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A FISHERY DATA COLLECTION SYSTEM: SAIPAN

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PREFACE

This report was prepared under contract (No. 82-ABC-00224) by CIC Research, Inc. of San Diego, California. The objective of the contract was to develop and recommend a statistically sound fisheries data collection system for the Commonwealth of the Northern Mariana Islands, Division of Fish and Wildlife. To do this the contractor made an on-site visit to study the historical data and data collection methodologies used by the Division. Survey techniques and expansion algorithms were developed. Since this report was prepared under contract, the statements, findings, conclusions, and recommendations herein are those of the contractor and do not necessarily reflect the view of the National Marine Fisheries Service.

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September 30, 1983

A FISHERY DATA COLLECTION SYSTEM: SAIPAN

FINAL REPORT

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INTRODUCTION

Since 1979, tourism in Saipan has increased by over 25 percent; an estimated 124,000 tourists visited the Island during 1982. The number of annual visitors to Saipan now exceeds eight times the size of the Island's resident population. This level of tourist activity, coupled with recently enacted regulations governing the purchasing of Island-produced commodities, subjects Saipan's fishing grounds to intense pressure. Not only do these fishing areas support an active commercial fleet, but a significant effort from subsistence and recreational fishermen as well.

At issue is determining the consequences that an increasingly significant fishing pressure will have upon the Island's fishing resources. In order to properly address this issue, a body of data describing the fishing activity on the Island must be compiled. The responsiblity for collecting fishing data falls on the Commonwealth of the Northern Mariana Islands' (CNMI) Division of Fish and Wildlife (DFW). It is the duty of the DFW to monitor all fishing activity on the Island in the hopes of identifying levels and trends in fishing participation, effort, and catch. To assist the DFW in their data collection role, this project will furnish the Division with the essential elements of a Fishery Data Collection System (FDCS) and indicate the procedures required to implement such a system.

The purpose of the FDCS is to generate a body of quality data on fishing activity on a continuous basis. Specifically, the major elements of the FDCS are as follows:

- Detailed description of FDCS objectives
- Specification of the general design components for the FDCS
- The required sampling designs
- Sampling activity procedures
- Processing methods for the system's data base
- Expansion algorithms and their reliability
- Quality assurance methods
- Presentation of FDCS data and results

In providing the framework for a FDCS, the study will assist the DFW in enacting a data collection program of its own.

The body of this report is divided into three sections: Section I briefly reviews the DFW's data collection activities. This review includes a look at past as well as current data gathering efforts. Section II describes the eight elements of an FDCS. This description involves a discussion of the range and type of activities which must be undertaken in order to satisfy the requirements for that particular element of the FDCS. Finally, Section III presents the recommendations on how to effectively implement the FDCS in Saipan.

This report is directed at Saipan and not the CNMI in general. However, the proposed system can be readily generalized to include the entire CNMI region. Throughout this report

possible alternatives or strategies for the FDCS will be discussed and assessed. The most feasible solution will always be identified. Again, the primary objective of this study is to serve as the cornerstone for the DFW's future data collection efforts.

SECTION I

REVIEW OF DATA COLLECTION ACTIVITIES

INTRODUCTION

Information describing Saipan's fishing activity has only recently been compiled. In fact, the DFW is now in the early stages of collecting fishing data. Primarily, the DFW's efforts have been directed to a single segment of the Island's fishing activity -- the commerical fishery. The DFW believes that 90 percent of the total Island-wide catch can be attributed to the commercial fishermen.

While the DFW's efforts in the field of collecting primary data may be relatively new, a review of these data gathering activities will be of value. The value of reviewing Saipan's past data collection efforts is twofold. First, such a review will assist during the specification stages of the FDCS's structure by reflecting the unique characteristics of the fishery. Second, by studying the data collection activities, previous pitfalls can be avoided when designing the FDCS. Therefore, this review will serve as the first step in developing a reliable and useful body of fishery statistics.

BRIEF HISTORICAL BACKGROUND OF DATA COLLECTION EFFORTS

The history of data collection efforts in Saipan shows a highly segmented and specialized approach to gathering fishing information. Beginning in the late 1970's, the DFW

entered the field of collecting fishing data. From the outset of these early survey efforts, the DFW has attempted to quantify the fishing activity of the offshore commerical fishery. These initial efforts were focused on the commerical fleet by developing vessel inventories. In addition, during this time, spotted effort was directed to obtaining catch information from the fleet. Most of the collection effort involved surveying retail outlets, thus providing information about only a portion of the commercial catch.

Unfortunately, due to a lack of procedural documentation, inconsistent surveying effort, and missing data, the past data collected is only of limited value. However, this information does provide a measure of commercial fleets' size. Basically, the size of the full-time commercial fleet over the past four years has been fairly stable, with only a slight increase. On the other hand, the part-time commercial fleet has grown over 40 percent since 1979. These figures indicate an overall growth in commercial fishing participation which can be attributed to the part-time fishermen.

CURRENT DATA COLLECTION SYSTEM

The DFW is now in the process of implementing a new data collection system. It is the goal of the DFW to establish a complete system which will accurately reflect the entire Island's fishing activity. During these initial developmental stages, the DFW has undertaken an ambitious survey program. However, before discussing the current program, a few

preparatory remarks are needed in order to place the current program in proper perspective.

Saipan is a relatively small island with 40 miles of beach coastline. The population of Saipan is approximately 15,000 residents. The DFW vessel log shows less than 150 fishing vessels and approximately 40 establishments buying local fish products. Together, each of these seemingly disjointed facts reveals a fishing activity level which is not numerically staggering and which may be suited to certain data collection procedures not normally feasible.

The DFW's personnel, primarily responsible for implementing the current system, possess unique and valuable knowledge about Saipan's fishing activity. Not only do these individuals have this knowledge base, but they personally know most of the Island's fishermen. These personal relationships represent a valuable asset to successfully implementing the current system.

Description of the Data Collection System

The DFW has chosen to develop its FDCS in a segmented manner by concentrating on a single type of fishing activity at a time. The focus of the current system is the commercial fishery. This fishing activity is the obvious choice because the bulk of past data collection efforts have been directed to commercial fishing. Essentially, the current system can be described as a census survey of the commercial fleet. The fleet includes full as well as part-time fishermen.

Two survey instruments have been developed and are being used to obtain the desired data. The first instrument is a fishing logbook. A logbook is provided to each fisherman. The fishermen are instructed on how to fill out the log information sheet. A sample information sheet is presented in Figure 1. At the conclusion of each fishing trip the fisherman is asked to fill out an information sheet completely. The DFW collects the information sheets on a monthly basis. Basically, the information collected from the commercial fishermen includes catch data, number of fishermen (participation), time fishing (effort), and fishing gear. The DFW meets regularly with the fishermen to ensure that the logbooks are kept current.

The second survey instrument is directed at another level in the marketing chain of fish -- the fish purchasing establishments. At the present time, the breakdown of these establishments is as follows:

- Hotels - 17%
- Retail Outlets - 40%
- Restaurants - 13%
- Government Programs - 3%
- Mobile Stands - 27%

Figure 1

Division of Fish and Wildlife

Department of Natural Resources

CNMI Government

Fish Landing data (88-309)

Boat owner _____ Date: _____

Boatname/Number _____

Time out: _____ Time in: _____

Fuel Consumed _____ gals. ( ) Gasoline
( ) Diesel

Number of fishermen on Board _____

Type of fishing:

( ) Trolling
( ) Bottom fishing
( ) Spear fishing
( ) Gill Net
( ) Trap
( ) Other (Specify)

Catch Report

Species	No. of Pieces	Total Weight	Areas Fished

Each establishment is supplied with a stack of commercial sales data forms. A copy of one of these forms is shown in Figure 2. Each form is to be filled out at the time of a fish purchase. The form primarily solicits catch information concerning the sale. The DFW works closely with these establishments to ensure that the sales information is properly recorded. Every two weeks or so, the DFW collects these forms. The DFW regularly updates the list of fish purchasing establishments and makes sure that all are well supplied with forms.

By providing survey instruments to all known commercial fishermen and fish-purchasing establishments, the DFW is censusing the commercial fishing activity. This data collection effort was begun in late 1982. By the beginning of 1983, the vast majority of fishermen had been given logbooks and all the fish buyers had been furnished with sales data sheets.

From the data compiled by the DFW, the following general information is known about the commercial fishing on the Island. Table 1 shows the breakdown of Saipan's boat population by the fishing activity in which the boats are primarily engaged.

Figure 2

DIVISION OF FISH & WILDLIFE
Department of Natural Resources
CNMI-Government

COMMERCIAL SALES DATA 550

BUYER: _____ DATE: _____

SELLER: _____

SPECIES	No. of Pieces	Price per Pound	Total Weight (lbs.)	Total Value
PELAGIC				
1.. Skipjack Tuna/Katsuo				
2. Yellowfin Tuna/Manguro				
3. Dogtooth/White Tuna				
4. Wahoo/Saowara				
5. Mahi Mahi/Dolphin				
6. Barracuda/Alu				
7. Rainbow Runner/Burri				
8. Marlin				
9. Other				
REEF FISH				
1. Big Eyed Scad/Atulai				
2. Goat fish/Satmonetti				
3. Squirrelfish/Sagamelon				
4. Mullet/Laiguan				
5. Rudderfish/Guili				
6. Rabbitfish/Hiting				
7. Surgeonfish/Hijok, Hugupao				
8. Parrotfish/Laggua				
9. Unicorn/Tataga				
10. Wrasse/Gaddas				
11. Other				
BOTTOM FISH				
1. Snapper/Mafuti				
2. Grouper/Gadao				
3. Onaga				
4. Opakapaka				
5. Gindai				
6. Other				
Lobster/Mahongan				

Table 1

PRIMARY FISHING ACTIVITY OF
SAIPAN'S BOAT POPULATION

Primary Fishing Activity	Percent Participating In Primary Activity
Full-time commercial fishing	23.4%
Part-time commercial fishing	68.8
Recreational fishing	7.1
No fishing	0.7

Source: CIC Research, Inc.
DFW

Ninety-nine percent of the boats in Saipan are used for fishing. The majority of these boats participate in part-time commercial fishing.

The primary fishing method for the commercial fleet is trolling, with spearfishing the most prevalent secondary method. Table 2 shows the distribution of fishing boats by fishing method, both primary and secondary. Principally, there are four fishing methods used: trolling, bottom, spear, and handline. Most of the fishing fleet is able to readily change fishing gear; this is especially true for the part-time fishermen.

Table 2

PERCENT DISTRIBUTION OF FISHING BOATS BY PRIMARY AND SECONDARY FISHING METHODS

Fishing Method	Percent of Boats	
	Primary Method	Secondary Method
Trolling	79.9%	-0-
Bottom	-0-	13.7%
Spear	11.9	45.3
Handline	7.5	35.2
Other	.7	5.8
	100.0%	100.0%

Source: CIC Research, Inc.
DFW

ASSESSMENT OF DATA COLLECTION ACTIVITIES

To assist the DFW in evaluating its data collection efforts, this concluding segment of Section I assesses the current programs. This assessment looks not only at the operational aspects of the program, but considers the theoretical approach as well. The comments contained in this section are not necessarily presented in order of their importance to the overall data collection program.

Feasibility of Voluntary Fishermen Logbooks

The current survey program rests upon the success of fishermen maintaining logbooks. From a historical perspective, a

voluntary logbook program in the fishing industry seldom yields the desired information. The reason is simple: fishermen fail to complete the logbook information requested. Therefore, the odds appear to be against the DFW making the logbook program workable. However, two factors are in the Division's favor, if they are properly implemented. First, DFW personnel know the fishermen on a personal level. These relationships will undoubtedly assist the DFW in obtaining the logbook information. Second, the number of fishermen on Saipan is small enough to make tracking each fisherman feasible. The DFW should be able to monitor the fishermen on a regular basis. If the DFW spends the necessary time and effort, the likelihood of having a successful voluntary logbook program will be greatly increased.

Census Survey Approach

Another element in the logbook program is the DFW's desire to census the Island's fishermen and fish-buying establishments. Two issues must be considered in this area of the survey program. First, for the census to succeed, each member of the census group must be identified. Therefore, the DFW must update the status of each fisherman and fish buyer on a continuing basis, as well as add any new member to the appropriate group. Also, the future feasibility of a census survey must be reviewed. As the fishing industry in Saipan grows, will it still be practical to census the entire industry? If not, the DFW must consider alternative sampling programs and determine the set of conditions that must exist in order to implement the new scheme.

Survey Instruments

Careful consideration should be given by the DFW to the survey instruments now being used. The DFW must first determine what type of information it desires in its efforts to describe the Island's fishing activity. Usually, fishing data comprises information on catch, effort, and participation. Also, to assist in evaluating this data, information concerning gear used and weather conditions is often collected. The questionnaire should be easily understood by the respondent to ensure that it is properly filled out. In addition, information from fishermen should be sought concerning the questionnaire design. The scope of the questionnaire must also be defined. For example, is the survey instrument to be used for all types of fishing activity (i.e., full-time commercial, part-time commercial, recreational) or is a separate questionnaire required for each group? The DFW must resolve each of these issues before the program can be properly implemented.

Overall Data Collection Strategy

By focusing on only the commercial fishing sector, the DFW is segmenting its data collection efforts. In view of the fact that the DFW has been collecting fishing data for only a short while, this strategy is sound. In building a data collection program, often the entire program is started up at once. This type of start-up process usually leads to numerous problems in all areas and significantly reduces the quality of the data being collected. By implementing the data collection effort in

a step-wise fashion, the likelihood of having a successful program is greatly increased.

Other Activities Involved in Collecting Data

Even though the DFW is targeting the commercial fishery alone, a number of activities must be engaged in to ensure that the desired data is obtained. The entire program must be fully documented in terms of procedures and methods introduced to collect the fishing information. Without proper documentation, future analysis of the data would be severely restricted. Specifically, the DFW must define the following activities:

- Data tabulation methods
- Data processing methods
- Data expansion procedures
- Quality assurance methods
- Document surveying procedures
- Alternative survey strategies
- Presentation of results

Often, little thought is given to the many activities surrounding the actual collection procedures. Failure to consider the activities listed above leads to the collection of a body of numbers with little, if any, value to providing insight into fishing activity. Sections II and III of this report address these issues in detail.

Summary

Basically, the DFW is proceeding with a data collection program which, if implemented properly, should be successful. However, the program will require constant attention, especially during these early stages. The DFW must look at the current program within the context of a completed FDCS -- an outline of which is presented in the next section. The process of collecting meaningful fishery data is based upon structuring a feasible system of data-gathering procedures. The DFW is now beginning that process.

SECTION II

ELEMENTS OF A FISHERY DATA COLLECTION SYSTEM

INTRODUCTION

This section of the report describes the basic elements of an FDCS without addressing the specific needs of the Saipan fishery. In addition, this section outlines the activities that must be undertaken in order to implement such a system. For ease of understanding, this section of the report is written in semi-outline form, identifying those key factors which comprise each element of the FDCS. These elements are:

- description of FDCS objectives
- general design components for the FDCS
- required sampling designs
- sampling activity procedures
- processing of the system's data base
- expansion algorithms and their reliability
- quality assurance methods
- presentation of the FDCS's results

Each of the eight components of the FDCS is presented and discussed in the remainder of this section.

OBJECTIVES OF A FISHERY DATA COLLECTION SYSTEM

Before undertaking a survey investigation, it is essential for the investigator to consider the kinds of things

he/she would like to know. The investigator should determine what the ultimate objective is and be prepared to state it clearly as the research goal. The essence of an FDCS is reflected in its objectives which provide the conceptual framework needed in directing the collection of fishery information. The following factors must be addressed during this initial stage of defining the FDCS:

- Specify research goal.
  - Compose a broad statement concerning the overall purpose of the research. This statement may deal with objectives beyond the results derived by the immediate study.
  - State the overall strategy for the data collections effort.
- Establish working objectives.
  - Break down research goal into a series of small operational objectives. The sum of these objectives is another way of stating the research goal.
  - Determine whether each individual's working objective may require a separate data collection activity.
- Define universe to be observed.
  - Specify what entities are to be observed in obtaining information concerning fishing activity.
  - Provide the statistical framework for future analysis.
- Delineate specific concepts and characteristics to be observed and measured.
  - Identify which characteristics are to be selected from the universe.
- Determine numerical values to be developed.
  - Decide which averages or totals are to be compiled.

- Decide which processes are to be examined.

Each of the above items is to be reviewed within the context of collecting fishing information. Many times the failure of a fishery data gathering effort can be traced to the lack of clearly-defined objectives. Properly stated objectives provide the directional focus for the FDCS.

GENERAL DESIGN COMPONENTS FOR FISHERY DATA COLLECTION SYSTEM

General design components refer to those considerations which must be examined during the formulation of the overall surveying design. In effect, these components act as framing constraints to the FDCS. The set of general design components can be divided into three groups: fishing experience, surveying factors, and surveying effort. While these three groups undoubtedly influence each other, for the purpose of this presentation each group will be outlined separately.

Fishing Experience

Understanding the nature of the fishing experience enhances the likelihood of selecting the proper structure for the FDCS. The fishing experience can be looked at in terms of its human, spatial, and temporal elements. Each of these elements must be considered in regard to the following factors.

- Consider human factors in the fishing experience.
  - Determine what is known about the fisherman participating in the fishing activity.
  - Assess what information is available concerning the fisherman's catch, participation, and effort.

- Classify the fisherman according to the reason for fishing, e.g., commercial, recreational, subsistence.

- Determine what is known about the non-fisherman. This information will assist in developing participation rates. If this information is not readily available, adjustments will be required in the FDCS.

- Identify primary fishing methods: inshore and offshore with respect to gear.

- Develop a fisherman profile built on existing data and knowledge. Once the FDCS becomes operational, this profile may change.

- Consider spatial factor in the fishing experience.

  - Identify locations for fishing activity, both inshore and offshore. The goal is to define the level of fishing effort occurring at a specific location. In the case of the offshore fishery, these locations are boat launching sites.

  - Determine how best to examine these sites, again both inshore and offshore.

  - Account for the entire Island in terms of its fishing activity or lack of it.

- Consider temporal factors in the fishing experience.

  - Select temporal unit of measure, usually a day.

  - Determine how FDCS will cover the entire 24-hour period.

  - Establish means for estimating the fishing activity during the 24-hour day.

Surveying Factors

A number of surveying factors exist which, upon identification, reveal in general terms the surveying procedures to be followed. These factors are as follows:

- Select unit on which determinations are to be made.
  - Determine which items are to be sampled and measured (ultimately, this unit is the fisherman; however, other units, i.e., boats, fishing sites, retail outlets, can provide information useful in the design and effort allocation stages.)
  - Determine advantages and disadvantages associated with each possible unit.
- Review possible surveying or sampling methods.
  - Specify methods: face-to-face interviews, sampler observations, telephone interviews, or mail interviews.
  - Determine the best way of obtaining the desired information.

Surveying Effort

The final design component to be considered deals with surveying effort. Three factors influence surveying effort: costs, variability, and tolerated error. Specifically, the following items must be considered when assessing these three factors.

- Develop preliminary cost information.
  - Review the proposed surveying proposals, and estimate cost figures.
  - Identify the fixed and variable costs from the above calculations.
- Assess variability of key variables to the FDCS.
  - Identify key variables for catch, participation, and effort (this is a statistical or numerical issue).
  - Develop some measure of the variance associated with each of the above variables.

- Identify factors, e.g., fishing gear, which tend to effect the variability of the above three variables.

- Select tolerated error level.
  - Determine the amount of error the FDCS will tolerate, i.e., 5, 10, 20, 50 percent.
  - Specify reasons for selected error figure. (Error level will be affected by budgetary factors, FDCS's objectives, uses of the data.)

Together, these three factors will enable actual levels of surveying or sampling effort to be determined. Such figures will be helpful during the sampling design stages.

THE SAMPLING DESIGN

While this element of the system is entitled Sampling Design, in fact it encompasses all designing functions related to the development of the entire FDCS, whether actual sampling is required or not. Hence, the sampling design specifies what procedures are to be followed in generating the desired data necessary for estimating fishing activity, especially total Island harvest. The determination of these procedures evolves from a selection process which takes into account each factor of the FDCS previously discussed, as well as the proposed expansion methods to be used. Essentially, the design procedures can be classified as two basic techniques: either statistical survey methods or qualitative inference methods. A statistical survey method refers to those procedures which involve observing fishing activity in a systematic fashion and thus rely primarily upon sound statistical survey theory. Qualitative inference methods, on the other hand, do not rely upon statistical bases, but involve arbitrary observation techniques.

Statistical Survey Methods

- Determine whether or not the observation unit can be surveyed.

  - Define nature of activity each observation unit is involved in, e.g., day inshore fishing (usually, the observation unit is the fisherman).

- Select survey method to be used.

  - Decide between sample and census

- Design survey procedures needed to properly examine the observation unit. (These procedures will obviously vary with each survey program. For the FDCS, the survey procedures center around catch, effort and participation activities.)

  - Determine if the activity to be surveyed can be stratified in some manner.

  - Choose sampling unit for each surveyed activity, e.g., fisherman, boat, fishing site, and so forth.

  - Decide if the survey requires sampling and, if so, determine the number and type of stages and places in the design. (A sampling stage refers to a level of sampling; if a two-stage design is employed, two levels of sampling exist. For example, an offshore design may require sample launch sites to be taken, then a sample of boats within each site. A sampling phase deals with the number of variables to be measured -- one phase for each variable.)

  - Determine sampling effort, i.e., the number of sampling units to be taken at each stage and at each phase. Allocate survey effort.

  - Estimate cost of survey operation.

  - Choose method for selecting sampling units, i.e., probability or judgment.

  - Outline procedures for dealing with "hard-to-get" fishing activities through sampling, e.g., night fishing.

  - Outline methods of making estimates from surveyed data.

Qualitiative Inference Methods

- Re-examine fishing activities which cannot be surveyed.
  - Determine why activity cannot be adequately surveyed.
- Identify and select those procedures which will provide information about these activities.
- Describe method for obtaining information about these "hard-to-get" activities, e.g., illegal fishing.
- Calculate costs and effort required to measure activity by qualitative means.
- Outline methods of making estimates from information obtained from the selected procedures.

The sampling design element of the FDCS is the single most important component of the system. This element lays out the entire design for obtaining the desired numerical estimates of fishing activity. Properly designing the system minimizes future problems that always occur in any data collection system.

THE SAMPLING ACTIVITY

This element of the FDCS deals with the actual implementation of the sampling design. Under normal circumstances, a sampling design dealing with fishing activity requires multiple data collection operations. Successfully implementing such a data collection system requires careful planning and involves a number of activities outlined below:

- Formulate sampling design structure into a series of detailed survey procedures.

- Fully describe the sampling design. (This step is an operational effort. It takes, for example, the idea of sampling offshore fishing 30 percent of the time to sampling every other day from 6 a.m. to 5 p.m. at a given site.)

- Design all recording forms.

  - (Examples of recording forms are questionnaires, tally sheets, samplers' log books, survey protocol packets, coding books, and any forms required for conducting the surveys).

  - Use existing forms as a basis for the set of recording forms. (A good rule of thumb is that a form should exist at each stage of the sampling program.)

  - Maintain tally sheets as questionnaires are collected, indicating whether or not the questionnaires are fully or partially completed, edited, etc.

  - Document sampler information gained during the survey activity on the proper forms. (This information will aid in the adjustment process associated with a new survey, as well as ongoing survey efforts.)

  - Keep the information in a sampler's log book, documenting the sampler's daily activities.

  - Develop a survey protocol packet and give one to each sampler. Items in the protocol should, at least, include the following:

    - sampler instruction manual, including a question-by-question discussion of questionnaire administration

    - statement of purpose and background of the study

    - scheduling calendar

    - tide and moon phase calendar

    - special instructions and notes of unique circumstances of which the sampler should be aware.

- map of survey route
- coding sheets
- administrative requirements
- sampler's log book

- Select and train sampler
  - Make sure that each individual involved in the survey procedures thoroughly understands their specific survey responsibilities as well as the program's objectives. (The training process is especially needed for those individuals participating in the qualitative inference methods.)
- Develop controlling procedures for sampler.
  - Adopt methods which allow the sampler's activities to be monitored and evaluated on a continuous basis.

PROCESSING THE SYSTEM'S DATA BASE

In general terms, as the survey work is completed, data processing procedures must be in place to ensure that the final data set is accurate. These data processing procedures commence the moment a questionnaire is brought out of the field.

- Prepare data processing facilities.
  - Set aside the necessary space to meet expected incoming data requirements.
  - Review processing status forms to make sure each processing step is properly set up. (The processing status form defines each of the steps necessary in processing the raw field data into the computerized form of the final data set.)

- Define data processing procedures.
  - Explain in detail each step of the data processing sequence, detailing how, what, when, and by whom that particular step is to be implemented.
- Review data set format designs.
  - Examine the format design and the incoming data to make sure they are compatible.
- Keypunch data into computer file.
  - Maintain original questionnaire for at least a year after all activities for that year's FDCS have been completed. (If space is available, hold questionnaires longer.)
  - Maintain necessary back-up files.

The key to this stage of the data collection activity is the existence of clearly-stated procedures for processing the raw field data into the form of the final data set.

EXPANSION ALGORITHMS AND THEIR RELIABILITY

The results of the survey activities provide numerical estimates of surveyed fishing activity only. The goal of the system is to develop estimates of Island-wide fishing activity. Obtaining Island-wide estimates from sampled data requires the use of an expansion mechanism. This expansion mechanism defines the functional relationship between the sample results and the desired Island-wide results. The expansion procedure involves calculating a point variable, usually total catch.

- Describe Island-wide fishing activity in terms of a mathematical equation.

- Write the equation first, in an implicit form, i.e., total catch equals offshore plus inshore catch. (Identify all variables in the equations.)

- Write out the equation next, in an explicit form, actually defining the mathematical relationship between the variables.

- Define the catch, effort, and participation activities through these equations.

- Review results of survey efforts.

  - Identify which survey results can be used to replace variables in the expansion equation.

- Review results of qualitative inference efforts.

  - Identify which qualitative results can be used to replace variables in the expansion equation.

- Review entire expansion equation to insure that all elements of the equation can be numerically estimated.

  - Document how proxy measure was calculated, if additional variable specification is required.

- Compute appropriate variance measure for each expansion equation.

  - Identify variables in equation with non-zero variance.

  - Specify variance calculation for those variables. (The nature of this calculation will be dependent upon the sampling schemes employed in estimating those variables. For example the variance formulated for a simple random sampling scheme and a stratified random scheme are different.)

  - Compute variance measure for the equation as a whole, drawing upon the mathematical properties of a variance (i.e., the variance of a sum of variables or a product of variables has certain functional forms).

- Define reliabliity measure.

  (This measure is usually a statistical confidence interval.)

QUALITY ASSESSMENT METHODS

An essential part of the FDCS is a series of quality assessment (QA) procedures. These procedures act as checks to insure that the data being collected, processed, and manipulated meet the desired quality level. QA procedures can be classified into two groups: internal and external. Internal methods involve sampling procedure checks and data processing checks, while external methods entail comparing estimated results with data from independent sources.

QA -- Internal Methods

- Undertake sampling procedure checks.
  - Direct these efforts to the survey activity element of the system.
  - Review sampler-specific survey results to uncover potential sampler bias.
  - Assess and, if necessary, adjust sampling allocation efforts from a review of new incoming data.
- Undertake data handling checks.
  - Gear these checks to evaluating whether additional error is being introduced into the system.
  - Subsample the data set and compare this sample with the original questionnaire. (If the error rate from the subsample is significantly higher than the desired rate, then the entire data set would have to be rechecked.)

QA -- External Methods

- Compile independent source material.

- Use these sources to develop independent fishing estimates. (Examples of these independent sources include demographic data, other related surveys and reports, e.g., the National Marine Recreational Fishing Survey.)

- Compute independent measure and compare with FDCS estimate. (For example, fishing participation estimates can be compared with population figures to determine if the relative sizes are reasonable.)

Together these QA methods provide the assurance necessary to generate a useful and viable fishery data collection system. Hence, a fundamental part of the FDCS must be a well-defined QA program.

PRESENTATION OF THE FISHERY DATA COLLECTION SYSTEM

Careful consideration must be given to the FDCS's presentation format. The governing criteria in this area is whether or not the presentation format correctly reflects the information collected by the system, not only in terms of the tables but in the written text as well. The effective presentation of the FDCS depends, in part, on the reader of the report.

- Design presentation format.
  - Take into account all tables, charts and figures.
  - Consult other reports, books or manuals dealing with fishing data for examples of clear and informative designs.
  - Include in the statistical results standard error measures.
  - Attach copies of questionnaires to the report.

SECTION III

RECOMMENDATIONS FOR IMPLEMENTING A FISHERY DATA COLLECTION SYSTEM

INTRODUCTION

Now that the DFW is instituting a formal fisheries data collection program it has the opportunity to develop a valuable tool for monitoring the fishing activity in Saipan. To assist the DFW in these efforts, this final section contains recommendations on the system's overall design as well as how to effectively implement the system. Generally speaking, these recommendations insure the development of a properly timed and flexible FDCS to meet the data collection needs of Saipan.

The data collection system must be built on sound conceptual and statistical survey principals. In this regard, special emphasis will be given to the recommendations involving the sampling design and expansion algorithm elements of the FDCS. In addition, each recommendation must fit within the constraints imposed by Saipan's existing fishing culture. Thus, the recommendations concerning the FDCS's structure will take into consideration present data collection methods and procedures. Recommendations related to each of the eight components to the FDCS are presented and discussed individually in this section.