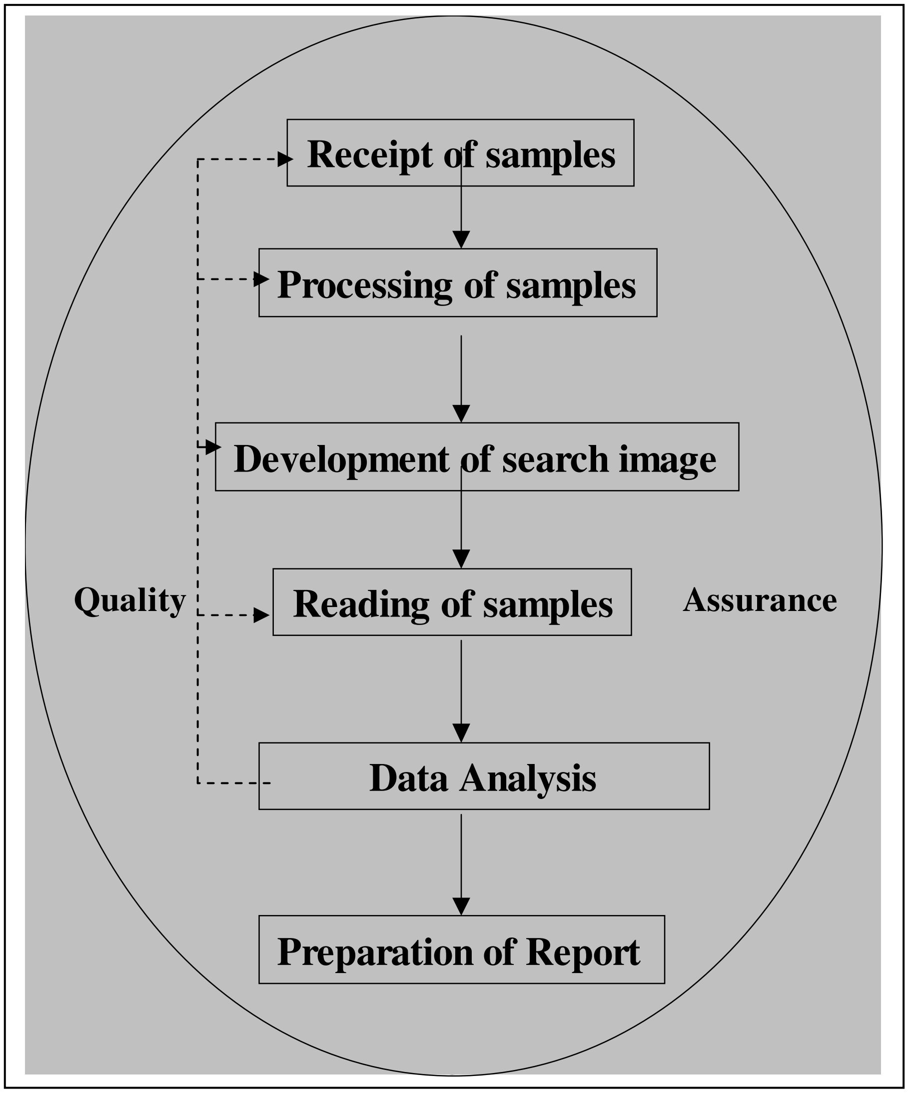

Figure 1: Protocol used in the CFRAMP/IMA Age and Growth Laboratory.

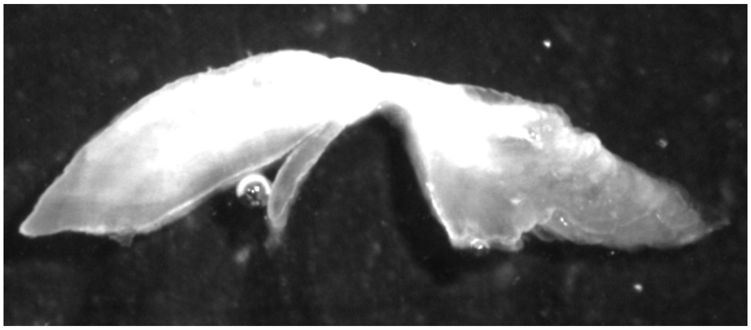

Figure 2. Sectioned otolith of *Acanthocybium solandri* AS 98/11/37 - 137 cm (FL) from Tobago. No clear banding patterns.

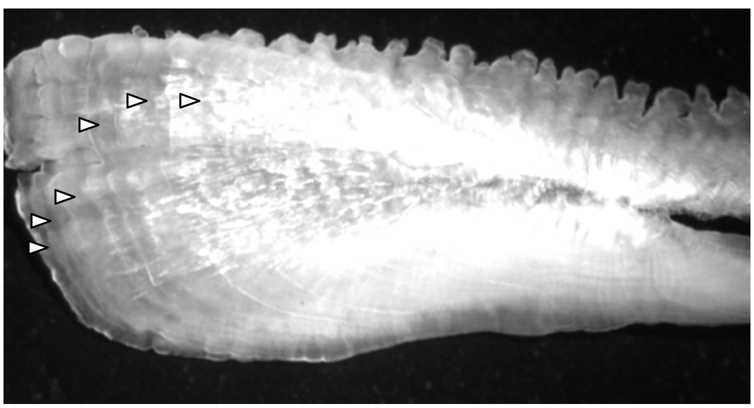

Figure 3. Whole otolith of *Acanthocybium solandri* (AS 98/11/37 - 6 annuli) showing annular banding patterns.

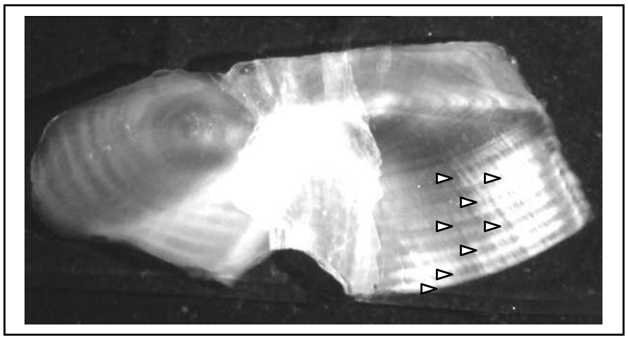

Figure 4. Sectioned otolith of *Lutjanus synagris* (LS97/02/84) showing annular banding patterns.

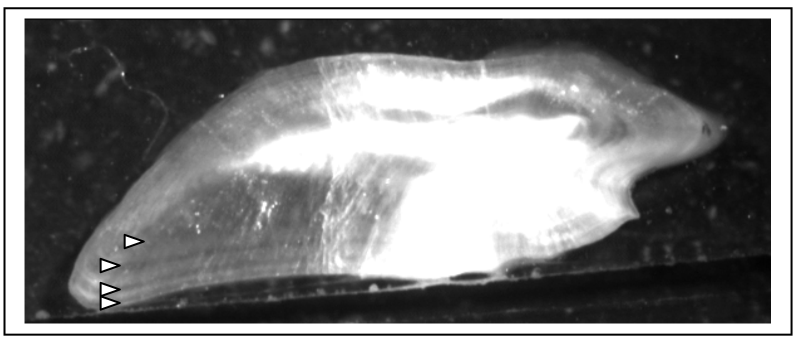

Figure 5. Sectioned otolith of *Holocentrus rufus* (HR 97/02/05 - 16 cm (TL); 4 years) showing annular banding patterns.

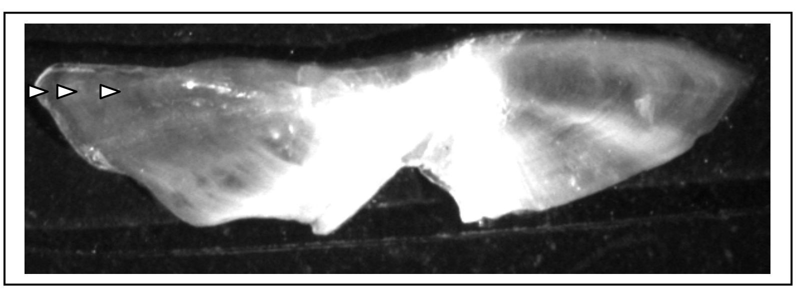

Figure 6. Sectioned otolith of *Epinephelus guttatus* (EG 95/08/02 - 30 cm (TL); 3 annuli) showing annular banding patterns.

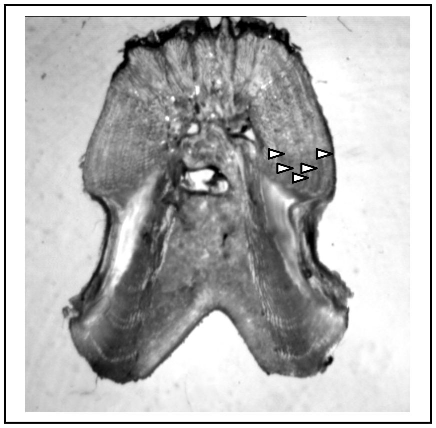

Figure 7. Sectioned spine of *Balistes vetula* (BV 96/04/12 - 30 cm (TL); 5 years) showing annular banding patterns.

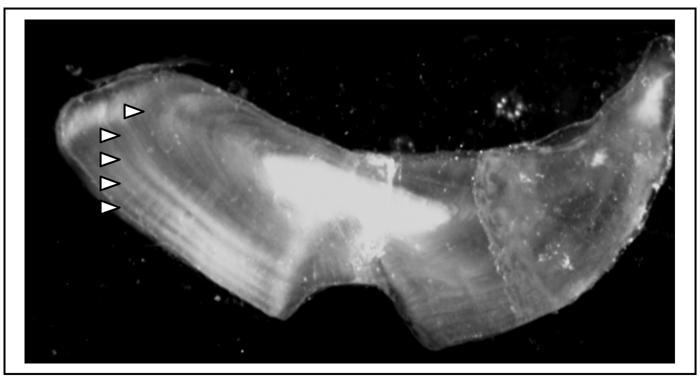

Figure 8. Sectioned otolith of *Acanthurus chirurgus* (AC 96/12/02 - 20 cm (TL); 5 annuli) showing annular banding patterns.

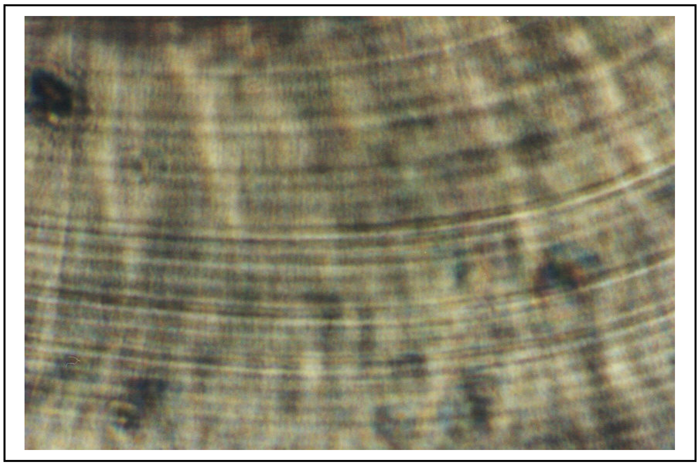

Figure 9. Lapillus of *Scomberomorus brasiliensis* (carite) showing daily rings. (One daily ring consists of one dark zone and one light zone).

4. WORKING GROUP REPORT

4.1 Working Group #1: TIP/LRS Software – The Future

Working Group 1
TIP and LRS the Future

Group Members

Sherril Barnwell	OECS (Group Leader)
Patricia Hubert	St. Lucia
Merline Hemmings	Belize-CFU (Presenter/Rapporteur)
Williana Joseph	St. Lucia
Raymond Ryan	St. Vincent & the Grenadines
Peter A Murray	OECS
Michael Braynen	Bahamas
Shellene Reynolds	Jamaica

Objective of TIP and LRS

Proposal or recommendation for the future of the CFRAMP supported software (the way forward)

Issues

- Address the current situation of TIP and LRS
- Migrate part/all of TIP and LRS to a Windows environment
- The need to determine the relevance of existing fields and modify as required
- The rate by which staff of fisheries departments "move-on", and poor transfer of knowledge to new staff.

Outputs-Outline Options

Our clients must be provided with software that could be utilised in the interim. To this end, the CFU will collate comments from test sites/member states, communicate comments to the programmer for feedback as to the

Outputs-Outline Options

Recommendations

1. Re-design the structural portion of TIP and LRS in a windows based environment. Mainly two development software were considered:
   SQL Server ("back end") with Delphi or Access "front end".
   Visual Fox Pro

2. The new CARIFORUM countries will continue to use their current data management software. A functional, TIP and LRS would be introduced to them for thorough review as a means of determining the best path for the integration of the various software. Provide assistance in Access training for countries desiring.

3. Provide demos (application) of TIP and LRS in Visual FoxPro and SQL to determine which development software would best (efficiently and expediently) address the need of our clients. The demo would be presented to our clients for comments.

4. Present Demos of the following of TIP and LRS in:
   i. SQL Server with both Delphi and Access "front end".
   ii. Visual Fox Pro

5. Present draft thorough review of TIP and LRS for:
   - Determine the social and economic data fields required –guided by recommendations from the social and economic data Consultancy proposed for the CFRAMP countries.
   - Consider other inputs from countries.

6. Design the new database or upgrade TIP and LRS

Outputs-Training

Training:

- Regional Administrator Training
- National troubleshoot technician
- End-user training

4.2 Working Group #2: Strengthening Data Collection Systems

WORKING GROUP 2
Strengthening Data Collection Systems

Group Members:	Beverley Wade	Belize
	Carlos Hamilton	Dominican Republic
	Dan Hoggarth	Consultant (Rapporteur)
	Koji Wright	Bahamas
	Melissa O'Garro	Montserrat
	Thania Chin-A-Lin	Suriname
	Sam Heyliger	St Kitts & Nevis
	Tricia Lovell	Antigua & Barbuda

1. Constraints and limitations on present data collection systems

a. Resources

Current data collection systems in all countries were constrained by the lack of adequate resources, including:

- funding;
- staff (overall numbers and training);
- equipment (office, vehicles etc);
- operational budgets (fuel, overtime etc); and
- supervision.

b. Staff issues

Due to the small size of many fisheries departments, limited opportunities are offered for career progression or promotion to senior positions. In combination with low salaries and the difficulty of the work, this results in a high turnover of staff.

c. Political support

Inadequate political support is given to the activities of the fisheries departments, especially in the area of data collection. Group members described the need to apply for external agency funds to support any 'research' activities.

2. Problems with current data collection systems

While recognising the significant progress made in recent years, data collection systems were felt to be failing, due to the above constraints, particularly in the following areas:

- the collection of **detailed effort data** (at least with enough detail to provide an index proportional to fishing mortality);
- the **coverage** of certain waters, especially away from central towns (e.g. Bahamas outer banks);
- the coverage of **artisanal fisheries** (e.g. those not covered by the census collection of landings slips at processing plants);
- collection of **socio-economic** data (covered by other working group).

3. Recommendations for improvements to data collection systems

a. Develop locally-appropriate systems

While accepting the need for some coordination and compatibility between countries, group members felt that future projects and the CRFM should resist imposing externally prioritised systems, and be more responsive to country needs. Participatory strategic planning exercises could, for example, be undertaken in each country, with the CRFM providing 'facilitators' rather than outside 'experts'.

b. Clarify the links between data collection and fishery management

To improve the quality of data collected, there is a need for all of the fishery's various stakeholders to more fully understand the whole system in place for managing each country's fisheries. Support should be provided for the design and/or clarification of country **management plans**, where required. Management plans should state clearly who is collecting which data, what those data will be used for, and by whom. Management plans should focus on the means of achieving management objectives selected for the fishery, and should go beyond the use of data purely to undertake *stock* assessment. Where appropriate, fisheries management plans should be integrated with equivalent plans being developed by coastal zone planning divisions etc. Both ministers and fishers should be able to see clearly that data are required to monitor and ensure the achievement of their selected objectives.

[To support this objective, the replacement/updated database should operate well enough to enable data to be used for its intended purpose ....]

c. Develop participatory co-management systems

Problems in both data collection and wider issues of governance and enforcement may potentially be reduced by improved management institutions. The group promoted the adoption of 'co-management' systems where appropriate, highlighting that this does NOT mean the total handing over of power to fishers (that is community-based management). Co-management implies a partnership between the various stakeholders, from government officers, fishers and associated processors, NGOs and other interested parties. The full range of stakeholders should participate actively in the *design* of management plans and the selection of shared objectives. 'Key' stakeholders (mainly government and fishers) should then participate in managing the fishery.

d. Provide feedback on progress

Feedback should be provided to stakeholders, e.g. by an occasional newsletter and workshops, showing the progress made towards management objectives over time. Such feedback should emphasise the importance of the data, e.g. by showing different CPUE trends in different areas and fisheries, followed by their implications for the fishers (e.g. any proposals for a new restriction or regulation).

e. Find the balance between capacity and needs

While some training may be given, and capacity increased (perhaps temporarily), data collection activities in the smaller countries should be in proportion to the likely continued small size of the fisheries departments. Not all countries should be expected to operate identical data collection systems.

f. Collect at least the minimum catch / effort data in a common format

While sampling coverage or frequency could be reduced in some of the smaller countries, it was agreed that at least the minimum common data should still be collected (especially catch/effort), and entered in a common format (e.g. the TIP replacement/update).

g. Clarify the detailed effort measures to be used for different gear types

Guidance is still required on the detailed effort measures - units, sizes, powers, times etc - to be used for the different gear types. The updated TIP manual provides revised guidance on this subject and should be circulated to all countries. For shared stocks, countries should meet to discuss the most compatible effort measures for their different gears and fishing vessels. Detailed consideration on this may be given at the terminal workshops for the different species groups, and guidance incorporated into the strategic plan for the CRFM.

h. Ensure that data collection is adequate to meet sectoral needs

Data collection should be designed to at least provide the minimum necessary information required to provide management advice, and any other sectoral needs. Group members highlighted the possible importance of being able to demonstrate the sustainable exploitation of natural resources, e.g. to meet FAO provisions for trade and/or project support (which?). Such proof may need basic biological data (length frequencies, species compositions, bycatch rates etc) in addition to catch/effort data.

i. Improve the design and coverage of data collection systems

Support should be given to enable countries to improve or update their **sampling frames**, including the preparation of thematic maps and frame surveys as required. Data collection systems should then be redesigned on the basis of the updated sampling frames, where required, to ensure the best possible coverage of the different fishery components (e.g. to include artisanal fisheries). Where necessary, sub-sampling should be used instead of census collection to provide the necessary coverage.

j. Improve licensing systems

LRS data collection systems should be improved where necessary to distinguish existing and active fishers and vessels.

k. Improve legislation supporting data collection systems

Where necessary, legislation may be improved to support data collectors in achieving their objectives. Boat owners may for example be required by law to register their vessels, and penalised for continuing to make offences. The CRFM could provide legal experts to search for any loopholes in the legislation of each country, as related to data collection.

l. Provide feedback to countries (e.g. peer review and exchange of expert staff)

Country members felt that greater feedback was required by e.g. CFRAMP and the CRFM on their progress and future needs. This could be achieved by supporting annual exchanges of staff between countries, and/or the peer review of annual country papers. Detailed feedback on the critical gaps in data collection (that constrain assessments) could also be provided by the stock assessment working groups.

m. Improve recruitment processes for fisheries division staff

Members reported that staff recruitment processes are sometimes superseded by political appointments, leading to ill-qualified or inappropriate staff, e.g. in data collection positions. Clearly, there is a need for the selection of the best available staff. There is also a need for improved opportunities for career progressions, and the provision of reliable transport etc to raise the status and job satisfaction of data collectors.

n. Train data collectors as extension agents and provide other skills
To enable data collectors to give something back to fishers instead of only *taking* data every day, they may be usefully trained as fisheries extension officers, and provided with the latest advice on fishing methods, gears etc. It was felt that the status of data collection staff could also be improved by renaming their positions as 'fisheries assistants'. Such fisheries assistants may be further trained to do other useful activities in the fisheries departments, in time not occupied by data collection.

o. Improve supervision
Data officers should improve field data collection by visiting field sites at least occasionally to ensure that good sampling practices are being maintained.

p. Provide environmental education
Group members felt that data would be easier to collect if fishers and other stakeholders understood the implications of their fishing activities on fish stocks and of the need for sustainable fishing practices.

4. Training requirements

Due to the ongoing losses of previously trained staff, training needs were identified in virtually all areas, including:

- data collection (random sampling, frame surveys, species identification etc);
- data handling and manipulation (computer software, hardware etc);
- age determination (e.g. otolith extraction and reading);
- stock assessment and statistical analysis;
- fishery management (selection of appropriate regulations and monitoring etc); and
- institutional development (e.g. establishment of new participatory regimes).

It was noted that the driving force for updating and improving country fisheries management strategies should originate within the countries, not with CFRAMP etc.

a. Spread training across division personnel
Training should be given to as many different country staff as possible, including the data collection staff. Even the data collection staff should be trained by external trainers where possible, to support the efforts of country officers.

b. Assess country training needs
To address these needs in a cost effective manner, training needs assessments should be made in each of the countries, to determine current departmental capacities, and numbers of staff requiring training. Such

assessments could either be made by short visits to each country, or perhaps by a suitable questionnaire (advice to be sought from a qualified training agency).

4.3 Working Group #3: Social and Economic Data Collection Systems

Working Group 3
Social and Economic Data Collection System

Group Members:

Terrence Phillips	CFU (Group Leader)
Yolanda Babb	Suriname
Ian Horsford	Antigua & Barbuda (Presenter)
Audra Barrett	Nevis
Shawn Wiggins	Guyana
June Gordon	Jamaica
Ramona Rosa Nolasco	Dominican Republic

Social and Economic Information Required

- National Statistics (GDP,employment, income, etc.);
- Decision-making in Fisheries Management;
- Monitoring/evaluating clearly defined Fisheries Management goals and objectives;
- Education (school curriculum, library)
- Financial institutions (loan agencies);
- Feedback to fishers and other stakeholders

Social and Economic Data Elements to be Collected

- Cost (fixed and variable);
- Earnings/revenue;
- Employment at various levels;
- Gender data;
- Export earnings;
- Import values.

Data Collection

- National census;
- Fisheries Census;
- LRS and TIP;
- Specific studies (e.g. fixed costs for vessels/gear);
- Variable cost as an addition to the existing data collection programme;
- Relevant agencies (e.g. trade statistics from Customs & Excise Departments).

(Standardisation of methodologies which would allow for regional comparison of data sets).

Stages to Collect Information

Depending on the type of fishery (artisanal, semi-industrial, industrial):

- Landing site/wharf;
- Processing plant;
- Field studies;
- Other agencies.

Data Management

- Part of the existing data management process (electronic, hard copies, back-ups, quality control);
- Make provisions for inclusion of social and economic data in the databases being considered for catch, effort and biological data;
- Separate software.

Analysis and Reporting

<u>Types of Analyses:</u>

- Cost and earnings;
- Bio-economic analyses/modeling.

<u>Reports:</u>

- National Statistics;
- Information for decision-making in fisheries management;
- Advice to financial institutions;
- Feedback to stakeholders;
- Production of educational materials.

Training Needs for of Data Supervisors/Managers/Collectors to Capture, Record and Report

<u>Types of Training:</u>

- Interview techniques for Data Managers, Collectors and Supervisors;
- Training for Supervisors/Managers;
- Data collection and storage;
- Team building;
- Bio-economic analyses and Risk Assessment
- Economic Evaluation (Returns on Investment etc.)
- Community Participation/Awareness
- Need to acquire skills of sociologist and economist.

Working Group 4
Report on the proposed Regional Data Management Centre (RDMC)

Group Members:

Sandra Grant	CFU/CFRAMP (Group Leader/ Rapporteur)
Capt. Roy Aynsley	Nevis
Harold Guiste	Dominica
Justin Rennie	Grenada
Joseph Simmonds	St. Kitts
Dr. Susan Singh-Renton	CFU
Christopher Parker	Barbados (Presenter)

Rationales for formation of RDMC

- To provide data for assessment and management of shared resources
- To facilitate the preparation of Regional Fisheries Management Organisation (RFMO) reports to regional and international bodies e.g COTED

Functions of RDMC

- Be a central repository for fisheries data and information for the use of participating countries
- Conduct quality checks and "clean" data before final storage and distribution of data
- Collate data and return summaries to contributing territories.
- Conduct statistical analyses for established working groups as required
- Act as an off-island back up system for important fisheries data

Data and information to be stored at the RDMC

- Catch and effort (commercial, recreational, industrial), biological, social and economical comprised of:
  - Type I data – aggregated data e.g monthly, annual summaries of landings by species –such data is summarised by the individual countries themselves.
  - Type II data- disaggregated data to be used to assess of specific shared resources
- Useful "Grey literature" of participating Fisheries Divisions

Who uses the data

- Working groups established for assessing important regionally shared resources e.g. dolphin, wahoo.
- Persons working in collaboration between any combination of territories for assessing species of special interest to those territories. Even if stocks are not shared.
- Final reports but not data may be released in public domain if appropriate

Important data collection and recording criteria

- Data collected in standardised manner by all territories to ensure comparability

- Raw data entered and stored by territories using same software as RDMC
- Data base should have more than one unassigned field codes for territories to use if necessary. Fields that are currently not used by anyone may be converted to unassigned fields.
- Territories must explain to RDMC what data has been entered in the unassigned fields and RDMC inform other territories immediately until the software can be updated.
- Data fields should be given unambiguous titles
- Sufficient codes should be available in pick lists to cover all options e.g. gear types

Data management logistics to be addressed by RFMO

- Data transmittal systems between territories and RDMC must satisfy strict security, confidentiality and accessibility criteria
- Choice of database and analytical software to be used
- Training of personnel in RDMC and territories. Each territory must have a data manager to check, clean and send the data to the RDMC.
- Defining database format, level of aggregation needed etc. through working groups as necessary

Other issues to be addressed by RFMO

- Writing TOR for participating territories
- TOR should include condition that countries must submit all necessary data on important shared resources to benefit from the facility
- Any other data submitted at territories discretion
- Legal advise on intellectual property rights regarding use of data must be sought and agreed on.

Human resource skills needed in RFMC

- Statistician
- Excellent computing skills
- Fisheries science background

4.5 Working Group #5: Alternative Approaches to present Data Systems

Working Group 5
Alternative Approaches

Group Members:

Stephen Willoughby	Barbados (Group Leader)
Rosemarie Kishore	IMA/Age and Growth Lab. (Rapporteur)
Sharon Corriett	Dominica
Dawn Maison	Guyana
James Finlay	Grenada
John Jeffers	Montserrat

Workable alternatives to the present data collection

The present data collection programme focuses on collecting biological data required by the mathematical models to predict future yield, biomass and value of the catch. There is little consideration of the wider body of knowledge resident in the fishing industry. This approach is inadequate since all the data and information needed to guide fisheries management are not collected and hence not taken into consideration in decision-making. Consequently, there is a need for a more holistic approach that shifts from a focus on stock assessment to a focus on assessment of the whole fishery including the fishers and their communities, the fishery resources, the ecosystem of which the fishery is part and the fisheries' linkages to other sectors of the economy. This alternative approach should:

- be simple, practical, people and vision oriented, cost-efficient and sustainable;
- incorporate a wider variety of data and information types, sources, approaches and methodologies;
- utilise common sense, local and traditional knowledge and fisheries science in decision making;
- use the best available information;
- address multiple-species fisheries and ecosystem health;
- pay greater attention to social, economic and ecological issues;
- involve stakeholders in decision-making, planning, executing, monitoring and evaluating.

Incorporated into the present data collection programme

- The present data collecting programme, because of its narrow focus, will require significant changes in methodologies and type of data collected in order to incorporate a more holistic approach. To consider a wider view of the fishery, as being proposed here, data collecting must take on a multi-disciplinary approach. It must be creative, innovative and consider new ideas, concepts, tools, methodologies and strategies.

- This is not a suggestion to abandon the conventional approaches, but rather to combine the new and conventional approaches to obtain a more holistic insight to the entire fishery system.

- There will also be a need to review the present LRS and TIP to make them more user-friendly and incorporate social and economic data.

- This new multi-disciplinary approach will also require retraining of Fisheries Officers in addition to re-staffing the Fisheries Departments. Fisheries will no longer be the domain of the fisheries biologists but will also require inputs from persons such as economists, sociologists, lawyers, managers and ecologists.

Framework and Action Plan for an Alternative Approach to the Present Data System

The following outlines a possible framework and action plan for an alternative approach to the present data programme. This approach requires stakeholder participation and the use of user-friendly databases, statistical packages and analytical models to allow for easy input, retrieval and analysis of data.

- **Step 1** ***Conduct a stakeholder analysis***
  Identify and describe the interests of all stakeholders in the fishery.

- **Step 2** Set out a shared Vision of the fisheries
  The shared Vision represents the stakeholders' shared hopes and aspirations for the future of the fishery. It clearly indicates what the fishing industry of the future (3-5years) should look like and identifies the data requirements.

- **Step 3.** Identify the obstacles that will prevent the Vision from being realised.
  The obstacles are the attitudes, issues and pitfalls that have to be addressed in order to realise the Vision.

- **Step 4** Develop a strategic plan to overcome the obstacles
  Strategic plan contains the broad actions or programmes that will overcome the obstacles and catalyse movement in the direction of the Vision.

- **Step 5** Set out an implementation plan
  The implementation plan is a set of actions that clearly describes the how the strategic plan will be implemented and monitored. It aligns resources, prioritises strategies based on importance, urgency and resources, assigns leadership roles and responsibilities, indicates how data and information will be collected and sets deadlines.

- **Step 6** Execute implementation plan
  Execution of the plan will require participation of all stakeholders to ensure success and hence realising of the Vision.

- **Step 7** Use information in decision-making

Combine the information generated with common sense in decision-making.

APPENDIX I - FEATURE ADDRESS - OPENING REMARKS

FEATURE ADDRESS

by

Dr. James Fletcher
Permanent Secretary
Ministry of Agriculture, Forestry and Fisheries
Castries, ST. LUCIA
Tel: (758) 452-3504

(Recognition of Distinguished Delegates)

- Mr. Milton Haughton
- Regional Chief Fisheries Officers and Data Management Officers
- Other technical Officers, data personnel,
- Ladies and Gentlemen…

It is indeed a pleasure for St. Lucia to host this important terminal activity for the CARICOM Fisheries Resource Assessment and Management Project. CFRAMP, despite its constraints and limitations, has formed an integral part of fisheries resource assessment and management initiatives during the last decade.

In particular, this Project has been able to achieve significant capacity building, at both the national and regional levels, within the area of fisheries data collection, analysis and interpretation, in the form of training at all levels, assistance in securing the necessary staff for catch and effort as well as biological data collection, and the development of an appropriate database programme for both catch and industry data.

Despite the stride made during the life-span of the Project, we must still objectively identify where further advances and amendments are now required. As signatories to UNCLOS, our countries are obligated to base levels of marine resources use on the *best available scientific information* regarding the status of those resources. We must be able to assess existing resources availability, monitor levels of productivity and understand the impact of all significant factors currently affecting resource viability.

In responsible fisheries management, we must ensure that our level of resources use is sustainable, that over-fished resources are given an opportunity to recover and that we engage in the judicious expansion of underutilized fish stocks. Data collection and interpretation are fundamental to rational development and management of our fisheries sectors. Inaccurate and inadequate data can have severe consequences on the sustainability of fisheries development, so we must ensure that adequate manpower, training and equipment are devoted to fisheries data collection, data analysis and interpretation.

Here in Saint Lucia, the Government has invested significantly in the expansion of capacity within the Data Management Unit of the Department of Fisheries. Funding is provided for 9 data collectors to operate at various sampling stations around the island, and our Data Unit is now manned by a well-qualified Data manager, data assistant and two data entry officers, one dealing with fisheries data entry and the other with licensing and registration.

Workshops are held twice yearly to train data collection personnel in innovative methodologies and approaches to data collection and management. An annual awards ceremony has also become part of this Ministry's work programme, where the most productive and the most improved data collectors as well as the most supportive fisheries extension officers are rewarded for their efforts each year.

The demand for quality fisheries data, including fish landings estimates and trends in fishing capacity (the number of vessels, fishermen, etc.) has increased dramatically over recent years. The Ministry of Planning, various development and commercial banks and rural assistance projects, as well as international assistance agencies, have become regular "customers" of the data management unit of our Ministry. We are required to ensure a high level of accuracy and regularity in our fisheries data and information, if these agencies and institutions are to invest confidently in the sustainable development of the fisheries sector.

With the strides that CFRAMP has allowed in human resources development at the national and regional levels, countries should be confident in producing detailed reports from the basic dat collected in the fields. Gone are the days for data to be collected and merely stacked on a shelf and allowed to collect dust! For data to be of any value it must be used and understood so as to appropriately guide the day-to-day decisions in fisheries management, development and investment.

Regionally, many fish stocks are shared, whether at the stage of the larvae or the adult. Only through regionally integrated resources assessment and management can we achieve rationale use and sustainability at the level of fish stock. Collaboration must be continued in the field of fisheries, and this is what we seek through the development of a Regional Fisheries Mechanism to succeed the linkages and capabilities that have been secured through CFRAMP.

The CFRAMP programme has allowed our region to come together in the designing of database programmes, statistics strategies and training packages that meet the peculiarities of regional needs. The programme has also led to joint initiatives in stock assessment and data exchange. At this point in time, the ball is in our court to use the building blocks provided by CFRAMP sub-projects such as this to best direct existing regional expertise and mechanisms to ensure responsible fisheries development; informed fisheries development.

This terminal workshop should be viewed as an important punctuation mark in our quest for wise regional fisheries management and development. In invite you to use this particular forum to chart the best way forward for fisheries data management within the region, based on your determination of the key constraints that still place limits on our capacity to monitor and quantify those resources and their level of use.

I take this opportunity to wish you all every success in your deliberations during the next few days.

OPENING REMARKS

by

Mr. Milton Haughton
Scientific Director
CARICOM Fisheries Unit
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Tel: (501) 2-34443; E-mail: haughton@caricom-fisheries.com

Mr. Chairman
Dr. James Fletcher, Permanent Secretary, Ministry of Agriculture, Forestry and Fisheries
Members of the head table
Invited guests
Ladies and Gentlemen
Good Morning.

First I would like to take this opportunity to extend a warm welcome to all of you here today, especially to our colleagues from the other Caribbean Islands. I hope that you had a good night rest and that you are ready for the challenges ahead. Before proceeding, I would like to thank the Government of St. Lucia for agreeing to host this workshop here. Special thanks to the Permanent Secretary of the Ministry of Agriculture and Fisheries Dr. James Fletcher, and Mr. Vaughn Charles and the other staff of the Fisheries Department for the excellent cooperation and support in organizing this workshop.

Most of the CARICOM States, are surrounded by the Caribbean sea and/or the Atlantic Ocean, from which we obtain countless benefits in the form of food, transportation, information, culture and recreation. Today, a vast array of problems such as global warming and sea level rise, marine pollution, overfishing, and the effects of tourism and population growth in the coastal zone are forcing us to think about the resources of the Caribbean sea and ocean much more seriously and to develop strategies to conserve, protect and better utilize these resources for sustainable development. A few years ago Professor Noriyuki Nasu of the University of Tokyo pointed out that at the rate at which world population is growing, current agricultural lands will not be able to produce enough food to support the projected population of 10 billion by the year 2050. As food from the land become scarce we will have to turn to the seas and oceans which cover 70.8% of the earth's surface, for food and sustenance.

We must use and protect our fishery resources in a way that provide optimal benefits to society, while ensuring their continuation as functional, self-sustaining components of the marine ecosystem. We must optimize benefits to the countries without compromising the long-term health of the fish stocks and the marine ecosystem.

As we enter into the new millennium, initiatives to promote improved understanding and management of fisheries resources are becoming increasingly important, globally and in the Caribbean, not only to improve the quality of life and standard of living of those who are dependent on the resources but also to achieve peace, stability, prosperity and economic development. Caribbean Governments have been paying more attention to fisheries and are making fisheries management issues important components of their development policies. Likewise several academic institutions and non-governmental organizations in the Caribbean have developed and active interest in conducting research, developing models and improving public awareness to ensure sustainable development and conservation of the regions fisheries.

Although significant progress has been made over the past two decades in understanding the importance of the fisheries sector, more is required, at both the national and regional levels. Fisheries are undervalued and irreplaceable sources of people' livelihood, contributing significantly to economic and social development in all Caribbean countries. Sustainable se of these resource systems requires that appropriate management policies are formulated and efficiently implemented. And such policies must be based on good understanding and knowledge of the biological and ecological aspects of the resource system and on the social and economic conditions of the fishers. It is therefore important that we have reliable systems for collection, processing and dissemination of data and information about the fisheries.

The CARICOM Fisheries Resource Assessment and Management Program (CFRAMP) is a sustainable development initiative of twelve CARICOM Member States. CFRAMP which is funded jointly by CIDA and the participating countries, commences operations in July 1991 and is scheduled to run until September 2001.

CFRAMP was established with 3 basic objectives:

- Strengthen fisheries management structures and improve management capabilities and technical expertise within the CARICOM region through training and advisory assistance;
- Provide information on fishery resource abundance and availability for management purposes within CARICOM; and
- Identify and establish a suitable regional fisheries management advisory mechanism

The main activities of CFRAMP are: training of fisheries personnel in areas related to fisheries assessment and management; establishment of fisheries data and information management systems; resource assessment studies; preparation of fisheries management plans; establishment of national advisory/decision making mechanisms; community awareness building and the strengthening of fishers groups and organization to increase their capacity to participate in co-management arrangements in partnership with the governments; and establishment of a permanent regional fisheries body which will continue to provide policy and technical support and coordination for sustainable fisheries development and management at the CARICOM level after Canadian funding for CFRAMP ends.

In 1992, CFRAMP and the participating countries launched the data and information systems project to improve the quantity and quality of data that would be available to the countries for planning and decision-making. Since then the project and the countries in collaboration with other organizations notably the OECS Fisheries Unit/NRMU have been working to establish and/or to strengthen the fisheries data and information systems.

Today we are gathered here to review the progress we have made and to begin plans for the future. We must learn from our collective experiences and we must consolidate and build upon the foundation laid to ensure that we have the information needed to make rational decisions for the sustainable development and management of the fisheries resources of the region.

Ladies and gentlemen, thank you very much.

APPENDIX II - WORKSHOP AGENDA

- Information Notes
- Agenda
- Annotated Agenda

INFORMATION NOTES
for
FISHERIES MANAGEMENT DATA SYSTEM TERMINAL WORKSHOP
"The Way Forward…
a Review and Planning Session"
November 25-28, 2000
Castries, St. Lucia

INTRODUCTION

The Fisheries Management and Data Collection System, under the CFRAMP program consisted of two major components:

1. WBS 310: Catch and Effort Data Collection Systems, with the main objectives being: To establish operational systems at the national level to collect, analyze and report on quantities of catch by species; and the effort (human and technical) made to obtain this catch; and to enhance the capabilities of the National Fisheries Divisions to analyze their data and report on the performance of their fisheries sector.

2. WBS 320: Licensing and Registration System, with the main objectives being: To establish national systems to monitor and manage the fisheries by tracking changes in the numbers of fishermen, fishing boats, fishing gear etc.; enhance the national and regional capability to design and manage their licensing and registration system (LRS); and computerize the LRS function of the Fisheries Department and improve on their ability to analyze and report on the data.

These two complementary subprojects have been implemented simultaneously throughout the program, with the activities being combined in the extension period (1998-2001). The expected output of the Fisheries Management Data System subproject are operating systems in each participating country, and the ability of the countries to use the information gathered in making fisheries management decisions.

The activities under these subprojects were determined during a Subproject Initiation Mission to the twelve participating countries in 1991. Country plans were further developed and approved during the Subproject Specification Workshop (SSW), June 1992. The implementation plans were refined based on recommendations of a review mission in 1994. Also, the activities of the 300 subprojects were further reviewed and refined based on the recommendations of the statistical training workshop held in Jamaica, October 1995. Based on these recommendations, a FoxPro/TIP programming workshop (November 1996), to train trainers to make programming changes to TIP, and a Regional Statistics Training workshop (March 1998), to assist countries in data analysis and reporting, were held. At this stage, the Fisheries Management Data Systems Terminal Workshop, to evaluate progress made and to determine the way forward, is being held in November 2000.

2. OBJECTIVES

The objectives of the Fisheries Management Data Systems Terminal Workshop are:

- Review the catch and effort data collection activities and achievements of the participating countries;
- Make recommendations and develop proposals for future implementation

3. EXPECTED OUTPUT

On completion of this workshop, the outputs will be:

- Data collection programs for participating countries reviewed;
- Plans/proposals for the future the data collection program activities;
- Fisheries Management Data System proposals for the Caribbean Regional Fisheries Mechanism;
- Review and make recommendations for computer software for fisheries database management.
- Achievements and failure of CFRAMP initiatives identified to strengthen catch & effort and LRS registration system.

4. SCHEDULE

DATE: The workshop is scheduled for November 25-28, 2000
LOCATION/VENUE: The workshop will be held at the Green Parrot Inn, Castries, St. Lucia

5. PARTICIPANTS

CFRAMP countries: Antigua and Barbuda, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Montserrat, St. Lucia, St. Kitts and Nevis, St. Vincent and the Grenadines and Trinidad and Tobago.

CARIFORUM countries: Bahamas, Dominica Republic, Haiti and Suriname.

Observers: British Virgin Island, Turks and Cacios

Suggested participants:

- Data Manager/Analyst or Data Collection Supervisor responsible for and directly involved in Catch and effort data collection and analysis.
- Chief Fisheries Officers/Directors/Fisheries Administrator or Policy makers responsible for Fisheries Division/Department.

CFRAMP will cover the cost of travel, accommodation and living expenses for two participants involved in the Data Collection Systems Program from each country.

6. WORKSHOP AGENDA

See Agenda

7. COUNTRY'S CONTRIBUTION

Country representatives will be expected to:

- Prepare and e-mail detailed report on their data collection system (catch & effort and data management system) to CFRAMP.
- Present summary reports of data collection and management systems at the workshop using power point or over-heads.
- Prepare and send total catch, total effort, import and export data (years 1990–1999) to Consultant /CFRAMP.

7.1 COUNTRY REPORTS FORMAT

NOTE: The county reports should be sent to CFRAMP by October 16 for review prior to the workshop

2. Introduction
    - Location
    - GDP
    - Policy
    - Legislation

3. Description of the fishery
    - Total number of fishers and boats
    - Types of vessel and sizes/gear type
    - Fishing areas
    - Types of fishery/ Commercially important species
    - Trends in catch and effort
    - Present status of the fishery

4. Management objective by fishery

5. History of the Data collection program
    - Indicate achievements made over the past 10 years (think about where you were and where you are now)

6. Present catch & effort data systems for all fisheries where data is being collected (eg. for reef fish, lobster, conch, shrimp etc.)

    5.1 Detailed description on the sampling plan for all fisheries (include data sheets and maps where necessary)
    5.2 Sampling schedule
    5.3 Limitations and strengths of sampling plan
    5.4 Recommendations

7. Data management

    6.1 Data Entry
    6.2 Data Storage systems, Backups
    6.3 Limitations and strengths of data management system
    6.4 Recommendations

8. Data analysis

    7.1 Type of analysis and information generated from catch & effort data
    7.2 Estimation of total landings
    7.3 Limitations and strengths
    7.4 Recommendations

9. Conclusion and recommendations for the future

8. REFERENCE MATERIAL

You should take copies of the following:

- ✓ Division/Department's Data collection Plan
- ✓ Fisheries Management Plan
- ✓ CFRAMP. 1993. Report of the Subproject Specification Workshops for Data and Information Systems and Licensing and Registration Systems. CARICOM Fishery Research Document No. 11.
- ✓ CFU. 1999. Workplan and Budget: Extension of the CARICOM Fisheries Resource Assessment and Management Program (CFRAMP). January 1999 – December 2000.
- ✓ FoxPro/TIP Programming Workshop Report
- ✓ Marine Fisheries Atlas
- ✓ Any in-country Reports

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FISHERIES MANAGEMENT DATA SYSTEM TERMINAL WORKSHOP
"The Way Forward… a Review and Planning Session"

November 25-28, 2000
Castries, St. Lucia

AGENDA

1. Opening Ceremony
2. Introduction of Participants
3. CFRAMP's Fisheries Data Management Program
4. Country report - Antigua and Barbuda
5. Country report – Barbados
6. Country report – Belize
7. Country report – Dominica
8. Country report – Grenada
9. Country report – Guyana
10. Country report – Jamaica
11. Country report – Montserrat
12. Country report - St. Lucia
13. Country report - St. Kitts
14. Country report – Nevis
15. Country report - St. Vincent and the Grenadines
16. Country report – Trinidad
17. Country report – Tobago
18. Country report – Bahamas
19. Country report – Dominica Republic
20. Country report – Haiti
21. County report – Suriname
22. Country report – Turks & Caicos
23. Regional Overview of Fish Catch and Effort in CARICOM and CARIFORUM Countries
24. National Data Management Software Systems (TIP and LRS)
25. Alternatives to Conventional Data Systems
26. The Importance of Collecting Otolith Information in Fish Stock Assessment
27. **The Way Forward**
    - Working groups

- Presentation of working groups

28. Any other business
29. Finalisation and adoption of workshop and closure of plenary sessions.

FISHERIES MANAGEMENT DATA SYSTEM TERMINAL WORKSHOP
"The Way Forward… a Review and Planning Session"
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ANNOTATED AGENDA

Friday, November 24

Hotel check-in
Check-in of Chief Fisheries Officers/Directors/Administrators and Data Collection Supervisors/Managers etc.

Saturday, November 25

8:00 – 8:30 Registration of Participants
8:30 – 9:30 **OPENING CEREMONY**

9:30 - 9:45 COFFEE BREAK

9:45 – 10:00

- Introduction of Country Delegates and invited consultants and observers
- Workshop Arrangements
- Election of Chairpersons
- Adoption of Agenda and procedural arrangements

10:00 – 10:40 CFRAMP's Fisheries Data Management Program (**Ms. Sandra Grant**)
This presentation will outline the goals and objectives of the Fisheries Data Management Program (WBS 300); introduce the two components (catch & effort and LRS); goals and objectives of the terminal workshop; and achievements of the countries.

COUNTRY REPORT
This should include: introduction; description of the fishery; management objective by fishery; history of the Data collection program; present catch & effort data systems for all fisheries where data being collected; data management; data analysis and conclusion and recommendations for the future.

10:40 – 11:00 Country Report – Antigua and Barbuda

11:00 – 11:20 Country report – Barbados

11:20 – 11:40 Country report – Belize

11:40 – 12:00 Country report – Dominica

12:00 – 12:20 Country report – Grenada

12:20 – 12:40 Country report – Guyana

12:40 – 2:00	**LUNCH**
2:00 – 2:20	Country report – Jamaica
2:20 – 2:40	Country report – Montserrat
2:40 – 3:00	Country report - St. Lucia
3:00 – 3:20	Country report - St. Kitts
3:20 – 3:40	Country report – Nevis
3:40 – 4:00	**COFFEE BREAK**
4:00 – 4:20	Country report - St. Vincent and the Grenadines
4:20 – 4:40	Country report – Trinidad
4:40 – 5:00	Country report – Tobago
5:00 – 5:15	Country report – The Bahamas
5:15 – 5:30	Country report – Dominican Republic
5:30 – 5:45	Country report – Haiti
5:45 – 6:00	County report – Suriname
6:00 – 6:15	Country report – Turks & Caicos Islands

Sunday, November 26

9:00 – 12:00 Pelagic Working Group Meeting - Plenary Session (**Dr. Susan Singh-Renton**)

Review of 2000 Assessment and Management Workshop Report; review and further discussion and development of workshop recommendations; sampling requirements for planned fish aging studies in 2000; preparation for 2001 workshop, including strategy for including other harvesters of possible shared resources (eg. Venezuela, Brazil, Bermuda, USA); ICCAT.

12:00 – 3:00	**LUNCH**
3:00 – 5:00	Sub-group session Cleaning and statistical analysis of available data on species selected for assessment in 2001.

Monday, November 27

8:00 –9: 30	Regional Overview of Fish Catch & Effort in CARICOM and CARIFORUM Countries (**Dr. Daniel Hoggarth**) Consultant will present a report on catch, effort, export & import, per capita consumption, supply and demand, social profile etc. trends in the region. (Discussion)
9:30 – 11:00	National Data Management Software Systems (TIP and LRS) (**Ms. Sherill Barnwell**) The Resource Person will present a report on the Goals and objectives of the CFRAMP supported software (TIP and LRS); Software development; Installation tips; Introducing the upgraded (improved) TIP and LRS; Querying capabilities; Data management tips; Future of the software; and Programming support for the software; Recommendations for the working group to debate. (Discussion)
11:00 – 11:15	**COFFEE BREAK**
11:15 – 12:15	Alternatives to Conventional Data Systems (**Mr. Stephen Willoughby**) This discussion paper looks at traditional/conventional data collection methods; new approaches to data collection; advantages and disadvantages to the methods highlighted. (Discussion)
12:15 – 12:40	IMA – The Importance of Collecting Otolith Information in Fish Stock Assessment (**Ms. Rosemarie Kishore**) Review the age and growth studies at the CFRAMP/IMA Regional Age and Growth Laboratory.
12:40 – 2:00	**LUNCH**
2:00 – 6:00	**The Way Forward -** Introducing the Working Groups Issues have been identified that as a region we need to address, eg. funding and technical support to continue programs in countries. It is important therefore that we begin to plan for the future. Certain activities have been identified and others need to be identified. We will split into groups to develop sub-activities, proposal and recommendations for the inclusion of activities in the CARIFORUM and CFRM activities. Working Groups Topics: 1. TIP/LRS the future (**Ms. Sherril Barnwell**) 2. Strengthening data collection systems (**Dr. Daniel Hoggarth**) 3. Social and economic data collection (**Mr. Terrence Phillips**) 4. Proposal for a regional database (**Ms. Sandra Grant**) 5. Alternatives to present data systems (**Mr. Stephen Willoughby**)

Tuesday, November 28

8:00 – 9:00	WG #1 report Working group presentation and discussion
9:00 – 10:00	WG #2 report Working group presentation and discussion

10:00 – 10:15	**COFFEE BREAK**
10:15 – 11:15	WG #3 report Working group presentation and discussion
11:15 – 12:15	WG #4 report Working group presentation and discussion
12:15 – 1:15	WG #5 report Working group presentation and discussion
1:15 – 2:15	Finalization and adoption of workshop and closure of plenary sessions.
3:00 – 5:00	Hotel Check-out Some data collection supervisor/managers will checkout Arrival of RFM participants

Wednesday, November 29

8:00	Opening of Caribbean Regional Fisheries Mechanism Hotel Check-out – Data collection supervisors/managers

APPENDIX III - LIST OF PARTICIPANTS

LIST OF PARTICIPANTS

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APPENDIX IV - WORKSHOP REPORT

REPORT OF THE FISHERIES MANAGEMENT DATA SYSTEM TERMINAL WORKSHOP
"The Way Forward…
a Review and Planning Session"
November 25-28, 2000
Castries, St. Lucia

2nd DRAFT

DAY 1: November 25, 2000

Item 1. Opening Ceremony
The Opening Ceremony commenced at 9:00am, with the playing of the St. Lucia National Anthem. Mr. Vaughn Charles, Acting Deputy Chief Fisheries Officer, St. Lucia Fisheries Department, welcomed participants to the workshop. On behalf of the CARICOM Fisheries Unit, Scientific Director, Mr. Milton Haughton, thanked the Government of St. Lucia for agreeing to host the Workshop and to the staff of the Fisheries Department for the excellent cooperation and support in organizing the workshop. Mr. Haughton outlined the objectives of CFRAMP and the objectives of the workshop.

The Permanent Secretary, Ministry of Agriculture, forestry and Fisheries, Dr. James Fletcher, gave the feature address. Dr. Fletcher acknowledged the work of CFRAMP in achieving significant capacity building, at both the national and regional levels, within the area of fisheries data collection, analysis and interpretation. Dr. Fletcher also noted the importance of regionally integrated resource assessment and management to achieve rationale use and sustainability at the level of fish stock.

During the Opening ceremony, Mr. Vaughn Charles honoured Mrs. Priscilla Edwards, Data Collector, Castries. Mrs. Edwards worked over 20 years with the St. Lucia Fisheries Department. Ms. Sarah George, Fisheries Biologist, St. Lucia Fisheries Department gave the closing remarks. Ms. Sandra Grant, Data Manager/Analyst CFU/CFRAMP, gave the vote of thanks. She thanked the Government of St. Lucia, CIDA and participants for coming and working together to chart the way forward.

Item 2a. Introduction of Participants
Mr. Milton Haughton (CFU, Scientific Director) introduced the Fisheries Management Data System Terminal Workshop and Ms. Grant (CFU/CFRAMP Data Manager/Analyst) outlined workshop arrangements. Country delegates later introduced themselves. Two delegates from Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Dominica Republic, Grenada, Guyana, Haiti, Jamaica, Montserrat, St. Lucia, St. Kitts & Nevis, St. Vincent and the Grenadines, Suriname, Trinidad & Tobago, British Virgin Island and Turks & Caicos were invited to the workshop. Unfortunately Haiti, Trinidad & Tobago, British Virgin Island and Turks and Caicos were unable to attend. Also present were several observers from the St. Lucia Fisheries

Department, Dr. Daniel Hoggarth (Consultant), Ms. Sherril Barnwell (OECS-NRMU) and Mr. Peter Murray (OECS-NMRU). A complete list of participants and observers are given in Appendix 1.

Item 2b. Election of Chairperson

In the absence of personnel from the St. Lucia Fisheries Department, and with no objections, Mrs. Sarah George, Fisheries Biologist, St. Lucia Fisheries Department was elected as the Chair for the Workshop as it customarily for the host country to chair the proceedings. It was suggested that in order to free up the country delegates to participate more fully in the various discussions that the CFRAMP delegates would fill in as chairs for the various sessions. The following chairs are as follows; Saturday 25th November (morning) – Mr. P. Murray (OESC-NRMU); and Saturday 25th November (afternoon) – Mr. M. Haughton.

Item 2c. Adoption of Agenda and Procedural Matters

No changes were made to the agenda (Appendix 2). Timing of meeting and coffee breaks according to agenda. Saturday sessions would terminate at 6:15PM and Monday and Tuesday sessions at 6:00PM.

Item 3. CFRAMP's Fisheries Data Management Program

Ms. Grant presented a historical overview of the CFRAMP's Fisheries Data Management Program (WBS 300). The goals and objectives of the program were reviewed, a history of the Fisheries data Management sub-project was documented and the achievements of CFRAMP participating countries were detailed through their respective workplans.

Capt. Roy Anslyn (St. Kitts and Nevis) raised the question about the legal aspects of his Department registering fishing vessels since it was the jurisdiction of the Custom Department. The definition of a fishing boat was also raised. Mr. Haughton asked if St. Kitts and Nevis maintained a registration system for vessels, to which Capt. Anslyn replied that there was nothing legal which allowed the Fisheries Department to do so. Mr. Murray commented that he thought within the Fisheries Act of St. Kitts & St. Kitts and Nevis there was some jurisdiction given to the Fisheries Department concerning registration of vessels of a certain size. He suggested that this was an internal matter, however, there already exist a regional framework for registration of vessels.

Item 5. Country Report Barbados

Mr. Christopher Parker, Fisheries Biologist, Barbados presented the report. The current fisheries policies of the Government of Barbados are outlined in the island's development plan 1993. This document outlines the development of the local fishing industry. Arising from this document was the first management plan. There are 845 commercial fishing fleets in Barbados, ranging from 8' to 90', propelled by oar or 5-75Hp outboard engine or 15-470Hp onboard engines. There are 2,200 fishers of which 80% are full-time fishers. The mean age of Captains is 51 years while that of regular crew is 41 years. The island shelf of Barbados is 320km^2. The main commercial fisheries are shallow-shelf reef fish, deep-slope, coastal pelagics, large pelagics, flying fish, sea urchins, sea turtles and lobster. The status of the coastal pelagics and large pelagics are unknown. However, shallow-shelf reef, sea eggs and turtles are over-exploited, while deep-slope is fully exploited. Presently, flying fish and dolphin fish dominate fish landings. There has been an increase in the number of registered vessels over the period 1989-1999 from 785 to 879.

The data collection system, since 1944, has been developed based on a marketing system. Bridgetown, Oistins and Speightown, primary sites, are the most important marketing centers in Barbados. Later, ten other active fish landing areas became secondary sites, equipped with fish landing sheds. Other sites, tertiary sites, have no physical structures. Fish landings have been recorded for primary landing sites since the 1950's. Presently, census catch data is collected from primary and secondary sites, while random sampling is done at tertiary sites. Under the CFRAMP programme, which started in 1993, there has been an improvement in the quality of fish landing statistics. To date catch, effort and biological data (yellowfin tuna, dolphinfish and wahoo) are being collected. The data collected is entered into the TIP database. While the database is designed to function to store fisheries data, it requires heavy dependence on the skill and time to extract basic information. Continued improvements to marketing and landing facilities were recommended.

Item 4. Country Report Antigua & Barbuda

Ian Horsford and Tricia Lovell, Fisheries Officers, Antigua and Barbuda presented the report. The Antigua and Barbuda fishery is small-scale and artisanal in nature. There are 899 registered fishers and 495 registered vessels. The main species caught are finfish and lobster using traps. There are 13 fishing grounds around the island, including a shelf of 3,568 km2 in total area. The main fisheries targeted are lobster, coral reef, shallow shelf fish and coastal pelagics. Recreational and sport fishers target mainly large pelagics. Shallow shelf, coral reef, conch and spiny lobster fisheries are all overexploited. Deep slope and coastal pelagics are considered under-exploited and large pelagics are not fully utilized. Antigua and Barbuda has seen an increase in the number of boats, from 132 in 1995 to 495 by mid 2000. This has led to an increase in total fish landed from 1,115.6 mt in 1995 to 2,207.52 mt in 1999. Although the total landings have increased, the catch per unit effort (CPUE, kg/day trip) has decreased for all length class vessels.

The first data collection programme began with the assistance from OECS Fisheries Unit. In 1993, the system was upgraded by CFRAMP. In 1998, a second review was done. The Division also identified the need to re-organize its data collection programme to ensure good data for sound management decisions is being collected. Presently, the department is operating with minimum staff and resources. No data collection of catch, effort or biological is being done in Barbuda. Because of the limited resource personnel and data collectors needed to collect fisheries data, the Fisheries Division recommended that a quota system should be set up, additional personnel acquired and a log books system particularly for sport fishers be establishment.

Mr. Haughton noted that the data presented gave a clear message of increasing number of vessels and reduction in CPUE.

Item 7. Country Report The Commonwealth of Dominica

Mr. Harold Guiste, Chief Fisheries Officer, Dominica presented the report. There are an estimated 2,725 fishers in Dominica, of which 60% are part-time and 1023 vessels. The shallow reef and bank fisheries are under-exploited due to the depths fishers have to fish and the lack of automated fishing devices. The greatest treat to the coastal pelagics is land-based pollution (siltation, agricultural erosion, etc.). Some species of coastal pelagics are under-utilized. Seasonal migratory pelagics are a major fishing activity.

There is a ban on the capture of conch, although small quantities are incidental catches. Lobster is landed in small quantities, most is sold in the French Islands of Martinique and Guadeloupe. Over the past eight years, fish production has increased steadily. This is due mainly to the amount if investments made by the Government of Japan, in areas such as fishing gear and technology.

Prior to CFRAMP, the Division collected catch and effort data. The data was entered in Lotus 123 spreadsheet. There was no registration of fishermen and boats. Over the past 10 years, the capacity of the Division to collect and manage fisheries data has improved. There have been improvements in sampling techniques, data quality control, computer software, computer hardware, computerized registration of boats and fishers and training. While the data management system has good capabilities some of its weakness are that TIP is not user-friendly and it is not Y2K compliant neither does the manual offer much help. Recommendations include more training in TIP, the development of a tutorial component in another version of TIP, or a user-friendlier TIP. To further improve on present achievements, further training, a more user-friendlier data software, assessment of shared fish stocks and flying fish will be required.

Mr. Peter Murray noted that a Y2K compliant version of TIP is available as well as a manual was developed to address some of the problems. Ms. Beverly Wade noted that Belize has a new version of TIP, but staff has been unable to get it to work. They needed assistance with this. Mr. Murray noted that the development of TIP was an iterative process and changes were done to suit the need of the countries. Dr. Hoggarth wanted to know why the emphasis on such an extensive data collection system (i.e. census and data collection). Mr. Haughton noted that the high appreciation for data collection in Dominica. Also that he was not aware that documents concerning TIP were not circulated to member countries and that he would try to rectify this. Mr. Murray noted that this might be attributed to turnover of staff. He also noted that data collection system has to be tailored to suit the country's situation.

Item 8. Country Report Grenada

Justin Rennie, Fisheries Officer, presented an overview of the nine fishery types in Grenada. The fisheries sector in Grenada is a major contributor to the national economy. The industry has approximately 2,000 fishers (1,600 are registered) and 750 vessels (660 are registered). The major fisheries resources are: (1) coastal pelagics, located along the west and north coast of the island, shows a 4% decline in landings over the past 21 years; (2) offshore pelagics, mainly along the west coast, accounts for 20-30% of total landings, this fishery has the greatest potential for expansion; (3) deep slope and shallow reef demersal along the north and south coasts; (4) lobster, which is presently approaching its MSY; (5) Conch is believed to have reached or surpassed the MSY due to the small size of conch being landed; and (6) sea urchins which has almost been depleted.

The data collection program, prior to 1992, was based on data in hard copy format. The data was collected and partially summarized by data collectors at the 7 district fish markets. There was no designed sampling plan. A licensing and registration system was implemented based on the requirements of the Fisheries Act and Regulations of 1986 and 1987 respectively. Since 1994 effort and other biological data has been collected. A census is collected at 6 district fish markets and 5 processors/exporters plants. No data is collected from non-market landing sites. Some problems with the data collection program are: there are isolated bays where data is not collected and no frame survey in place to determine levels of potential effort; presently data is entered in EXCEL and monthly reports of catch by species are generated; need extended times series of catch and effort for more analysis; there is a high turnover of data entry clerks; inadequate storage space and additional computers are needed; social and economic data should be incorporated into data collection systems; continued capacity building;

focus on co-management in fisheries management; and more manageable program should be devised to take care of catch and effort data.

Mr. Murray noted that a frame survey was done in 1995, and probably the changeover of staff and resultant lack of continuity could have accounted for this. Mr. Haughton also noted that a Frame Survey was done and a report produced. Mr. Murray also noted that tape drives were supplied to countries in 1994. Dr. Hoggarth recommended using writable CDs to store data. Mr. Guiste wanted to know why wait on time series data to do analysis. Mr. Rennie noted that there was no catch and effort data. Capt. Anslyn wanted clarification on registered and non-registered vessels. Mr. Rennie noted that boats over15ft, are required by law to register their vessels. There are no incentives, which could encourage boats under 15 ft to register. Mr. Simmonds wanted to know what aspects of social and economic data were important and how should it be used in fisheries management. Mr. Rennie noted that fisheries tend to be undervalued and information such as data on the fishers and revenue should be collected. Mr. Haughton noted that improvements have been made and that there are a number of issues: census vs. sampling (which one is more appropriate); social and economic data; personnel and other logistic resources (hardware/software problems); fishing effort and registration of fishing boats.

Item 6. Country Report Belize

Ms. Beverly Wade, Acting Fisheries Administrator, presented an overview of the fishery. The Belize fishing sector is mainly a commercial artisanal fishery. The industry is said to be very successful, based on high prices of seafood obtained from foreign markets. There are four main fisherman's cooperatives, which is entirely owned by local investors (mainly fishermen) who own shares in the organization. There are 2,662 licensed fishermen, 72% are full-time while the remaining are part-time. There are 790 licensed fishing vessels, comprising open boats, sail sloops and canoes, 3-9 m in length and propelled by outboard engines. There are over 62,000 lobster traps and over 2,00 shades (casitas) in Belizean waters. Other gear types include hook-sticks, spearguns, free-dive, gillnets, fish pots, tires, drums and hand-lines. There are also, six fishing zones based on distinct habitats types.

The Department has been collecting data since 1948. During the period 1948-1975, only export data and information from the operational cooperatives was collected. By 1975, some effort data was collected. Since CFRAMP, 1992, catch, landings, morphometrics and biological data on lobster, conch and some commercial finfish was collected. Licensing and registration was implemented in 1998. Presently, the data collection programme is ongoing, with data collected from the cooperatives' purchase slip, random sampling at primary market sites and sampling once/twice per month at tertiary sites. Catch, effort and biological data is inputted into TIP and fishers/vessels registration into LRS. In order to enhance the fisheries management capabilities of the department, the government sees the need to hire additional staff, training, the need for accurate and reliable database established, the inclusion of fishers in collection of data and the encouragement of co-management as priority areas.

Item 10. Country Report Jamaica

Ms. June Gordon (Fisheries Officer) and Ms. Shellene Reynolds (Regional Trainer) presented the country report. Jamaica has over 20,000 fishermen, of which 12,539 are registered. There are about 9,000 boats of which 3,951 are registered. These vessels range in length from 4-20 m, propelled by outboard, inboard or oars, operating from 187 fishing beaches. There are 6 main fisheries exploited in Jamaica, these fisheries are exploited on the island shelf, inshore and offshore banks. The most important fishing methods are fish traps used to catch demersal, nets (gillnets, seine) for coastal pelagics, line for pelagic species and diving for the capture of conch and spiny lobster.

Previous estimates of landings were based on sample surveys, however, in 1995, with assistance from CFRAMP, the Division developed a data collection programme. The aim of the data collection programme was to obtain catch, effort, and biological data by fishery group, based on random stratified sampling based on gear type/vessel type fishery. A data collection plan was developed for coastal pelagics, demersal, offshore pelagics, lobster and conch. The Jamaica Fisheries Division's data collection programme has come a long way. The Division now has up-to-date statistics on catch, effort, social and economic data readily available. However, the Division is faced with many problems, such as, personnel, logistics, transportation, legislation and weather.

Mr. Terrence Phillips commented that regarding improving census information, the recent census is currently being analysed. Mr. Murray was concerned about us improving the data collection system and how comparisons would be made between the improved and the unimproved system. Ms. Hemmings indicated that statistical analysis could control for such difference and allow comparisons to be made. Mr. Christopher Parker raised the question of standardizing data to allow comparisons.

Item 11. Country Report Montserrat

Ms. Melissa O'Garro, Chief Fisheries Officer, presented an overview of the fishery. Prior to 1995, the fishing industry had 170 fishermen and 5 boats, utilizing 5 fishing ports. Since the ongoing volcanic activities from July 1995, the numbers of fishers, boats and fishing ports have reduced to 80, 33 and 1 respectively. The main species exploited are shallow shelf, reef fish and coastal pelagics. These species are said to be moderately to over-exploit. The deep slope and bank fish are under-exploited and the status of the large pelagics and flying-fish is largely unknown but offers the potential for increased exploitation.

The data collection programme began in 1986. During this time only fish landing data was collected. With assistance from CFRAMP and OECS, the data collection programme was restructured due to continuous volcanic activities, there has been a reduction in the Fisheries Unit staff and fishing activities, which is reflected in a reduction in GDP contribution from 1% in 1995 to 0.49% in 1999. At the single fishing port in operations, a census is taken of landing. The data management system suffered a lot since 1986, due to the destruction of fisheries facilities (hurricane Hugo), hardware malfunction and loss of staff (volcanic crisis). However, steps have been taken to bring the unit and its activities back on track. The TIP and LRS systems have been upgraded, new staff and others technical staff have been trained and efforts are being made to recruit a new data manager.

Ms. O'Garro was asked if fish poisoning was related to the volcanic activity and she indicated that she did not think so. Ms. Sara George wanted to know if fishing was allowed in the vicinity of the volcano. Ms. O'Garro indicated that it was illegal to fish in the environs close to the volcano; if individuals were caught they would be fined. Mr. Christopher Parker commented that Montserrat is a good example of unforeseen events that can affect a country's fisheries and the availability of expertise, hence the need for Regional Expertise. Milton Haughton commented that the TCDC allow the sharing of expertise between countries.

Item 12. Country Report St. Lucia

Ms. Williana Josephs, Fisheries Biologist, presented an overview of the fishery. The fishery in St. Lucia is artisanal in nature. There are 2,016 fishermen and 974 registered open vessels ranging in length from 3-20 m, powered by engine ranging from 15-150 hp. The first catch and effort data collection was implemented in 1979, during this time no biological data was collected on a regular basis. The system has gone through various changes since then. By 1984, catch, effort and biological data was collected from landing sites. There was also the transformation of data from hardcopy to an electronic version using the database programme RBASE developed by the OECS Fishery. Further improvements were made with assistance from the CFRAMP's fisheries management and data collection sub-project. The current data collection system is base on stratified random sampling of size of landing sites, fishery types and volume of fish landed. The component of the system includes, catch, effort, biological, registration of fishers and boats, SCUBA diving establishments, sport vessels and speargun fishers.

The Department has a good data management system, from quality control checks with the data collectors, to checks by supervisors. Although TIP and LRS software are functional, serious consideration needs to be done to the upgrading of the software and making it more user friendlier using current technologies. Although the Department is satisfied with the present data collection plan, further improvements were identified, eg. collection of information from non-sampled sites, conducting a frame survey every 5 years, integration of biological, social and economic data into the data collection programme, training and upgrading TIP and LRS.

Mr. Peter Murray commented that there is a need to have a frame survey more frequently than the current 5-year interval.

Item 13. Country Report St. Kitts and Nevis

Mr. Samuel Heyliger, Fisheries Officer, did an overview of the fishery in St. Kitts. In 1990, there were 263 registered fishermen, this represents about 70-80% of the estimated total fishers. There are also, 188 registered vessels, ranging in length from 10-25 ft., powered by oars or engines (15-75hp). There are three major gear types, traps, seine and SCUBA. Other minor gears are handline, trolling and skin diving. The value of direct investments based in 1997 estimates were EC$3,479,750-EC$3,500,000.

The data collection programme began in the early 1980's, at that time the data collected was limited to exports and import of fish and fishery products. Later the data collection was extended to specific landing sites. The data was stored on an Apple IIC personal computer. The introduction of the TIP software by CFRAMP brought with it problems. Presently, the Fisheries Management Unit (FMU), has designed its own data entry system in EXCEL. It is the opinion of the Department that any future data collection system implemented should first meet the needs of the local stakeholders rather than regional and international bodies.

Mr. Guiste indicated that no fish was caught on a particular day is no reason not to still sample as data might be lost by not sampling. He also suggested that the days for sampling at a particular site should be rotated. The frame survey suggested that some sites cannot be sampled on certain days, due to lack of fishing activity, but the site should still be checked to be sure. Ms. Grant inquired how landings from St. Kitts and Nevis were treated in St Kitts. Mr. Heyliger said that it was treated as landings from St. Kitts and Nevis that stays in St. Kitts. He also indicated that fishers from St. Kitts and Nevis and St Kitts fish in the same fishing ground. Also there is a need to collect effort data.

Item 15. Country Report St Vincent and the Grenadines

Mr Raymond Ryan (Fisheries Officer) presented an overview of the fishery. The fishing industry is a small-scale artisanal fishery, with approximately 2,500 fishermen of which about 1,550 are registered, fish handlers, traders, gutters and handlers make up an additional 500 persons. There are 00 vessels of which only 558 are registered powered by outboard engines. The main fisheries are offshore pelagics, inshore pelagics, demersal, shell-fish, sharks, turtles and whales.

Prior to 1991 data collection was limited to fish exports and landings toll receipt (catch and price by species) at the Kingstown Fish Market. In 1998, the OECS Fishery formulated a plan to revise the data collection system using path diagrams detailing the movement of fishery products from fishermen, at 21 landing sites in St. Vincent, 12 in the Grenadines and 13 trading vessels. In 1992, CFRAMP implemented a revised data collection system, based on stratified cluster zone sampling. The plan was designed to cover all missing categories of data. The landing sites are clustered into zones (7 zones) and stratified according to categories (36 landing sites). Data collectors submit data sheets monthly to be entered into TIP. There is the need for the TIP and LRS programmes to be compatible with windows. The Data collection programme in St. Vincent and the Grenadines have made tremendous strides, as more that 5 years of consistent data has been collected.

Item 14. Country Report St. Kitts and Nevis
Mr. Audra Barrett, Fisheries Assistant, presented an overview of the fishery in Nevis. There are about 225 persons involved in the fishing industry of which 187 are registered fishers. There are 96 registered fishing boats operating from 7 landing sites. Most of the vessels are artisanal open dories and pirogue types, ranging in length from 12-14 ft, mainly powered by 14-225 hp. Main fisheries exploited are reef, slope, ocean, coastal, lobster conch and turtle. Over the past decade the landing of lobster has declined considerably, this is reflected in the decline in fish landed. The Division is encouraging fishers to venture offshore to target ocean pelagics and deep slope fishes.

In the early days the Division has a partial data collection system in place. Later with assistance from the OECS Fisheries Unit and CFRAMP, the Division started a data collection and sampling program. A census was taken at two landing sites and random sampling at the other sites. Presently, there is no detailed sampling plan for all the fisheries, the data collector samples only one landing site. The data collection programme also has other limitations, such as fishers unwilling to provide information, limited financial resources, insufficient data on resources for assessment and analysis, etc.

Mr. Christopher Parker suggested that one of the main difficulties in data collection is that fishers are not educated as to why the Departments need the data. He also suggests that once the data is processed the information should be fed back to the fishers. Ms. Yolanda Babb asked, “How do you explain no effort at landing sites?” Mr. Barrett responded that no data field was used. Mrs. Sarah George indicated that hurricane and other natural disasters prevent data from being collected.

Item 18. Country Report Commonwealth of The Bahamas
On overview of the fishery was presented by Mr. Michael Braynen, Director of Fisheries. The commercial fishing industry is based on the shallow water banks. The main fishery resources caught commercially are spiny lobster, conch, shallow and deepwater fishers, sponges, turtles and queen helmet. Spiny lobster (locally known as crayfish) is the most important fishery product harvested in terms of weight and value. The 1995 census data showed that there were about 650 active and licensed fishing vessels, however, in 1999 only 395 vessels were licensed. There are 5 main gear type used by fishers in the Bahamas, nets, hook and line, impaling gear, pots or traps and casitas.

In the early 1970’s census data was recorded by weight, value, species, effort and fishing location at the Nassau Public market. By the following decade the data collection system was expanded to a number of other island in The Bahamas. In 1998, FAO gave the Department 2 computers and The Bahamas Fisheries Information System (BFIS). This information program was written in dBase III+, it was established as storage for daily landings and fishing permit issue. Presently, no sampling plan exists. However, daily catch and effort data is recorded from landing sites from 4 islands. Processing plants are also required to submit monthly purchase slips to the Department. The data is then entered into the BFIS database. Catch figures are available for the entire country, however, catch and effort data is only recorded for a few of the islands. The main focus of the Department at this time are, implementing training for quality assurance and seafood safety, exploratory fishing of deepwater and shallow water species resources and the development of a fishery for stone crabs on the Banks.

Captain Roy Anslyn wanted to know if the Bahamas had: closed season for lobster, a sponge industry and an effective means of collecting data for recreational fishing. Mr Braynen indicated that the closed season was from 31st March to 1st August, the Bahamas export cleaned and dried sponge (millions of dollars worth per year) to Europe and there is no effective means of collecting data from the recreational fishery. However a number of tournaments send summaries at the end of the tournament to the Fisheries Department. Mr. Andre Kong asked how was the lobster permit monitored? Mr. Braynen said that data on the actual number of traps was not available. Mr. Braynen also indicated that casitas are not regulated in The Bahamas. Mr. Joseph Simmonds asked about enforcement? Mr. Braynen said there was little he could do when casitas were stolen and it is a source of frustration.

Item 19. Country Report Dominican Republic

Mr. Carlos Hamilton, Director of Aquaculture, presented an overview of the fishery. The main fisheries in DR are demersal, pelagics, spiny lobster, queen conch and shrimp. There are 160 landing sites and 16 coastal provinces; these landing sites are grouped into five fishing zones. There are about 3,752 boats and an estimated fishing population of 8,640 fishers. It is estimated that the fishing industry directly and indirectly supports 42,000 to 45,200 people. Catch and effort data collection activities are coordinated from three offices, PROSPESCAR Sur (south coast), the Fisheries Department (north and east coast) and CEDEP (north-east coast). Presently, the main obstacle confronting the Department is the importance of the sector to policy-makers. Other obstacles include the reliable statistical data on catch and effort of various species under exploitation. Recommendations for the future includes: the development of a management plan, training, extension programme, develop a data collection system, monitoring licensing and registration and the creation of a national network for collection and dissemination of fisheries statistics

A participant suggested the production of tilapia and freshwater fish.

Item 21. Country Report Republic of Suriname

Mrs. Thania Chin-A-Lin, Fisheries Officer and Mrs. Yolanda Babb, Head of Research and Statistics presented an overview of the fishery. The overall policy of the Fisheries Department is to increase fish landings through the expansion and modernization of the artisanal fleet without overexploiting the fishery resources. The fishery is divided into industrial (offshore), coastal, brackish water, fresh water fisheries and aquaculture. The industrial fishery includes shrimp-trawling fishery, finfish trawls snapper fisheries and sea-bob trawls. The coastal fishing is artisanal in nature. The main fishing gears used are drifting gill-nets, pin seine and bottom longline. The main species caught are Sciaenidae, Ariidae and marine catfish.

In 2000, there are 216 registered industrial vessels and 358 coastal fleets. In 1998, it was estimated that the sector employed an estimated 4,283 (which include foreigners). There are 16 fishery resources being exploited in Suriname, and about 17 different gear types being used. The Fisheries information System (FIS) was established in 1990 through a UNDP/FAO project, which operated optimally until 1994. Presently, the catch and effort data collection programme is based on stratified sampling based on gear and boat types. Biological sampling for shrimp and fish are conducted at processing plants. The data collection progamme is being affected by the shortage of data collectors, the need for a flexible database and assistance in data analysis.

Mr Braynen asked how was data extracted from the Dbase database. Mrs. Babb said that a computer expert was employed to transfer the data to Excel.

Item 9. Country Report Republic of Guyana

Mr. Shawn Wiggins, Senior Fisheries Officer presented an overview of the fishery. The economic contribution of the fishery sector in Guyana has grown in recent years. It is important for food supply, contribution to GDP, export earnings, income & employment and government revenue. The fisheries sub-sector can be divided into 3 main areas, marine, inland and aquaculture. The marine fishery can be divided into 2 main areas, offshore industrial (trawl) fishery and the inshore artisanal fishery. The offshore industrial fishery consists of 126 trawlers and 14 processing plants. The average boat length is 20.42 m, powered by 365-425 hp inboard diesel engines. The inshore artisanal fishery consists of 1,331 wooden boats powered by sail, outboard or inboard engines, using line or nets. There are approximately 4,500 artisanal fishers.

The penaeid shrimp resource is presently being fished at its optimum sustainable level, while the seabob resource is under-exploited and the status of the finfish resources is unknown. Data collection for artisanal and industrial fisheries is done by random stratified sampling based on vessels/gear types. Catch, effort and biological data is collected from vessels selected randomly at the landing sites. The logbook programme consists of industrial, artisanal and plant logs. The objective of this programme is to record discards at sea, and to give an idea of what goes on at sea. The observer programme, still to be implemented, seeks to capture by-catch at sea and to record all fishing activities. The Department has established an on-going data collection programme, however, to maintain such a system, they need to implement the observer programme, train technical staff, community involvement programme, etc.

End of Country Reports

Mr. Milton Haughton made the following comments based on the country presentations:

- He noted that significant improvements have been made regardless of the software problems and lack of personnel.
- Need to review or reject the software
- Re-think the data we want to collect bearing in mind the limitation of resources
- Maximize the benefit cost of data collection
- Analysis and interpretation were major gaps
- Software development need to be more realistic
- Data collection should be guided by the Management Plans

Mr. Andre Kong felt we needed to identify the minimum data required that would allow for a statistically sound system. Mr. Christopher Parker felt we needed to identify data that is important to stakeholders and to find innovative ways to link the fisheries with other sectors (e.g. tourism).

Item 16. Country Report Republic of Trinidad and Tobago
Participants were not able to attend the workshop for Trinidad.

The fishery in Trinidad is mainly artisanal, although there are some semi and industrial trawlers. There are 1,251 vessels and an estimated 8,040 fishers, another 13,000 persons are directly and 50,000 persons indirectly involved in the fishery. The mainly fisheries exploited are coastal pelagic, shrimp and groundfish, demersal, oceanic pelagic. Catch and effort data have been collected since 1954; by 1956 data was collected through 2 wholesale markets. In 1957 the Government established a statistical branch of the Fisheries Division and by 1991 there were full-time enumerators at 17 landing sites. The type of data recorded and recording process has remained the same over the years. Also in 1991, under a FAO project a suite of programmes were written in dBASE III language to provide computerized data entry, processing and reporting. Also under this project logbooks were introduced for the semi-industrial and industrial shrimp trawlers. The system was re-designed in 1991, incorporating it into the general fisheries management information system (FIMIS). The components of this system are socio-economic module (fishers and boat registration, import/export, etc.), harvest module (commercial landings, logbook records, recreational landings) and stock assessment module (aging data, resource survey data, catch sampling data, oceanographic and remote sensing). In the mid-1990's, CFRAMP enhanced the supervisory mechanism for field data collectors, which contributed to the improved precision in reporting. Presently, the data collection programme targets only the artisanal inshore fleet, such that, the beach represents an artisanal fishing activity within a zone.

Item 17. Country Report Republic of Trinidad and Tobago
Participants were not able to attend the workshop for Tobago

Item 20. Country Report Republic of Haiti
Participants were not able to attend the workshop

Item 22. Country Report Turks and Caicos Island
Participants were not able to attend the workshop

DAY 2, November 27, 2000
Mrs. Sarah George, St. Lucia Fisheries Department and Mr. Milton Haughton chaired the meeting.

Item 23. Regional Overview of Fish Catch and Effort in CARICOM and CARIFORUM Countries
Fisheries consultant, Dr. Dan Hoggarth, delivered this presentation. Dr. Hoggarth provided an overview of basic fisheries data collection objectives and requirements, and the data collection activities for a number of CFRAMP countries. Additionally, Dr. Hoggarth presented and discussed the results of analyses of CFRAMP countries' catch, effort, and trade data available from the FAO FISHSTAT+ database. Dr. Hoggarth also examined ways in which catch and effort data collection could be improved in CFRAMP countries.

Participants commended Dr. Hoggarth for the quality and content of his presentation. There was concern about the use of FAO data, which were considered to be unreliable for various reasons. It was clarified that the FAO data were used only because the more detailed data requested from countries had not been submitted in time to complete the report. Several participants offered explanations for the results of the FAO data analyses, highlighting the fact that intimate knowledge of the fishery was essential for accurate interpretation of the observed trends. For instance in the case of the shrimp fishery in Guyana, it was pointed out that catch patterns changed with certain events: the establishment of an Exclusive Economic Zone (EEZ), changes in the target species, and a decrease in motorization of fishing vessels.

The importance of submitting accurate data to FAO was emphasized, and participants were reminded that their Divisions/Departments had full responsibility for this task. It was suggested that countries could prepare detailed responses to Dr. Hoggarth's report, in order to document more accurate explanations for the FAO data trends observed. Additionally, participants appreciated the need to conduct analyses of better quality data that had been collected by countries in more recent years. It was noted that there was still time and opportunity to analyse these more recent data, if submitted to Dr. Hoggarth in the very near future prior to finalisation of his report. In this regard, participants were reminded of the importance and necessity to utilise the best available data for making management decisions.

Item 24. National Data Management Software Systems (TIP and LRS)

TIP & LRS – Ms. Sherill Barnwell, data manager with the OECS-NRMU, gave an overview of the TIP and LRS software packages, and their further development during the CFRAMP years.

Participants asked about the progress in upgrade of TIP and LRS, emphasizing the need to resolve those problems, which had been brought to the attention of CFU over the past years. For instance, the data extraction and data querying/report sections of TIP have not been easy to use, and participants noted the urgent need for improvements, including greater flexibility and adaptability in reports produced. Queries were raised concerning the inclusion and modification of specific data fields, and the possibility of including the ‘pick list’ tool in the data querying/report section. It was recommended that these and other specific concerns be addressed during the planned working group session responsible for dealing with TIP and LRS issues.

The Way Forward – Ms. Merline Hemmings, data manager with CFU/CARIFORUM, presented three data management software options that would provide greater flexibility than the current TIP and LRS systems. Participants asked about the cost-effectiveness of the new software. Ms. Hemmings confirmed that maintenance costs had been considered for the various options, with the SQL Server being the most expensive and the POSGRES option being the cheapest because it is free, however, the problem is with administration. There was concern whether TIP data could be exported to the new database, or whether these data would have to be re-entered. CFU confirmed that it would ensure that the new database would be able to import data that were previously entered into TIP.

Recognising the widespread availability and familiarity of the MS Access software, participants sought clarification regarding the complexity of the proposed database and the reason for not choosing a MS Access environment. Ms. Hemmings explained that the proposed database was likely to be complex in terms of its ‘interactions’ and ‘communications’, and it was anticipated that MS Access would not be able handle the required tasks satisfactorily and efficiently. Regarding the issue of connectivity between national databases and the regional database, participants noted that a very complex system might not be required, if data are updated only annually as might be expected. It was suggested that a suitable combination of the SQL and Access software tools might offer efficiency as well as a user-friendly environment, and would be a useful option to consider.

Ms. Hemmings noted that more persons could be trained in the use of MS SQL Server and MS Access software tools than the POSGRES software, which is known to be more complex. Regardless of the option selected, participants recognised the importance of having a number of persons trained to handle database queries. CFU confirmed that the development of the new database was considered to be a high priority activity, and expected the new database to be available for installation by the middle of 2001. Training would commence at that time also.

Item 25. Alternatives to Conventional Data Systems

Mr. Stephen Willoughby, Deputy Chief Fisheries Officer with the Barbados Fisheries Division, delivered this presentation. The presentation compared the feasibility of using only conventional approaches to fish stock assessment and management with that of applying alternative approaches requiring less data inputs and which would be more people-oriented. These alternative approaches are considered to be more suitable to serve the needs of small-scale, multi-species, multi-gear fisheries, with limited resources for data collection.

It was noted that the proposed alternative approaches would appear suitable for developing management strategies in the short-term; Fisheries Divisions/Departments should strive to continue to improve their data information systems to accommodate the conventional approaches of fish stock assessment and management. Participants recognised that Fisheries Divisions/Departments have focused on traditional fisheries development and stock assessment needs. It was acknowledged therefore that Fisheries Divisions/Departments would need to broaden their skills to deal with the alternative approaches, and that this would probably involve an increase in staff numbers. In view of this, participants recognised that redefining Fisheries Divisions/Departments would also increase operational costs.

Notwithstanding, participants appreciated the necessity to collect social and economic data as well as the conventional fish catch and effort data, and to include fishers in the management process. It was further noted that empowerment of fishers should be bound to responsibility. Analyses of data, and provision of management advice to politicians and other decision-makers should be timely. Participants agreed that co-management is the desired approach, and that the conventional approaches should be combined with the alternative approaches proposed by Mr. Willoughby. However, depending on the boundaries of the resource, participants recognised that co-management would not be applicable to all situations. The clear distinction of stakeholder boundaries would also be important to ensure effective participation in fisheries management.

Item 26. The Importance of Collecting Otolith Information in Fish Stock Assessment

Ms. Rosemary Kishore, Research Officer with the CFRAMP/IMA Regional Fish Age and Growth laboratory (subsequently referred to as the ‘Regional Laboratory) delivered the presentation. Ms. Kishore gave an overview of the use of age and growth data in fish stock assessment, briefly reviewed the Laboratory work plan prepared in collaboration with CFRAMP countries in 1994, and gave details of the progress of age and growth studies carried out by the Laboratory for selected species.

Participants acknowledged the progress made to date by the Regional Laboratory, despite a limited operational budget and training, and several changes in senior staff. Participants asked if fish scales could not have been used for age and growth studies instead of otoliths. Ms. Kishore responded that scales are generally not reliable for providing a complete history of individual age and growth. A question was raised regarding the comparison of Laboratory procedures and findings with those reported in the primary literature. Ms. Kishore noted that other studies examined either whole or sectioned otoliths. She further noted that validation of age readings is important to have a reasonable level of confidence in the results obtained.

Participants asked about the future of the Regional Laboratory, and continuation of fish age and growth research after CFRAMP ends. CFU confirmed that the Regional Laboratory would be able to continue to operate under the CARIFORUM project. CFU further confirmed its intention to finalise an arrangement for continuing operations of the Regional Laboratory on a permanent basis.

DAY 3, November 28, 2000

Mrs. Sarah George, Deputy Chief Fisheries Officer (Ag.), chaired the plenary session for the presentation of working group reports. After each presentation, time was taken to answer questions and receive comments. Set out below is a summary of the questions, responses and comments provided for each presentation.

Item 27. The Way Forward – Working Groups Presentations

Working Group 2 - Strengthening Data Collection Systems

Group Members:	Beverley Wade	Belize
	Carlos Hamilton	Dominican Republic
	Dan Hoggarth	Consultant (Leader/Rapporteur/Presenter)
	Koji Wright	Bahamas
	Melissa O'Garro	Montserrat
	Thania Chin-A-Lin	Suriname
	Sam Heyliger	St Kitts & St. Kitts and Nevis
	Tricia Lovell	Antigua & Barbuda

I. Constraints and limitations on present data collection systems

1.1 Resources

Current data collection systems in all countries were constrained by the lack of adequate resources, including:

- Funding
- Staff (overall numbers and training);
- Equipment (office, vehicles etc);
- Operational budgets (fuel, overtime etc); and
- Supervision.

1.2 Staff issues

Due to the small size of many fisheries departments, limited opportunities are offered for career progression or promotion to senior positions. In combination with low salaries and the difficulty of the work, this results in a high turnover of staff.

1.3 Political support

Inadequate political support is given to the activities of the fisheries departments, especially in the area of data collection. Group members described the need to apply for external agency funds to support any 'research' activities.

2. Problems with current data collection systems

While recognising the significant progress made in recent years, data collection systems were felt to be failing, due to the above constraints, particularly in the following areas:

- the collection of **detailed effort data** (at least with enough detail to provide an index proportional to fishing mortality);
- the **coverage** of certain waters, especially away from central towns (e.g. Bahamas outer banks);
- the coverage of **artisanal fisheries** (e.g. those not covered by the census collection of landings slips at processing plants);
- collection of **socio-economic** data (covered by other working group).

3. Recommendations for improvements to data collection systems

3.1 Develop locally-appropriate systems

While accepting the need for some coordination and compatibility between countries, group members felt that future projects and the CRFM should resist imposing externally prioritised systems, and be more responsive to country needs. Participatory strategic planning exercises could, for example, be undertaken in each country, with the CRFM providing 'facilitators' rather than outside 'experts'.

3.2 Clarify the links between data collection and fishery management

To improve the quality of data collected, there is a need for all of the fishery's various stakeholders to more fully understand the whole system in place for managing each country's fisheries. Support should be provided for the design and/or clarification of country **management plans**, where required. Management plans should state clearly who is collecting which data, what those data will be used for, and by whom. Management plans should focus on the means of achieving management objectives selected for the fishery, and should go beyond the use of data purely to undertake *stock* assessment. Where appropriate, fisheries management plans should be integrated with equivalent plans being developed by coastal zone planning divisions etc. Both ministers and fishers should be able to see clearly that data are required to monitor and ensure the achievement of their selected objectives.

[To support this objective, the replacement/updated database should operate well enough to enable data to be used for its intended purpose ....]

3.3 Develop participatory co-management systems

Improved management institutions may potentially reduce problems in both data collection and wider issues of governance and enforcement. The group promoted the adoption of 'co-management' systems where appropriate, highlighting that this does NOT mean the total handing over of power to fishers (that is community-based management). Co-management implies a partnership between the various stakeholders, from government officers, fishers and associated processors, NGOs and other interested parties. The full range of stakeholders should participate actively in the *design* of management plans and the selection of shared objectives. 'Key' stakeholders (mainly government and fishers) should then participate in managing the fishery.

3.4 Provide feedback on progress

Feedback should be provided to stakeholders, e.g. by an occasional newsletter and workshops, showing the progress made towards management objectives over time. Such feedback should emphasise the importance of the data, e.g. by showing different CPUE trends in different areas and fisheries, followed by their implications for the fishers (e.g. any proposals for a new restriction or regulation).

3.5 Find the balance between capacity and needs

While some training may be given, and capacity increased (perhaps temporarily), data collection activities in the smaller countries should be in proportion to the likely continued small size of the fisheries departments. Not all countries should be expected to operate identical data collection systems.

3.6 Collect at least the minimum catch / effort data in a common format

While sampling coverage or frequency could be reduced in some of the smaller countries, it was agreed that at least the minimum common data should still be collected (especially catch/effort), and entered in a common format (e.g. the TIP replacement/update).

3.7 Clarify the detailed effort measures to be used for different gear types

Guidance is still required on the detailed effort measures - units, sizes, powers, times etc - to be used for the different gear types. The updated TIP manual provides revised guidance on this subject and should be circulated to all countries. For shared stocks, countries should meet to discuss the most compatible effort measures for their different gears and fishing vessels. Detailed consideration on this may be given at the terminal workshops for the different species groups, and guidance incorporated into the strategic plan for the CRFM.

3.8 Ensure that data collection is adequate to meet sectoral needs

Data collection should be designed to at least provide the minimum necessary information required to provide management advice, and any other sectoral needs. Group members highlighted the possible importance of being able to demonstrate the sustainable exploitation of natural resources, e.g. to meet FAO provisions for trade and/or project support (which?). Such proof may need basic biological data (length frequencies, species compositions, by-catch rates etc) in addition to catch/effort data.

3.9 Improve the design and coverage of data collection systems

Support should be given to enable countries to improve or update their **sampling frames**, including the preparation of thematic maps and frame surveys as required. Data collection systems should then be redesigned on the basis of the updated sampling frames, where required, to ensure the best possible coverage of the different fishery components (e.g. to include artisanal fisheries). Where necessary, sub-sampling should be used instead of census collection to provide the necessary coverage.

3.10 Improve licensing systems

LRS data collection systems should be improved where necessary to distinguish existing and active fishers and vessels.

3.11 Improve legislation supporting data collection systems

Where necessary, legislation may be improved to support data collectors in achieving their objectives. Boat owners may for example be required by law to register their vessels, and penalised for continuing to make offences. The CRFM could provide legal experts to search for any loopholes in the legislation of each country, as related to data collection.

3.12 Provide feedback to countries (e.g. peer review and exchange of expert staff)

Country members felt that greater feedback was required by e.g. CFRAMP and the CRFM on their progress and future needs. This could be achieved by supporting annual exchanges of staff between countries, and/or the peer review of annual country papers. Detailed feedback on the critical gaps in data collection (that constrain assessments) could also be provided by the stock assessment working groups.

3.13 Improve recruitment processes for fisheries division staff

Members reported that staff recruitment processes are sometimes superseded by political appointments, leading to ill-qualified or inappropriate staff, e.g. in data collection positions. Clearly, there is a need for the selection of the best available staff. There is also a need for improved opportunities for career progressions, and the provision of reliable transport etc to raise the status and job satisfaction of data collectors.

3.14 Train data collectors as extension agents and provide other skills

To enable data collectors to give something back to fishers instead of only *taking* data every day, they may be usefully trained as fisheries extension officers, and provided with the latest advice on fishing methods, gears etc. It was felt that the status of data collection staff could also be improved by renaming their positions as 'fisheries assistants'. Such fisheries assistants may be further trained to do other useful activities in the fisheries departments, in time not occupied by data collection.

3.15 Improve supervision

Data officers should improve field data collection by visiting field sites at least occasionally to ensure that good sampling practices are being maintained.

3.16 Provide environmental education

Group members felt that data would be easier to collect if fishers and other stakeholders understood the implications of their fishing activities on fish stocks and of the need for sustainable fishing practices.

4. Training requirements

Due to the ongoing losses of previously trained staff, training needs were identified in virtually all areas, including:

- data collection (random sampling, frame surveys, species identification etc);
- data handling and manipulation (computer software, hardware etc);
- age determination (e.g. otolith extraction and reading);
- stock assessment and statistical analysis;
- fishery management (selection of appropriate regulations and monitoring etc); and
- institutional development (e.g. establishment of new participatory regimes).

It was noted that the driving force for updating and improving country fisheries management strategies should originate within the countries, not with CFRAMP etc.

4.1 Spread training across division personnel

Training should be given to as many different country staff as possible, including the data collection staff. Even the data collection staff should be trained by external trainers where possible, to support the efforts of country officers.

4.2 Assess country training needs

To address these needs in a cost effective manner, training needs assessments should be made in each of the countries, to determine current departmental capacities, and numbers of staff requiring training. Such assessments could either be made by short visits to each country, or perhaps by a suitable questionnaire (advice to be sought from a qualified training agency).

5. *Issues/Comments*

The country representatives suggested that data collectors should be included among those participating in future data management workshops as this would assist in improving on their knowledge as well as their status in the fisheries management process. It was also recommended that further training should be provided in otolith extraction, preparation and reading/aging.

In terms of the implementation of the recommendations from Group II, it was noted that with the limited resources available (equipment, human and financial), the types of data to be collected should be determined and clearly set out in the data collection plans/programmes, with data being collected to the species level. It was pointed out that the issue of the standardization of fishing effort needed to be addressed.

It was recognized that for some species, such as conch, the existing assessment models were not adequate and as such the types of data to be collected were not clear. As such, the need to develop suitable models was identified.

Working Group 3: Social and Economic Data Collection System

Group Members:	Terrence Phillips	CFU (Leader)
	Yolanda Babb	Suriname
	Ian Horsford	Antigua & Barbuda (Presenter)
	Audra Barrett	St. Kitts and Nevis
	Shawn Wiggins	Guyana
	June Gordon	Jamaica
	Ramona Rosa Nolasco	Dominican Republic

1. Social and Economic Information Required

- National Statistics (GDP, employment, income, etc.);
- Decision-making in Fisheries Management;
- Monitoring/evaluating clearly defined Fisheries Management goals and objectives;
- Education (school curriculum, library)
- Financial institutions (loan agencies);
- Feedback to fishers and other stakeholders

2. Social and Economic Data Elements to be Collected

- Cost (fixed and variable);
- Earnings/revenue;
- Employment at various levels;
- Gender data;

- Export earnings;
- Import values.

3. Data Collection
- National census;
- Fisheries Census;
- LRS and TIP;
- Specific studies (e.g. fixed costs for vessels/gear);
- Variable cost as an addition to the existing data collection programme;
- Relevant agencies (e.g. trade statistics from Customs & Excise Departments).

(Standardization of methodologies that would allow for regional comparison of data sets).

4. Stages to Collect Information
Depending on the type of fishery (artisanal, semi-industrial, industrial):

- Landing site/wharf;
- Processing plant;
- Field studies;
- Other agencies.

5. Data Management
- Part of the existing data management process (electronic, hard copies, back-ups, quality control);
- Make provisions for inclusion of social and economic data in the databases being considered for catch, effort and biological data;
- Separate software.

6. Analysis and Reporting
6.1 Types of Analyses:
- Cost and earnings;
- Bio-economic analyses/modeling.

Reports:
- National Statistics;
- Information for decision-making in fisheries management;
- Advice to financial institutions;
- Feedback to stakeholders;
- Production of educational materials.

Training Needs for of Data Supervisors/Managers/Collectors to Capture, Record and Report
Types of Training:
- Interview techniques for Data Managers, Collectors and Supervisors;
- Training for Supervisors/Managers;
- Data collection and storage;
- Team building;
- Bio-economic analyses and Risk Assessment

- Economic Evaluation (Returns on Investment etc.)
- Community Participation/Awareness
- Need to acquire skills of sociologist and economist.

7. *Issues/Comments*

Participants pointed out that it was necessary to look at fisheries in the context of it's contribution to the national economy as well as in relation to rural development and the other spin off benefits to the communities involved. They noted that each country should have a fisheries management plan with clearly defined goals and objectives. It was pointed out that Fisheries Divisions staff would require training in the areas of bio-economic assessment and fisheries management. It was indicated that CFU would undertake a consultancy to determine how it could improve on the collection and analysis of data in the social and economic areas.

Recognising the importance of the sport fishery in some countries, it was noted that such fisheries should be evaluated as well.

Working Group 4: Report on the proposed Regional Data Management Centre (RDMC)

Group Members:	Sandra Grant	CFU (Leader/ Rapporteur)
	Capt. Roy Aynsley	St. Kitts and Nevis
	Harold Guiste	Dominica
	Justin Rennie	Grenada
	Joseph Simmonds	St. Kitts
	Dr. Susan Singh-Renton	CFU
	Christopher Parker	Barbados (Presenter)

1. Rationales for formation of RDMC

- To provide data for assessment and management of shared resources
- To facilitate the preparation of Regional Fisheries Management Organisation (RFMO) reports to regional and international bodies e.g COTED

2. Functions of RDMC

- Be a central repository for fisheries data and information for the use of participating countries
- Conduct quality checks and "clean" data before final storage and distribution of data
- Collate data and return summaries to contributing territories.
- Conduct statistical analyses for established working groups as required
- Act as an off-island back up system for important fisheries data

3. Data and information to be stored at the RDMC

- Catch and effort (commercial, recreational, industrial), biological, social and economical comprised of:
  - Type I data – aggregated data e.g monthly, annual summaries of landings by species –such data is summarised by the individual countries themselves.
  - Type II data- disaggregated data to be used to assess of specific shared resources
- Useful "Grey literature" of participating Fisheries Divisions

4 Who uses the data

- Working groups established for assessing important regionally shared resources e.g. dolphin, wahoo.
- Persons working in collaboration between any combinations of territories for assessing species of special interest to those territories. Even if stocks are not shared.
- Final reports but not data may be released in public domain if appropriate

5. Important data collection and recording criteria

- Data collected in standardized manner by all territories to ensure comparability
- Raw data entered and stored by territories using same software as RDMC
- Database should have more than one unassigned field codes for territories to use if necessary. Fields that are currently not used by anyone may be converted to unassigned fields.
- Territories must explain to RDMC what data has been entered in the unassigned fields and RDMC inform other territories immediately until the software can be updated.
- Data fields should be given unambiguous titles
- Sufficient codes should be available in pick lists to cover all options e.g. gear types

6. Data management logistics to be addressed by RFMO

- Data transmittal systems between territories and RDMC must satisfy strict security, confidentiality and accessibility criteria
- Choice of database and analytical software to be used
- Training of personnel in RDMC and territories. Each territory must have a data manager to check, clean and send the data to the RDMC.
- Defining database format, level of aggregation needed etc. through working groups as necessary

7. Other issues to be addressed by RFMO

- Writing TOR for participating territories
- TOR should include condition that countries <u>must</u> submit all necessary data on important shared resources to benefit from the facility
- Any other data submitted at territories discretion
- Legal advise on intellectual property rights regarding use of data must be sought and agreed on.

8. Human resource skills needed in RFMC

- Statistician
- Excellent computing skills
- Fisheries science background

9. Issues/Comments

Some participants suggested that un-assigned fields could be included in the regional database to cater for data needs in some countries. The inclusion of such fields was questioned and it was agreed that the issue would be further evaluated. It was also suggested that a multi-user approach could be examined in terms of the fields that countries may not want to use. In such an approach, only the fields utilized by a country would show up in the process. It was pointed out that a regional database should include a section on the types of skills available in the region.

Working Group 1: **TIP/LRS Software – The future**

Group Members:	Sherril Barnwell	OECS-NRMU (Leader)
	Patricia Hubert	St. Lucia
	Merline Hemmings	CFU/CARIFORUM (Presenter/Rapporteur)
	Williana Joseph	St. Lucia
	Raymond Ryan	St. Vincent & the Grenadines
	Peter Murray	OECS-NRMU
	Michael Braynen	Bahamas
	Shellene Reynolds	Jamaica

1. Objective

Proposal or recommendation for the future of the CFRAMP supported software (the way forward).

2. Issues

- Address the current situation of TIP and LRS
- Migrate part/all of TIP and LRS to a Windows environment
- Determine the relevance of existing fields and modify as required
- Staff turn-over, and poor transfer of knowledge to new staff

3. Outputs Options

- Our clients must be provided with software that could be utilized in the interim. To this end, the CFU will collate comments from the test sites/member states, communicate comments to the programmer for feedback as to the soonest time for delivery and recommendations for the best form of delivery.
- Re-design the structural portion of TIP and LRS in a windows based environment. Mainly tow development software were considered:
  - o SQL Server (“back-end”) with Delphi or Access “front end”
  - o Visual Fox-Pro

4. Activities

- The new CARIFORUM countries will continue to use their current data management software.
- A functional TIP and LRS would be introduced to them for thorough review as a means of determining the best path for the integration of the different software.
  - o Provide demos (application) of TIP and LRS in Visual FoxPro and SQL to determine which development software would best (efficiently and expediently address the need of the clients (the demo would be presented to clients for comments).
- Provide assistance in Access training for countries desiring.
- Workshop
  - o Present demos of the following of TIP and LRS in SQL Server with Delphi and Access “front end” and Visual FoxPro
  - o Present draft thorough review of TIP and LRS to determine the social and economic data fields required (guided by recommendation from the social and economic data

Consultancy proposed for the CFRAMP countries and consider other inputs from countries.
- Design the new database or upgrade TIP and LRS.

5. Training
- Regional Administrator training
- National troubleshoot technician training
- End-user training

6. Issues/Comments

Some participants questioned the continued use of FoxPro in the development of databases as it was noted that Microsoft had acquired FoxPro, and as such it may not be maintained after a while. It was suggested that it might be safer to go with a Microsoft product such as Access/SQL.

It was suggested that rather than producing two demo versions, one could be developed after doing a diagnostic review and determining the needs in terms of data and a suitable software. It was indicated that the management planning terminal workshop might provide a suitable forum for this exercise.

Working Group 5: Alternative Approaches

Group Members:	Stephen Willoughby	Barbados (Leader/Presenter)
	Rosemarie Kishore	Trinidad (Rapporteur)
	Sharon Corriett	Dominica
	Dawn Maison	Guyana
	James Finlay	Grenada
	John Jeffers	Montserrat

Workable alternatives to the present data collection

The present data collection programme focuses on collecting biological data required by the mathematical models to predict future yield, biomass and value of the catch. There is little consideration of the wider body of knowledge resident in the fishing industry. This approach is inadequate since all the data and information needed to guide fisheries management are not collected and hence not taken into consideration in decision-making. Consequently, there is a need for a more holistic approach that shifts from a focus on stock assessment to a focus on assessment of the whole fishery including the fishers and their communities, the fishery resources, the ecosystem of which the fishery is part and the fisheries' linkages to other sectors of the economy. This alternative approach should:
- be simple, practical, people and vision oriented, cost-efficient and sustainable;
- incorporate a wider variety of data and information types, sources, approaches and methodologies;
- utilise common sense, local and traditional knowledge and fisheries science in decision making;
- use the best available information;
- address multiple-species fisheries and ecosystem health;
- pay greater attention to social, economic and ecological issues;
- involve stakeholders in decision-making, planning, executing, monitoring and evaluating.

Incorporated into the present data collection programme

- The present data collecting programme, because of its narrow focus, will require significant changes in methodologies and type of data collected in order to incorporate a more holistic approach. To consider a wider view of the fishery, as being proposed here, data collecting must take on a multi-disciplinary approach. It must be creative, innovative and consider new ideas, concepts, tools, methodologies and strategies.

- This is not a suggestion to abandon the conventional approaches, but rather to combine the new and conventional approaches to obtain a more holistic insight to the entire fishery system.

- There will also be a need to review the present LRS and TIP to make them more user-friendly and incorporate social and economic data.

- This new multi-disciplinary approach will also require retraining of Fisheries Officers in addition to re-staffing the Fisheries Departments. Fisheries will no longer be the domain of the fisheries biologists but will also require inputs from persons such as economists, sociologists, lawyers, managers and ecologists.

Framework and Action Plan for an Alternative Approach to the Present Data System

The following outlines a possible framework and action plan for an alternative approach to the present data programme. This approach requires stakeholder participation and the use of user-friendly databases, statistical packages and analytical models to allow for easy input, retrieval and analysis of data.

- **Step 1** ***Conduct a stakeholder analysis***
  Identify and describe the interests of all stakeholders in the fishery.

- **Step 2** Set out a shared Vision of the fisheries
  The shared Vision represents the stakeholders' shared hopes and aspirations for the future of the fishery. It clearly indicates what the fishing industry of the future (3-5years) should look like and identifies the data requirements.

- **Step 3.** Identify the obstacles that will prevent the Vision from being realized.
  The obstacles are the attitudes, issues and pitfalls that have to be addressed in order to realize the Vision.

- **Step 4** Develop a strategic plan to overcome the obstacles
  Strategic plan contains the broad actions or programmes that will overcome the obstacles and catalyse movement in the direction of the Vision.

- **Step 5** Set out an implementation plan
  The implementation plan is a set of actions that clearly describes the how the strategic plan will be implemented and monitored. It aligns resources, prioritises strategies based on importance,

urgency and resources, assigns leadership roles and responsibilities, indicates how data and information will be collected and sets deadlines.

- **Step 6** Execute implementation plan
  Execution of the plan will require participation of all stakeholders to ensure success and hence realizing of the Vision.

- **Step 7** Use information in decision-making

Combine the information generated with common sense in decision-making.

Issues/Comments

Participants noted that in some cases co-management and stakeholder participation might be moving to the extreme of the management spectrum, but it was pointed out that if countries really wanted co-management then they must be prepared to share the vision with all stakeholders. As such, personnel with the required social and communication skills would be required. The need for training in the areas of negotiation and facilitation was identified. Also, participants pointed out that sustainability would be important in this process (fish stocks, incomes, etc.).

Item 28. Any other business

No matters were discussed under this agenda

Item 29. Finalisation and adoption of workshop and closure of plenary sessions

The Scientific Director in his closing remarks noted that the countries had moved forward from where they were eight to nine years ago. He observed that countries had improved on their computing capacity and were making use of the Internet. He said databases were improving, and that countries were becoming more knowledgeable of their fisheries as was shown by the technical reports (assessments and atlases) being produced. He indicated that several persons had been trained in the areas of data collection, stock assessment and management. He further pointed out that there was more sharing of information among countries using various means such as TCDC. He noted that the countries still had a long way to go in the fisheries management process and pointed out that the use of Working Groups was one of the ways to move forward.

In terms of the implementation of the recommendations coming out from the Workshop the Scientific Director said that they would be done by the following means:

1. CFRAMP – September 31, 2001
2. CARIFORUM – 4 countries, also, CFRAMP\CARIFORUM
3. CRFM.

In terms of the prioritization of the recommendations coming out of the Workshop, the following was suggested:

1. Upgrade TIP and LRS;
2. Support to strengthen the data collection systems in countries;
3. Improve on the social and economic data collection programs in countries;

4. Develop the regional databases;
5. Refine fisheries management plans;
6. Utilise and disseminate the fisheries information being generated, noting the Shrimp & Groundfish experience where regional workshops were held for the fisheries managers and national workshops were held for the other stakeholders; and
7. Seek to involve the other stakeholders in Regional meetings.

In closing, some participants noted that the role and structure of the Fisheries Departments in terms of the fisheries management process would have to be evaluated in order to improve on their capacity to fulfill their function in the provision of information for fisheries management and decision making. In this regard, it was recommended that a review be done of Fisheries Departments, including the IMA, with the intent of holding discussions at the terminal workshop on fisheries management and institutional strengthening.

The Workshop ended with both the chair and Scientific Director thanking participants for their participation in and contribution to the success of the event.