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PLANNING PORTFOLIO FOR POTENTIAL PARTICIPANTS

The Stock Assessment Collaborative Research Support Program

(Stock Assessment CRSP)

The University of Maryland
Planning Entity

Chesapeake Biological Laboratory
Solomons, Maryland
USA

U.S. Agency for International Development
Board for International Food and Agricultural Development
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PLANNING PORTFOLIO

FOR POTENTIAL PARTICIPANTS

THE STOCK ASSESSMENT COLLABORATIVE

RESEARCH SUPPORT PROGRAM

(Stock Assessment CRSP)

THE UNIVERSITY OF MARYLAND

PLANNING ENTITY

CHESAPEAKE BIOLOGICAL LABORATORY

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JUNE 1983

U.S. Agency for International Development
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This is a Planning Portfolio for the Stock Assessment Collaborative Research Support Program (Stock Assessment CRSP) to be funded by U.S. AID. The Stock Assessment CRSP was conceived to promote stock assessment research pertaining to artisanal or small-scale fisheries in developing countries. The research is intended to be collaborative between U.S. universities and institutions in developing countries. This Planning Portfolio presents the results of the planning activities which identified Stock Assessment CRSP Project Specifications and is to be used as a guide in the development of collaborative Project Proposals.

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INTRODUCTION

This document presents research projects submitted for consideration under the Stock Assessment CRSP, provides background information concerning them, and indicates to potential participants the planning processes which are designed to transform the Project Specifications into Project Proposals.

A major feature of the Stock Assessment CRSP planning was the Planning Workshop held in Rome, Italy, March 7-10, 1983. A primary purpose of this meeting was to solicit views from representatives of developing countries concerning their perspectives on the importance of artisanal or small-scale fisheries, the problems associated with the rational management of artisanal and small-scale fisheries and the research approaches to solving these problems in order to provide a background for understanding the importance and nature of proposed Stock Assessment CRSP project topics. A second purpose of the meeting was to explore views concerning collaborative research and to discuss previous experiences in order to foster and facilitate successful relationships under the Stock Assessment CRSP. Finally, this group's views were solicited concerning the merits of different approaches to funding projects e.g., as pilot studies, as a guide for deliberations concerning the implementation framework of the Stock Assessment CRSP.

The views of this particular group were solicited as a sample of informed opinion. The members of the group were selected on the basis of their experience with artisanal or small-scale fisheries and thus represented several countries and geographical regions and various training disciplines. The views of this group in discussions concerning issues of the Stock Assessment CRSP are summarized in the Report of the Planning Workshop, which also contains several supporting documents which formed a basis for the discussions; as such the Report of the Planning Workshop provides a focus for further planning activities.

The present document contains the Report of the Planning Workshop which is comprised of the Proceedings and several supporting documents relating to the meeting discussions which are attached as appendices. The Project Specifications which have been received by the Planning Entity are attached as a final appendix to the Report. These include those received at the Planning Workshop and those submitted by mail to the Planning Entity. Guidelines for the construction of Project Specifications were provided in the Stock Assessment CRSP Planning Guide[1]. The Project Specifications are presented in the form in which they were submitted to the Planning Entity.

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[1] Published in December, 1982 by the Planning Entity.

In order to facilitate the construction of Stock Assessment CRSP Project Proposals, the Planning Entity intends to convene a Coordinating Workshop. Invitees to this Workshop will include U.S. university representatives and representatives from potential Stock Assessment CRSP host countries. In order to undertake the planning of this Workshop, the Planning Entity requests that potential U.S. university participants submit a) a ranking of projects of interest by order of preference, b) a description of research activities and expertise and c) curriculum vitae of proposed project participants. Utilizing these responses, the Planning Entity will frame the structure of the Coordinating Workshop. The result of this Workshop will be a collection of collaborative research Project Proposals to be considered for funding. Details concerning the review of these proposals are provided in the Stock Assessment CRSP Planning Guide.

REPORT OF THE PLANNING WORKSHOP

THE STOCK ASSESSMENT COLLABORATIVE RESEARCH SUPPORT PROGRAMME

(STOCK ASSESSMENT CRSP)

Hotel Dei Congressi, Rome

7 to 10 March 1983

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INTRODUCTION

The Planning Workshop for the Stock Assessment CRSP was called to order by Brian Rothschild at the Hotel dei Congressi, Rome at 10 a.m. on 7 March 1983.

Allan Furman, Attache for Development Affairs, Alternate U.S. Permanent Representative to the International Food Agency; Norman Pease, Fishery Adviser, U.S. AID; and Armin Linquist, Director, Fishery Resources and Environment Division, FAO made opening remarks. Mr. Furman emphasized the interest of the United States in contributing to the solution of world food problems and discussed avenues taken to seek these solutions. Mr. Pease indicated the interest of U.S. AID in developing fisheries research projects under the Stock Assessment CRSP. Dr. Linquist commented on the common interests between FAO programs and the Stock Assessment CRSP.

The meeting was attended by representatives from 10 countries, a representative from ICLARM and additional representatives from FAO. In attendance were: T.O. Ajayi, Nigeria; Woo-Il Choo, Korea; S. Jablonski, Brazil; J. Ordonez, Philippines; J.C. N'Jock, Cameroon; A. Samba, Senegal; M.S.M. Siddeek, Sri Lanka; M. Unar, Indonesia; C. Villalobos, Costa Rica; S. Zabi, Ivory Coast; D. Pauly, (ICLARM) Philippines and J. Caddy and S. Garcia (FAO), Rome. Complete addresses, telephone numbers and cable addresses may be found in Appendix I.

The Agenda (Appendix II) was organized to provide for substantive discussions on perspectives on small-scale fisheries and collaborative research.

BACKGROUND

The purposes and intent of the Workshop was discussed. The Workshop was intended to develop a perspective on small-scale fisheries and to obtain a set of Project Specifications from representatives of various countries attending the meeting.

With respect to the Stock Assessment CRSP planning, the Planning Entity's desire to have the Project Specifications be designed by potential host countries so that the projects reflected problems that were perceived to be most important to the involved countries was stressed. After assembling the Project Specifications that have been submitted to the program, the Planning Entity will review them with potential collaborators from U.S. universities and participating countries. After this review recommendations for funding will be made to USAID. It was pointed out that the exact amount available for implementing the Stock Assessment CRSP is not presently known and that the Planning Entity will therefore need to take this into consideration when making recommendations to USAID.

The primary focus of the Stock Assessment CRSP will be the production of a handbook at the end of the five-year programme which will a) provide multidisciplinary guidance on stock assessment and management methods for small-scale fisheries and b) provide experience papers based on research conducted under the Stock Assessment CRSP.

Susan Brunenmeister, Coordinator of the Stock Assessment CRSP, gave a detailed review of the various planning activities in the Stock Assessment

CRSP. She pointed out that a Coordinating Workshop is intended to be the next major event in the planning cycle. At present, a tentative date for the coordinating workshop is late May or early June. The exact nature and timing of the Coordinating Workshop will depend on a review of the proceedings of the present meeting.

It was indicated that the Planning Entity hopes to invite the participants in the Planning Workshop to the Coordinating Workshop. The participants of the Planning Workshop will be relied upon in the future for advice regarding the programme in general and also as points of contact for the further development of the Project Specifications which they brought to the meeting.

PERSPECTIVE ON SMALL-SCALE ARTISANAL FISHERIES

The discussion concerning small-scale fisheries touched on several important aspects of these fisheries including their relation to industrial fisheries, their contribution to national economies and their status with respect to management and development. It was recognized that a considerable proportion of the global catch of food fish is taken by small-scale fisheries. Operationally, small-scale fisheries are often thought of as:

- "labour-intensive"
- "productive of low income"
- "involving minimal capital complexity"
- "being fished by the economical and socially disadvantaged".

Because of the large magnitude of the small-scale fishery catch and the apparent impoverishment of these fisheries, there is considerable concern for their development and effective management. Can the resources be harvested more efficiently? Can the lot of the small-scale fishermen be improved?

It is precisely these questions that will be addressed by the Stock Assessment CRSP. The Program's research emphasis is to pursue questions that focus upon critical issues and yet are of sufficiently general interest in order to provide transferable methodologies applicable to a wide variety of small-scale fishery stock assessment and management problems.

In order to deal with small-scale fishery problems on a global basis, however, it is necessary to have a view characterizing small-scale fisheries and their special problems. With this in mind, we have prepared an "Overview of Small-scale Fisheries" which discusses catch magnitudes in different parts of the world, employment levels, and catch compositions, marketing and dispositions as well as landing trends, interactions between small-scale and large-scale fisheries, and the status of various small-scale fisheries (Appendix III).

The "Overview of Small-scale Fisheries" formed a basis for discussion and each representative presented a perspective on small-scale fisheries of his country (see Table 1.) The perspectives are collected in Appendix IV. The discussion touched on several aspects of small-scale fisheries.

Some Common Elements

The discussion reflected a number of important points regarding small-scale artisanal fisheries. The first were definitional in character:

- "Small-scale", "traditional", "artisanal", "indigenous", and "municipal" are terms that have been used to characterize what might be called non-industrial fisheries whereas an industrial fishery is generally thought of as involving relatively highly mechanized fishing vessels with crews of several individuals. The so-called non-industrial fisheries are often described, as indicated above, as "labour-intensive", "productive of low income", involving minimal capital complexity, and being fished by economically and socially disadvantaged fishermen, etc.

- However, all of these apparently negative characteristics are not necessarily common to all non-industrial fishermen and furthermore some of them may not be negative when referenced to other parts of the local economy. Dr. Garcia's comments in this regard provided a basis for further discussion (see Appendix V).

- Thus, while in general there are often numerous but converging problems associated with non-industrial fisheries, one must be cautious with stereotyped definitions, and care must be taken to place various metrics of non-industrial fishery performance in the context of the national and regional economics.

The difficulty of defining small-scale artisanal fisheries was therefore recognized.

However, it was agreed by all participants that small-scale or artisanal fisheries centred around the family as a basic unit. The fishermen frequently owns and operates the craft with members of his family/friends as the crew with his wife and son doing the processing and/or marketing. If more than one craft is owned, relatives or close friends may be put in command on a proceeds sharing arrangement rather than as hired or paid labour.

It was agreed that definitions of small-scale or artisanal fisheries as defined by the countries represented at the Workshop would be adopted. These definitions could broadly be classified into two categories:

a) The first type is typified by the West African situation, where small-scale or artisanal fisheries consist of owner-operated wooden 3-12 m canoes with or without outboard motor engines. All kinds of passive gear ranging from traps, hooks and nets are fished as well as beach-seines. Usually the payload of the craft and its range is small. Most of the work is done manually and this determines the number of men participating.

b) The second type is represented by regions where fishing has either had a longer history or is comparatively more developed as in the Philippines, Indonesia, Korea and Brazil and Costa Rica. Here artisanal or small-scale fishermen use craft as large as 25 m in length and can sail relatively long distances, e.g., from Indonesia to Australia. Some limited skilled labour may have to be employed to augment family labour. Gear used are comparatively more sophisticated and may include simple winches. Usually only 1 vessel is owned and no more than two.

Important Issues

Points brought out concerning biological, economic and sociological issues illustrated other important concerns. These were that:

- Resource abundance may be negatively affected by pollution or other habitat destruction. The effects of reef destruction are better documented than those that owe to mangrove destruction or pollution.

- The small-scale fisheries are difficult to assess and manage because they often consist of many fisheries scattered over vast areas. Therefore, any research programme needs to take account of this problem in designing sampling theoretic surveys of catch and nominal effort.

- Economies in small-scale fisheries may be dependent upon various commodities. Thus, in addition to marine fish and shellfish, fishermen may depend upon agriculture or aquaculture, for example, for their livelihood and any consideration of small-scale fisheries needs to take into account such other commodities.

- For some small-scale fisheries, enforcement and surveillance may be important, but in general the magnitude of this problem needs to be referred to each specific fishery in terms of the costs and benefits of enforcement.

- The potential yields in many small-scale fisheries are finite. Because any programmes that affect one sector of a small-scale fishery may have a negative affect on other sectors, considerable caution needs to be exercised when providing subsidies or grants to small-scale fisheries.

- Despite increased public-sector investment in fisheries, catches have not increased substantially. These investments have mostly been oriented toward the industrial sector. Now the pendulum is swinging towards investing in small-scale fishing. But it has been shown that careless investing in small-scale fishing can cause substantial economic problems for small-scale fisheries. Therefore considerable attention needs to be paid to the short and long/term investment strategies in small-scale fisheries in terms of their ultimate results.

- The fragile social structure and the often tenuous economic position of small-scale fishermen suggests that the long-term effects of investment be understood. Critical to these effects is the status of the stocks. There are, in fact, considerable problems in the stock assessment and mangement of small-scale fishing. These involve a) assessing and estimating fishing effort and catch b) determining best sizes for capture c) determining recruitment variability and d) designing an integrated management system for the stock. These are all important research problems.

DISCUSSION OF COLLABORATIVE RESEARCH

Points covered in the discussion on collaborative research concerned the amount of contributions to be made by U.S. universities and by host countries, and options for funding projects. It was noted that while there is no requirement for host countries to contribute monies, U.S. universities are required to contribute 25% of the costs.

With respect to funding options, since there will be a finite amount of funding available, considerations ranging from supporting only one or two large projects to funding several small projects, perhaps as pilot studies, were discussed. With respect to the latter, a number of small projects might be funded as pilot studies which would eventually evolve into larger projects depending on their relative success and interest levels. Merit was found for each type of approach, with that of pilot studies receiving particular attention.

Each representative presented a Project Specification intended for collaborative research and discussed the importance and features of the proposed research and the desired research areas of collaboration (see Appendix VI).

In the discussion of research approaches, Daniel Pauly referred to his paper presented at the ACMRR Working Party concerning near-shore living tropical resources noted above (see Appendix VI).

Table 1. Perspectives on Small-Scale Fisheries in Countries Represented by Planning Workshop Participants.

1. A Brief Statement on the Artisanal Small-Scale Fishery in Nigeria by T.O. Ajayi.

2. A Perspective on the Small-Scale Fishery in Korea by Woo-il Choo.

3. Brazilian Small-Scale Fisheries by S. Jablonski.

4. Perspective on the Small-Scale Fishery in Cameroon by J.C. N'Jock.

5. A Perspective of the Small-Scale Fishery in the Philippines by J. Ordonez.

6. Perspective on the Senegalese Small-Scale Fishery by A. Samba.

7. The Small-Scale Fishery in Sri Lanka by M.S.M. Siddeek.

8. The Role of Penaeid Shrimp in the Indonesian Small-Scale Fisheries by M. Unar.

9. Costa Rican Fisheries by C. Villalobos.

10. Perspective on Small-Scale Artisanal Fisheries in the Ivory Coast by S. Zabi.

Table 2. Project Specifications presented by each country representative at the Planning Workshop.

	Title	Author
1.	Relative fishing power of the multi-gear small-scale fisheries of Nigeria and the categorization of their catches by source.	T.O. Ajayi
2.	The assessment of fishery resources propagated by the artificial reef in Korea.	Woo-Il Choo
3.	The artisanal fishery in northeast Brazil: Improvement of the assessment analysis of stocks under exploitation by artisanal fishermen, in northeast Brazil and a follow up on the effects of fishing on the available resources.	S. Jablonski
4.	Research and development on the marine artisanal fisheries in Cameroon. Etude et aménagement de la pêche artisanale maritime camerounaise.	J.C. N'Jock
5.	Stock assessment of the coastal waters of Palawan Island including the Calamianes and Cuyo Island groups, Philippines.	J.A. Ordonez
6.	Estimation of near-shore marine species catch possibilities by the artisanal fishery all along the southern coast of Senegal (between the Cap-Vert peninsula and the Guinea border.)	A. Samba
7.	Stock assessment studies in Palk Bay and Gulf of Mannar areas of Sri Lanka.	M.S.M. Siddeek
8.	Stock assessment of the penaeid shrimp in Cilacap, the south coast of central Java, Indonesia.	M. Unar
9.	Stock Assessment CRSP Project Specification concerning the improvement of the conditions of artisanal and shrimp fisheries in the Golfo de Papagayo area, through stock assessment and fishery management, Costa Rica and evaluation of the fish resources of the water surrounding Cost Rican Dome.	C. Villalobos
10.	The marine and lagoon artisanal fishery development project in the Ivory Coast. La peche artisanale maritime et lagunaire en Cote d'Ivoire.	S. Zabi

APPENDIX I

LIST OF ATTENDEES

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APPENDIX II

AGENDA

1. INTRODUCTIONS

   a) Allan Furman, Norman Pease, Others
   b) Meeting participants
   c) Housekeeping details, per diem, etc.

2. APPROVAL OF AGENDA

3. BACKGROUND

   a) Evolution of Meeting and cooperation with FAO
   b) Stock Assessment CRSP planning

      The Stock Assessment CRSP Planning Guide will be reviewed

   c) Discussion on Stock Assessment CRSP planning
   d) Future participation in planning

4. PERSPECTIVE ON SMALL-SCALE FISHERY

   Viewpoints will be solicited from each representative on importance of small-scale fisheries, the relation of small-scale fisheries to industrial fisheries, importance of small-scale fisheries to national economies, the status of fishery management and development.

5. DISCUSSION OF COLLABORATIVE RESEARCH

   a) General comments on collaborative research
   b) Project Specifications of individual representatives

6. OTHER ITEMS

7. FINAL DISCUSSION AND APPROVAL OF REPORT

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APPENDIX III

AN OVERVIEW OF SMALL-SCALE FISHERIES

Susan L. Brunenmeister

This paper provides an overview of the characteristics of small-scale fisheries and an understanding of their importance. These aspects are examined by discussing catch magnitudes in different regions of the world, employment levels, and catch compositions, marketing and dispositions. Other features of these fisheries discussed include landing trends, interactions between small-scale and large-scale fisheries and status of the fisheries.

Definitions

The diverse nature of small-scale fisheries with respect to type and size of boats used, degree of motorization and type of gear utilized makes arriving at a comprehensive methodological definition a difficult, if not impossible, task. However, small-scale fisheries can be characterized by several economic and social features. The Workshop on the Legal and Institutional Aspects of Fisheries Resources Management and Development[1] articulated the following definition:

> "Small-scale fisheries are labour-intensive and are conducted by artisanal craftsmen whose level of income, mechanical sophistication, quantity of production, fishing range, political influence, market outlets, employment and social mobility, and financial dependence keep them subservient to the economic decisions and operating constraints placed upon them by those who buy their production."

Stressing the economic aspect, Gerhardsen (1977) considered small-scale fisheries to be "those fisheries (including aquaculture activities) in which the poorest one-half to two-thirds of the fishermen are engaged." He considered "Hence all countries have a small-scale problem but the extent of the poverty problem, the type of labour-intensive technology which is considered appropriate as well as the prospects for growth vary from country to country." This sentiment was echoed in the definitional approach taken by the IPFC Symposium on the Development and Management of Small-Scale Fisheries[2] where it was concluded that "each country understands what is meant by its own small-scale fisheries, in marine and inland, capture and culture fisheries." The Symposium further noted that "overlaying all [definitions] was the understanding of the poverty and underprivileged state of the small-scale fishermen."

This paper, then, considers small-scale fisheries as defined by the nations themselves. The particular types of boat, propulsion and gear types utilized in each fishery included here are thus diverse and range from canoes

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[1] Report of the Workshop on the Legal and Institutional Aspects of Fishery Resources Management and Development, 5-8 April 1976, Manilla. South China Sea Fisheries Development and Coordinating Program. SCS/76/GEN/3. June, 1976.

[2] 19th Session of the Indo-Pacific Fishery Commission. Kyoto, Japan 21-30 May 1980, cf. Proceedings Section III. Symposium on the development and management of small-scale fisheries.

in western Africa to small-scale trawlers in the eastern Mediterranean. The type of gears referred to as small-scale and large-scale by different countries are summarized in Appendix I.

Importance of Small-Scale Fisheries

Catch magnitudes, revenues and disposition, and domestic support and employment levels can each be used to gauge the national, regional, or global importance of these fisheries. These characterizations are somewhat broad in certain cases as statistics and available information vary in completeness, precision, accuracy, and timeliness.

With respect to catch magnitudes, the contribution of the small-scale fisheries sector varies from region to region and country to country. In western Africa small-scale fisheries accounted for over half the fisheries landings in 10 of 18 countries in 1976 (Table 1). While this ratio declined in 1978 somewhat, small-scale fisheries steadily accounted for 57-58% of the total landings in the region during these years. Small-scale landings were of greatest magnitudes in Senegal, Nigeria and Ghana.

Data available for Indian Ocean and Western Pacific areas show a greater variability in the relative catch magnitudes of small-scale fisheries of countries, with small-scale fisheries accounting for 50% or more of the landings in only 7 of the 16 countries represented (Table 2). In these regions, small-scale landings were of greatest magnitudes in China, Indonesia, India and the Philippines.

In Central and South America, available quantitative data was scanty (Table 3). Highest landings were observed for Chile and Venezuela and the magnitudes of these landings were intermediate to those observed in the previous two regions. Data for the Mediterranean were also less readily available (Table 4). Catch magnitudes of small-scale fisheries in the eastern Mediterranean were generally low, with highest landings occurring in Egypt. The magnitudes of small-scale fishery landings in this region appear low compared to other regions.

The economic importance of small-scale fisheries is both a function of the catch magnitude and catch composition and relations of these aspects to the industrial fisheries landings. In Bangladesh, where small-scale fisheries account for 95% of the fishery production, they contribute most substantially to the c. 6% of the GNP attributable to fishery production (Ali and Haque, 1980). Municipal fishermen of the Philippines landed c. 60% of the total fishery production in 1979; in 1978, the fishery industry contributed 4.9% of the GNP (Anonymous, 1980a). In Sri Lanka, in which the fishery industry as a whole amounted to 1.3% of the GNP in 1978, small-scale fishery landings exceeded 95% of the total landings (Fernando, 1980). In contrast, industrial fisheries overshadow the production of small-scale fisheries in Thailand, and, as such, small-scale fisheries play a minor role in the fishing industry today (Bhukaswan, 1980).

With respect to catch composition, which affects catch value and hence, market disposition, small-scale fisheries in both Indonesia and Pakistan produce valuable export products. In Indonesia, 76% of the shrimp export volume is due to the small-scale fishing sector (Anonymous, 1980b) and in Pakistan, both shrimp and salted dried fish produced by the small-scale fishery is export-oriented (Anonymous, 1980c). In the Philippines, hand-line caught yellowfin tuna is important for export (Anonymous, 1980a).

In most nations, the small-scale fishery production is destined for domestic consumption and, in many cases, represents an important source of protein. In Sierra Leone, the main source of animal protein is fish, with per capita consumption estimated at 11 kg in 1973/1974 (Sierra Leone Ministry of Natural Resources, 1976). In Togo, the artisanal sector produces almost all the fish landings and is the major supplier of fish to the population (FAO, 1982). In Guatemala, the artisanal catch is the basic source of fish for the country (Martinez A., 1976) and in Nicaragua, artisanal production almost completely meets domestic fish requirements (Flores Arana, 1976). In Pakistan, small-scale fishery production is the main source of protein for the poor (Anonymous, 1980c). In the Philippines, the municipal fisheries provide protein to 95% of the 45 million people dependent upon fishing and fishery products (Anonymous, 1980a). In Chile, 80% of the fresh fish and all shellfish that are consumed are produced by artisanal fishermen (Constantinides, 1976).

The value of the small-scale fishery production was estimated in Japan in 1978 to equal 600 billion yen (= U.S. $3.1 billion[3]; Asada, 1980). In Sri Lanka, coastal production in 1978 amounted to 758.6 million rupees (= U.S. $48.9 million[3]) or 95% of all fishery production (including inland) value (Fernando, 1980). In India, the landed value of the traditional fisheries catch, which was close to 60% of the marine fisheries landings was 2,160 million rupees (= U.S. $263.8 million[3]; Silas and Alagarswami, 1980). Data pertaining to the value of landings of small-scale fisheries in Taiwan, Malaysia, Philippines and Thailand in 1979 from SEAFDEC (1981) below indicate that in Taiwan and Philippines the relative value of landings was generally proportional to the magnitudes of the landings. In Thailand and Malaysia the values per kilogram of the small-scale fisheries landings averaged 143% and 52%, respectively, higher than those of the large-scale fisheries.

Quantity Landings in 1979 (MT)

	% Small-Scale	MT Small-Scale	MT Large-Scale
Taiwan	4.03	29,929	713,069
Malaysia	24.24	152,732	477,727
Philippines	59.56	737,587	500,747
Thailand	13.43	227,030	1,463,350

Value Landings U.S. $1,000 in 1979

	%	Small-Scale		Large-Scale	
	Small-Scale	Value	Value/kg.	Value	Value/kg.
Taiwan	4.50	30,177	1.01	640,821	0.90
Malaysia	32.80	188,458	1.23	386,122	0.81
Philippines	60.41	808,830	1.10	529,985	1.06
Thailand	27.06	154,362	0.68	415,985	0.28

[3]Conversion rates per Statistical Abstract of the United States. 1979. U.S. Dept. of Commerce, Bureau of the Census. Superintendent of Documents, U.S. Printing Office, Washington, D.C.

In terms of employment, small-scale fisheries, because they are labour-intensive, tend to support large numbers of people. In the Philippines the municipal fishery supports around 600,000 people in fishing villages and provides jobs for around 5% of the working force (Pulanco, Dickson, Gante and Signey, 1982). Marine fisheries of Indonesia, of which virtually all the production is from small-scale fisheries, employ more than 250,000 persons, thereby supporting over 1.2 million people (Indonesia Directorate General of Fisheries, 1982). The canoe fisheries of Sierra Leone of which there are c. 12,000 full- and part-time fishermen support a fishing industry totalling around 24,000 people or 0.4% of the population (Sierra Leone Ministry of Natural Resources, 1976). Silas and Alagarswami (1980) indicated the total fishermen population in India amounted to 1.4 million of which 22.5% were actually engaged in fishing.

With respect to employment of fishermen per se, in Malaysia 90% (95,000 persons) of the total fishing population are small-scale (Kiat, 1980). In Pakistan, 61,000 of 98,227 fishermen are small-scale (Anonymous, 1980c). In Sri Lanka, in 1979, small-scale fishermen numbered 47,075 persons or 97.6% of the fishermen in marine and inland fisheries (Fernando, 1980).

While small-scale fisheries often provide a livelihood for significant numbers of people, the level of support in many cases is often below the poverty level. Often too, the rate of decline in poverty in this sector lags behind the overall national rate such that fishermen are among the poorest, if not the poorest, of the economic sectors. In Peninsular Malaysia, 1980 estimates indicated about 45% of the 42,800 fishing households were at the poverty level, whereas in the population as a whole, poverty levels declined from 49% in 1970 to 29% in 1980 (bin Ismail, bin Lamin and Omar, 1982).

Marketing of Catches

As much of the production of small-scale fisheries is domestically, often locally, consumed, most of the catch is either sold fresh or preserved by relatively simple processes. Catches of the Chilean artisanal sector are primarily sold fresh (77%) with the remainder being pickled (19%) or dried salted, smoked or frozen (4%) (Campos Lira, 1976). In Indonesia, approximately 50% of the total fish production is salted or dried with much of the remainder being marketed fresh, frozen or alive with only a small amount being canned (Anonymous, 1980a). In Sierra Leone, only a small amount of the catch of the canoe fishermen is sold fresh; the remainder is smoked which preserves the fish for about five days (Sierra Leone Ministry of Natural Resources, 1976). In Sri Lanka, 85% of the artisanal catch is consumed fresh, with the remainder processed primarily into dried fish (Fernando, 1980). In India, 70% of the catch is consumed fresh, 12% is sundried, 9% is salted with the remaining 9% being frozen, canned or converted to fish meal (Silas and Alagarswami, 1980).

The production of small-scale fishermen is generally marketed through middlemen. Catch mark-ups are generally high, with relatively low prices being paid to the fishermen and with low revenue accruing to the community. In Sierra Leone, retail prices are 4-5 times higher than the original prices paid by the middlemen to the fish "mammies", the women who handle the fishermen's catch (Sierra Leone Ministry of Natural Resouces, 1976). In Honduras, Cabellero (1976) noted in a major fish producing area, middlemen make a gross profit of 166% and that retailers make a gross profit of 150% to 188%. The resulting differential in price paid to the fishermen and price paid by the consumer is 500%. Gines (1976) stated that fishermen in Venezuela receive one-third the price of that which the consumer pays for fresh fish and

receive a price one-half of that which the consumer pays for salted fish.

In response to the generally low prices received by fishermen for their catches, cooperatives have been formed in many areas. In most instances, however, these attempts did not result in permanent organizations. Initial attempts in the late 1950's in Benin proved unsuccessful due to lack of permanent supervisory assistance. In 1976, however, the government concluded a campaign to educate and inform fishermen, and the effort by 1979 resulted in the formation of some cooperatives (FAO, 1982). Fishing cooperatives failed in Togo due to a variety of factors including poor management, lack of fishing gear supplies and refrigeration facilities, and opposition of the market women who felt the amount of fish they handled would be reduced (FAO, 1982). Silas and Alagarswami (1980) indicated that fishing cooperatives in India have generally not been successful with 61% showing losses and an additional 10% showing no profits. They attributed the situation to lack of management training and to vested interests and indicated that fishermen continued to be exploited by middlemen and merchants. In some areas in Central America, cooperatives have also not been generally successful, e.g. in Nicaragua (Flores Arana, 1976) Panama (Arellano-Lennox, 1976) and Guatemala (Martinez A., 1976).

Interactions between small-scale and industrial fishermen

In several countries, detrimental effects on artisanal and small-scale fishermen by industrialized fisheries have been noted. In many cases, these interactions take the form of conflicts over fishing areas. Damage to small-scale fishing gear by trawlers has been a frequent result, for example, in the Congo and Mauritania (Everett, Ansa-Emmin, Robinson and Roest, 1982) and to ameliorate these situations several states have adopted laws which exclude industrial fishing in certain areas and/or during certain times (Table 8). In India, conflicts over fishing rights have led to loss of life and destruction of boats and other property (Silas and Alagarswami, 1980).

Less physically direct interactions between artisanal and industrial fisheries also can occur through harvesting of the same stocks; this occurs, for example, with sardines in the Congo and Sierra Leone (Everett et al., 1982), and with shrimp, oil sardines and mackerel in India (Silas and Algarswami, 1980). While such harvesting can adversely impact the productivity of each fishery from a biological standpoint, more direct economic impacts can occur. In Nigeria, the conflict is economic and occurs when the larger amount of fish landed by the industrial fishery keeps prices paid to the small-scale fishermen low (Everett et al., 1982).

Table 1. Catches of Small-Scale and Industrial Fisheries of West Africa (MT)
(See Appendix II for footnotes to table)

Country	1976[1]				1978[2]			
	% Small-Scale	Small-Scale Catch	Industrial Catch	Total Catch	% Small-Scale	(Estimated) Small-Scale Catch	Industrial Catch	Total Catch
Morocco	0.0	1,000	291,900	292,900		N/A		
Mauritania	35.1	13,400	24,800	38,200	33.3	7,000	14,100	21,100
Senegal	78.8	276,600	74,300	350,900	44.1	150,000	190,300	340,300
The Gambia	75.0	8,000	4,000	12,000	100.0	10,000	0	10,000
Cape Verde Is.	75.3	7,000	2,300	9,300	72.3	6,000	2,300	8,300
Guinea Bissau	71.4	5,000	2,000	7,000	78.9	1,500	400	1,900
Guinea	28.6	4,000	10,000	14,000	77.8	7,000	2,000	9,000
Sierra Leone	92.5	62,000	5,000	67,000	46.2	22,000	25,600	47,600
Liberia	83.3	20,000	4,000	24,000[4]	-	20,000[6]	-	14,800[6]
Ivory Coast	33.5	24,000	47,600	71,600	40.1	30,000	44,900	74,900
Ghana	60.5	118,455	77,295	195,750[3]				
Ghana	72.6	154,300	58,300	212,600[5]	59.2	130,000	89,600	219,600
Togo	82.5	9,400	2,000	11,400[5]	39.5	3,000	4,600	7,600
Benin	42.9	3,000	4,000	7,000[5]	83.3	4,000	800	4,500
Nigeria	92.9	157,700	12,000	169,700[5]	73.4	200,000	72,600	272,600
Cameroon	53.7	11,600	10,000	21,600[5]	-	25,000[6]	-	21,600[6]
Cabon	46.4	2,600	3,000	5,600[5]	89.3	5,000	600	5,600
Congo	25.2	3,700	11,000	14,700[5]	36.8	6,000	10,300	16,300
Sao Tome & Principe								1,500
Zaire	20.0	2,000	8,000	10,000[5]	14.3	200	1,200	1,400
Equatorial Guinea					45.0	1,800	2,200	4,000
Total	57.1	765,000	574,200	1,337,500	58.0	628,500	454,400	1,082,100

Table 2. Catches of Small-Scale and Industrial Fisheries in Indian Ocean and Western Pacific (MT) (See Appendix II for footnotes to table)

Country	% Small-Scale	Small-Scale Catch	Industrial Catch	Total Catch	Year
Brunei[1]	100.0	2,793	0	2,793	1979
China (Taiwan)[1]	4.0	29,929	713,069	742,998	1979
Malaysia[1,10]	24.2	152,732	477,227	629,959	1979
Philippines[1]	59.6	737,587	500,747	1,235,334	1979
Singapore[1]	36.3	5,775	10,131	15,906	1979
Thailand[1]	13.4	227,030	1,463,350	1,690,380	1979
Bangladesh[2]	95.0	95,000	5,000	100,000[2]	1980[2]
Pakistan[3]	40.0	103,120	154,680	257,800	1978
Indonesia[4]	100.0	1,317,744	0	1,317,744	1979
China[5]	98.0	2,265,760	46,240	2,312,000	--[5]
Hong Kong[6]	20.0	31,400	124,543	155,943	1978
Kampuchea[5]	20.0	2,160	8,640	10,800	--[5]
Vietnam[5]	25.0	209,300	627,900	837,200	--[5]
India[7]	62.2	(873,288)[7]	(530,712)[7]	1,404,000	1978
Sri Lanka[8]	97.9	147,500	3,210	150,710	1979
Japan[9]	21.7	1,979,000	9,136,000	9,136,000	1978
Papua New Guinea[5]	25.0	15,757	47,272	63,029	--[5]

Table 3. Catches of Small-Scale and Industrial Fisheries of Central and South America (MT) (See Appendix II for footnotes to table)

Country	% Small-Scale	Small-Scale Catch	Industrial Catch	Total Catch	Year
Chile[1]	--	89,000	--	--	average 1969-1973
Ecuador[2]	--	20,000	--	--	N/A
Peru[3]	--	139,900	--	--	1974
Venezuela[4]	79.3	138,134	36,057	174,191	1973
Guatemala[5]	--	800	--	--	N/A

Table 4. Catches of Small-Scale Fisheries in the Eastern Mediterranean from Grofit (1981).

Country	% Small-Scale	Small-Scale Catch	Industrial Catch	Total Catch	Year
Egypt	--	11,636	--	--	1978
Gaza & N Sinai	--	4,700	--	--	1978
Israel	--	3,525	--	--	1978
Lebanon	--	1,200	--	--	1977
Syria	--	720	--	--	1976
Turkey	--	1,788	--	--	1976
Cyprus	--	1,320	--	--	1978

Table 5. Catch composition of small-scale Central and South American fisheries in metric tons. 00 = very common occurrence in catches; 0 = common in catches. Source is footnoted; catches were organized to match FAO (1979) categories. (See Appendix II for footnotes to table.)

FAO Group No.	Categories	Peru[1] 1974	Chile[2] 1969-1973 average	Ecuador[4] 1974	Venezuela[6] 1973	Panama[7]	Costa[8] Rica	El Salvador[10]	Guatemala
	Marine Fishes								
31	Flounders, halibuts, soles, etc.						0[9]		
33	Redfishes, basses, congers, etc.	35,480	3,800		0	0	0[9]	0	
34	Jacks, mullets, sauries, etc.	36,590	12,000		0	0		0	
35	Herrings, sardines, anchovies, etc.	15,867			0			0	
36	Tunas, bonitos, billfishes, etc.	2,841			0	0		0	
37	Mackerels, snooks, cutlassfishes	7,205	7,000		0				
38	Sharks, rays, chimaeras, etc.				0		0	0	
39	Miscellaneous marine fishes		14,200	8,567[5]				0	0
	Crustaceans								
42	Sea spiders, crabs, etc.				0			0	
43	Lobsters, spiny rock lobsters, etc.			00	0		0	0	
44	Squat-lobsters, nephrops, etc.								
45	Shrimps, prawns, etc.			00				0	
47	Miscellaneous marine crustacea		2,000[3]		0			0	0
	Molluscs								
52	Abalones, winkles, conchs, etc.							0	
53	Oysters				0		0	0	
54	Mussels	13,415	18,000		0		0	0	
55	Scallops, pectens, etc.	3,000							
56	Clams, cockles, arkshells, etc.		8,000		9,000			0	
57	Squids, cuttlefishes, octopuses				0				
58	Miscellaneous marine molluscs		13,000	0	0				
13	Miscellaneous freshwater fishes				0				
	Other								
72	Turtles and other reptiles				0		0		
75	Sea urchins & other echinoderms		3,000						
93	Green seaweeds & other algae		7,000						
	Miscellaneous	15,492							
	Total	139,900	89,000	c.20,000	138,134				c.800

Table 6. Catch compositions of small-scale West African fisheries in metric tons. 00 = very common occurrence in catches; 0 = common in catches; Source is footnoted; catches were organized to match FAO (1979) categories. (See Appendix II for footnotes to tables.)

FAO Group No.	Categories	Nigeria[1] 1976	Senegal[2] (1978) canoe fisheries	Ghana[3] (1976) canoe fisheries	Ghana[3] (1976) inshore vessels	Sierra[4] Leone	Congo[5]
	Marine Fishes						
31	Flounders, halibuts, soles, etc.	12,660	332			0	00
33	Redfishes, basses, congers, etc.	80,181	12,943	10,674	10,680	0	0
34	Jacks, mullets, sauries, etc.	91,633	7,995	2,573	682	0	0
35	Herrings, sardines, anchovies, etc.	3,477	64,000	56,866	3,025	0	~4000
36	Tunas, bonitos, billfishes, etc.		2,000	14,079	174	80.0%	
37	Mackerels, snooks, cutlassfishes	3,005	10	1,298		0	00
38	Sharks, rays, chimaeras, etc.	19,161	1,115	2,185		0	0
39	Miscellaneous marine fishes	30,947	26,770	16,265	1,988		
	Crustaceans						
43	Squat-lobsters, nephrops, crabs, etc.						0
45	Miscellaneous marine crustacea		1,728				
	Molluscs						
57	Squids, cuttlefishes octopuses		996		55		
58	Miscellaneous marine molluscs		1,421				
	Freshwater Fishes						
11	Carps, barbels & other cyprinids	5,522					
12	Tilapias and other cichlids	38,099					
13	Miscellaneous freshwater fishes	148,960					
	Diadromus Fishes						
24	Shads, milkfishes, etc.			14,515	422		
25	Miscellaneous diadromus fishes	48,237					
	Total	484,882	119,310	118,455	17,026	32,537	6,000

Table 7. Catch composition of small-scale fisheries in the Western Pacific and Indian Ocean in metric tons. 00 = very common occurrence in catches; 0 = common in catches. Source is footnoted; catches were organized to match FAO (1979) categories. (See Appendix II for footnotes to table.)

FAO Group No.	Categories	China[1] (Taiwan) 1979	Malaysia[1] West Coast 1979	Malaysia[1] East Coast 1979	Malaysia[1] Sabah 1979	Malaysia[1] Sarawak 1979	Philippines[1] Luzon 1979	Philippines[1] Visayas 1979	Philippines[1] Mindanao 1979	Thailand Gulf of Thailand 1979	Thailand[1] Indian Ocean 1979	Bangladesh[2] 1971-72 sample in %	Pakistan[3] 1978	India[4], East Coast: Bay of Bengal. average landings in % 1975-1979
	Marine Fishes													
31	Flounders, halibuts, soles, etc.	7	179	7	55	12	294		44	55	378		0	
33	Redfishes, basses, congers, etc.	608	11,097	5,190	6,330	2,786	70,997	36,638	27,322	5,160	2,474	3.16	0	22.96
34	Jacks, mullets, sauries, etc.	2,010	4,299	12,582	6,052	2,859	48,034	25,802	53,722	6,436	1,931	8.18	0	5.25
35	Herrings, sardines, anchovies, etc.	2,131	2,156	1,107	423	1,453	51,763	32,285	42,685	25,158	1,123	7.51	0	17.25
36	Tunas, bonitos, billfishes, etc.	4,054	261	5,275	751	643	21,828	46,194	55,796	1,386	19	10.00	0	2.68
37	Mackerels, snooks, cutlassfishes	1,203	4,575	6,333	2,497	2,554	19,163	16,640	11,678	6,636	904		0	7.24
38	Sharks, rays, chimaeras, etc.	1,468	1,637	257	301	1,295	4,686	1,993	1,254	1,711	146	0.30		7.25
39	Miscellaneous marine fishes	12,155	15,091	2,421	179	5,408	1,248	524	411	26,360	11,473	33.63		27.07
	Crustaceans													
42	Seaspiders, crabs, etc.													
43	Lobsters, spiny-rock lobsters, etc.	559	1,319	97	972	217	5,189	8,023	427	17,523	4,412		0	
44	Squat-lobsters, nephrops, etc.	78			76		1,158	16	282	11,933			0	
45	Shrimps, prawns, etc.	3,381	21,798	660	1,000	5,598	10,980	4,263	1,453	18,922	10,110		0	5.38
47	Miscellaneous marine crustacea		6,950	947		116	249	11						3.15
	Molluscs													
53	Oysters	21					798			1,781	23			
54	Mussels						2,367	11	586	3,683	268			
55	Scallops, pectens, etc.	3						7	46					
56	Clams, cockles, arkshells, etc.	250	1,186		88		4,695	13	105	4,224	319			
57	Squids, Cuttlefishes, octopi	392	443	735	216	3	4,621	2,426	8,908	4,862	335			
58	Miscellaneous marine molluscs	1,195				4	908	64	624	242				
	Diadromous Fishes													
24	Shads, milkfishes, etc.	217	509	145	170	64	379	369	606			37.22		
25	Miscellaneous diadromous fishes		293	7			20	69	63					
	Other													
72	Turtles and other reptiles													
75	Sea urchins and other echinoderms	45					30	10		43,235[5]	60,280[5]			
81	Pearls, mother-of-pearl, shells, etc.						19	1	63	4	10			
83	Sponges						264	1	179					
92	Red seaweeds							6	43					
94	Miscellaneous aquatic plants	152					11	535	105,561					
	Total	29,929	72,093	37,363	19,530	23,446	249,771	175,918	311,898	189,415	37,615			average landings 387,298 MT
										2,087	45	(574 MT)		

Table 8. Measures designed to reduce conflicts between artisanal and industrial fishing activities.

Country	Measure	Source
Benin	3-mile zone reserved for marine artisanal fishermen; extension to 5 nautical miles under consideration	FAO (1982)
Congo	3-mile zone reserved for artisanal fishery (depths 10-20 m). Artisanal fishery extends to 30 m depth. Industrial fishery range from 10-80 m.	FAO (1982)
Mauritania	3 mile limit in which artisanal fishermen have special privileges	FAO (1982)
Nigeria	2 mile zone exclusive to artisanal fishermen	FAO (1982)
Sierre Leone	5-mile zone exclusive for artisanal fishermen newly drafted.	FAO (1982)
Senegal	6-mile zone reserved for artisanal fishery	FAO (1982)
India	5 km zones reserved by most states exclusively for traditional craft	Silas and Alagarswami (1980)
Indonesia	Coastal fishing belts reserved for small-scale fishermen with most simple fishing methods. Number of bottom trawlers controlled in certain areas to reduce impacts on demersal resources.	Anonymous (1980b)

Appendix I. Craft and Gear Characteristics of Small-Scale and Large-Scale Fisheries

Country	Small-Scale	Large-Scale	Table	Reference
All countries in Table 1. 1976 catches	All canoe fisheries and vessels ≤12m (39') in length		1	Everett (1978)
Table 1. 1978 catches:				
Morocco	Craft up to 12m, with a maximum 15 GRT fishing in territorial waters. Boats <10 GRT most common. Gear longline, boats with gill nets and trammel nets, bonito nets, pots, handlines and hooks		1	FAO (1980)
Mauritania	Gear includes bottom set and surface gill nets, ring nets, purse and beach seines, handlines and cast nets. Most fishing done with handlines		1	FAO (1980)
Senegal	Refers to canoe fishery and improved artisanal fishery. Canoe fishery: craft 6-15m long, may or may not be motorized. Improved artisanal fishery uses small vessels 13m in length which use trawls, seines or handlines.		1	FAO (1980)
Sierre Leone	Canoes ranging from traditional one-man canoe to 13 man canoe. Gear includes handline, drift gill nets, bottom set nets, ring nets, small purse seines and beach seines.		1	FAO (1980)
Benin	Canoes, 25% (in 1980) motorized. Gears used are surfaced gill nets and bottom set nets, sardinella nets, surrounding gill nets, shark nets, purse seines, beach seines, handlines		1	FAO (1980)

Country	Small-Scale	Large-Scale	Table	Reference
Togo	Canoes, 70% (in 1980) motorized. Main gears used are single and multiple hook handlines, cast nets, beach seines, gill nets and purse seines		1	FAO (1980
Nigeria	Most canoes not motorized. Main gears are gill nets, cast nets, beach seine trawl nets, purse seines, ring net, traps, hooks and handlines, hooks and longlines. Small boats 25' fiberglass boats recently introduced.		1	FAO (1980
Congo	Two types of canoes ~6m, and 12m average lengths, c. 25% motorized. Gear include bottom set net (most common), surface gill nets, beach seines, dip nets, handlines, cast nets.		1	FAO (1980
All other countries	Canoes and small boats		1	FAO (1980)
Brunei	Outboard-powered boats and inboard-powered boats of ≤60' (18. m) L.O.A. and less		2	SEAFDEC (1981)
China (Taiwan)	No boats; non-powered boats fishing <3 nautical from shore "coastal fisheries"	Powered fishing boats fishing >3 nautical miles from shore. Usually include "inshore fisheries" and "deep-sea fisheries"	2	SEAFDEC (1981)
Malaysia	In inshore-waters ≤3 nautical miles from shore. Uses traditional gear (hand-line, gill nets, sunken drift net, mini-trawls, beach seines, etc) Boats <10 GT in inshore waters "inshore or artisanal fishery"	Uses modern gear types such as trawl, purse seines Boats >10 GT in waters >3 nautical miles from shore "offshore fisheries"	2	SEAFDEC (1981)

Country	Small-Scale	Large-Scale	Table	Reference
Philippines	Fishing without a boat; boats ≤3 GT	Boats >3 GT	2	SEAFDEC (1981)
Singapore	Inshore fishery using palisade traps, drift nets, beach seine, fish pots, etc.	Offshore fishery using otter trawls, long lines, etc.	2	SEAFDEC (1981)
Thailand	Pomfret gillnet; shrimp gill net; other gill nets. Squid cast net with light; cast nets Acetes scoop net; scoop nets. White board for catching shrimp; collecting shellfish; Others	Otter-board trawl, pair trawl, Thai purse seines Chinese purse seine, Luring purse seine, anchovy purse seine, Spanish mackerel gill net, Mackerel encircling gill gill net, Bamboo stake trap	2	SEAFDEC (1981)
Bangladesh	Two types of plank-built boats; dinghi, 6m-8m long powered by oar or sail and chandi powered by sail or motorized. Dugouts 10-20m (5m-26m in length) in length powered by sail. Fixed bag net; stake nets.	Trawlers 17-44 m.	2	Mohiud'n, Hibria, Hossai and Ali (1980)
Pakistan	Four types of unmotorized boats, and outboard motorized sail vessels. Main gears are castnets handline, gill nets, longlines.	Mechanized gill nets (55-72' overall, in-board diesel engines ranging from 88-150 hp); trawlers	2	Anonymous (1980c)
Indonesia	Un-motorized boats; Fishing accomplished without boats. Motorized boats <10 GT		2	Indonesia Directorate General of Fisheries (1982)
Hong Kong	Vessels <40' L.O.A., fishing in coastal waters 15-25 fathoms deep	Vessels ≥40' L.O.A. fishing in offshore waters >25 fathoms deep	2	SEAFDEC (1981)
	6m inshore vessels (<48 hp) gear include trawls, gill nets (<17 hp), handlines (<17 hp), longlines, purse seines; non-mechanized boats; traps, crab netting, surface shrimp trawling		2	Gaiger and Richards (1980)

Country	Small-Scale	Large-Scale	Table	Reference
India	Indigenous craft ranging from log catamarans to constructed boats. Use wide range of gear including hook & lines, drag net, bag net, gill net, drift net, trawl nets, boat seine, shore seine. Mechanized boats use trawls, purse seines, gill nets		2	Silas and Alagarswam (1980)
Sri Lanka	28-32' foot inboard mechanized boats; 17 1/2' outboard mechanized boats; traditional non-mechanized boats	Trawlers, tuna boats, 10/11 ton boats	2	Fernando (1980)
Japan	Unpowered and powered boats <10 tons		2	Asada (1980)
Chile	bongo: wooden boat (3-7m in length) oars or motorized no cabin; chalupa: wooden boat (7-11m in length) powered by oars or inboard motor, usually no cabin; lancha: wooden boat (11-15 m in length) powered by inboard motor with cabin, 5-10 member crew. Iron or wooden boats >15m in length, instrumentation, crew 6-10 men. Gears include handline, hook & line, longlines, trotlines, nets, traps, harpoons, diving for shellfish.		3	Campos Lira (1976)
Ecuador	Boats <5 MT, canoes, catamarans plank-built boats. Gears include circular gill net, beach net, trammel net, gill net, cast net, trolling, traps, barrier nets, longlines, dip nets, push nets		3	Ecuador Instituto Nacional de Pesca (1976)
Peru	Great diversity of craft from small "totora" craft to 30 tons hold purse seiners. c. 25% are motorized; rest powered by oar or sail. Main gear are hook and line, long line, casting net, gill net, seines		3	Ancieta (1976)

Country	Small-Scale	Large-Scale	Table	Reference
Venezuela	Gear in order of importance are seines, gill nets, cord nets, trap nets, bottom set longline, dredges, harpoons, casting nets, beach nets. Most boats <5 MT, c. 33% not-motorized; 60% of motorized have outboard motors. Most are wooden-hulled: launches, boats, three-corner sails, flatboats, yawls, canoes, dug-outs, cayucos, Indian canoes, pirogues.		3	Ginés (1976
Guatemala	Vessels are powered by sail or oars; a few are motorized with outboard motors. Most vessels are cayucos. Use simple fishing gear.		3	Martinez A. (1976)
Eastern Mediteranean countries	Open, wooden boats 4-7m long, powered by sail, usually outboards. Gear are handlines, pots, beach seines, nearshore gill nets and trammel nets. Small-decked boats 7-15m long used mostly as purse seiners; diesel inboards (20-100 hp); inshore trawlers 12-20m long, 60-180 hp inboard with steel or wooden hulls.		4	Grofit (1981)

Appendix II. Footnotes to Tables

Table 1. Catches of small-scale and industrial fisheries of West Africa (MT)

1. Everett (1978)
2. FAO (1980).
3. Mensah (1977)
4. 1974 data
5. 1975 data
6. [sic] Total catch 13 less than small-scale catch

Table 2. Catches of small-scale and industrial fisheries in the Indian Ocean and Western Pacific (MT)

1. SEAFDEC (1981)
2. Mohiuddin, Kibria, Hossain and Ali (1980); excludes estuarine catch of approximately 20,000 MT; statistics referred to as "current annual".
3. Anon. (1980b)
4. Indonesia Directorate General of Fisheries (1982)
5. Smith (1979); total catches were based on FAO 1977. Yearbook of Fishery Statistics.
6. Gaiger and Richards (1980)
7. Silas and Alagarswami (1980); small-scale and industrial catches estimated from total catch and estimated proportion of small-scale landings in reference.
8. Fernando (1980)
9. Asada (1980)
10. Kiat (1980) states small-scale fishery contributes 80% of total landings equalling 500,000 MT.

Table 3. Catches of small-scale and industrial fisheries of Central and South America (MT)

1. Campos Lira (1976)
2. Ecuador Instituto Nacional de Pesca (1976)
3. Ancieta (1976)
4. Ginés (1976)
5. Martinez A. (1976)

Table 5. Catch compositions of small-scale Central and South American fisheries (MT)

1. Ancieta (1976)
2. Campos Lira (1976)
3. Barnacles - *Megabalanus*
4. Ecuador Instituto Nacional de Pesca (1976).
5. "pesca blanca"
6. Ginés (1976)
7. Arellano-Lennox (1976); "pescado blanco", primary species groups listed
8. Bravo P. (1976)
9. "la pesca blanca"
10. Fuentes (1976); partial listing, I could not find equivalents for all species mentioned; equivalents used per Republic of Venezuela (1982).
11. Martinez A. (1976)

Table 6. Catch composition of small-scale African fisheries (MT)

1. Tobar, Oladoye, Oladipo, Okpanefe and Ekwemalor (1976); FAO (1979).
2. CRODT (1979).
3. Mensah (1977).
4. FAO (1982) provides total catch estimates for 1979; major species in catches from Sierre Leone Ministry of Natural Resources (1976).
5. FAO (1982)

Table 7. Catch compositions of small-scale fisheries in the Indian Ocean and Western Pacific (MT)

1. SEAFDEC (1981)
2. Mohiuddin *et al*. (1980)
3. Anonymous (1980b)
4. Silas, Jacob, George and George (1980)
5. Numbers represent numbers of eggs

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APPENDIX IV. PERSPECTIVES OF SMALL-SCALE FISHERIES

A BRIEF STATEMENT ON THE ARTISANAL SMALL-SCALE FISHERY IN NIGERIA

T.O. Ajayi

The industrial fishery in Nigeria, using 12-24 m trawlers at sea, targets demersal fish or penaeid shrimps, landing by-catches of shrimp and fish, respectively. A fleet usually consists of more than five vessels employing skilled personnel who invariably are not members of the boat-owner's family.

The much older artisanal small-scale fishery uses dug-out or wooden canoes 3-10 m in length. About 15-20% of these boats are propelled by 5-48 hp outboard motor engines. The majority use paddles but can also take advantage of a wind to sail. Artisanal fishermen were active in the lagoons, creeks and the coastal waters where they conflicted with the trawlers. In 1971, legislation made the exploitation of the immediate two nautical miles of the sea exclusive to the small-scale fishermen. More recently, increased motorization and bigger and more stable craft have permitted longer forays far into the sea. Usually the canoes are owner-operated, drawing its crew from among members of the owner's family. Marketing is done by the owner's wife and proceeds are shared by all on a pre-agreed formula. In the few instances where a "wealthy" fisherman/family own two or three other canoes, sharing arrangements are worked out with his relatives or "hired" crew who run the boats. Sometimes a middleman/financier provides all the input and in return, has the catch. The crew is rewarded or paid in kind or cash. This is gradually being phased out. Friends often pool their resources together to set themselves up.

The number of men in a canoe unit, ranging between one and eight men, depends on the gear, craft and the fish species or group sought. Various gear are used including traps, hooks, set gill nets, drift nets and encircling nets. Beach-seines and beam trawls were recently introduced. There is however some element of targeting of fish species and, therefore, specialization which makes for efficiency. The Tarpon *Megalops atlantica* fishermen, for example, read the tides and the Bonga *Ethmalosa fimbriata* fishermen, the moon phases so well that the effort is accordingly distributed to a good effect. Juvenile shrimps are also exploited during the 3-4 months resident time in the brackish waters.

In the inshore areas, adult fish congregate to breed. The area also serves as a nursery for juveniles and the young. Both juveniles and adults are therefore caught by the small-scale fishermen. The industrial vessels find the dense concentrations of fish tempting, resulting in a clash of interest.

Development of the artisanal fishery has centered around the provision of inputs at 50% subsidy - canoes, outboard motors, fuel, nets and accessories. Landing site infrastructure and facilities like flaked ice are also being provided.

Current management measures include a ban on "obnoxious fishing techniques" including explosives and synthetic or natural poisons - cocoa insectides and *Tephrosia* spp. extracts.

Artisanal fisheries in Nigeria account for 60-70% of the total landings. The high number of full-time fishermen and the total amount of fish protein

supplied are an index of the contribution of the small-scale fishery to the national economy. In spite of this, the socio-economic status of the fishermen is, overall, poor. Effort is currently being made to redress this.

A PERSPECTIVE ON THE SMALL-SCALE FISHERY IN KOREA

Woo-Il Choo

Since the early 1960 decade, the Korean fishing industry has enjoyed ever-increasing catches due to expanding domestic and international fish markets. But the situation has been changed from 1977. The distant deep-sea fishery shrunk rapidly as a result of the U.N. Sea Law and oil shock. The expansion of aquaculture has also been restricted by the frequently occurring red-tide in the suitable aquaculture area, and by the limited number of culturable species. The development of new species technically and economically suitable for culture is being delayed. Though the inland fishery is growing now, the portion of production is still minor to the whole production. Therefore, the additional fish production to match the increasing demand should, if possible, come from coastal and offshore fisheries.

Unfortunately, the adjacent fishing grounds to Korea are being exploited by several strong fishing nations such as Japan, Soviet Union, China, North Korea as well as South Korea and even Formosa. It is difficult to apply an international management scheme in the areas, because each country is in a competitive position. The total fishing effort seems to be expanding presently. As a result, the fishery stocks are depleting, which hampers the normal growing of industrial fisheries.

On the other hand, rapid urbanization has appeared since the late 1960 decade in Korea. In fact, the number of fishing households has decreased since 1967. The fishing households can be categorized into three groups; 1) the fishing household which has no side-job, and maintains its living entirely by means of fisheries, 2) the fishing household with side-job, but the income from fishing activities consists more than 50% of total household income, 3) the fishing household of which fishery income is a minor part of the total household income.

The clear trend of the number of fishing households is that during the last 15 years, the number of Category 1 households and Category 3 households has been decreasing. The numbers of Category 2 households, those fishing households with a minor income side-job, have not decreased. This phenomenon can be interpreted that it becomes difficult for a fishing household to live solely on fishing, but should have a side-job to maintain the household in Korea. But fisheries are difficult and time-consuming work to maintain as a minor side-job. That is why the fishing households with minor side-jobs become a major group, but in turn, is the way that the fisheries remain at a small-scale level. Therefore the portion of fishermen categorized in the small-scale fishery increases - but the portion of catch is still minor compared to that of the industrial fisheries.

BRAZILIAN SMALL-SCALE FISHERIES

S. Jablonski

The total yield from marine fisheries in Brazil is around 800,000 MT yearly. If we include inland waters this total reaches 1 million tons. Half of the marine production is harvested by the artisanal fishery.

The industrial fishery is directed to oceanic resources such as pink shrimp in the north and southeast region of the country, demersal fish, sardines and skipjack tuna in the southeast and south regions as well as lobsters and snappers along the northeastern shelf area. The fleets are well diversified concerning boat size composition but they operate within common patterns, all of them integrated to industrial systems.

The artisanal fleet operates along a coastline of about 9,000 km with several types of gear and a very diversified catch composition (in the northeastern area the number of species reaches almost 200). In the south and southeast regions, the artisanal fishery is more restricted to coastal lagoons and estuarine areas aiming, in most cases, at shrimp. In the northeast areas, there is an important multispecies fishery scattered along about 3,000 km of coastline yielding almost 90,000 MT yearly. There are a variety of environments including sandy bottoms, mangroves, pockets of mud and a rather large extension of hard bottom due to the calcareous algae. The number fishermen operating in this area is 150,000 and they utilize a variety of boats and types of gear such as beach-seines, hand-lines, traps, small trawl nets manually operated, and gill nets.

The interaction between the two types of fisheries is relatively limited. Two examples of overlap are shrimp, the artisanal fishermen frequently operating in nursery areas, and the catfish fishery in the mouth of the Amazon River.

The assessment and management of Brazilian fishery resources has been directed to those species which are subjected to relatively intense industrial fishing. As far as small-scale fisheries are concerned, there are only a few fisheries for which suitable data are available and except for those which concern shrimp in nursery areas, the other coastal fisheries have rarely been monitored and the available data only includes the total landings. However, the information is not always reliable.

Some qualitative control measures have been applied in regional areas. Among these are the establishment of minimum landing sizes, closed areas or seasons and the regulation of mesh size. However, there are no objective appraisals concerning the state of these stocks, or, in the case of fishing in nursery areas, no guarantee as to the possible relationships between the juvenile population and the adult stock. Also, in some cases, management and regulation measures have been applied to avoid conflicts between fishermen due to the overlap of different types of fishing gear operating in the same fishing area.

PERSPECTIVE ON THE SMALL-SCALE FISHERY IN CAMEROON

J.C. N'Jock

1. IMPORTANCE OF SMALL-SCALE FISHERIES

1.1 Fishing Canoes

The artisanal fishery is very intensive in Cameroon but the relevant statistics are not known precisely. Estimates are:

- 1,000 canoes (from 3 to 12 m long). 50% are motorized.
- 5,000 fishermen of which 80-90% are immigrants from Nigeria, Ghana and Benin

1.2 Fishing Gear

Traditional: Different types are used i.e.:

- gill nets
- shrimp nets
- bongo nets
- "strong kanda" (sardinella) nets

Recent imported gear:

- beach-seiners
- about 20 purse-seiners

2. RELATION OF SMALL-SCALE FISHERIES TO INDUSTRIAL FISHERIES

The two activities are practiced in the same coastal area. However, the sector within 2 miles is prohibited for industrial fishing and reserved for artisanal vessels.

2.1 Difference Between Small-Scale Fisheries and Industrial Fisheries

- small-scale fisheries catches are mainly composed of Clupeidae: *Sardinella* spp. and *Ethmalosa* spp. which give 80% of the artisanal production. The other 20% are shrimps and some demersal fishes (Sciaenidae).

- Industrial fisheries production:

  The fishing boats are trawlers, fishing demersal species:

  Sciaenide, Cynoglossidae, Ariidae and shrimps.

2.2 Interaction Between the Two Activities

The interaction comes principally from shrimp caught at different ages. The industrial fishery catches large shrimp and the artisanal fishery catches small shrimp. Shrimp production had decreased since 1978. It would be interesting to know the reason for the decrease in order to determine management procedures.

3. IMPORTANCE OF SMALL-SCALE FISHERIES TO FOOD PRODUCTION

Annual consumption of fishery products is more than 150,000 MT, of which 13% are from industrial fisheries, 20 to 33% are artisanal, 16% are imported, and 40% are from inland fisheries. This last class is not to be considered within the scope of this proposed project. All figures cited are approximate.

The industrial fisheries are controlled by four companies with about 30 boats/trawlers. Statistics are relatively well known for this facet of Cameroonian fisheries, and show a stagnation in production for the last 5 years relative to fishing effort. A decrease in the size of species fished has also been noted for the same period. Statistics on artisanal fishing are not available even though it is thought that this practice can increase utilization of marine resources and can reduce the amounts of fish which are currently imported. The production of the small-scale fisheries is smoked and sent to regions located far from the main landing sites.

4. IMPORTANCE OF SMALL-SCALE FISHERIES TO NATIONAL ECONOMY

Full or part-time fishing is the main occupation of the local people living in the coastal area composed of more than 35 localities.

They are engaged in four types of work which are important for the economy of that area i.e.:

- construction of fishing nets and canoes
- fishing
- processing
- marketing

It will be important to evaluate the role of all these activities in the national economy. The artisanal fishing is actually practiced with inefficient methods : wooden canoes without motors, fishing nets not suited to local conditions, etc. Motorization of boats, introduction of new methods and the improvement of existing techniques will contribute to the development of this activity. The Cameroonian Government intends to accomplish this through a Cameroon/Canada Joint Project called MIDE-PECAM.

A PERSPECTIVE OF THE SMALL-SCALE FISHERY IN THE PHILIPPINES

J. Ordonez

The total fish production of the Philippines based on 1981 statistics is about 1.7 million metric tons. Of this total, more than 50% comes from the municipal fishery, about 40% from the commercial fishery and about 10% from the fishpond production.

The capture fishery in the Philippines is categorized into the municipal fishery and the commercial fishery based on the tonnage of fishing craft used. The municipal fishery involves the use of fishing craft 3 gross tons or less, while the commercial fishery uses fishing vessels of more than 3 gross tons.

There are close to 600,000 fishermen engaged in municipal fishing, - from sustenance/survival fishing to artisanal or small-scale fishery. The gears they use range from simple hand-line, spear or traps operated by individual fishermen to seiners of various types using group effort like the beach-seines, scareline fishing, simple round haul seine fishing and "baby" trawling. The municipal fishery is mostly confined along shallow coastal areas, bays, coves and inlets, but some municipal fishermen fish beyond such areas and venture into quite distant fishing grounds using motorized dug-outs or bancas. They engage in hand-line fishing for tuna, skipjack and other species in deep waters and also in reef fishing in near and distant shoals and reefs.

The small-scale fishery is quite important as far as providing a livelihood to many people in the coastal areas dependent on the sea. However, many of them are part-time farmers. The increase in the population in these areas has brought about the problem of "overfishing" resulting in the decline of catch by individual fishermen in some areas, particularly in shallow trawling grounds.

However, there are areas which could continue to provide better livelihoods for the fishermen if given some assistance from the government. The "Brynyang Dagat" (Bounty from the Sea) Programme of the government assists fishermen by providing them with loans so that they can improve their capability in terms of fishing craft and gear. Government aid is also given in terms of extension services and technical assistance on gear design improvement, rigging and fishing techniques.

The small-scale fishery is a contributor to the national economy in terms of exports and also in the domestic trade. The fishery contributes in the export of tuna, shrimps, squids, aquarium fishes, seaweeds and ornamental shells.

Locally, the dried fish industry of the small-scale fishery answers the protein needs of the people during periods when the fresh fish is not available during lean periods. Fish drying, smoking, fish paste and fish sauce processing are a major contribution of the small-scale fishery to the economy.

Conflicts between the municipal and the commercial sectors occasionally arise and also between or among municipal fishermen themselves who use different kinds of gear.

This allegation that certain types of fishing operations cause the depletion of the resource brings about the question of what should be the basis for recommending appropriate action on such problems or conflicts. In trying to resolve such problems the socio-economic condition of the affected group of fishermen is of prime consideration.

There are conservation/management rules and regulations which are aimed at protecting the fishery resources of fishing grounds from over-exploitation using legitimate gear as well as from destructive means using fine-meshed nets, dynamite, poison and obnoxious materials.

Some areas have been declared closed to certain types of gears/fishing operations, e.g. the coastal waters of Palawan are closed to commercial purse-seiners and trawlers. The gathering of strong corals and the catching

and slaughtering of the green turtle is prohibited.

There are enough laws to regulate the fishing activities but enforcement of such laws and other rules and regulations appear to be ineffective as violations in some cases do not lead to convictions in court.

Apprehending violators is a big problem in the Philippines particularly in remote areas. The national justice and the coast guard have problems enforcing fishery laws. There is a need to strengthen their capability in terms of additional manpower and logistic support.

Fishery development projects in certain areas are implemented with the assumption that there is available a resource that could be explcited and thus bring about economic and social benefits. In many cases, such projects lead to failure. This leads to the question whether there was prior consideration on the exploitability of the target resource.

It is only in recent times that the matter of resource evaluation is being given serious consideration prior to planning fishery development projects. However, there is not enough data upon which scientific advice can be sought for by planners, policy-makers and other decision-makers.

PERSPECTIVE ON THE SENEGALESE SMALL-SCALE FISHERY

A. Samba

I. IMPORTANCE OF SMALL-SCALE FISHERIES

The fishing activity in Senegal is responsible for about 240,000 metric tons of marine fish landed by artisanal and industrial fisheries.

The artisanal fishery is the most important activity: 150,000 tons landed, 27,000 fishermen involved and using up to 4,400 dug-out canoes, 80% of them using outboard engines. The main gears used are purse-seines, hook-and-lines, surrounding gillnets and beach seines.

II. RELATION WITH INDUSTRIAL FISHERIES

One of the aims of the Senegalese Government is to promote the development of the artisanal fishery. In this way, there are some regulations and laws to protect coastal fishing grounds. There is a 6-mile limit separating an inshore zore for the artisanal fishermen and an off-shore zone where trawlers have to operate.

In our area, the main fished stocks are shared between several countries and are migrating from the north to the south according to hydrological conditions. It is proved that especially the adult part of the stock is concerned with these migrations and the juvenile one is fished by the artisanal gears in the nearshore zone. This pattern is predominant in the southern area. As well, the 6-mile limit is respected by the trawlers. Therefore there should be no great conflict between the two communities of fishermen, but unfortunately it is not the case. According to the government goals, the artisanal fishery is to provide local populations with marine products while the industrial fishery's orientation is to export. Recent

studies have shown that some factories get at least 40% of their products from artisanal landings.

III. IMPORTANCE OF ARTISANAL FISHERY TO A NATIONAL LEVEL

While inland waters production is declining these last years due to dryness in the Sahelian area, the artisanal fishery landings can cover population needs in animal protein. Fish is cheap and is distributed either fresh or processed (smoked, salted etc.) all over the country and even abroad.

Despite the fish marketing process being handled by very active middlemen, the artisanal fisherman does not have the lowest income in the society. To improve their conditions of life, these fishermen organize themselves into cooperatives through which they get duty-free gasoline and outboard engines without taxes. In each region, all the cooperatives merged into a regional union of cooperatives and all these unions are gathered into a federation. Through these associations, the fishery administration tries to solve fish distribution problems and marketing by building a fish distribution chain controlled by the cooperatives. In each big landing site is built a fish trade centre with ice production, refrigerated vehicles for distribution, and cold rooms.

IV. THE STATUS OF FISHERY MANAGEMENT AND DEVELOPMENT

The two main problems for developing fishing activity within Senegal are the following ones:

- the fishing vessels are too old
- fish marketing processes are not well developed

As our subregion is rich and in order to properly manage our fish resources, we try to apply some regulations by:

- controlling the catch, especially of those foreign vessels fishing through joint ventures (EEC and Spanish boats): we have put observers on such boats which are not landing their catch in Senegal.

- controlling the mesh sizes: the use of small mesh size (less than 70 mm stretched) is responsible for a great amount of by-catch (up to 40-60% of the catch in some cases).

- controlling fishing grounds: its efficiency is doubtful.

The management of the resources in our subregion must be a regional one because of the main stocks shared by several countries. That is why, through the CECAF project, the countries involved (Mauritania, Senegal, The Gambia, Cape Verde, and Guidea Bissau) have set up a subregional committee which is the best way to preserve our fish resources.

THE SMALL-SCALE FISHERY IN SRI LANKA

M.S.M. Siddeek

1. Sri Lanka is an Island with a total land area of 65,584 km^2 and a population of 14.8 million, situated southeast of the Indian subcontinent between latitudes 5-10° North and longitudes 79-82° East. It has a coastline of 1,760 km. The continental shelf is relatively narrow (except in the north and northwest where it is wider), and averaging a little over 22 km.

2. The subject of fishing comes within the purview of the Ministry of Fisheries and the National Aquatic Resources Agency (NARA). NARA is a specialized institution coming within the purview of the above Ministry, and one of its responsibilities is to undertake scientific investigations of the aquatic living resources within Sri Lanka's 200 mile Exclusive Economic Zone.

3. The fishing industry contributes around 1.6% (1980) to Sri Lanka's economy. Fish contributes around 61% (1980) to the total supply of animal protein in Sri Lanka and the per capita fish consumption was 32 lbs. per annum in 1981.

4. The 1981 fresh fish production of 203,586 tons comprises 2,144 tons (1%) from offshore and deep sea regions (arbitrarily fixed at beyond 25 miles from the coast), 172,318 tons (85%) from coastal waters and 29,124 tons (14%) from fresh waters, respectively.

Around 4,700 tons (23%) of valuable tuna, Spanish mackerel, and horse-mackerel and around 6,000 tons (3%) of valuable prawn, lobsters, squids and cuttlefish were landed in 1981. However, 37% of the total fresh fish landings are coastal small pelagic clupeoids, anchovies, etc. The most productive areas are found on the west coast of Sri Lanka. They are Palk Bay (32.5% of the total landings), Negombo (11.2%) and Puttakam (8.5%). In 1981, Sri Lanka exported 17.5 million U.S. dollars worth of non-finfish, mainly prawns, and imported 6 million U.S. dollars worth of fish products and fishing nets.

5. The total number of people involved in all sectors of the fishing industry is around 79,000 with 58,000 active fishermen. Well above 95% of them are small-scale fishermen, fishing in the coastal waters with little over 21,000 craft (1982) of which 44% are non-mechanized. Forty-one percent of the landings come from non-mechanized craft. The 1982 breakdown figures of fishing craft are given below:

11 m and above (offshore - deep sea)	Approx. 50
9 m - 3 1/2 ton boats with 30 hp inboard engines	3,325
6 m fibreglass boats with 6-15 hp outboard engines	8,865
Non-mechanized traditional craft (planked, dugout, lograft, outriggers etc.)	9,388

6. Gillnets with varying mesh sizes are the most used gear (above 70%). Beach-seines, cast nets (mostly used in lagoons), handline, longline, pole-and-line, traps, and stationary nets and traps are the other types of gear used around Sri Lanka.

7. The offshore and deep-sea fisheries in Sri Lanka are negligible. There is scope to increase production in this sector.

8. In the land fishery sector, the Ministry of Fisheries had earlier (1950's) concentrated on stocking large and small tanks with fingerlings of Thilapia mosambica and now have diverted to introducing other species of freshwater fish. However, 85% of the freshwater fish landings (1981) are Thilapia mosambica.

9. There were records of fishery surveys and experimental fishing conducted around the Island since the 1920's, which broadly indicates that the shelf in the northern part of Sri Lanka is broad and trawlable, rich in penaeid prawns, crab, squid, cuttlefish, bivalves, and finfish clupeoids, anchovies, leiognathids, crangids, lethrinids, shark and skate, while the shelf in the rest of the Island is narrow, uneven, untrawlable (with normal trawls), rich in demersal fish - carangids, lethrinids, lutjanids, Epinephlelus, skates; small pelagic fish - clupeoids, anchovies, etc. and large pelagic fish - tuna, Spanish mackerel, sharks etc.

In addition, coral reefs rich in ornamental and edible coral fish are found in most parts of the Island.

The 1978-80 acoustic surveys conducted on the continental shelf of Sri Lanka by the research vessel "FRIDJOFT NANSEN" indicated a maximum sustainable yield of 250,000 tons per annum of which 170,000 tons are pelagic and 80,000 tons are demersal, respectively. With a previous estimate of 30,000 tons of large oceanic fish, the 1983 target for harvesting was set at 300,000 tons. This target was planned to be achieved by increasing the production in deep-sea waters and the demersal habitats. The present yield from coastal fisheries is considered to be near its maximum, thus giving little hope for further development of this sector.

11. In Sri Lanka, the type of fishery and the intensity of fishing are related to monsoon weather. During the southwest monsoon (March-August), the mechanized craft and sail craft on the west coast are engaged in tuna fishing while non-mechanized craft are inactive or engaged in lagoon fishing or migrate to other, calmer areas. The beach-seine fishery (more labour-intensive fishery) is also inactive during this season. The same pattern of fishing takes place on the east coast during the northeast monsoon (October-February). The prawn fishery is seasonal and a fair number of prawn fishing craft (9 m - 3 1/2 t craft) migrate to different prawn grounds accordingly. These migrations have created numerous conflicts with the local artisanal fishermen in the recent past.

The research done in the past with regard to resource assessment, biology, oceanography and distribution of commercially important fish is limited. Most work has been directed towards taxonomy, catch composition, catch rate and fishing methods. Unfortunately, the catch data have not been collected continuously for useful analysis.

12. The lack of scientific advice on the resource potential left one option with the managers, that is to introduce more craft and gear to increase fish production at any cost and risk.

THE ROLE OF PENAEID SHRIMP IN THE INDONESIAN SMALL-SCALE FISHERIES

M. Unar

I. INTRODUCTION

Fish production is an important sector in the Indonesian economy. More than 60% of the animal protein intake per capita annually comes from fish and such is the condition in most Southeast Asian countries. Indonesia is an archipelago geographically bordering two oceans, the Pacific and the Indian Ocean, and consists of several big islands and thousands of smaller ones with an estimate of about 33,000 miles of coastline. The pattern of human settlements started along this coastal line which were followed by fisheries developments. The fisheries which were becoming an occupational activity for the fishermen were responsible for the supply of animal food (fish) to the coastal communities and extended their operation to rural areas where human settlements grew to inland areas. These traditional fishing and marketing activities are still alive and the small-scale fisheries still play the most important role in fish production. In fact, they are mostly individual producers, vital for the health of the country but different from state enterprises and private commercial or industrial fishing companies - they are not backed up for better or strong capabilities in investments so that the need to be organized in fishery cooperatives is essential not only for a better living of the fishermen, as their benefit are gained by the cooperatives, but also for joining in the management of the coastal resources, through scientific advice and management measures which are also beneficial for their future.

II. PRODUCTION AND PRODUCTIVITY OF THE COASTAL WATERS

The total fish production of 1982 is estimated to be 1,992,000 tons of which 1,494,000 tons comes from marine fisheries and 498,000 tons from inland fisheries including natural-waters, fresh and brackish water ponds.

The number of motorized vessels increases every year and reached 65,100 vessels in 1982, while non-powered vessels remain almost at the same level since 1978, totaling around 225,000 vessels. The number of fishermen is approaching 1 million and the biggest concentrations are in Java, Sumatra and Sulawesi where also the highest production comes from. More specifically, those concentrations are adapted to the favourable conditions required by small-scale fisheries, and shallow waters are found off those concentrations.

Tropical fauna is characterized here by estuarine (including mangrove and tidal flats) and coral reef fauna, respectively, and so far the highest productivity in tropical waters is observed to be in the coastal areas, especially those directly influenced by the estuaries. Depending on the size of run-off and size of each estuary, the brown water nearest to the estuaries is characterized by fishes such as threadfins, *Polynemus* spp., white pomfret, *Pampus argenteus*, Chinese herring, *Alosa* spp., a number of other species in the herring family such as *Selijenna* spp. and *Coilia* spp. On the bottom, sciaenid fishes are common while shrimp is typically represented by *Parapenaeopsis* spp., although juveniles of other penaeids such as *Penaeus merguiensis* are also common. Sergestid shrimp are the earliest target of small-scale fisheries operating in such areas; it is fermented and processed into shrimp paste, a fishery product known to be found almost in every household throughout the country. Outside this brown water, pelagic fishes

important to the fishery are the carangid fishes Decapterus spp. and Selar spp., the two important groups, followed by the mackerels, Rastrelliger brachysoma and in bigger schools Rastrelliger kanagerata, and Sardinella spp. Anchovies are found almost in all coastal waters.

Soft bottoms of mud and sand, in most cases also influenced by estuaries, are good trawling grounds where pony fishes/slipmouths - members of the family Sciognathidae - usually predominate the catches. Penaeid shrimp, which require such bottom conditions and estuaries as their nursery grounds provide a clear understanding that their concentrations are located in shallow coastal waters and that statistical observations reveals the possible correlation between their abundance and mangrove forest availibility, since mangrove is directly associated or a component of an estuary. So a rough estimation of productivity in shrimp which indicates a range between 2.5-3.5 tons/km^2/year seems to be reliable.

III. THE MANAGEMENT OF SHRIMP

Although sergestid shrimp are still important in the daily diet of the Indonesian people, penaeid shrimp presently form one of the most valuable fishery resources. The high price and acceptance on world markets attracts increasing entries into the fishery but their limited fishing ground and of course their limited stock, in the absence of management measures, results in fishing intensity rising too fast causing excessive capacities in coastal areas where not only the limited resources are destroyed but friction between groups of fishermen (inshore fishermen and trawlers) both fishing in the same limited area cannot be avoided. The banning of trawls imposed by the Government is based on this situation but still the fishermen are struggling to catch the highly valued resource although they have to operate with less efficient gear.

Further studies on penaeid shrimp biology for a sound management program is badly needed including stock recruitment, mangrove fauna and its relations with shrimp fisheries, the inter-relationship among shrimp species and between shrimp and fish.

IV. INSTITUTIONAL FRAMEWORK

The national administration of fisheries is carried out by the Directorate General of Fisheries while provincial fishery sources have their responsibilities on local or provincial fisheries controlled directly by their respective governors.

Agricultural research (including fisheries) is under the AARD (Agency for Agriculture Research and Development) and a Central Research Institute for Fisheries is established, supervising three research institutes:

1. Research Institute for Marine Fisheries
2. Research Institute for Inland Fisheries
3. Research Institute for Fish Technology

Each has a number of stations assigned with general or special research programs.

Stock assessment on marine resources is conducted by the Research Institute for Marine Fisheries which is equipped with 9 research vessels

ranging from 7-250 gross tons (2 trawlers). Five scientists are specializing in shrimp stock assessment; one of them is still working for his Ph.D. in Bogor Agricultural Institute; general technicians are capable in designing and constructing trawl nets.

COSTA RICAN FISHERIES

C. Villalobos

Costa Rica is a country whose economy is based primarily upon agricultural activities. The two major crops, coffee and bananas, account for over 60% of the internal gross product. Hence most of Government attention has been directed toward the development of these activities. It is not therefore surprising that, from the administrative point of view, the fisheries sector is under the power of the Ministry of Agriculture, and so, subject to all limitations imposed by such a complex structure.

Fisheries in Costa Rica take place on both the Pacific and Caribbean coasts. However, there are fundamental differences between the two. Fisheries on the Caribbean side are based upon two migratory species (turtle and lobster) counting for less than 10% of total landings. Conversely, on the Pacific side, finfish, shrimp and tuna count for over 80% of total landings, the remainder, 10% or so, being represented by shellfish, squid and lobsters.

The fisheries have been divided for conventional purposes into three categories: artisanal, semi-industrial and industrial. Artisanal fisheries take place within a 12-mile zone, in three major fishing grounds: the northern ones, the Golfo de Nicoya and the southern grounds. At the present time, some 1,300 boats are operating in the Pacific and 200 in the Caribbean. Approximately 90% of finfish landings result from artisanal fisheries; the remainder, 10%, comes from trawling operations. The shrimp fleet operates within the 12-mile zone and is composed of 69 Florida-type trawlers. Total shrimp production for 1981 was around 1,500 MT, being mainly exported to U.S. markets.

Industrial fisheries refer to tuna operations that take place outside the 12-mile zone. Total production for 1981 reached 4,000 MT. Total landings for the country were close to 13,000 MT, this figure represents less than 1% of the internal gross product of the country. From the social organization point of view, several models have been developed at the three levels mentioned above. These include "camaras" (boards), cooperatives and unions. At the present time, a national committee of artisanal fishermen is in the process of being established.

In terms of the information available to fishermen and the private sector, the Department of Fisheries of the Ministry of Agriculture has produced statistical data on a monthly basis, since 1962.

Evaluation of the resources was done by FAO in the mid 60's in the Caribbean and in the early 70's in the Pacific, and more recently by the University of Rhode Island in the late 70's. However, a lot of information is still required if a management programme is to be developed in Costa Rica.

PERSPECTIVE ON SMALL-SCALE ARTISANAL FISHERIES IN THE IVORY COAST

S.G. Zabi

1. Interest of the small-scale fisheries

The artisanal fishery which concerns both marine and brackish waters fishing activities is very important in the country.

Between 3500 and 4000 fishermen for the marine fishery and a little less for the lagoon artisanal fishery explore the Ivorian Coast coastal waters. The total annual production may be estimated between 30,000 and 40,000 tons of fish.

In other words, the artisanal fishery production contributes more than 50% of the total fish production (including the industrial fishery).

Many types of engines are used (inboard or outboard) and the common gears are purse-seines, beach-seines, surrounding gillnets and hook and lines.

2. Relation of small-scale fisheries to industrial fisheries

As mentioned above the small-scale fisheries concern both the sea and the lagoons, but the industrial fishing activities are only located along the coast.

The lagoon artisanal fishery is based for instance on:

Ethmalosa fimbriata
Penaeus duorarum

The industrial fishery is characterized by the tuna landings and is also based on some pelagic species like *Sardinella aurita* and *S. eba* and on some demersal fish species such as *Balistes capriscus*.

3. Importance of small-scale fisheries to food production

The need of animal protein at a national level goes with the importance of the small-scale fisheries, producing about 50% of the annual comsumption. It means there is a strong need of fish importation. This figure is approximate.

The management of the small-scale fisheries is one of the objectives we would like to achieve in the marine and lagoon artisanal fishery project we have presented.

The stock assessment will deal with marine/lagoon stocks (*Elops*, *Sardinella*, *Pomada* spp) to promote the fishery activities development in the country.

For the time being, the lagoon artisanal fishery has been more studied and permitted to elaborate the on-going regulation of the artisanal fisheries. At a regional level, the extension of the CECAF program or of some other pertinent projects in the lagoons will be a very important action towards the national aims identified by the government in the national policy of fishery development.

APPENDIX V

COMMENT ON THE DEFINITIONS OF ARTISANAL FISHERIES

Serge Garcia

It is difficult to define artisanal fisheries in general, although in any single country there seems to be a clearly perceived distinction between the artisanal fishery and the industrial fishery. The reason for this is that at the national level there are often two groups, easily distinguishable in terms of size of boats, level of investment, gears, commercial organizations, which help the authorities in setting their own definition. In countries where sophisticated technologies have been transplanted (trawlers, for instance), the dichotomy is very clear and the indigenous fishery can be easily distinguished from the introduced one. This dichotomy may be less easy to perceive when the country concerned has developed its own fishing technologies, internally and progressively (this is particularly true in developed countries). However, at the world level, the underlying characteristics of these two groups vary so much that the dichotomy disappears leaving a continuum of boat sizes, gear type and organizations which makes the elaboration of any definition of the typical small-scale fishery difficult.

Most definitions of artisanal fisheries are negative in the sense that they tend to describe them as some sort of "crippled" element of the fishing sector, a perspective which then seems to lead to the conclusion that they are a problem (an illness) for which something has to be done. This is unfair and largely reflects our ignorance. All the elements of the definition, quoted by Brunenmeister could be made more positive by considering that artisanal fisheries:

(a) provide incomes at the same level as the rural sector, of which it is a part;

(b) generally use a cheap (compared to the industrial sector) but perfectly adapted fishery technology (especially for multi-species fisheries) and are able to exploit successfully in untrawlable areas;

(c) provide the highest production per unit of capital and running costs (including energy costs);

(d) operate in variable ranges from a few miles (off Guinea) to many hundreds (in Senegal);

(e) lose political influence on the national level when the traditional structures have been destroyed or weakened, but are often locally powerful when these structures have been kept (and can therefore be used for locally based management at low enforcement costs);

(f) distribute cheaply the production in the country because landing sites are wide-spread; provide food at a price which is adaptable to the local economy; can even contribute to wide-scale traditional export markets (often not monitored) such as those existing in the countries around Lake Chad, between the Ivory Coast and Ghana, from Senegal which exports an unknown quantity of artisanal fish to Ghana, Ivory Coast, Nigeria, Cameroon and even Congo or from

Mauritania where the traditional market has long been for exported salted/dried stock fish;

(g) provide the highest number of jobs per unit of investment in rural areas and are therefore a stabilizing factor for rural areas against drift towards big cities. They are also a regulation mechanism for part-time employment from the agriculture sector in the slack season through labour-intensive technologies (such as beach seines, e.g., Senegal);

(h) they have been operating for decades or centuries in total financial independence from the state (as opposed to highly subsidized industrial fisheries). The operation is often based on middlemen, whose existence is often criticized, but whose effective role is rarely impartially assessed. Analyses made in Senegal and the Philippines have shown the middlemen to be of utmost importance in keeping the capture system functioning and in ensuring an adequate market under very unfavourable conditions (insufficient capital, bad roads, inadequate landing places, bad weather, etc.). An in-depth analysis of their costs and revenues has in fact shown that they are often not receiving the whole rent at the expense of the fishermen, as it is too often stated, but are making only reasonable profits (15% to 20% in Senegal), while the rent is dissipated through lack of proper organization. This "underdevelopment" loss should in fact be charged to the state and not to the middlemen.

Small-scale fisheries have suffered from lack of interest for decades due to policies oriented towards industrial fishery development. If they often look poor, it is because these development policies have de facto preferentially allocated the resource to industrial craft owners. When some attention was given to them, the approach adopted for industrial fishing development was applied, the analysis was often limited to a superficial understanding of the constraints at the capture level, so that results have more often than not been a general impoverishment of the sector.

It must be stated that poverty in small-scale fishing can often be more the indirect consequence of governmental carelessness than an intrinsic limitation of the fishery itself.

APPENDIX VI

EXTRACTS FROM "The research process and communication of results: lessons learned from a multidisciplinary analysis of a tropical small-scale fishery"[a]

D. Pauly[a] and I.R. Smith[b]

INTRODUCTION

Along with an increase of their relative share of the total world catch, most tropical countries have experienced in the last decades an expansion of their fisheries research activities. These activities, whether based solely on the funding of national institutions, or on international institutions, multilateral or bilateral cooperative projects, have produced noticeable insights into the nature of the factors which determine fishery yields in the tropics. Yet, the complex nature of the fisheries resources and the overall scarcity of the human resources that have been devoted to applied fisheries research are such that large gaps in our understanding remain concerning tropical fisheries and their management.

In an effort to address some of these questions, the Institute of Fisheries Development and Research (IFDR) of the University of the Philippines in the Visayas and the International Center for Living Aquatic Resources Management (ICLARM) conducted a multidisciplinary investigation of the fisheries of San Miguel Bay in the Bicol region of the Philippines, from 1979 to 1981. Detailed results of this study have been published in several technical reports. Here we will mainly address the issues of <u>why</u> we did what we did, and <u>how</u> we went about it rather than elaborate on the results obtained. Our aim was to identify an approach generally applicable to the multidisciplinary study of tropical multispecies multigear fisheries, through a presentation of our research process and discussion of lessons learned regarding research methodologies and communications of results.

[a]Presented at the ACMRR Working Party on the Management of Living Resources in Near-Shore Tropical Waters, Rome 28 February - 4 March, 1983.

[b]International Center for Living Aquatic Resources Management (ICLARM), MCC P.O. Box 1501, Makati, Metro Manila, Philippines.

THE LOCATION OF THE STUDY: WHY WE CHOSE SAN MIGUEL BAY

San Miguel Bay, located on the southeastern (Pacific) coast of Luzon Island is one of the major fishing grounds of the Philippines; it covers an area of 840 square kilometers.

The physical characteristics most relevant to the historical expansion of fisheries there are:

- the surrounding area is heavily populated and few non-agricultural employment opportunities exist;

- the Bay, because it is sheltered, is the only fishing ground along the Pacific coast of the Philippines where fishing operations continue throughout the year, in spite of the heavy monsoon winds;

- the bay is extremely productive, due to its extreme shallowness and to the fact that it is an estuary of the Bicol River whose waters are heavily silt laden; and

- the bay is highly accessible and is connected by road to Manila, the final destination of a significant part of the catch from the Bay, especially high-valued shrimp.

Because of the physical features of the bay itself, the fisheries of San Miguel Bay are rather isolated from the surrouding fisheries, thus providing us with a "unit fishery." The estuarine nature of the bay, moreover, has the effect that the bay's fish communities are rather easy to separate from the fish communities outside the Bay, which consist predominantly of rocky bottom and coral reef communities. The relatively small amount of interchange between these fauna thus provided us with a more or less homogeneous (multispecies) "unit stock."

The major motive for studying San Miguel Bay, rather than any other fishing ground resulted, however, from our interest in a fishing ground reported to be overfished. Also, it was perceived that given the large number of poor fishermen around San Miguel Bay, the primary objctive of our study should be to conduct:

> "an in-depth study of the San Miguel Bay fisheries to facilitate this sector's inclusion in the Bicol integrated area development program, a plan from which fishing communities have been generally excluded."

The study was therefore designed to help in deciding what degree of emphasis, if any, should be placed on programs which encourage the movement of small-scale fishermen into other economic activities. This focus on the possible need for reducing fishing effort was, when it was formulated, in stark contrast to government policy at that time (1979) which was geared toward fishery development and the provision of loans to fishermen (including those around San Miguel Bay) to facilitate the purchase of improved vessels, engines and gear.

The San Miguel Bay fisheries are exploited with a variety of small-scale gear (such as gillnets and fixed gears) and by a fleet of small trawlers. Under current Philippine law, these trawlers must fish in water deeper than seven fathoms. A number of petitions submitted to the President of the

Philippines by small-scale fishermen protesting the illegal operation of trawlers in the shallow waters of the bay provided a certain sense of urgency to our study.

To summarize, we chose San Miguel Bay as the site of a multi-disciplinary fishery research project because of:

(1) its importance as a fishing ground;

(2) its physical characteristics which provided relatively isolated unit stocks and unit fisheries;

(3) the socio-economic and political relevance of the issues to the area concerned; and

(4) its potential for serving as a model of multidisciplinary studies of fisheries in the Philippines and elsewhere.

With a broad primary objective related to rural development issues, it was obvious that biological methods (i.e., stock assessment methods sensu stricto) alone would be insufficient, and that therefore, other disciplines (fisheries economics, sociology) would have to be involved. The specific objectives for the various disciplines in the study were formulated as follows:

- Stock assessment: To assess the status of the fishery resources of San Miguel Bay;

- Economics: To determine catch, effort and incomes of municipal fishermen, costs and returns for the major municipal fishing gears and the economic efficiency of the marketing and distribution system;

- Sociology: To assess the socio-economic development of the six San Miguel Bay municipalities, and to analyze in selected communities, social and external linkages, attitudes and preferences toward fish production, processing and marketing; and to examine the nature of the flow of human resources between municipal fisheries and other rural sectors, and to assess the potential of programs that seek to reduce the dependence of fishing households on capture fishing.

MAJOR RESULTS OF THE STUDY

The study's major findings regarding appropriate methods are two-fold. First, our main result is that it appears unnecessary to develop overly sophisticated bio-economic models in the first instance to improve one's understanding of a given fishery. Indeed, given the paucity of high quality time-series data on most tropical fisheries, sophisticated model building would seem to be particularly inappropriate. The important key to a comprehensive research process, it seems to us, is to make clear statements at the onset of the project about manageable objectives and plan how these goals are to be reached by listing data requirements, including quantity and quality, data sources and analysis planned.

A second result is that the simultaneous application of methods from several disciplines lowers the overall costs of data acquisition, and provides extremely useful checks, confirmation and further insights to the findings of

any one discipline. The advantages of a multidisciplinary approach can be demonstrated by the following summary presentation of specific research findings.

The stock assessment work, total biomass and single-species methods led to the conclusion that overfishing takes place in the bay in the sense that further increases of effort will not increase catches. If, as appears likely, increased effort comes in the form of additional trawlers, there will be a transfer of a further proportion of that catch away from the non-trawl fishery (about 3,000 households) to the trawl fishery (about 40 households) (Table 1).

The economic analysis confirmed this competition between non-trawl and trawl gears. The fishery, which is worth approximately ₱ 53 million per annum, produced a resource rent (pure profit) of only ₱ 3 million in 1980-81. Unless entry is limited, expected additions to the trawler fleet will probably completely dissipate this rent in the next few years. Moreover, the present resource rent is distributed very unevenly, with the trawlers earning 85% of the pure profits, while the non-trawl fishery earns the balance. Data on concentration of fishing asset ownership provided by the project sociologists indicated the highly skewed distribution of benefits from the fishery.

The sociological studies, particularly the studies on the occupational and geographical mobility of the San Miguel Bay fishermen, added another dimension to these results by showing that employment opportunities outside the fishing sector are rather poor and that there is a high rate of migration out of fishing communities. This migration, however, is more than offset by population growth so the absolute number of small-scale fishermen will continue to increase.

Table 1. Summary of data on the San Miguel Bay fishery (1980-1981)

Characteristics	Trawl	Non-trawl
No. of fishing units	95	2,300
No. of fishermen	600	5,000
No. of households owning fishing units	40	2,000
Percent of total catch[a]	56%	44%
Percent of total value	55%	45%
Percent of pure profits (resource rent)	85%	15%

[a]total catch is about 20,000 MT per annum; most species groups are caught both by the trawl and non-trawl fisheries.

The Bay can be characterized as having a growing number of fishermen but finite fish resources. Thus, all three disciplines gave the San Miguel Bay fishery the same bill of health; namely that it sorely needs management to address the twin problems of overfishing and inequitable distribution of benefits from the fishery.

It is obvious from our research results that managing the bay's resources will require some limitation on fishing effort. Failure to do so will not only contribute to further overfishing, but will also exacerbate the already inequitable distribution of benefits from the fishery between the trawl and non-trawl sectors. This leads to a final problem that relates to the problem mentioned above regarding the integration of research with planning. Possibly the best way of reaching this integration would be to set up a permanent body (e.g. involving fishermen representatives, the Bureau of Fisheries and Aquatic Resources and the municipalities concerned) with clear prerogatives and tasks - one of which should be the continuation of information gathering.

APPENDIX VII

STOCK ASSESSMENT CRSP PROJECT SPECIFICATIONS

The Stock Assessment Collaborative Research Support Program

Nigerian Project Specification

by

T. O. Ajayi

Nigerian Institute for Oceanography and
Marine Research, P. MB. 12719,
Victoria Island, Lagos. Nigeria

Title:

Relative fishing power of the multi-gear small-scale fisheries of Nigeria and the categorization of their catches by source.

Background:

The six maritime states in Nigeria share between them about 800 km of coastline. Approximately mid-way is the rather large delta of the River Niger, marked by an extensive system of creeks and lagoons. In addition to these brackish waters, the first two nautical miles seawards delimit an area exclusively exploited by artisanal fishermen. Beyond this area reserved for small-scale fisheries, an industrial trawl fishery is active within Nigeria's 200 n. mi. EEZ. The industrial fishery consists of a shrimp component (about 100 multinational 24 m double rigged vessels) with considerable fish by-catch and a fin-fish component.

The set nets of the small-scale fishermen catch much the same fish species as those exploited by the industrial trawl fishery. Records in fact suggest that the small-scale fishermen account for over 70% of the total landing.

How much of the historical catches by small-scale fishermen originated from the sea as distinct from the creeks has been difficult to determine.

Nature of the project and time frame:

It is important therefore to establish for the different gear (used by the three main fishery interests) measures of the fishing power to standardize their performance. It is also important to determine the fraction of the small-scale catches which originated from either marine or brackish waters. The project will conduct a statistically significant number of fishing surveys using the various gear in both marine and brackish waters. The replicates will emphasize the standardization of the various gear. Experiments will cover two complete fishing season cycles i.e. two years, one being a check on the other. A third year will be required for the analysis of the data and compilation of the report.

Available Personnel and Equipment:

The Nigerian Institute for Oceanography and Marine Research (NIOMR) which is the local participating agency will provide the use of a research vessel as required. Two NIOMR marine biologists (graduates) will also be redeployed full time to the project. They would use the work for higher degrees in either a Nigerian or U.S. institution. Adequate numbers of supporting staff (fishermen) will also be assigned full-time. The U.S. institution will be required to commit to the project a leader experienced in fishing surveys and one or two assistants, preferably graduate students registered for

higher degrees. There is a higher chance of success with that level of expertise and involvement on both sides.

Benefit to Nigeria:

The immediate benefit of the project is that the basis for using models such as Schaefer's for historical catch and effort data will be established. The use of such models will lead to an estimate of the resource potential. The long term socioeconomic implication is that rational exploitation can be more effectively planned.

Currently, NIOMR is investigating the growth and mortality rates of the key species exploited by the small-scale fisheries. These will indicate the response of the species to the current level of effort and therefore the exploitation status of the "stocks." The CRSP project will complement the NIOMR program.

NIOMR has enough expertise to be able to use the results of the successful completion of the CRSP project.

Stock Assessment CRSP Project Specification

Assessment of Fishery Grounds and Determination of Fisheries Resources Presence in the Middle Zone of Peru

RESEARCHERS:

National University of San Marcos:

Dr. Roger Quiroz Bazan
Title: Biologist
Speciality: Fishery Biology
Full Professor
(COORDINATOR)

Dr. Luis Izaguirre P.
Title: MSc. Statistician
Speciality: Fishery Statistics
Associate Pr essor

Dr. Manuel Samame Linares
Title: Dr. Biological Sciences
Speciality: Population Dynamics
Associate Professor

Dr. Teodoro Amoroto Calderon
Title: Biologist
Speciality: Ichthyology
Full Professor

Blg. Walter Cabrera Febola
Title: Fishery Biologist
Speciality: Systems Ecology
Assistant Professor

National University of Agriculture:

Blg. Victor Paredes Guerra
Title: Fishery Biologist
Speciality: Fishing Gear
Full Professor

Eng. Luis Garayar Melendez
Title: Fishery Engineer
Associate Professor

Eng. Raul Tomaylle
Title: Fishery Engineer
Speciality: Fisheries Management
Associate Professor

Eng. Oscar Malpica Moreno
Title: Fishery Engineer
Speciality: Fishing Boats
Associate Professor

OBJECTIVES

General Objective: Get a better knowledge of the region and its resources, attempting estimates on abundance and relative availibility of commercial species.

Specific Objectives:

Determine technically the accessibility of the resource.
Determine the level of the effort of the artisanal fishery.
Assess the level of fishery management in the region.
Study improving the fishing methods used.

RESEARCH PLAN:

Phase I. - Survey and assessment of the technological level of the fishermen of the region.

Phase II. - Identification and assessment of the features of the fishing boats and fishing gears used in the zone.

Phase III. - Oceanographic, biological and fishery study of the region.

Phase IV. - Tests of commercial - experimental fishing.

This plan will need at least two years, being commendable its carrying out for the maximum available, which is five years.

This program will increase the knowledge of regional fishery situation, recommending some necessary rules for more adequate management of the resources of the central coast of Peru.

IMPORTANCE TO THE COUNTRY:

Of the greatest long-term importance to improved fishing is the accumulation of knowledge about natural resources. The resulting information on the where, when and why of fish concentrations permits increased catches at reduced costs. The fisheries scientist is also interested in seasonal and geographic variations on fish quality. The fisheries region under study supports around 2,000 artisanal boats and about 6,000 artisanal fishermen. All this contributes 30% of the total landing of human consumption of fish in Peru. The feasibility of this project is to introduce the model studied into the other fishery villages along the Peruvian coast, because the artisanal fisheries do have common features along the coast.

COLLABORATORS FROM OTHER INSTITUTIONS:

- Peruvian Sea Institute (IMARPE)
  Staff of Extraction Division
- PESCA PERU Public Enterprise
- U.S. University personnel, especially on the oceanographic aspects

Many members of the staff from sponsor universities of this project have followed postgraduate courses in Japan, Germany, Spain, etc. In order to support the project, the sponsors have available a small research vessel (36')

with some oceanographic equipment on board. Likewise some equipment, though insufficient, is available in the biological laboratories at the universities.

BUDGET (2 years):

Salaries	120,000
Cost of Research	186,000
Study trips	66,000
Capacitation	102,000
Consultant	12,000
Seminary	30,000
Support service	54,000
TOTAL of operation costs	570,000
Equipment:	
TOTAL of stock cost	30,000
TOTAL of subsidy requested	$ 600,000

Stock Assessment CRSP Project Specification

Name of the Project:

Assessment of the inshore fishery resources of the Mediterranean Coast of Israel.

Principal Investigators:

Adam Ben-Tuvia, Department of Zoology the Hebrew University of Jerusalem, Israel. Menachem Ben-Yami, Department of Fisheries, Ministry of Agriculture, Tel-Aviv, Israel.

Objectives:

1. To determine the species composition and relative abundance of the stocks of fish utilized by the present inshore fisheries of the region (gill nets, trammel nets and hook-and-line).

2. To determine the distribution, size and density of the stocks by biotopes and bathygraphic stratificaation.

3. To add basic life history data on the principal species of commercial importance.

4. To evaluate the impact of the Suez Canal immigrants from the Red Sea on the fisheries ecology of the Levant.

5. To use the results of the stock assessment and the biological information for rational management and future development of the inshore fisheries.

	1st Year
	U.S. $
2 Research assistances	28,000
1 Technician	12,000
Expenses at sea (12 cruises)	6,000
Transportation and travel in Israel	5,000
Laboratory materials (expendable)	3,000
Car	20,000
Chartered boat	120,000
Equipment (Research)	10,000
Repairs & Maintenance	5,000
Statistical consultancy	18,000
Computer time	10,000
International travel	5,000
Fishery gear and equipment	25,000
Reporting & photography	10,000
Overhead 20%	51,400
	326,000

Stock Assessment CRSP
Project Specification for Korea

The Assessment of Fishery Resources Propagated by the Artificial Reef in Korea

Submitted by Woo-Il Choo

Mar. 7 - 10, 1983

1. Institution: Korea Rural Economics Institute
4-102 Hoigi-dong, Dongdaemoon-ku
Seoul, Korea

2. Principal Investigator:
Woo-Il Choo
Chief,
Fishery Development Research Division
Korea Rural Economics Institute

3. Collaborative Organizations:
Fisheries Research and Development Agency (Busan, Korea)
Korea Ocean Research and Development Institute
(Seoul, Korea)

4. Title of Proposed Research:
The Assessment of Fishery Resources Propagated
by the Artificial Reef in Korea.

5. Background Information on Proposed Research:

Lacking suitable areas for animal husbandry, Korea, located in a peninsula, has long been dependent on marine products as the major source of its animal protein supply. Marine products have been vital to the subsistence of Korean people. Even though the importance of fish protein has decreased recently, more than 60% of animal protein intake is still supplied by the fishery sector. With two ocean currents, a cold one from the north and a warm one from the south, meeting in its offshore waters, Korea is favored with excellent oceanographic fishing conditions and this has contributed in making the country a big fishing nation. Korea has become more dependent on the coastal and offshore fisheries after the deep-sea fishery has shrunk rapidly as a result of U.N. Sea Law and oil shortages. Many indications have shown that the coastal fishery stocks are depleting, and the environmental conditions for fish rearing habitat have become worse. However, the yearly catch amount of the coastal fishery maintains almost the same level during the last several years. It is not due to the stability of coastal fishery resources but due to the ever-increasing number, size and motorization of coastal fishing boats as well as to the improvement of fishing gear in order to compensate the low catch rate. The propagation of fishery resources is very much needed in this sense, and the authorities concerned have recognized the importance of a propagation project for fish stocks. The artificial reef construction project is chosen as a means of the propagation of fishery resources, improvement of environmental conditions and disturbing the illegal coastal fishing activities.

6. Objectives of Proposed Research:

In Korea, the artificial reef construction project was initiated in 1971 with 1,527 concrete blocks and 58 old ships in the eastern and southern coast of Korea. But the project has not been much supported by the government

budget since initiation. The result was that a total of 42,620 concrete blocks and 151 old ships were thrown into the area of 2,520 hectares up to 1981. From last year (1982), the project was emphasized to build 15,219 concrete blocks and 293 old ships in the area of 3,033 ha. The result achieved last year was remarkable compared to the previous ones. It is assumed that there are roughly 80 thousand ha in the eastern and southern coast which are suitable to build artificial reefs, and half the area will be scheduled to construct the artificial reefs until 1986. The systematic research is needed to follow the effect of the artificial reefs before the project is expanded.

The result can be contributed to amend the future artificial reef project. The following questions should be solved even tentatively through the research: the condition of adequate area to construct the artificial reefs, the attracting degree of fish according to the size, shape of reefs, and type of construction, how long the effect of reef can be maintained after construction.

7. Time Schedule of Proposed Research:

Several spots where the artificial reefs were constructed will be selected according to the area located, time constructed, size, shape and arrangement of artificial reefs. On-the-spot investigation will be done by a scuba diver every other month to check the change of fishery stock density and fauna diversification. The inquiry survey will be conducted regularly to collect data on catch and catch-per-unit-effort at the fishing harbor nearby the artificial reef. The investigation and data collection survey will be continued at least two years until the artificial reefs are proved to be mature as natural reefs.

8. Personnel:

Woo-Il Choo - Born Seoul, Korea, May 29, 1941; B.S. Seoul National University; M.S. National Fisheries University of Busan; Studied on population dynamics at University of Washington in 1969; Attended Training Centre on Methods of Fish Stock Assessment held under the auspices of FAO in 1970. Worked at the Fisheries Research and Development Agency (Busan, Korea) 1966-1973; Worked for FAO in Italy 1971-1972; Served as Assistant Professor at Cheju National Universiey 1973-1978; Worked as Tuna Consultant at FAO in South China Sea Fisheries Development and Coordinating Programme during March-June 1980 in the Phillipines; Serving as Chief, Fishery Development Research Division, Korea Rural Economics Institute from 1978 to present.

STOCK ASSESSMENT CRSP PROJECT SPECIFICATION

PROPOSAL FOR A REGIONAL PROJECT ON STOCK ASSESSMENT

Veravat Hongskul

PROJECT TITLE: FISHERY RESOURCE ASSESSMENT AND MANAGEMENT IN THE SOUTHEAST ASIAN REGION

IMPLEMENTING AGENCY:

Training Department
Southeast Asian Fisheries Development Center (SEAFDEC)
P. O. Box 4, Phrapradaeng
Samutprakarn, THAILAND

COLLABORATING AGENCIES/INSTITUTES :

THAILAND:

1. Department of Fisheries
   Ministry of Agriculture and Cooperatives
   Bangkok

2. Faculty of Fisheries
   Kasetsart University
   Bangkhen, Bangkok

MALAYSIA:

1. Fisheries Research Institute, Penang
   Fisheries Division
   Ministry of Agriculture

2. Universiti Sains Malaysia
   Penang

3. Marine Fisheries Department
   Kuching, Sarawak

4. Fisheries Department
   Kota Kinabalu, Sabah

BRUNEI:

1. Fisheries Department
   Bandar Seri Begawan, Brunei

PHILIPPINES:

1. Bureau of Fisheries and Aquatic Resources
   Quezon City, Metro Manila

2. Institute of Fisheries Development and Research
   College of Fisheries
   University of the Philippines
   Diliman, Quezon City, Metro Manila

DURATION : Five years (1984-1988)

RATIONALE :

The past two decades saw a spectacular increase in the marine fishery production from the South China Sea area, with a total production of more than 7.1 million metric tons in 1980, valued at over US $5,436 million.

The rapid expansion of this marine fishery production is due to the increase in the capacity and efficiency of fishing craft and gear employed by the countries in the region. This rapid development has unfortunately caused over-fishing in many areas of Southeast Asian waters, particularly the Gulf of Thailand. The countries of Southeast Asia still do not have adequate knowledge of the stocks, the biology and the bionomics of the species being exploited. Furthermore, the statistics on fishing catch and effort are also insufficient to enable a detailed appraisal of the size of the resources.

The Training Department of the Southeast Asian Fisheries Development Center has initiated major programs to improve this situation in order to fulfill its prime objective in promoting the development of fisheries and rational utilization of resources in the region. Since 1976, the Department has compiled and published an annual Fishery Statistical Bulletin for the South China Sea Area, which has become the main source of fishery statistical data in the region. Moreover, it has launched a study on the fishery resources in the waters of Southeast Asia and the program of activities in this field was approved by the Council at its Twelfth Meeting in Singapore, 6-10 November 1979, subject to the availability of funds and personnel.

As knowledge of the resources and fisheries is essential for the development planning and the management of these resources with a view to conservation, especially in the light of the extended maritime jurisdiction by coastal states in the region, this Project proposal has been formulated by the Training Department. However, since the Training Department's funds for this Project are, at present, inadequate, external assistance is required for effective implementation of the Project.

WORK PLAN :

The proposed five-year project on the fishery resource assessment and management in the Southeast Asian region would comprise the following five components, which are interrelated:

I. Fishery resource survey in the region.

II. Resource assessments.

III. Collaborative research with national institutes in Thailand, Malaysia, Brunei and the Philippines, in collaboration with U.S. institutions/universities.

IV. Seminar/Workshop on the status of major stocks in the region.

V. Compilation and publication of reports.

The interrelationships between these components are shown in Figure 1.

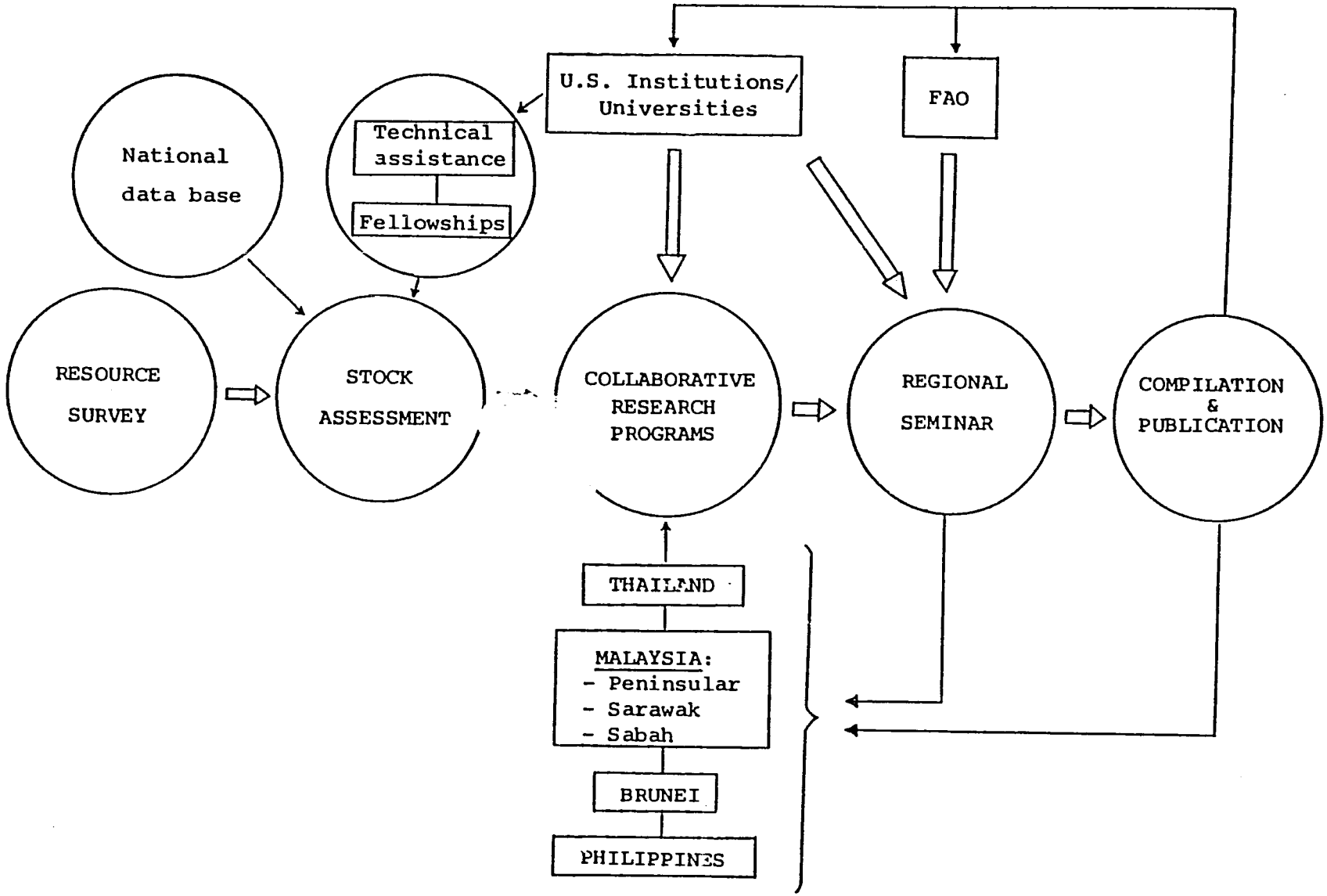

Fig. 1. Interrelationships between the components of the Project.

I. FISHERY RESOURCES SURVEYS

In the area under study, SEAFDEC as an intergovernmental body has the unique characteristic of coordinating multilateral research programs with the Member Governments concerned through their Departments of Fisheries. Moreover, the Training Department has its own research and training facilities, including three research vessels and experts in the fields of fishery oceanography and stock assessments, to carry out specific research and resource surveys to the extent required by the Project.

In order to assess the potential of fishery resources in the region, in particular of those in the EEZs and off-shore areas, for further exploitation, it is proposed that fishery resource surveys be conducted by the Training Department during the first three years of the Project, i.e., 1984-1986.

The three-year plan for the fishery resource surveys in the Southeast Asian region would comprise two separate activities:

(a) survey cruises in which data would be collected and compiled; and

(b) laboratory analysis of the fishery information, including existing data from the national bases of the participating countries.

The services of M.V. PAKNAM, a 386 gross ton stern trawler, and M.V. PLATOO, a 68 gross ton modern purse seiner, both owned by the SEAFDEC Training Department, could be employed for the eight annual cruises. Emphasis would be on population studies of economically important pelagic species in the region as well as demersal fishes. Moreover, the operations of these vessels during the survey cruises could also serve as demonstration-cum-training courses for the local fishermen in the Member Countries to upgrade their technological know-how.

As for laboratory analysis, the following additional data would be assessed: (a) data concerning demersal fish stocks collected by the Departments of Fisheries of Member Countries; and (b) data pertaining to demersal fish stocks and large-size pelagic fishes (tuna, etc.) as was collected by M.V. CHANGI of SEAFDEC/Marine Fisheries Research Department.

The population study would be based on information gathered from the research vessels' surveys and on national statistics. For the analysis on demersal fish stocks and large-size pelagic fish, the data would be analyzed by using a computer. The survey of pelagic resources, including mackerel, sardines and scads as well as trash fish in the pelagic catches, would be conducted both by field surveys and by laboratory analysis.

Throughout the course of the surveys and data analysis, scientists from the collaborating agencies/institutes would be invited to participate in order to promote the transfer of technological know-how to the personnel involved in the Project and thus assist in developing national expertise for further collaboration in the joint research programs.

II. RESOURCE ASSESSMENTS

Based on the outcomes of the fishery resource surveys and the studies conducted by the research staff of SEAFDEC, assessments on the resource potentials would be conducted by the Research Division of the Training Department. Preliminary assessments at the national level have already been made, such as the assessments of the small pelagic resources in the Gulf of Thailand (Shindo and Chullasorn 1980, 1983), of the demersal stocks along the Indian Ocean coast of Thailand (Hayase 1983) and of the multispecies demersal fisheries in the southern part of the Gulf of Thailand (Sommani 1983). The Department will attempt to expand these studies to cover the Sunda Shelf, the South China sea and the Malacca Strait as well as the Andaman Sea, during the period covered by the Project.

The major stocks that would be assessed under this component are:

1. The small pelagic resources in the South China Sea and the Sunda Shelf area.

2. The demersal resources in the Gulf of Thailand, off eastern Peninsular Malaysia (Sarawak to Sabah), and around the eastern Philippine islands.

3. The shrimp resources of Member Countries (national potential).

4. The squid resources of Member Countries (national and regional potentials).

5. Other invertebrate resources in the region as potential resources for development.

These assessments would employ both traditional stock assessment methodology (i.e., using resource survey data, commercial fishing data and analytical methods) and a multispecies approach. Development of a new theoretical concept for the latter would be the major concern under this component. Technical assistance in the form of foreign experts would be required to ensure success in developing such a concept.

III. COLLABORATIVE RESEARCH WITH NATIONAL INSTITUTES AND U.S. INSTITUTIONS/ UNIVERSITIES

In order to promote collaborative programs between the academic institutions in developing countries and U.S. universities, under the Stock Assessment Collaborative Research Support Program, it is proposed that a network of research programs be established in the participating countries, namely Thailand, Malaysia, Brunei and the Philippines, which would be coordinated by the SEAFDEC Training Department and the U.S. counterpart experts.

This network would consist of two major components:

a) Higher education/training at U.S. institutions/universities for selected scientists from the participating agencies in order to prepare a team of qualified personnel for stock assessment

programs at the national level.

Fellowships for such study and training are requested to be provided under the Project for at least 8 scientists (two each for Thailand and the Philippines, one each for Peninsular Malaysia, Sarawak, Sabah and Brunei) to attend M.S. degree programs at U.S. universities specialized in fish stock assessment, during 1984-1986.

b) Collaborative research programs between the participating agencies and U.S. institutions/agencies on selected topics pertaining to stock assessment, with a view to providing better understanding of the roles of fisheries dynamics for management purposes.

Endeavours should also be made to follow up the outcomes of the resource surveys and of the preliminary assessments carried out by SEAFDEC in Parts I & II. In addition, experimental research should be conducted on the topics as recommended by the FAO World Conference, the ACMRR Working Party on Management of Living Resources in Near-shore Tropical Waters and the IPFC/SCORRAD with a view to implementation in the countries participating in the Project.

It is expected that such collaborative programs would not only strengthen national capability in stock assessment research but also provide an excellent venue for the scientists from the USA to work closely with their Asian counterparts in solving the problems of tropical fish stock assessment.

In the carrying out of its part of the Project, SEAFDEC could serve as coordinator to assist U.S. scientists and the national agencies in discussing the problems that may arise, and in planning and executing the programs as well as in providing follow-up activities after completion of the Project.

IV. SEMINAR/WORKSHOP

As a sequence to the activities outline in Parts I-III, it would be appropriate to organize a Seminar/Workshop on the status of fish stocks in the Southeast Asian region and the management strategies for the optimum utilization of these resources.

It is therefore, proposed that a Seminar/Workshop be held in 1987 or early 1988, about four years after the FAO World Conference. A review of the status of stocks should be presented and the outcomes of the collaborative research programs (Part III) should be discussed. Although SEAFDEC and some U.S. universities could play a leading role in organizing this regional meeting, experts from FAO, and IPFC/SCORRAD should collaborate in order to provide guidance for the effective implementation of the recommendations addressed to the participating countries in the region.

V. COMPILATION AND PUBLICATION

The last stage of this Project will be the documentation of all activities undertaken under the Project for further consideration by the participating governments in the Southeast Asian region in implementing their fisheries development plans. Undoubtedly, the publication of such material would be of very great value to those who are interested in fisheries resource assessment and management in the region. Since, the cost of compilation and publication is likely to be rather high, it has been included as part of the Project costs.

TIMETABLE :

The time schedule for this five-year Project is proposed as follows:

I.	Resource surveys	early 1984 to 1986 (3 yrs.)
II.	Resource assessments	1985 to 1987 (3 yrs.)
III.	Collaborative programs	1986 to 1987 (2 yrs.)
IV.	Seminar/Workshop	late 1987 or early 1988
V.	Compilation and Publication	1985 to 1988

BUDGETARY REQUIREMENTS:

(See attached table)

BUDGETARY REQUIREMENTS (in US dollars):

Item	Year 1	2	3	4	5	Total	%
I. Resource survey							
1.1 M.V. PAKNAM (60 days/yr)	78,000	85,800	94,380	-	-	258,180	
1.2 M.V. PLATOO (90 days/yr)	67,500	74,250	81,675	-	-	223,425	
1.3 Trip expenses (6 scientists)	9,000	9,900	10,890	-	-	29,790	
						511,395	34.9
II. Resource assessments							
2.1 Laboratory expenses	-	20,000	10,000	10,000	-	40,000	
2.2 Travel expenses	-	10,000	10,000	10,000	-	30,000	
2.3 Research Assistants	-	5,000	5,500	6,050	-	16,550	
						86,550	5.9
III. Collaborative research[1/]							
3.1 Fellowships ($15,000 each/yr)	60,000	120,000	60,000	-	-	240,000	
3.2 Mic ocomputers (10 units)	-	80,000	-	-	-	80,000	
3.3 Research expenses	-	-	200,000	150,000	-	350,000	
3.4 Equipment	-	-	20,000	20,000	-	40,000	
3.5 Others	-	-	10,000	10,000	-	20,000	
						730,000	49.9
IV. Seminar/Workshop	-	-	-	30,000	-	30,000	2.1
V. Publications	-	10,000	15,000	30,000	50,000	105,000	7.2
Total (US $)	214,500	414,950	517,445	266,050	50,000	1,462,945	
%	14.7	28.4	35.4	18.2	3.3	100.0	

1/ Not including travel, salary and allowances for US experts assigned to the Project and other related costs.

STOCK ASSESSMENT CRSP PROJECT SPECIFICATION

Artisanal Fishery in the Northeast Brazil

Silvio Jablonski

Background Information

For many years, data on Brazilian fishing activities as well as on the biology of some important commercial species was collected and analyzed by various federal, local and private institutions mostly without specific criteria.

An excessive exploitation was seen as a real problem after the institution of a Program of financial support (Federal Law 221, 1968), as a result of the increase in investments in the sector and the resultant increase in the fishing effort. A responsible and sharp knowledge of the available resources and the optimum exploitation levels was needed to make possible a better global yield.

The Superintendency of Fishery Development - SUDEPE, through the PDP (Development Program of Fishery Research) and through other regional institutions has promoted the creation of training groups for the development of know-how on evaluation of fish stocks under exploitation by the industrial fleet, which is responsible for the most of the fish production. Besides, some recommendations were made for the increase of research works, in an effort to get more complete and reliable data.

Following this philosophy, SUDEPE has accelerated the development and the implementation of a large program to grant effective collection of data on qualitative and quantitative composition of the major fish stocks, through the systematic sampling of landings of industrial fishing fleet and regular surveys carried out by research vessels.

The data on major stocks under exploitation are now being analyzed by the "Permanent Study Group". The results gathered by the PSG are being used as the basis for some administrative decisions such as limitation of the number of boats fishing on single species; the definition of minimum landing size, and the determination of closing time and area for captures.

The continental area of Northeast Brazil corresponds to the States of Maranhao, Piaui, Ceara, Rio Grande do Norte, Paraiba, Pernambuco, Alagoas, Sergipe and Bahia, covering almost 19% of the Brazilian territory and about 40% of its shoreline. The region lies between the limits 1°01'S to 18°20'S and 48°50'W to 34°46'W.

Table 1 Shoreline (km) and continental shelf area (mi^2) of NE Brazil

States	Shoreline	Continental Shelf - Depths (m)			
	(m)	0 - 2	20 - 50	50 - 100	Total
Maranhao	640	4881	10663	5960	21504
Piaui	65	397	532	318	1247
Ceara	573	4656	4412	2471	11539
R.G.Norte	399	2140	1311	358	3819
Paraiba	130	380	660	100	1140
Pernambuco	178	417	933	174	1524
Alagoas	335	609	1494	286	2389
Sergipe	163	400	496	203	1099
Bahia	1188	2788	7796	3963	14547
TOTAL	3671	16678	28297	13833	58808
Brazil	9000				

In the main part of its extension the continental shelf is relatively narrow, with marked limits at the beginning of the slope. Southwards the shelf becomes progressively narrow, varying from 120 mi in the State of Maranhao to 20 mi in Pernambuco, and expanding afterwards until the southern region of Bahia, where it again exceeds the 120 mi.

The bottom near the coast is sandy, with large extensions in front of Maranhao, but the more characteristic regional bottom is that formed by calcareous seaweeds (Rhodophyceae). It occurs all along the shelf from 20m depth on. There are also some pockets of mud which are directly due to the influence of coastal rivers.

The most important estuarine areas are closely related to a few permanent rivers of the region as the Gurupi, Parnaiba, Jaguaribe and Sao Francisco, but at those areas extensive mangroves can be found.

In the Northeastern region of Brazil, fishing is mainly done by artisanal methods and scientific information on this practice is very limited due to scarce information on capture and fishing effort, the use of multiple kinds of fishing gear and to the diversity of species captured. Paiva (1971) estimated the annual potential catch for that fishery to be around 141,600 tons. Later on in 1974, a research made by SUDENE - Superintendency for the Development of the Northeast region - with the help of hydroacoustic techniques estimated a maximum sustainable yield for the whole region of about 220,000 to 350,000 tons.

Due to the great increase of the fishing effort levels of the industrial fishery (basically on snappers and lobsters) and to the high prices of fuel, SUDEPE has directed its attention to the expansion of the artisanal fishery on the Northeast coast.

Therefore, a better knowledge on the current state of the exploited stocks is urgently needed in order to guarantee a more efficient harvest of the resources. For this, it is necessary to provide a catch and effort data base and to evaluate the effects of the artisanal fishery upon the exploited stocks.

Justifications

The studies on stock evaluation are related to species of commercial relevance, to attend the necessary basis for the establishment of scientific criteria aiming at a rational exploitation of the sea, estuarine and continental resources. Consequently, research studies in some areas in this field were developed in the northeastern region, because of the economic importance of such species as lobster and snappers. These have been under intensive exploitation; in some cases, it seems to have reached or even surpassed the maximum yield level.

As to other species, especially those captured by artisanal fishermen, the scientific information level is well behind that expected by SUDEPE. This is due to the lack of statistical data and the characteristics of the artisanal fishery.

Therefore more emphasis is needed on evaluation studies of small-scale fisheries based not only on traditional models, but also on those specifically designed to provide a good understanding of events in multispecies communities that occur under exploitation.

Following this direction, SUDEPE is intending to reshape the collection of information gathered by a "Fishery Statistic System" to make possible a diagnosis of the effects of the artisanal fishing on fish stocks.

To make this possible the training of Brazilian personnel on the application, adaptation and development of the assessment models directed to small-scale fishing activities is needed. Such models have to take into account the great number of species the fishery is based upon and the variety of fishing methods.

Furthermore, technical assistance by specialists will be necessary to help on the analysis of the data collected and in order to program, to process and to interpret this information.

For the systematic development of this program, the facilities of the "Research and Fishery Extension Center of the Northeast Region" in Tamandare, Rio Formoso County, in Pernambuco State will be used.

Objectives

To improve the assessment analysis of stocks under exploitation by artisanal fishermen, in the Northeast Brazil as well as to follow up the effects of the fishing on the available resources. This aims to bring up to date the

measures of control of fishing activity and analyze the future effects of these measures referring to the biological aspects of the stocks and social and economic life of the fishermen.

Work Plan

A - Description of the activities.

Project activities	Time duration and beginning of the activities.
Diagnosis of the biostatistics data collection program of stocks selected for analysis.	6 months - July 1984
Development of a biostatistics sampling program aimed to artisanal fishing including design of a catch and effort sample survey.	2 years - January 1985
To advise on the statistical interpretation of data for stock assessment purposes.	2 years - January of 1985
Training of Brazilian personnel in stock assessment methods.	1 year - January 1985

B - Definition of International Personnel.

Fishery statistics consultant with large experience particularly on methods used in stock evaluation.

Fish stock assessment consultant, preferably with large experience in the application of models for stock evaluation in small-scale fishery.

C - Training

Besides the training to be given to the Brazilian personnel by the consultants, we expect to be giving scholarships to our Brazilian technicians according to the following specifications:

2 scholarships of six months duration on the adaptation, application and development of assessment models for small scale fisheries.

1 scholarship of six months on fishery statistics.

1 scholarship of six months on collection and data processing.

D - Participation

Brazilian:	Management - SUDEPE Execution, PDP, with the participation of the Laboratorio de Ciencias do Mar da Universidade do Ceara.
American:	To be negotiated.

APPENDIX 1

LANDINGS OF ARTISANAL FISHERY IN THE NORTHEAST REGION - 1979 (tons).

STATES	
Maranhao	41479
Piaui	1115
Ceara	11528
Rio Grande do Norte	6093
Paraiba	2028
Pernambuco	2672
Alagoas	2776
Sergipe	3923
Bahia	17712
TOTAL	89326

Appendix 2

List of common species in the artisanal fishing in State of Ceara, NE Brazil.

Common Names	Scientific Names
agulha branca	Hemirhampus Cuvier
agulha preta	Hemirhampus brasiliensis (Linnaeus)
agulhao de vela	Istiophorus americanus (Cuvier & Valenciennes)
albacora	Genero Thunnus South
aliquinn	Genero Scorpaena Linnaeus
arabalilla	Elagatis bipinnulatus (Quoy & Gaimard)
arenque	Familia Engraulidae
arraco	Lutjanus synagris (Linnaeus)
arrata(s)	Ordem Batoidei
bagre amarcho	Familia Tachysuridae
bagre branco	Familia Tachysuridae
bagre costeiro	Familia Tachysuridae
bagre espelho	Familia Tachysuridae
baiacu caixao	Lactophrys trigonus (Linnaeus)
baiacu de croa/bostacu pintado	Spheroides testudinus (Linnaeus)
baiacu de espinho/bostacu graviola	Chilomycterus spinosus (Linnaeus)
baiacu garajuba	Lagocephalus laevigatus (Linnaeus)
baiacu listado	Colomesus psitacus (Bloch & Schneider)
barbudo	Polydactylus virginicus (Linnaeus)

batata
bicuda branca
bicuda preta/bicuda cachorra
bijapita/cacao de escama
biquata
boca mole
boca negra
bonito
buchao
cabeca dura
cacao flamenco
cacao lixa
cacao pana/cacao martelo
cacao piolho/pielho
cagao rabo seco
cambuba/macasso
camurim
camurupum/pema
canguito
cangulo fernande
cangulo papo amarelo
cangulo velho/cangulo pavao
cara do mar/dormioco
caranha
carapeba
carapieu
carapitanga/dentao
carauna/laneeta
cavala
cavala empinge
cioba
congro
coro amarelo
coro branco
corvina
cururuca
dourado
espada
ferreiro
frade
galo do alto/galo rabudo
galo corcunda
garabebel/pampolistado
garajuba amarela
garajuba preta
garapau/gurapau, olhao
garaximbora/garacimbora
garoupa branca
garoupa preta
garoupa rajada
garoupa vermelha
gato
guaiuba
guaxumba
jacunda
judeu/judeu branco

Genero Sparisoma Swainson
Sphyraena guachancho (Cuvier & Valenciennes)
Sphyraena barracuda (Walbaum)
Rachycentron canadus (Linnaeus)
Haemulon plumieri (Lacepede)
Cynoscion petranus (Ribeiro)
Lutjanus buccanella (Cuvier)
Euthynnus alletteratus (Rafinesque)
Familia Labridae
Genero Stellifer (Oken)
Ordem Selachii
Ginglymostoma cirratum (Bonaterre)
Sphyrna tiburo (Bijelow & Schroeder)
Familia Echencididae
Ordem Selachii
Haemulon steindachneri (Jordan & Gilbert)
Centropomus undecimalis (Bloch)
Tarpon atlanticus (Valenciennes)
Genero Orthopristis Girard
Melichthys piceus (Poey)
Balistes vetula Linnaeus
Alutera scripta (Osbeck)
Lobotes surinamensis (Bloch)
Genero Lutjanus Bloch
Genero Diapterus Ranzani
Lucinostomus gula (Cuvier & Valenciennes)
Lutjanus jocu (Bloch & Schneider)
Acanthurus (Forskal)
Scomberomorus cavalla (Cuvier)
Acanthocybium solandri (Cuvier & Valenciennes)
Lutjanus analis (Cuvier & Valenciennes)
Familia Ophichthyidae
Conodon nobilis (Linnaeus)
Genyatremus luteus (Bloch)
Micropogon undalatus (Linnaeus)
Micropogan furnieri (Desmarest)
Coryphaena hippurus (Linnaeus)
Thichiurus lepturus (Linnaeus)
Paralonchurus brasiliensis (Steindachner)
Anisotremus virginicus (Linnaeus)
Alectis ciliaris (Bloch)
Vomer setapinnis (Mitchill)
Trachinotus glaucus (Bloch)
Genero Caranx Lacepede
Genero Caranx Lacepede
Selar crumenophthalmus (Bloch)
Caranx latus Agassiz
Genero Epinephelus Bloch
Genero Epinephelus Bloch
Alphistes afer (Bloch)
Genero Epinephelus Bloch
Paralabrax dewegeri (Metzclaar)
Ocyurus chrysurus (Bloch)
Familia Carangidae
Diplectrum radiale (Quoy & Gaimard)
Menticirrhus martinicensis (Cuvier)

Common Names	Scientific Names
manjuba	Familia Engraulidae
mariquita	Holocentrus ascensionis (Osbeck)
mero	Promicrops itaiara (Lichtenstein)
more	Labrisomus muchipinnis (Quoy & Gaimard)
morcia	Familia Muraenidae
muriongo	Ophichthus gomesii (Castelnau)
olho de boi/pargo olho de boi	Priacanthus arenatus (Cuvier)
olho de vidro/pargo olho de vidro	Lutjanus vivanus (Cuvier & Valenciennes)
pacamao	Amphichthys cryptocentrus (Cuvier & Valenciennes)
palombeta	Chloroscombrus chrysurus (Linnaeus)
pampo	Trachinotus carolinus (Linnaeus)
pargo	Lutjanus purpureus (Poey)
parum	Chaetodon striatus (Linnaeus)
parum amarelo/bicudo	Chaetodon ocellatus (Bloch)
parum branco/sete bucho	Chaetodipterus faber (Braussonet)
pataca	Peprilus paru (Linnaeus)
pescada branca	Cynoscion leiarchus (Cuvier)
pescada curvina	Cynoscion virescens (Cuvier)
pescada de dente/pescada dentao	Cynoscion bairdi (Steindachner)
pescada de escanta/pescada cascuda	Cynoscion acoupa (Lacepede)
pescada rabo de fogo	Macrodon ancilodon (Bloch)
pintadinho	Scyliorhinus boa (Goode & Beau)
pira	Malacanthus plumieri (Bloch)
pirambu	Haemulon parrai (Desmarest)
pitanema	Dermatolepis inermis (Cuvier & Valenciennes)
piranga/pargo piranga	Rhomboplites aurorubens (Cuvier & Valenciennes)
pirauna	Cephalopholis fulvus (Linnaeus)
sabao	Rypticus saponaceus (Bloch & Schneider)
salema	Archosargus unimaculatus (Bloch)
salema do alto/pirabanha	Kyphosus incisor (Cuvier & Valenciennes)
sapuruna/sapuruna preta	Haemulon melanurum (Linnaeus)
sardinha	Opisthonema oglinum (Le Sueur)
sargo/sargo de pedra	Archosargus probatocephalus (Walbaum)
serigado/sirigado	Mycteroperca bonaci (Poey)
serra	Scomberomorus maculatus (Mitchill)
solha	Genero Achirus Lacepede
tainha	Genero Mugil Linnaeus
tibiro	Genero Oligoplites Gill
traira branca	Synodus intermedius (Agassiz)
traira preta	Genero Synodus Scopoli
trombeta	Aulostomus maculatus Valenciennes
ubarana boca de rato	Albula vulpes (Linnaeus)
ubarana verdadeira	Elops saurus (Linnaeus)
voador cascudo	Cephalacantus volitans (Linnaeus)
voador tainha	Familia Exocoetidae
xarcu	Caranx hipps (Linnaeus)
xerne	Familia Serranidae
xira	Haemulon aurolineatum (Cuvier)
xixarxo	Carangops amblyrhyncus (Cuvier & Valenciennes)
zambaio cachorro	Familia Belonidae
zambaio rolico	Familia Belonidae
zambaio taba	Familia Belonidae

Appendix 3

NUMBER OF ARTISANAL FISHERMEN IN THE NE REGION - 1978

STATES	FISHERMEN
Maranhao	68000
Piaui	9025
Ceara	17965
Rio Grande do Norte	10000
Paraiba	4492
Pernambuco	10000
Alagoas	5040
Sergipe	6000
Bahia	35000
TOTAL	165522

NUMBER OF ARTISANAL BOATS IN THE NE REGION - 1975

STATES	CANOES	RAFTS	SAILBOATS	ENGINE BOATS	TOTAL
Maranhao	637	1238	120	194	2189
Piaui	-	-	-	-	-
Ceara	1110	1061	469	279	2919
Rio G. do Norte	425	0	786	81	1292
Paraiba	3607	209	170	162	4148
Pernambuco	-	-	-	-	-
Alagoas	554	600	20	71	1245
Sergipe	1014	0	517	4	1535
Bahia	1852	0	383	18	2253
TOTAL	9199	3108	2465	809	15581

Dash (-) means no data available.

Appendix 4

Available facilities in the "Research and Fishery Extension Center of the Northeast Region in Tamandare, Pernambuco.

- Accommodations
- Transport facilities
- Data processing facilities (Micro computer - 48K)
- 3 boats of about 8m long for surveys with artisanal gears
- 1 vessel (23m long) equipped with bottom trawl net, gillnets and handlines
- Brazilian technical staff: 4 Fishery Biologists.

THE STOCK ASSESSMENT COLLABORATIVE

RESEARCH SUPPORT PROGRAM

(Stock Assessment CRSP)

USAID - University of Maryland

Rome, March 7-10, 1983

Research and Development Project on the Artisanal Marine Fisheries in the United Republic of Cameroon

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1 - STUDY AREA.

Located in the Gulf of Guinea between 2°20'N and 4°50'N, the Cameroonian coast line extends 360 km from Nigeria (Akwayafe River) to Equatorial Guinea (Campo River).

The coastal environs of Cameroon are characterized by:

1)- An extensive region of mangrove swamps/estuaries located at the entrances of large rivers (Rio del Rey, Bimbia, Cameroon, Sanaga and Nyong). These regions are rich nurseries and habitats, which contrast with the relative poverty of surrounding waters.

2)- A rocky coast of volcanic origin between Bibundi and Cape Bimbia. This area serves as a habitat for several important species, including penaeid shrimps.

3)- Sandy bottoms found south of the Nyong River to the Equatorial Guinean border. Several large rocky outcroppings are found here, which are habitats for lobsters and other species.

2 - CURRENT STATUS OF RESOURCES RESEARCH AND DEVELOPMENT.

The continental shelf extends from the northern border to the Nyong River as a plane of sand and of sand/mud. In the southern areas of the shelf, the bottom topography is more uneven, with coral formations and rocky outcroppings surrounded by patches of sand and mud.

Centered in the Bay of Biafra, the Cameroonian continental shelf is subject to the hydrology of the Gulf of Guinea and to the effects of numerous rivers which empty there. As such, the surface water is warmer ($T^{o}>25^{o}C$) and less saline ($S^{o}/oo<35$) while deeper water is cooler and more saline.

In spite of earlier attempts to begin to organize information in "Fond De Peche le long des cotes de la Republique Federale du Cameroun" - CROSNER, ORSTOM, 1964 ("The Oasis of Coastal Fisheries in the RFC"), much of the information concerning the Cameroonian marine zone is either out of date or non-existent: faunal inventory assessment, evaluation of fish stocks, life history strategies of principle commerical species, distribution patterns of marine sediments, and benthic topography.

Cameroonian fisheries are classed as being either industrial or artisanal, and are exclusively coastal. Depths fished range from 6 to 40 meters to several thousand meters.

Annual consumption of marine products is more than 150,000 tons of which 13% are from industrial fisheries, 20 to 33% are artisanal, 16% are imported, and 40% are from inland fisheries/aquaculture. This last class is not to be considered within the scope of this proposed project. All figures cited are approximate.

The industrial fisheries are controlled by four companies with about 30 boats/trawlers. Statistics are relatively well known for this facet of Cameroonian fisheries, and show a stagnation in production for the last five years relative to fishing effort. A decrease in the number of

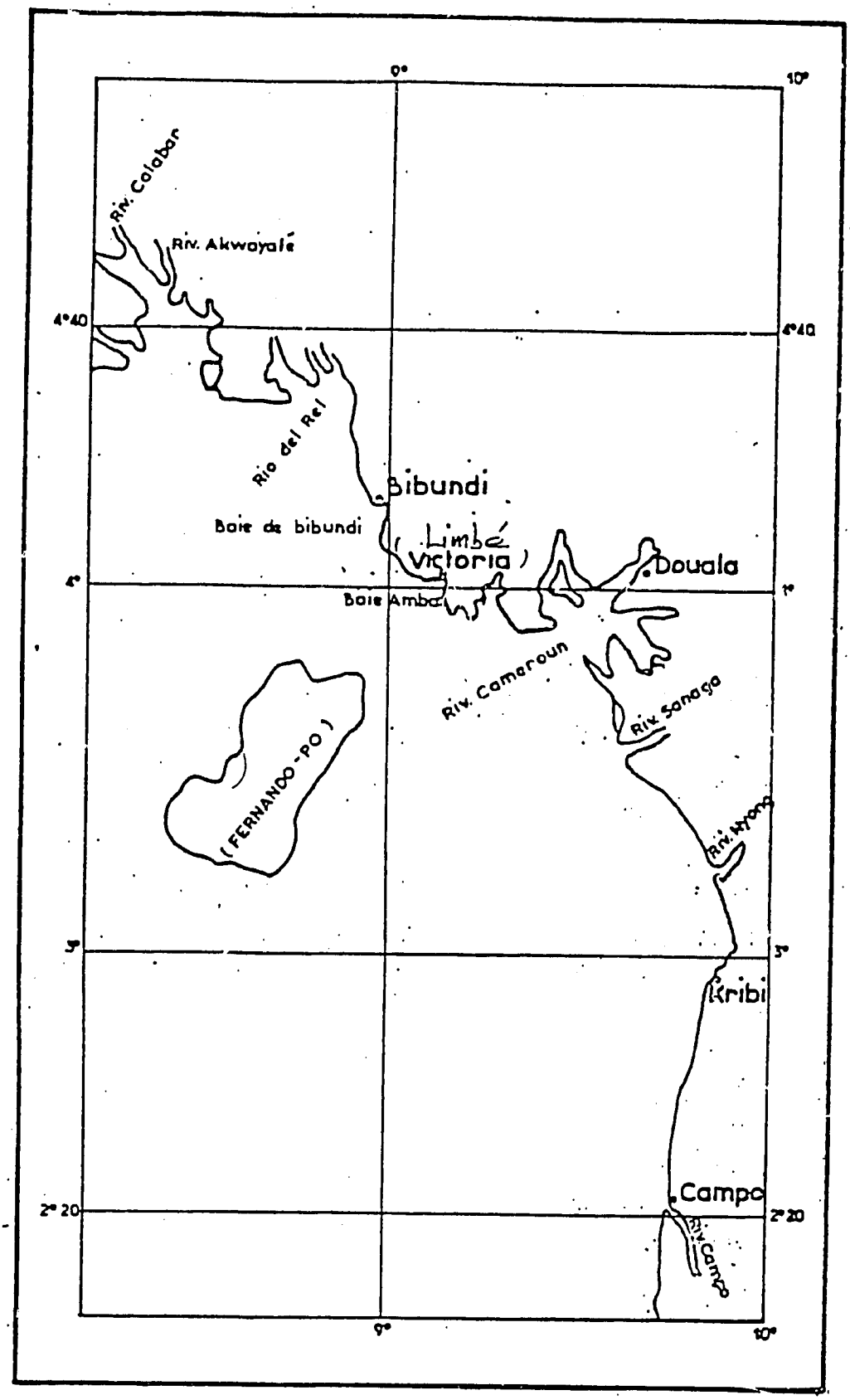

Fig. 1 - Présentation de la côte Camerounaise

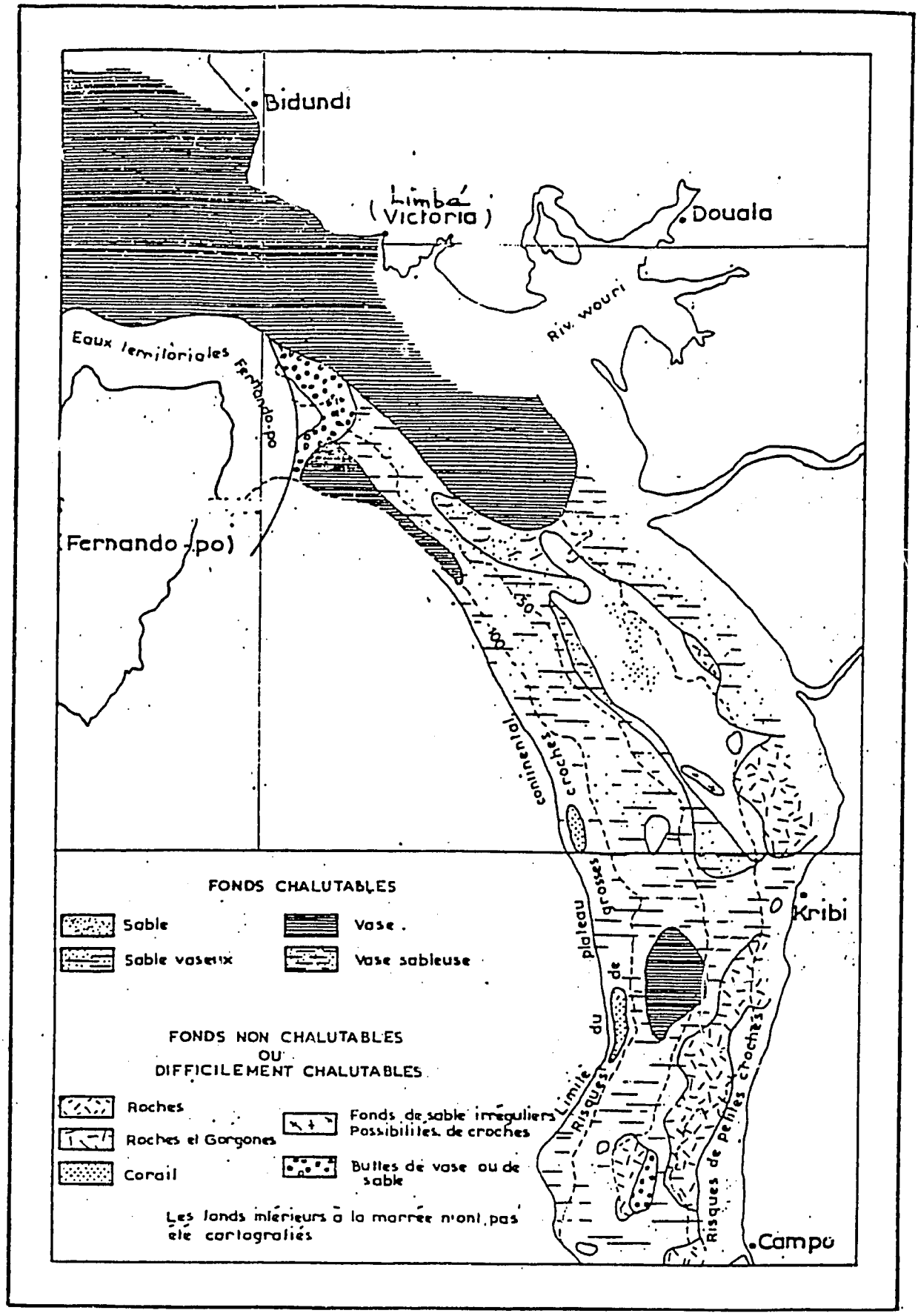

Fig. 2 - Carte des fonds du plateau continental camerounais
(d'après A. CROSNIER 1964)

species fished has also been noted for the same period. Statistics on artisanal fishing are not available even though it is thought that this practice can increase utilization of marine resources and can lessen the amounts of fish which are currently imported. Since artisanal techniques are rudimentary, it is necessary to introduce more efficient methods. In order to improve results in the development of artisanal fisheries, a research and development project is needed to examine the following areas.

3 - PRESENTATION OF THE PROJECT:

3 - 1. TITLE: Research and development on the marine artisanal fisheries in Cameroon.

3 - 2. Objectives: There are three objectives which correspond to the Cameroon government's priorities in fisheries development.

a) Scientific objectives

- Evaluation of fishery potential for coastal waters
- Management of commercial stocks
- Research and development in traditional fishing methods.

b) Economic objectives

- Evaluation of research benefits on artisanal fish production
- Increasing national production of fish
- Improving the livelihood of artisanal fishermen

c) Other objectives

- Promotion of international cooperation in research on artisanal fisheries.

3 - 3. DESCRIPTION OF STUDY:

The research activities examined in this project must be done under the offices of the General Delegation for Scientific and Technical Research (DGRST), as this is the Cameroonian government organization charged with all scientific research in the country. The following are the areas considered essential.

3-3-1. Collection and analysis of fisheries statistics:

If appreciable progress has been realized in the collection of industrial fisheries statistics, little data has been gathered from artisanal fisheries. To overcome this problem a frame survey is needed on the catch, production, and fishermen activity. A frame survey for the entire coast will give yearly data and will be permanently centered at fish landing points. The information thus collected will assist in determining artisanal fishing effort.

3-3-2. Resource Monitoring and Prediction:

As with the collection of statistics, the implementation of a monitoring and prediction program will give an understanding of abundances of

the principal stocks. Also, this program will enable an exact identification of nursery zones needing protection.

3-3-3. Dynamics of principal stocks:

An understanding of the population dynamics of the fish stocks is needed to establish a management plan for Cameroonian fisheries. In this context, the establishment of different parameters must be made. These are: mortality, growth, recruitment, and the selectivity of fishing gear. The principal species studied will be the clupeids *Ethmalosa* spp. and *Sardina* spp., and penaeid shrimps. These are the main groups fished by artisanal methods. Within the shrimp fisheries, it will be interesting to ascertain the relationship between industrial and artisanal exploitation of the stocks, as these two activities pressure the same stocks, but at different developmental stages.

3-3-4. Modernization of traditional fishing methods:

The artisanal fisheries are actually practiced with inefficient methods: wooden canoes without motors, fishing nets not suited to local conditions, etc. Motorization of boats, introduction of new methods, and the improvement of existing techniques will contribute to the development of this activity. The new method envisioned will establish an intermediate fishery between current levels of industrial and artisanal activities. Fishing with longlines and traps utilizing small boats with different fishing gear are particularly indicated in the area south of Kribi, which is a difficult zone in which to trawl. Certain species there are commercially important, such as lobster and barracuda. In other regions, utilization of purse seines will give good results.

3-3-5. Socio-economic studies:

Once the biostatistics have been organized, questions of profitability and of changes in the livelihood of artisanal fishermen will need to be studied. These studies will have to precede all investment operations in this area and will help to orient government policy in modernizing and developing fisheries.

3 - 4. Length of project:

A period of not less than five years will be needed to effectively implement this research and development project. This period will consist of two parts: the first (two years) will be centered on the development of a collection system for fisheries statistics; the second (three years) will examine specific aspects covering evaluation of stocks and their development.

3 - 5. Institution charged with implementing the project:

The General Delegation for Scientific and Technical Research (DGRST) is the organization charged with all scientific and technical research in Cameroon. DGRST comprises five separate institutions, including the Institute for Animal Research (IRZ l'Institut de Recherches Zootechniques), under which is the Fisheries Research Station, Limbe (SRHL, la Station de Recherches Halieutiques de Limbe). Since the organization of SRHL in 1980, efforts have centered on the logistical problems concerning the establishment of research programs in fisheries and aquaculture. A research center with 15 offices and

laboratories has been built. A motorized fiberglass 8 meter (48 hp) boat has been purchased for research in artisanal fisheries. Three vehicles have been given to assist with research activities. As explained before, the first efforts are to collect biostatistics.

The Fisheries Research Station Limbe is currently staffed with three researchers (with three others in advanced training overseas), a dozen technicians, and an administrative staff. In order to implement the "Stock Assessment CRPS Research Project" and its impact on a national program of fisheries research, the equipment and personnel of SRHL will be put at the disposal of this project.

3 - 6. Contribution of American Research Institutions to the project:

The contribution of American research institutions will be of great benefit in the development of artisanal fisheries. In the first phase of this project, biologists will be needed who specialize in the evaluation of fish stocks, in their development, in fishing technology, and, if possible, in socio-economic questions.

3 - 7. Liaison between American and Cameroonian institutes:

All official correspondence from the University of Maryland and other agencies on the organization of future meetings should be addressed to:

Director
Institute of Animal Research (IRZ)
c/o Delegate General for Scientific
and Technical Research (DGRST)
B.P. 1457
YAOUNDE (Cameroon).

THE STOCK ASSESSMENT COLLABORATIVE
RESEARCH SUPPORT PROGRAM
(Stock Assessment CRSP)
USAID - UNIVERSITY OF MARYLAND
Rome, March 7-10 1983

PRESENTATION DU PROJET D'ETUDE ET D'AMENAGEMENT DE LAX PECHE ARTISANALE MARITIME CAMEROUNAISE

Par

Jean-Calvin N'JOCK
Chef de la Station de
Recherches Halieutiques de
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R.U. CAMEROUN

1 - PRESENTATION DU MILIEU D'ETUDE

Situé au fond du Golfe de Guinée, entre le 2° 20'N et le 4° 50'N, ce qui correspond en suivant la côte à une distance d'environ 360 km de la frontière Equato-Guineenne au sud (Rivière Campo) à la frontière nigerianne au nord (Rivière Akwayafé), le littoral camerounais est caractérisé par :

- Une vaste zone de mangrove qui se développe au niveau des embouchures des grands fleuves dont les principaux représentants sont le Rio del Rey, la Bimbia, la Rivière Cameroun, la Sanaga et le Nyong. Ces rivières qui créent des zones d'estuaires dont la productivité contrastent avec la pauvreté des eaux lorsqu'on s'éloigne des côtes constituent des lieux de reproduction et de concentration pour de nombreuses espèces côtières.

- Une côte rocheuse offrant un substrat de nature volcanique entre Bibundi et le Cap Bimbia. C'est le lieu de nurseries pour certaines espèces, les crevettes Pénaeides notamment.

- Des formations sableuses importantes situées au sud de l'embouchure du Nyong, jusqu'à la frontière équato-guinéenne. Elles sont entrecoupées par d'importantes formations rocheuses qui constituent des zones d'abri pour une faune spéciale (langoustes).

2 - ETAT DES CONNAISSANCES ACTUELLES

Quand on s'éloigne des côtes, le plateau continental présente au nord de la parallèle passant par l'embouchure du Nyong une plaine de vase et de vase sableuse parcourue dans sa partie méridionale par un banc de sable parallèle à la côte et parsemé de petits massifs coralliens. Au sud de cette ligne le relief est plus accidenté. On y rencontre des massifs coralliens et des bancs de roches entre lesquels se trouvent soit du sable, soit de la vase ou de la vase sableuse.

Faisant partie intégrante de la Baie de Biafra, le plateau continental camerounais est principalement soumis au régime hydrologique qui règne dans cette partie du golfe de guinée et accesoirement à l'influence des conditions locales liées au déversement de nombreux fleuves qui arrosent la region : les eaux de couvertures dites eaux guinéennes sont chaudes (T 25°) et dessalées (S % <35%) tandis que les eaux sous jacentes sont froides et de salinité plus forte.

Malgré ces bribes de connaissances dues à l'étude des "Fonds de pêche le long des côtes de la République Fédérale du Cameroun. - CROSNIER, ORSTOM 1964" beaucoup de renseignements concernant la zone marine camerounaise font actuellement défaut : les problèmes d'inventaire faunistique, d'évaluation des stocks halieutiquess, de recrutement des principaux d'entre eux, de sédimentologie littorale, de courantologie locale et de cartographie restent entiers.

Il est tout au plus connu que la pêche qui s'y développe, qu'elle soit industrielle (chalutage) ou artisanale, est exclusivement côtière et se pratique par fonds de 6 m à 40 m à quelques milles de la côte.

La consommation totale annuelle des produits aquatiques s'élève à plus de

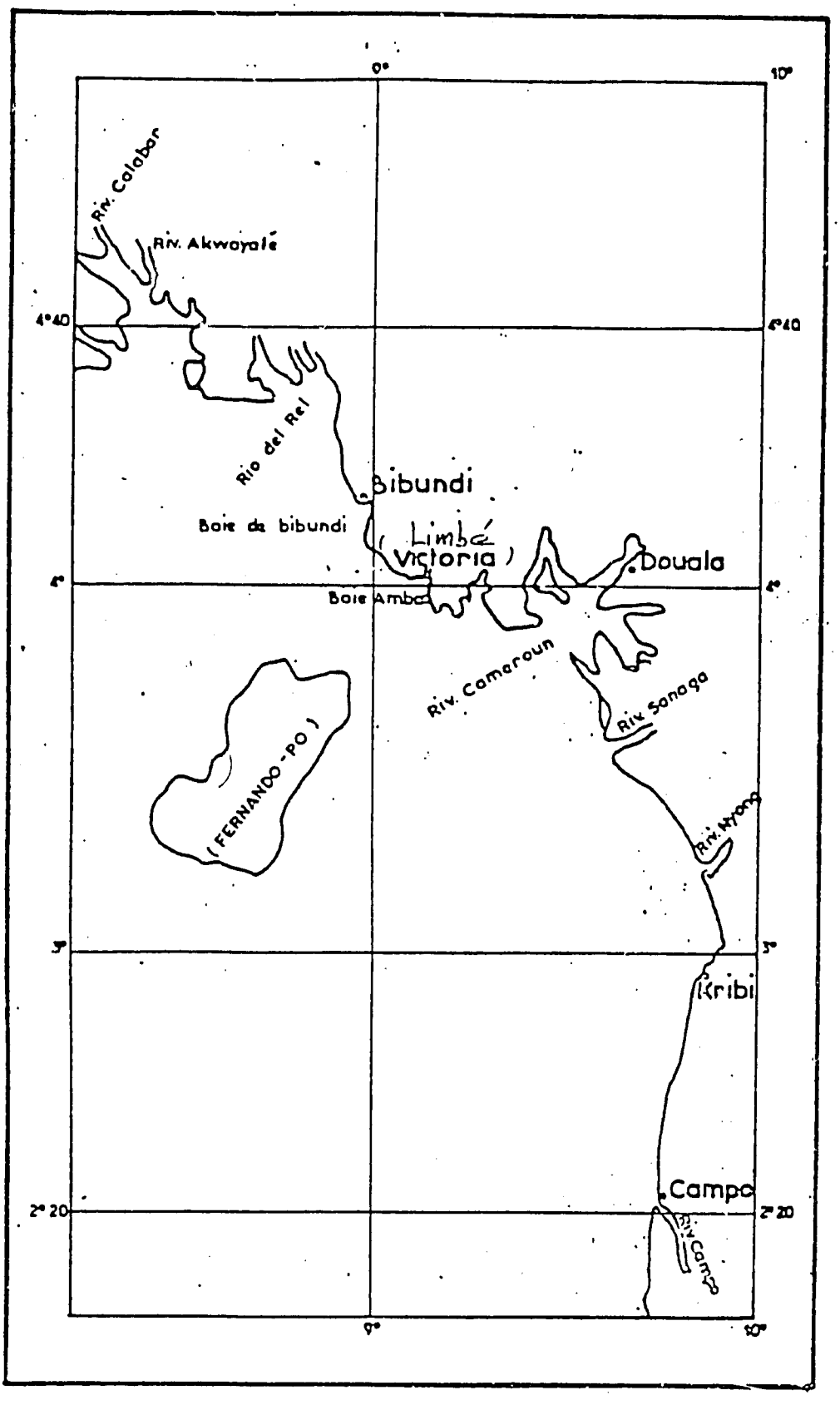

Fig. 1 - Présentation de la côte Camerounaise

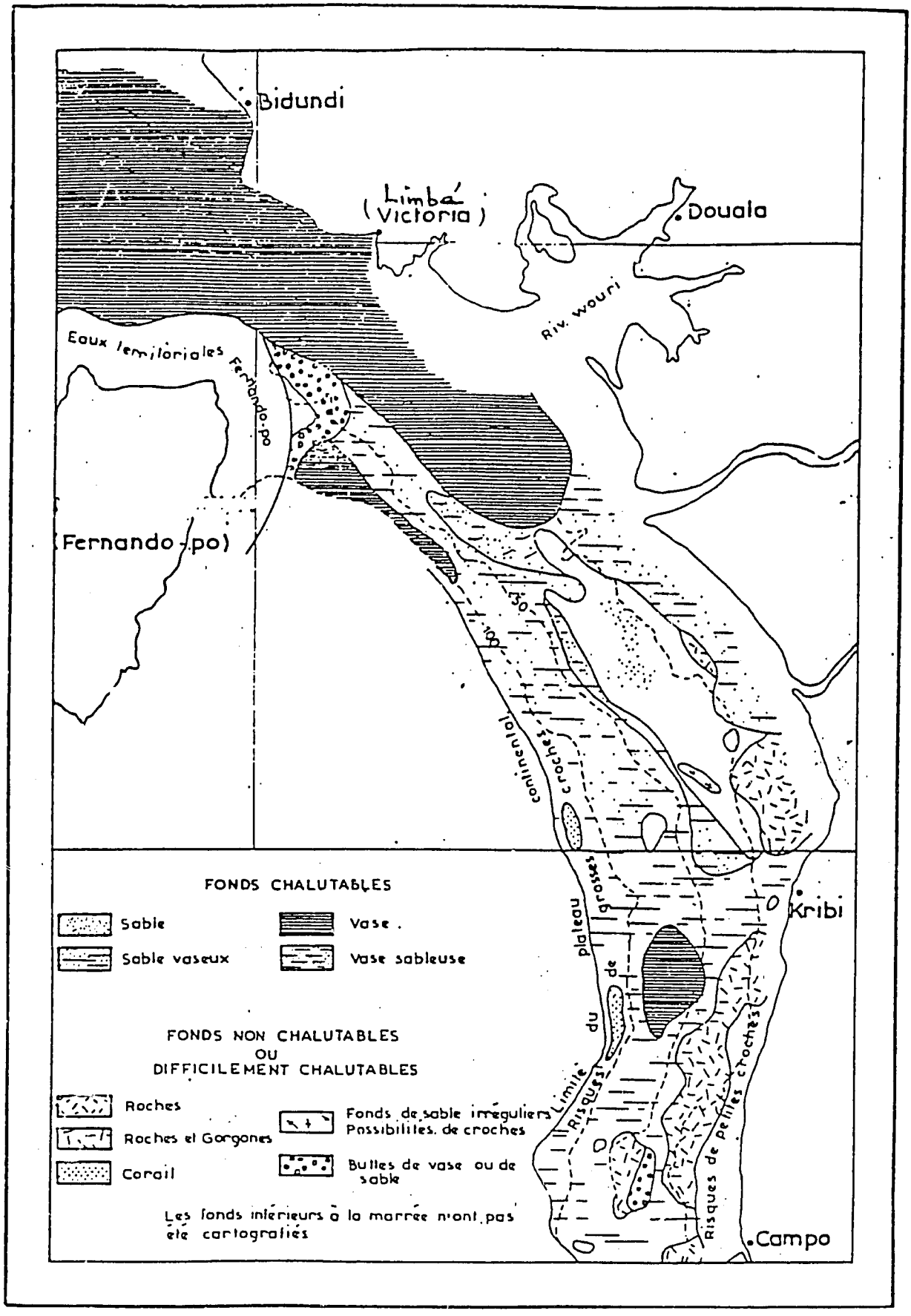

Fig. 2 - Carte des fonds du plateau continental camerounais
(d'après A. CROSNIER 1964)

150.000 tonnes dont 13% proviennent de la pêche industrielle, 20 à 33% de l'activité artisanale, 16% des produits d'importation et 40% de la pêche continentale. Cette dernière n'ayant pas d'intéret dans le cadre du présent projet, les chiffres cités ne le sont qu'à titre indicatif.

La pêche industrielle utilise une trentaine de navires appartenant à quatre sociétés. Ses statistique qui sont relativement bien connues montrent une stagnation de la production au cours des cinq dernières années alors que l'effort de pêche augmentait. Une dimunition de la taille des espèces pêchées a par ailleurs été notée pendant la même période. Bien qu'aucune information de ce genre ne soit disponible dans le secteur de la pêche artisanale on pense que c'est en développant cette activité qu'il sera possible de tirer meilleur profit des ressources halieutiques d'origine marine et par là même de réduire la part des produits importés à un moment où des difficultés se font sentir pour l'équilibre de la balance commerciale. Les techniques de pêche étant rudimentaires, il est nécessaire de les améliorer et d'en introduire de plus performantes. Pour qu'il donne de bons résultats cet effort de développement de la pêche artisanale devra s' accompagner d'un plan d'études et d'aménagement dont les principaux points sont exposés comme suit :

3 - PRESENTATION DU PROJET

3 - 1. Titre : Etude et aménagement de la pêche artisanale maritime camerounaise.

3 - 2. Objectifs :

Ils sont de trois ordres et correspondent à des préocupations prioritaires du gouvernement camerounais en matière de développement des pêches.

a) - objectifs scientifiques :

- Evaluation des potentialités halieutiques des eaux côtières,
- Gestion rationnelle des stocks exploités,
- Etude et amélioration des méthodes de pêche traditionnelles.

b) - objectifs economiques :

- Evaluation de l'impact de la recherche sur la production de la pêche artisanale,
- Augmentation de la production nationale de poissons,
- Amélioration du niveau de vie d'artisans pêcheurs.

c) - autres objectifs :

- Promotion de la coopération internationale en matière de recherche sur la pêche artisanale.

3 - 3. Specification des études à entreprendre

Les activités de recherche prévues dans le cadre du présent projet doivent compléter celles déjà entreprises par la Délégation Générale à la Recherche Scientifique et Technique, organisme chargé de concevoir,

d'orienter et de mettre en oeuvre la politique gouvernementale dans le domaine de la science et de la technologie. Elles découlent des objectifs retenus plus haut et devraient couvrir les domaines ci-après :

3-3-1. La collecte et le traitement des statistiques de pêche

Si de progrès appréciables ont été réalisés pour la collecte des statistiques de pêche industrielle, il est par contre à déplorer le manque total d'informations sur la pêche artisanale. Pour combler cette lacune des efforts devraient être portés sur l'élaboration d'un programme d'enquêtes cadre axées sur la connaissance des données de base concernant les pêcheurs, leurs activites ainsi que leurs moyens de production. L'enquête cadre qui couvre l'ensemble de la côte pourrait avoir lieu une fois par an et devrait être complétée par des enquêtes realisées de facon permanente au niveau des principaux points de débarquement. Les renseignements ainsi recueillis devraient aider à déterminer les mesures appropriées pour la définition de l'effort de pêche.

3-3-2. La prospection des ressources

Comme la collecte des statistiques, l'exécution de campagnes de prospection permettrait de disposer d'indices d'abondance de principaux stocks. De même il serait possible de délimiter les zones de nurseries afin de les protéger contre une exploitation anarchique.

3-3-3. La dynamique des principaux stocks pêchés

La dynamique des populations rentre nécessairement en ligne de compte dans les politiques d'aménagement des pêcheries. Dans ce contexte l'étude des différents paramètres qui régissent la population doit être envisagée. Il s'agit de la mortalité, de la croissance, du recrutement et de la sélectivité des engins utilisés; les espèces étudiees étant certains représentants de la famille des Clupéidés (Sardinelles et Ethmaloses) et des crevettes Pénaeides spécialement recherchés par les pêcheurs artisans. Dans le cas de ce dernier groupe d'espèces, il serait intéressant de comprendre les interactions qui pourraient exister entre les pêches artisanale et industrielle. Ces deux activités exploitent en effet les mêmes stocks à différents stades de leur développement.

3-3-4. Modernisation des méthodes de pêche traditionnelles

La pêche artisanale est actuellement pratiquee avec des moyens rudimentaires peu perfomants : pirogues non motorisées, filet mal adaptés aux conditions de pêche. La motorisation des unités, l'introduction de nouvelles méthodes et l'amélioration de celles déjà existantes pourraient apporter une contribution appréciable au développement de cette activité. Les nouvelles méthodes envisagées devraient être étudiées de facon à créer une activité intermédiaire entre la pêche traditionnelle et la pêche industrielle. La pêche aux palangres et aux casiers utilisant de petites unités mixtes de type cordiens - caseyeurs est particulièrement indiquée dans une zone difficilement chalutable située au sud de KRIBI qui recelle

certaines espèces nobles comme les langoustes et les brochets (Sphyraenidés). Dans les autres régions l'utilisation de la seine tournante pourrait donner de bons résultats.

3-3-5. Etudes socio-economiques

Elles complètent les études biostatistiques et devraient définir, en fonction des critères choisis, le seuil de rentabilité des actions à mener dans le développement des pêches. Elles doivent précéder toute opération d'investissement dans ce domaine et par là même orienter la politique gouvernementale dans l'élaboration des projets de modernisation et de développement de la pêche.

3 - 4. Durée du projet :

Il faudra une période minimum de 5 ans pour que les résultats des recherches envisagées soit appréciables. Cette période pouvant comprendre deux phases dont la première (2 ans) sera axée sur l'amélioration du système de collecte des données statistiques alors que la deuxième traitera des aspects spécifiques portant sur l'évaluation des stocks et les problèmes d'aménagement.

3 - 5. Institution chargée de l'exécution du projet :

La Délégation Générale à la Recherche Scientifique et Technique (D.G.R.S.T.) est l'organisme habilité à l'exercice de la recherche au Cameroun. La D.G.R.S.T. comprend 5 instituts dont l'Institut de Recherches Zootechniques (I.R.Z.) au sein duquel a été créée en 1980 la Station de Recherches Halieutiques de Limbé (S.R.H.L.). Depuis sa création la SRHL s'efforce de mettre en place des structures logistiques pour la recherche dans le domaine de la pêche et de l'aquaculture. Un immeuble comportant une quinzaine de bureaux et laboratoires vient d'être construit. Une pirogue motorisée de 8 m (48 chevaux) pour les recherches en pêche artisanale vient d'être acquise et 3 véhicules sont mis au service de la station. Sur le plan de la recherche proprement dite, les premiers efforts ont porté sur la collecte des données biostatistiques.

La SRHL compte actuellement 3 chercheurs (3 autres sont en formation à l'étranger), une dizaine de techniciens sans compter le personnel administratif.

Dans la mesure ou le "Stock Assessment CRSP research project" sera intégré au programme national de recherche halieutique, les équipements et le personnel de la SRHL seront naturellement mis à la disposition de ce projet.

3 - 6. Contribution des institutions de recherche américaines au projet :

La contribution des institutions de recherche américaines pourra être d'une grande utilité dans le domaine de la formation du personnel local. Celle-ci se fera pendant la réalisation du projet. Mais tout au début de la première phase il serait souhaitable de faire appel à des biologistes des pêches spécialisés en évaluation des stocks, en aménagement, en technologie et si possible en socio-economie.

3 - 7. Relation entre institutions camerounaises et américaines :

Toute correspondance officielle émanent de l'Université de Maryland et portant sur l'organisation des réunions ultérieures devra être adressée au Directeur de l'Institut de Recherches Zootechniques S/C du Délégué Général à la Recherche Scientifique et Technique

B.P. 1457

YAOUNDE (Cameroun).

STOCK ASSESSMENT CRSP PROJECT SPECIFICATION

Jose Ordonez

I. COUNTRY: Philippines

II. TITLE: Stock Assessment of the Coastal Waters of Palawan Island including the Calamianes and Cuyo Island Groups

III. NATIONAL IMPLEMENTING AGENCY: Bureau of Fisheries and Aquatic Resources, Ministry of Natural Resources

IV. NATIONAL COOPERATING INSTITUTIONS: The College of Fisheries and the Institute of Fisheries Development and Research, University of the Philippines in the Visayas (UPV).

V. GEOGRAPHIC AREA COVERAGE: The project area covers the coastal waters east and west of Palawan Island, from Balabac in the southwest towards the northeastern end. There are about 29 fishing grounds which have more or less defined sustenance/small-scale fisheries. Among them are the fisheries in Honda Bay, Green Island Bay, Taytay Bay, Malampaya Sound, Imuran Bay, Balabac Strait, etc.

The area includes the Island Groups of the Calamianes and Cuyo. The Calamian Islands are Busuanga, Coron, Culion and Linapacan. The Cuyo Group is Composed of Cuyo, Agutaya, Dit, Quiniluban and other numerous islands and shallow reefs and inlets which forms a separate shelf from the other islands of the country.

VI. THE FISHERY OF THE AREA: The Coastal waters of Palawan is one of the most productive fishing grounds of the country, contributing roughly 14.05% of the total fishing production.

The area is better known for its small pelagics fisheries, principally the roundscad, the sardine and the anchovy fisheries. The reef fisheries activities are quite extensive.

Demersal fishing exists in trawlable areas like Malampaya Sound, Bacuit Bay and the Dumaran area.

After World War II, most of the fishing vessles which operated in the Manila Bay Area (Malabon and Navotas) such as purse seiners and "basnigan" shifted their fishing operation to Palawan waters during the greater part of the year. Almost 100% of the catch of fish and other marine products are landed at the Navotas Fish Landing Center, and then distributed to Metro Manila and other parts of Luzon; hence, little catch is landed on the Island itself. However, the most important landing place in is Coron where some of the "basnigan" lay over after fishing while their

catches are brought to Manila by fish carriers. In the whole Philippine archipelago, it is doubtful if any fishing ground may be compared with the production of Palawan waters which for the past 25 years has remained productive, although some of the smaller bodies of waters surrounding Palawan Island are at times showing signs of overfishing.

Studies conducted in 1956 showed that the galunggong (Decapterus spp.) is the most important fish group taken from the area. This fishery comes in when they are 15 cm long in February, when the fishing season starts, they become available to the fisheries throughout summer when the fish grow very fast. However, during the period of studies almost all of the fish were not mature which means that the adult matured fish moves out of the locality into the deeper saline water to breed. This might be a reason why the fisheries have not been badly affected by overfishing.

Up to the present, most of the galunggong caught in the area are still immature but small sized galunggong are taken during the early part of the year when the young fish move to unknown localities.

The fishery in this area is throughout the year as fishing can be undertaken on the side of the islands that is protected by the prevailing monsoon winds. During the southwest monsoon (May to October), fishing is undertaken along the Sulu Sea; during the northeast monsoon (November to April), fishing is undertaken in the South China Sea area of these islands.

VII. DESCRIPTION OF THE PROJECT: The Bureau of Fisheries and Aquatic Resources has conducted intensive researches on the biology of the most important commercial species of both the pelagic and demersal fishes in Manila Bay as part of the stock assessment study of the most important fishing grounds of the country and results show that these are fast becoming biologically overfished.

A sampling program started a year ago at the Manila Fishing Port to study and monitor the catches of fish landed in Manila coming from Palawan waters.

Although the intention of the program is to set up sampling stations in the fishing ground to complement or verify the real source of the fish from Palawan waters, lack of personnel and economic consideration precluded this.

This project intends to meet this need by setting up one (1) big laboratory and two (2) sampling laboratories in Northern Palawan to undertake this stock assessment study and enlarge the sampling team to make an integrated study of the fishery resources of the

area.

Cuyo, which is one of the important fish landing areas with an ice plant and cold storage would be an appropriate site for this stock assessment laboratory where "basnigan" and purse seiners get their supplies of ice instead of going to Manila.

With the availability of technical assistance, the findings from these laboratories would be used for implementation in other parts of the country which we hope will be useful for the proper management of the fishery resources of the country.

The lack of adequate knowledge of population dynamics of fish stocks, etc., and more detailed data on the biological and hydrological aspects of our waters has prevented us from making proper conservation measures in many of our pelagic and demersal fisheries.

VII(1): OBJECTIVES: The Project shall have long range and short range objectives.

The long range objectives are as follows:

a. determine the levels of productivity and abundance estimation of the most important fish stocks of the area.

b. determine/clarify the taxonomic identification of the various important fish species.

c. know more about the biology with particular reference to reproductive cycle and spawning area of the various fish species particularly roundscads and sardines.

d. correlate oceanographic conditions with the occurrence, distribution and seasonality of of the various fish groups.

e. determine ichthyoplankton identification and distribution.

The short range objective is to determine levels of productivity of the Culion-Coron area with reference to the implementation of the Asian Development (ADB) assisted Northern Palawan Fisheries Development.

VII(2): WORK PLAN:

a. Taxonomic studies based on variations (racial and population) in species of fishes caught in

northern Palawan waters are to be conducted. Detailed taxonomic studies to determine the correct identification and up-date the classification of the fishes that comprise the fishery and comparing comparison of some of them with those found in other regions are to be conducted also.

b. Continuation of life history studies of the important commercial pelagic and demersal fishes in Northern Palawan water will be made.

Samples of commercially important species from at least four (4) samplings every two (2) weeks with 50-200 individuals are to be collected and studied in detail for length and weight of the individual fishes as well as for sex, gonad and maturity stages.

The statistical data are to be compiled and graphic representations made. Later, all data are to be analyzed and interpretations made especially on stock assessment and biological behavior of the fish.

c. Oceanographic studies, particularly on the ichthyoplankton (fish eggs, larvae and juveniles) aspects to determine the recruitment strength of various fish stocks are to be conducted. An assessment model shall be devised and tested.

d. The status of the trawl fishery in Palawan waters shall be studied and a comparison with other kinds of fisheries will be made.

This is also with reference to the considerable portion of the catch considered as trashfish. We intend to make an appropriate study of the composition of this trashfish to determine how we can prevent the capture of the young fish which mostly comprise the catch.

VII(3): ANTICIPATED BENEFITS: The Palawan waters, particularly the northern portions of the area, as we have stated is the primary source of fresh fish, mostly of small pelagics, which supply Metropolitan Manila and the outlying towns of Central Luzon.

It is about time that a comprehensive stock assessment study be made so that we can determine management policies to get the best maximum economic yield from the various fisheries, especially of the galunggong (roundscad) fishery.

Our knowledge of the biology and fishing mortality of the listed species in northern Palawan waters are poorly known but the expected further detailed studies of the fish in the area would help in the conservation of the fisheries which we suspect are on the verge of becoming over-fished. Further knowledge gained from this conservation purposes of the country.

VII(4): RELEVANCE OF THE PROJECT TO SOCIAL AND ECONOMIC DEVELOPMENT OF ARTISANAL OR TRADITIONAL COASTAL FISHERIES: The fishery resources in the Project Area are mainly taken advantage of by artisanal and traditional coastal fishermen in as much as the whole Island of Palawan and surrounding area had been reserved for them. The commercial vessels (more than 3 gross tons) can fish only in areas beyond 7 km from the shore.

An understanding of the life history of fishes and their availability would be very beneficial to economic and social development of the small-scale fishermen. Knowledge of the stock of fishes which may be available during certain seasons of the year would help the fishermen to determine the right gear to use appropriate for the size of small pelagic fishes.

VIII. PROPOSED PROJECT COORDINATION: The project shall be coordinated with proposed and on-going government and university research programs which are as follow:

a. The BFAR has an on-going fishery oceanographic research project under the Bureau's Test Fishing Program. The oceanographic project includes physio-chemical observations, plankton investigation, acoustic survey and experimental fishing.

b. The BFAR has started a regional sampling and monitoring program of the major fishing grounds of the country through the Bureau's regional offices which are also collaborating with the fishery statistics monitoring work of the Bureau's Central Office.

c. The BFAR is also conducting analysis of the fish catch from Palawan being landed in the Navotas Fish Landing Market.

d. The Phillipine Fishery Development Authority is to be in charge in the implementation of the ADB-assisted Northern Palawan Fisheries Development Project (Culion-Coron Area) whose objectives are to (1) develop marketing-oriented investment in fisheries for small-scale fishermen by optimizing the catch in underfished areas, (2) prevent waste

in the utilization of the fish and (3) improve the economic returns to fishermen by linking them to stable markets and upgrading their fishing technology.

An assessment of the Culion-Coron fishery resource can be done through an analysis of the catches of the fishermen who shall be awarded the engines and the fishing gears. This is one assurance stipulated in the Memorandum of Understanding that the Philippines shall provide the implementation of the ADB assisted Project coupled with taking appropriate action conducive to immediate and long term resource management.

e. The UPV has a joint survey with BFAR using their own research vessel "Sardinella" whose survey program is similar with BFAR's Researcher.

IX. ELEMENTS OF WORK AND TIME FRAME UNDER WHICH THEY ARE DESIRED TO BE ACCOMPLISHED:

1. Taxonomic studies and identification of species for possible racial and population groups are to be conducted. The work will be intensive for the first three months and then sporadic for the rest of the period of study.

2. There shall be collection of biological statistical data from commercial catches and continuous for a year, the intervals to be determined later.

3. There shall be a collection of catch statistics from commercial and municipal fishing for the whole period of the study to determine the fishing effort. The schedule is to be determined during the start of the study.

4. Acoustic survey in the area to determine the different school population of fishes, their movement, migration, diurnal movement, size of population during their season in the fishery for the duration of the study shall be conducted. Sampling of schools determined by acoustic survey using BFAR research vessels to verify the acoustic readings shall likewise be made.

5. Intensive biological and taxonomic studies of the catches of the BFAR research vessel shall be conducted including fecundity, food habits, age determination of fish, and other habits. Using BFAR vessels, a hydrographic survey in the surrounding waters of Palawan shall be undertaken to determine the prevailing water movement and density of fish eggs, larvae and juveniles. This study should be carried further off-shore to determine the distribution of fish eggs, and fish populations of different species. Previous studies have shown that especially the roundscad breed far off-shore from Philippine

waters.

6. Possible spawning areas may be determined through the use of the BFAR research vessels in these surveys. Night light collection will be undertaken during these cruises to catch fish eggs, larvae and juveniles that are attracted to light. Plankton tows as well as larval tows will be made in each oceanographic station occupied.

7. Tagging experiments will be undertaken of the species in the study to determine migration of the species. Following the recommendations of experts, the various data collected after six months should be processed through simple computerization to determine the parameters of the fish under study.

8. The status of the medium trawl in Palawan waters will be studied. Catch statistics data will be undertaken as well as biological studies.

X. PERSONNEL AVAILABILITY FOR THE PROJECT AND THE TYPES OF EXPERTISE DESIRED OF U.S. UNIVERSITY COLLABORATORS:

The majority of personnel that would be available for the project will come from the BFAR's Central Office Research Division, Statistics Section and the BFAR's Regional Office No. 4 and some from the UPV.

Most of the research personnel from BFAR C.O. are resource biologists, technologists, statisticians and oceanographers who could more or less work on full time. They have undergone various levels of academic and practical training on fisheries biology, resource evaluation, oceanography, statistical sampling design, and gear research and development.

There are also field research and statistics personnel who are available for monitoring, sampling and data gathering of catch statistics.

Personnel from other institutions/agencies of the government are also available on full time or part time basis, those particularly from the Universities and state schools of fisheries.

On the types of expertise desired of U.S. University collaborators are those on (1) sampling design preparation, data processing, analysis and interpretation; (2) fish biology; (3) population dynamics; (4) fisheries oceanography; (5) plankton analysis; (6) larval fish identification; (7) physical oceanographic interpretation.

XI. EQUIPMENT/FACILITIES AVAILABLE FOR THE PROJECT

1. BFAR

   a. Research vessels - "Researcher" (500 GT), "Lapu-lapu" (150GT)

      "Sabalo" (150GT), etc. Experimental crafts available are:
      a) Inboard - "Penaeus monodon" dug-out type, 16 m
      b) Inboard - Catamaran type, 16 m (new)

   b. Field status/laboratories

      a) District Fishery Office Liminangcong, Taytay, Palawan
      b) District Fishery Office Puerto Princesa City
      c) Coron Fishery Station-Coron, Palawan
      d) Cuyo Fishery Station - Cuyo, Palawan

   c. Ice Plant and Cold Storage

      a) Liminangcong
      b) Coron
      c) Cuyo

2. Other Facilities

   a. Private Ice Plant and Cold Storage - 11 in number

   b. Fishery Schools
      a) Coron
      b) Aborlan
      c) Puerto Princesa

   c. Fishermen's Cooperatives and/or Associations (26)

   d. Fishery Ports (17)

   e. Fish markets and/or landings (39)

XII. FUNDING FOR SPECIFIC REQUIREMENTS/ACTIVITIES/NEEDS OF THE PROJECT

1. An identification mission and design preparation team.
   This group will be composed of multi-disciplinary experts who shall identify the problem areas in small-scale fisheries with reference to resource inventory and stock assessment. This group shall finally recommend a design for carrying out the assessment work. Funding for this shall be separate from the funding for implementation.

2. Setting-up and/or improving laboratories and sampling stations.

The laboratory and sampling station shall be in Puerto Princesa and Coron, while sampling stations shall be in Balabac, Narra, Liminangcong and Cuyo.

3. Consultants, both foreign and local, for long term and short term assignments during the implementation of the Project.

4. Maintenance and Operating Expenses
   a. Supplies and materials for the laboratories, sampling stations and research water crafts.
   b. Traveling expenses of the foreign and local consultants, local researchers and field support staff members.

5. Equipment/Apparatus/Instruments for the laboratories, sampling stations and research vessels and crafts.

6. Training for graduate degrees and short term training in the various disciplines of marine fisheries biology in an appropriate U.S. university or fisheries laboratory.

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Table 1. Commercial Production of West Sulu Sea
In metric tons (1981)

Species	Purse Seine	Trawl	Muro-Ami	Hook & Line	Bag-net	Long line	Push net	Gill net	Grand Total
Roundscad	35,440	9,948		805	544	102		16	46,855
Sardines	10,590	4,794		35	372			8	15,802
Frigate tuna	8,290			194	266	15			8,765
Slipmouth	115	2,002			302				2,440
Threadfin	47	1,057		87					1,191
Cavalla	74	297	230	283			3		887
Grouper		201	17	527					745
Sp. mackerel	290	104		12					406
Anchovies	27	38			300				365
Silverside					49				49
Siganid			20	8					28
Mullet	5			1					6

Fishing Grounds included in West Sulu Sea

1. Dumaran Channel
2. Green Island Bay
3. Honda Bay
4. Island Bay
5. San Antonio Bay
6. Balabac Strait

Table 2. Production of West Palawan Waters
In Metric tons (1981)

Species	Municipal	Commercial	Grand Total
Anchovies	479	3,493	3,972
Slipmouth	546	3,081	3,627
Sardines	12	3,060	3,072
Roundscad	939	932	1,871
Silverside	-	1,804	1,804
Spanish mackerel	12	1,328	1,340
Cavalla	836	333	1,169
Threadfin	6	1,081	1,087
Siganid	-	586	586
Frigate tuna	6	1,050	1,056
Mullet	-	169	169

Fishing Grounds included in West Palawan Waters

1. Bacuit Bay
2. Malampaya Sound
3. Imuruan Bay
4. Ulugan Bay
5. Treacherous Bay
6. Eran Bay

Table 3. Production of Cuyo Pass
In Metric Tons (1981)

Species	Municipal	Commercial	Grand Total
Roundscad	2,464	3,703	6,167
Sardines	2,752	1,840	4,592
Anchovies	1,465	2,214	3,679
Frigate tuna	1,213	812	2,025
Cavalla	159	404	563
Threadfin	250	4	254
Grouper	74	72	146
Spanish mackerel	62	812	123
Siganids	112	-	112
Mullet	66	-	66
Silverside	-	41	41

Fishing Grounds included in Cuyo Pass

1. Cuyo Pass
2. Taytay Bay
3. Coron Bay
4. Linapacan strait
5. Paluan Bay

Table 4. Production of West Palawan Waters by Gear (Municipal) in metric tons - 1981

Species	Gill Net	Bag net	Hook and line	Fish corral	Baby trawl	Pole & line	Spear	Lift net	Push net	Crab lift net	Other	Grand total
Anchovies	2,052	1,224	-	17	183	-	-	13	4	-	-	3,493
Slipmouth	1,767	993	-	224	87	-	-	-	-	10	-	3,081
Sardines	1,779	1,070	-	23	158	-	-	18	12	-	-	3,060
Roundscad	598	185	-	84	65	-	-	-	-	-	-	9[illegible]
Silverside	1,147	601	-	10	46	-	-	-	-	-	-	1,804
Spanish mackerel	1	-	1,089	-	-	141	94	-	-	-	3	1,328
Cavalla	34	-	152	71	5	54	13	-	2	-	-	333
Grouper	-	-	783	1	-	86	223	-	-	-	-	1,115
Threadfin	10	-	770	61	9	193	33	-	-	10	-	1,085
Frigate tuna	-	-	783	-	-	233	-	-	-	-	-	1,050

Table 4. Continued

Commercial Production of West Palawan Waters

Species	Bagnet	Hook & Line	Grand Total
Roundscad	939	-	939
Cavalla	818	18	836
Slipmouth	546	-	546
Anchovies	479	-	479
Grouper	-	29	29
Spanish mackerel	12	-	12
Sardines	12	-	12
Frigate tuna	-	6	16
Threadfin	-	6	6

Table 5. Municipal Production of Cuyo Pass in Metric Tons - 1981

Species	Purse Seine	Hook & Line	Beach Seine	Gill Net	Bag net	Troll line	Long line	Fish Corral	Others	Total
Sardines	-		1,207	1,536	9	-	-	-	-	2,752
Roundscad	2,087	159	36	182	-	-	-	-	-	2,464
Anchovies	486	47	889	17	26	-	-	-	-	1,465
Frigate tuna	-	1,164	-	-	-	41	8	-	-	1,213
Slipmouth	-	-	6	102	-	-	-	176	-	278
Threadfin	-	195	20	-	-	-	35	-	-	250
Cavalla	-	61	41	45	-	-	12	8	-	159
Siganid	-	-	-	26	-	-	-	82	4	112
Mullet	-	-	-	59	-	-	-	7	-	66
Grouper	-	23	-	-	-	-	1	48	-	74
Spanish mackerel	-	64	-	-	-	8	-	-	-	62

Table 5. Continued

Commercial Production of Cuyo Pass
(1981)

Species	Bagnet	Purse Seine	Hook and Line	Trawl	Muro-ami	Grand Total
Roundscad	1,535	33	-	2	-	3,703
Anchovies	2,182	-	-	32	-	2,214
Sardines	1,774	65	-	1	-	1,840
Slipmouth	1,535	33	-	2	-	1,570
Frigate tuna	123	683	1	-	-	812
Cavalla	255	136	4	-	9	404
Grouper	-	-	60	12	-	72
Spanish mackerel	40	1	-	-	-	41
Threadfin	-	-	4	-	-	4

List of Pelagic and Demersal Fish Species
from Northern Palawan Waters to be Studied

1. Roundscads

a. *Decapterus macrosoma*/layang
b. *D. russelii*
c. *D. maruadsi*
d. *D. kuroides*
e. *D. russeli* - like
f. *D. macrosoma* - like

2. Anchovies

a. *Stolephorus indicus*
b. *S. heterolobus*
c. *S. commersonii*
d. *S.* species A
e. *S.* species B

3. Sardines

a. *Sardinella longiceps*
b. *S. sirm*
c. *S. fimbriata*
d. *S. melanura*
e. *S. perforata* or *brachysoma*

4. Sprat

a. *Spratelloides delicatulus*
b. *S. gracilis*

5. Chub mackeral

a. *Rastrelliger brachysoma*
b. *R. kanagurta*
c. *R. faughnii*
d. *Scomber japonicus*
e. *S. australasicus*

6. Frigate mackeral

a. *Auxis thazard*
b. *A. rochei*
c. *Euthynnus affinis*

7. Cavalla

a. *Caranx* (Selar) *crumenopthalmus*
b. *C. boops*
c. *Caranx* (Selar) spp.

8. Mullet

a. *Mugil cephalus*
b. *Liza vaigiensis*
c. *L. seheli*
d. *L. macropelis*

9. Slipmouth

a. *Leiognathus daura*
b. *L. equilus*
c. *L. bindus*
d. *L. splendens*
e. *L. fasciatus*
f. *L. elongatus*
g. *L. equulus*
h. *Gazza minuta*

10. Lizardfish

a. *Saurida tumbil*
b. *S. gracilis*
c. *S. undosquamis*

6.1.a. CONSULTANT STAFF

1	Project Manager/Stock assessment biologist	60 m/m
3	Stock Assessment biologists	60 m/m
1	Plankton expert	60 m/m
2	Fishery Biologists	48 m/m
1	Ichthyologist	12 m/m
2	Senior Statisticians	26 m/m
1	Larval fish expert	12 m/m
1	Oceanographer (Fisheries)	48 m/m
1	Oceanographer (physical/chemical)	36 m/m
2	Masterfisherman (small gear/sustenance gear)	

Philippine Government Counterparts

1 Chief Fishery Biologist
3 Supervising Fishery Biologists
6 Senior Fishery Biologists
6 Fishery Biologists
6 Junior Fishery Biologists
6 Junior Statisticians
24 Samplers
Administrative support (as needed)

Boat/Research vessels personnel requirement

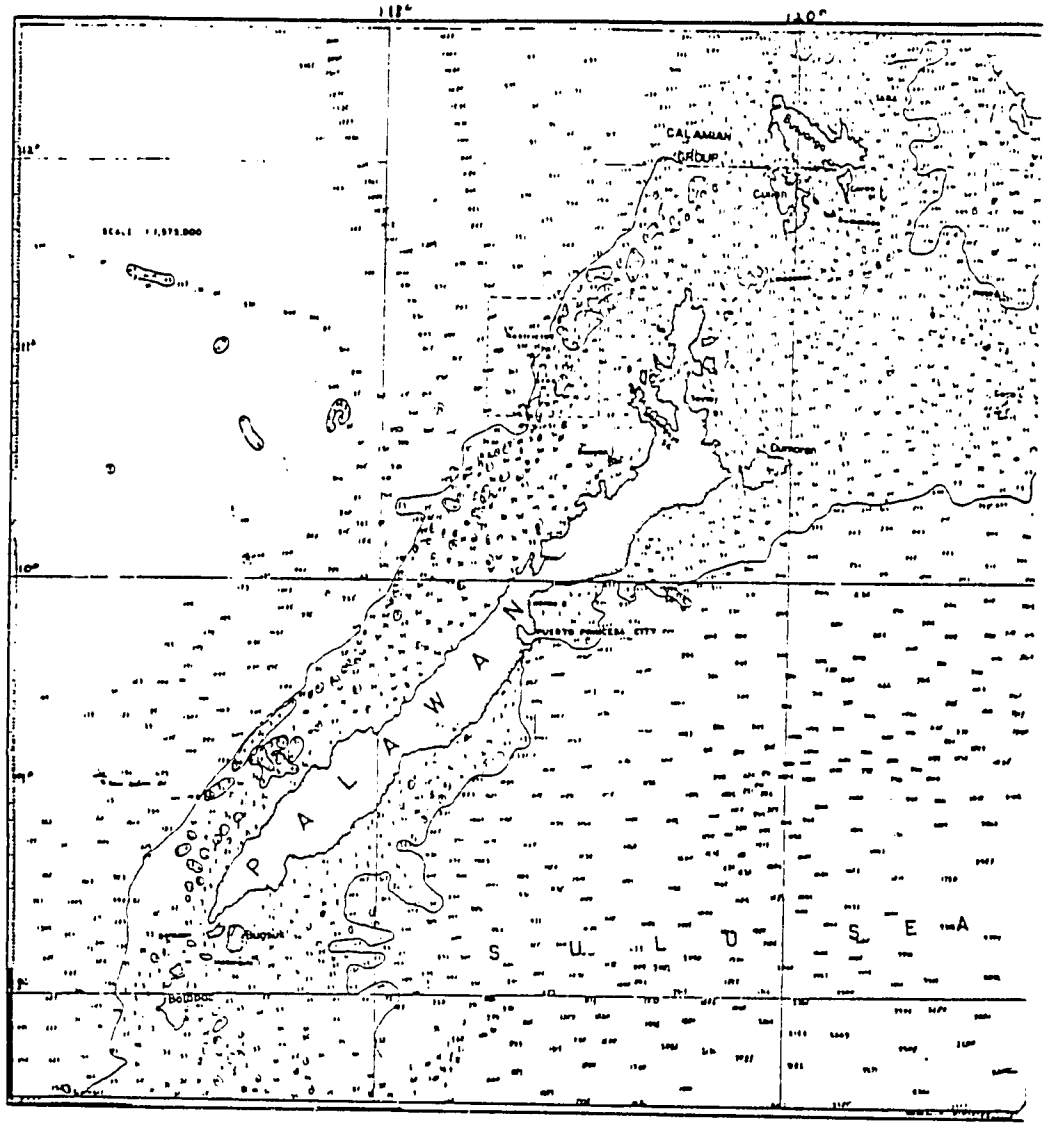
4 Boat operators
2 Carpenters
12 Seamen
4 Mechanics
2 Electricians
12 Casual workers
24 Fish samplers
12 Field biologists

Expendable equipment:

Nettings, twines, and ropes
Fish tags
Gill nets (various)
Seines (various sizes)
Trawls (various sizes)
Rubber boats
Collecting field survey equipment
Containers
Preserving jars
4 Portable water pumps
Battery lamps, etc.

Equipment:

- 4 Portable electric generators
- 1 Plankton shadowgraph
- 6 Low power stereoscopes
- 6 High power stereoscopes
- 4 Plankton samplers
- 3 35 HP outboard motors
- 3 50 HP outboard motors
- 4 Dugout bancas
- 6 Reversing thermometers
- 4 Rubber boats
- 4 Sets of diving equipment
- 4 Salinometers
- 4 Current and light meters
- Office equipment
- 4 pH meters
- Bathythermograph
- Hydrological equipment
- 4 Refrigerators
- 4 Freezers
- 4 SSB radio telephones
- 1 Sounder
- 2 Portable radar and spares
- 62 Calculators
- 8 Typewriters
- Office furniture
- Longline/gillnet combination


CALAMIAN
GROUP
PALAWAN
SULU SEA

Instituto del Mar del Perú - The University of Maryland
(IMARPE) Planning Entity

U. S. Agency for International Development

PROGRAMA COOPERATIVO DE INVESTIGACION Y ASISTENCIA

TECNICA EN LA EVALUACION DE POBLACIONES

(Stock Assessment CRSP)

PROYECTO # 1

(PERFIL)

"DISENO Y ESTABLECIMIENTO DE UN SISTEMA ESTADISTICO PESQUERO CON FINES DE EVALUACION DE RECURSOS QUE SUSTENTAN LAS PESQUERIAS ARTESANALES Y ORIENTACION PARA EL MANEJO DE DICHAS PESQUERIAS"

PROYECTO PRESENTADO POR LA DIRECCION DE ESTADISTICA Y ESTUDIOS ECONOMICOS PESQUEROS DEL IMARPE, COMO TOPICO Y OBJETIVO DE INVESTIGACION IMPORTANTE DE LA LISTA CONSIDERADA POR EL PROGRAMA COOPERATIVO DE INVESTIGACION Y ASISTENCIA TECNICA EN LA EVALUACION DE POBLACIONES.

Ref.: Planning Guide for Potential Participants (STOCK ASSESSMENT CRSP) (THE UNIVERSITY OF MARYLAND) (U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT)

Por: Blgo. MANUEL FLORES PALOMINO
Blgo. JOSE A. MENDOZA DEZA

IMARPE, 11 Marzo 1983

CONTENIDO

INTRODUCCION

I. DESCRIPCION DE LOS PRINCIPALES ASPECTOS DEL PROYECTO:
1. NATURALEZA Y OBJETIVOS DEL PROYECTO
2. PROYECCION DE BENEFICIOS
2.1 INCREMENTO EN EL CONOCIMIENTO DE LA PESQUERIA
2.2 INCREMENTO EN EL BENEFICIO SOCIAL ECONOMICO
3. EFECTOS DEL PROYECTO AL DESARROLLO ECONOMICO Y SOCIAL DE LA PESQUERIA ARTESANAL

II. RELACION ENTRE LOS PLANES DEL GOBIERNO EN EL SECTOR PESQUERO Y LOS OBJETIVOS DE INVESTIGACION DEL INSTITUTO DEL MAR DEL PERU

III. NECESIDADES DE ASISTENCIA TECNICA Y PERSONAL CIENTIFICO
1. PERSONAL PERUANO
2. PERSONAL CONTRAPARTE
3. BECAS
4. VIAJES DE COORDINACION
5. OTROS

IV. COSTO DEL PROYECTO
1. RECURSOS HUMANOS
- PERUANO
- CONTRAPARTE
2. MATERIALES Y EQUIPOS
3. OTROS

V. CRONOGRAMA

INTRODUCCION

La Pesquería Artesanal es una de las actividades más antiguas, más extendidas y que se da permanentemente en el litoral peruano. Se desarrolla en base a un complejo de especies 25-30 costeras y que constituyen en su mayoría recursos en explotación actual a través de 20,000 pescadores con 4,000 a 5,000 pequeñas embarcaciones.

Uno de los aspectos más importantes que deben conocerse de dicha pesquería, son las estimaciones de biomasa por especies y sus correspondientes stocks explotables.

Para lograr dicho objetivo, que en el IMARPE es de responsabilidad del Proyecto de Investigación y Evaluación de Recursos Costeros, debe ofrecerse informaciones de captura y esfuerzo que con oportunidad y representatividad espacial y temporal puedan lograrse.

Reconociendo que en Perú no existen un sistema Estadístico Pesquero Ad-hoc para Fines de Evaluación de Recursos Artesanales, el presente Plan o Anteproyecto lo propone co caracter de primera aproximación.

I. DESCRIPCION DE LOS PRINCIPALES ASPECTOS DEL PROYECTO

1. NATURALEZA Y OBJETIVOS DEL PROYECTO

- La naturaleza del Proyecto es eminentemente práctica e incluye

la adaptación y/o desarrollo de un modelo teórico para entender dicha realidad.

- Los Objetivos Centrales del Proyecto pueden ser resumidos en:

  a. Ofrecer información procesada sobre captura y esfuerzo de la pesca artesanal que permita evaluar la magnitud de los recursos pesqueros costeros y otroas determinaciones como el stock explotable.

  Las informaciones que asi se ofrezcan deberán ser precisadas y coordinadas con el Proyecto que efectuará la Evaluación de STOCKS.

  b. Ofrecer informaciones estadisticas pesqueras que permitan realizar estudios de eficiencia técnica y rendimiento económico de la actividad pesquera, al Proyecto presentado para estudiar la "Estructura y Funcionamiento de la Pesquería Artesanal e incrementar sus beneficios sociales y económicos".

  Para este objetivo las principales informaciones están referidas a:

  - Recursos. - Especies, cantidad desembarcada, zonas de pesca y desembarque, epocas de pesca.
  - Flota. - N° y tipo de embarcaciones, material de construcción, medio de impulsión, número de pescadores, edad de la embarcación.
  - Pescadores. - Número y distribución de labores.
  - Ventas. - Valor de venta en el punto de desembarque por especies y sistema de transacción.

  - Estimación de Gastos y Utilidades. - Lubricantes, gasolina/petroleo, aparejos de pesca, repuestos, impuestos, pagos de personal, etc.

  NOTA: El Universo y tamaño de muestra serán determinados previamente.

2. PROYECCION DE BENEFICIOS

2.1 INCREMENTO EN EL CONOCIMIENTO DE LA PESQUERIA

- El efecto de los resultados del Proyecto será inmediato y directo al ser base para el Proyecto de Evaluación de Stocks costeros.

- Asimismo será de efecto directo e inmediato para el Proyecto que estudiará la Estructura y Funcionamiento de la Pesquería Artesanal.

2.2 INCREMENTO EN EL BENEFICIO SOCIAL Y ECONOMICO

El beneficio social, por mayor disponibilidad de alimentos y el económico por mayores ingresos son beneficios indirectos de este Proyecto, por cuanto sus resultados son "insumos" para los dos Proyectos señalados.

3. EFECTOS DEL PROYECTO AL DESARROLO ECONOMICO Y SOCIAL DE LA PESQUERIA ARTESANAL

A mediano plazo e indirectamente contribuirá con sus resultados al mejor conocimiento de la pesquería y a elevar sus rendimientos y por lo tanto a incrementar su importancia en la economía nacional.

II. RELACION ENTRE PLANES DEL GOBIERNO A TRAVES DEL SECTOR PESQUERO Y LOS OBJETIVOS DE INVESTIGACION DEL INSTITUTO DEL MAR DEL PERU

El Plan Nacional de Desarrollo del Perú establece prioridad para el desarrollo de la pesquería artesanal a fin de lograr mayores abastecimientos de alimentos. EL IMARPE debe recojer este lineamiento de política del Estado y contribiur a hacerlo realidad. Sin embargo, esto no es muy posible en la situación actual por limitaciones técnicas y económicas. Por ello resultante expectante el apoyo de AID y determinante sus resultados.

III. NECESIDADES DE ASISTENCIA TECNICA Y PERSONAL CIENTIFICO

Lo siguiente es una primera aproximación

1. PERSONAL PERUANO.-

Existente	Nuevo
1 Biólogo Director (part time)	1 Estadístico
1 Biólogo Jefe	1 Biólogo en Recursos Costeros
2 Tecnológos (Recepcion y archivo)	
2 Codificadores	
10 Inspectores de Pesca	

2. PERSONAL CONTRAPARTE.-

1 Estadístico en Sistemas Pesqueros
1 Analista de Sistemas Pesqueros

3. BECAS

Para el personal peruano, por tiempos determinados y para aspectos concretos.

4. VIAJES DE COORDINACION

4.1 En Perú. - Para ejecución y Seguimiento del Proyecto
4.2 En U.S.A.- Para los Workshops

VI. COSTO DEL PROYECTO

Esta parte deberá ser estimada mejor, cuando se conozca que el presente Anteproyecto de Plan de Trabajo sea de la conformidad de la Universidad Planificadora o del primer Workshop que se ejecute.

Un anticipo del costo del Proyecto deberá considerar la siguiente estructura.

RUBRO	APORTE DE PERU (S/.)	APORTE AID (US $)
1. Recursos Humanos		
- Peruano		
- Contraparte		
2. Materiales y Equipos		
3. Facilidades de Viajes y Capacitación		
4. Publicación		
5. Otros		

V. CRONOGRAMA

A. PRIMERA ETAPA

Fase I
1. Desarrollo de Comunicaciones Enero 1983 (O.K.)
2. Coordinación para identificación de Proyecto: Marzo 1983 (O.K.)
3. Taller de Coordinación y Planteamiento: Jun.- Jul. 83

Fase II
1. Preparación del Documento Final: Agos - Set. 83
2. Selección de Proyectos: Oct. Nov. 83.

Fase III
1. Selección pos la Entidad Planificadora: Dic. 83

B. SEGUNDA ETAPA. - (Por determinar)

Fase I Ejecución
Fase II Informes

Instituto del Mar del Perú - The University of Maryland
(IMARPE) Planning Entity

U.S. Agency for International Development

PROGRAMA COOPERATIVO DE INVESTIGACION Y ASISTENCIA

TECNICA EN LA EVALUACION DE POBLACIONES

(Stock Assessment CRSP)

PROYECTO # 2

(PERFIL)

"LOGRAR UN BALANCE APROPIADO EN LA ESTRUCTURA Y FUNCIONAMIENTO DE LA PESQUERIA ARTESANAL (SMALL-SCALE FISHING) PARA OPTIMIZAR SU EFICIENCIA TECNICA E INCREMENTAR SUS BENEFICIOS SOCIALES Y ECONOMICOS"

PROYECTO PRESENTADO POR LA DIRECCION DE ESTADISTICA Y ESTUDIOS ECONOMICOS PESQUEROS DEL IMARPE COMO TOPICO Y OBJETIVO DE INVESTIGACION IMPORTANTE DE LA LISTA CONSIDERADA POR EL PROGRAMA COOPERATIVO DE INVESTIGACION Y ASISTENCIA TECNICA EN LA EVALUACION DE POBLACIONES.

Ref.: Planning Guide for Potential Participants

Por: Biólogo MANUEL FLORES P.
Biólogo RAUL HIDALGO REYES.

IMARPE, Marzo 11, 1983

CONTENIDO

INTRODUCCION

I. DESCRIPCION DE LOS PRINCIPALES ASPECTOS DEL PROYECTO:
   1. NATURALEZA Y OBJETIVOS DEL PROYECTO
   2. PROYECCION DE BENEFICIOS
      2.1 INCREMENTO EN EL CONOCIMIENTO DE LA PESQUERIA
      2.2 INCREMENTO EN EL BENEFICIO SOCIAL Y ECONOMICO
   3. EFECTOS DEL PROYECTO AL DESARROLLO ECONOMICO Y SOCIAL DE LA PESQUERIA ARTESANAL

II. RELACION ENTRE LOS PRANES DEL GOBIERNO EN EL SECTOR PESQUERO Y LOS OBJETIVOS DE INVESTIGACION DEL INSTITUTO DEL MAR DEL PERU

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   5. OTROS

IV. COSTO DEL PROYECTO
   1. RECURSOS HUMANOS
      - PERUANO
      - CONTRAPARTE
   2. MATERIALES Y EQUIPOS
   3. OTROS

V. CRONOGRAMA

INTRODUCCION

La Pesquería Artesanal del litoral peruano es una de las activedades más antiquas, más extendidas y que se da permanentemente. Se sustenta en una variedad de aproximadamente 25-30 expecies significativas, las que se desembarcan en más de 150 punto del litoral. Dando trabajo aproximadamente a 20, 000 pescadores que operan con 4,500 a 5,000 pequenas embarcaciones.

Sin embargo de su importancia, principalmente por dar alimento directo a las poblaciones costeras en un promedio de 50% del desembarque de pescado para el consumo humano directo, esta es una de las actividades poco conocidas teónicamente y se asume que podría elevar su rendimiento y beneficios, sea por mayores desembarques o por el mejoramiento de la calidad de sus pescas a los niveles actuales. Y este es el problema que el presente Plan de Trabajo intenta conocer y mejorar.

1. DESCRIPCION DE LOS PRINCIPALES ASPECTOS DEL PROYECTO

1. NATURALEZA Y OBJETIVOS DEL PROYECTO

- La naturaleza del Proyecto se circunscribe al aspecto eminentemente práctico, aplicando o desarrollando algún modelo teórico a la realidad del problema.

- El objetivo central es conocer la estructura de la pesquería artesanal en sus diferentes modalidades, identificar los fatores que la determinan y luego de conocer su funcionamiento, aplicar las medidas convenientes para mejorar dicha pesquería en términos de un mayor o mejor (o ambos) rendimiento.

2. PROYECCION DE BENEFICIOS

2.1 INCREMENTO EN EL CONOCIMIENTO DE LA PESQUERIA

Permitirá conocer técnicamente el funcionamiento de la pesquería artesanal desde el punto de vista global. Lo que podría facilitar recomendaciones sobre los recursos, su extracción, su transporte, desembarque, comercialización u que beneficios.

2.2 INCREMENTO EN EL BENEFICIO SOCIAL Y ECONOMICO

El beneficio social puede darse por un incremento o mejora en la disponibilidad de alimentos para la comunidad pesquera o para las poblaciones costeras aledañas.

El beneficio económico puede darse por incremento en el ingreso bruto por ventas sea por mayores volumenes o mejores condiciones del producto al consumidor.

3. EFECTOS DEL PROYECTO AL DESARROLLO ECONOMICO Y SOCIAL DE LA PESQUERIA ARTESANAL

A large plazo, con los resultados logrados con el Proyecto y con la Proyección de Beneficios señalados en los puntos 2.1 y 2.2, se espera mejorar y en el mejor de los casos desarrollar la actividad de la Pesquería y mejorar su perspectiva en la Economía Nacional.

II. RELACION ENTRE PLANES DEL GOBIERNO A TRAVES DEL SECTOR PESQUERO Y LOS OBJETIVOS DEL INSTITUTO DEL MAR DEL PERU

El Plan Nacional de Desarrollo del Perú, establece prioridad notable al desarrollo de la pesquería artesanal. El objetivo principal señala un mayor abastecimiento de sus productos pesqueros para contribuir a la alimentación nacional.

EL IMARPE debe recoger esta indicación y orientar sus actividades y sus capacidades técnicas, humanas y económicas para tratar de alcanzar dicho objetivo. Sin embargo esto será dificil de lograr, por lo menos en el corto plazo con las actuales capacidades y recursos económicos limitados. En esta situación resulta expectante la posibilidad de obtener asistencia técnica y economica para planear y ejecutar un Proyecto o Plan de Investigación que contribuya a lograr el objetivo ya señalado.

III. NECESIDADES DE ASISTENCIA TECNICA Y PERSONAL CIENTIFICO

Una primera aproximación a los requerimientos que será necesario plantear son:

1. PERSONAL PERUANO.-

EXISTENTE	NUEVO
1 Biólogo Director	1 Costista
1 Biólogo Jefe	1 Ingeniero Pesquero
1 Economista	1 Estadístico
	1 Biólogo en Rec. Costeros

2. PERSONAL CONTRAPARTE - (Por tiempos por definir)

1 Economista Pesquero
1 Administrador de Recursos Pesqueros
1 Biólogo especialista en Recursos Costeros
1 Profesional en embarcaciones y artes de pesca

3. BECAS

Para el personal peruano, por tiempos determinados y para aspectos concretos relativos a su responsabilidad in el Proyecto.

4. VIAJES DE COORDINACION.-

4.1. - En el Perú. - Para el seguimiento del Proyecto en su ejecución.
4.2. - En U.S.A. - Para los Workshops y otros que se prevean

5. OTROS

IV. COSTO DEL PROYECTO

Est parte deberá ser estimada, mejor, cuando se conozca que el presente Anteproyecto de Plan de Trabajo sea de la conformidad de la Universidad Planificadora o del primer Workshop que se ejecute.

Un anticipo del costo del Proyecto deberá considerar la siguiente estructura.

RUBRO	(S/.) APORTE DE PERU	(US $) APORTE AID
1. Recursos Humanos		
- Peruano		
- Contraparte		
2. Materiales y Equipos		
3. Facilidades de Viajes y Capacitación		
4. Publicación		
5. Otros		

V. CRONOGRAMA

A. PRIMERA ETAPA

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2. Selección de Proyestos: Oct. Nov. 83

Fase III
1. Selección por la Entidad Planificadora: Dic. 83

B. SECUNDA ETAPA. - (Por determinar)

Fase I Ejecución
Fase II Informes

STOCK ASSESSMENT CRSP PROJECT SPECIFICATION

INSTITUT SENEGALAIS DE RECHERCHE AGRICOLE
CENTRE DE RECHERCHES OCEANOGRAPHIQUES DE DAKAR-THIAROYE

A. Samba

I. Project Title

Estimation of near shore marine species catch possibilities by the artisanal fishery all along southern coastern of Senegal (between Cap-Vert peninsula and Guinea border; see the attached map).

II. Objective

To determine the optimum of potential catch and related artisanal fishing effort with regard to stock biomass changes, depending on:

- variations of environmental conditions,
- impact of different types of fisheries on the stock.

The analysis of socio-economic conditions will give more accuracy to the definition of a harmonious scheme for artisanal fishery development.

III. Justification

The artisanal fishery is a very important activity all along the southern coast of Senegal as shown by the following table (data - 1981).

Species	Northern Zone Dakar-Saloum	Southern Zone Casamance	Total	Value (10^3 CFA)
Ethmalosa dorsalis	6764 m. tons	100 m. tons	7764 m. tons	155.280
Sardinella aurita	35633	-	35633	855.192
Sardinella maderensis	19209	-	19209	345.762
Pomadasys ssp.	1918	43	1961	219.632
Decapterus rhonchus	1768	-	1768	231.608
Caranx spp.	1482	73	1555	290.785
Scomber japonicus	929	-	929	77.107
Mugil spp.	3746	1214	4960	471.200
Miscellaneous	19740	800	20540	410.800
Total pelagic fish	91189	3130	94319	3.057.366
Arius spp.	4118	9685	5083	518.466
Epinephelus spp.	1015	-	1015	452.690
Pseudotolithus spp.	469	698	1167	533.319
Sparus spp.	700	39	739	102.721
Cynoglossus spp.	174	93 m.	267	64.347
Sepia officinalis	646	-	646	10.422
Sharks	294	312	606	30.600
Skates	384	-	384	9.600
Miscellaneous	6172	14	6186	433.020
Total demersal fish	13972	2121	16093	2.245.855
Grand Total	105161	5251	1104412	5.303.251
N° of canoes	2469	266	2735	
N° of fishermen	11907	855	1279	
N° of induced employment	47628	3540	51168	

However the data indicate that fishing activity (and landings) are not well distributed among the two zones. While the northern zone is intensively exploited, the zone between The Gambia and Casamance has a very low fishing activity. However, the yields obtained by fishermen in the southern zone are really very high (145 kg per outing for a canoe using gillnets). Thus, very substantial development possibilities exist in this area.

The Senegalese government, fully aware of this reality, wants to achieve two main objectives: management of the fisheries stock between the Cap Vert peninsula and Soloum (Small Coastal area), and development of fishing activities within the southern zone (Casamance).

- Small Coastal area and the Saloum region in particular: this zone is heavily exploited by an artisanal and an industrial fishery and it is noticed, as shown in recent analysis, the existence of some areas where overfishing occurs. Quantifying the fish biomass in this zone becomes an urgent need for the management of the resources.

- Casamance zone: this region has very important marine resources: only scientific research results can propose means to develop the exploitation of these resources on a rational basis.

In order to avoid costly errors in economic and social terms, it is important to know as precisely as possible the maximal catches which can be harvested from the southern stocks.

To determine the optimum catch and effort level, we have to consider two main points. First, fish caught by the artisanal fishery are also exploited by industrial fishermen in offshore areas: it is necesary to work out an equilibrium between these two fishing types. Second, several examples show that in near shore tropical waters, fluctuations in environmental conditions induce very important fish biomass variations. In Senegal, such relationships have been proven for some small pelagic fish such as sardinella, and for shrimps. It will be advisable to adjust catch and effort levels in relation with trends of climatic factors.

IV. Project Description

This project covers the zone of a depth of 0-25 m between the Cap-Vert peninsula and the Guinea border. The project can be divided into three research operations:

IV.1. Environment Survey

Some work has already been done and other programs are underway. This study is aimed at completing and refining the knowledge already gained.

Two kinds of research activity will be undertaken:

(a) an accurate survey of Djiffer region:

This area has an abundant stock of fish (where more than half of the artisanal fishery's landings are made). On the other hand, Djiffer is the central point of the project zone and is easily accessible from Dakar.

Following parameters will be investigated:
- wind
- currents
- turbidity
- temperature
- Salinity
- oxygen
- nutrients: phosphates, nitrates, silicates
- phytoplankton: (fast qualitative study, biomass).

At the end of this survey, a decision will be taken for setting up a possible hydrological coastal station.

(b) Hydrological survey all along the project area.
The results of this study will serve to place Djiffer's observations within the project zone's context.

Following parameters will be investigated:

- currents	- oxygen
- turbidity	- nutrients
- temperature	- phytoplankton
- salinity	- zooplankton

With this survey, it will be possible to specify the enrichment processes occurring in the zone, and later on to establish the relationship between biomass changes and variations in environmental conditions.

IV.2. Study of the biomass and its variations, using hydroacoustical methods

Hydroacoustical surveys have been regularly undertaken in Senegal since 1973, but only within zones deeper than 10 meters and have mainly been directed toward small coastal pelagic fish.

To obtain good biomass assessments for coastal fish, it will be useful to develop new methods in hydroacoustical surveys. A promising technique involves towing a sled (supporting a high frequency transducer) along the sea bed from a small research vessel.

For this study it is useful to measure the target strength of different fish species for different size classes. Thus, it will be necessary to build a basin in CRODT for these experiments. Species identification will be done by trawling and by using an under-water camera already available in CRODT.

The development of this methodology would provide accurate estimations of near shore fish biomass, absolutely independent of methods based upon fisheries statistics, the latter one being difficult to collect properly from artisnal landing sites. A good knowledge of this biomass is the basic condition for the management and rational development of the artisanal fishery on the southern coast of Senegal.

Two kinds of research activity will be undertaken:

- periodical surveys all along the Senegalese coastline,
- accurate studies in zones with large fish concentrtions, i.e. Djiffer zone and Casamance.

IV.3. Study of catch statistics, biological and socio-economic data.

For the Senegalese industrial fishery, good catch statistics data are now available. A very big effort has been made for the artisanal fishery data collection: good results are obtained in the Northern Coast (from St. Louis to Dakar) and the Cap-Vert peninsular. Some progress can be noticed in the southern coast but the results are not yet sufficient.

The information gathered for the first zone, and which will be collected in the project area are the following ones:

- the canoe fleet: composition and variations
- landing and fishing effort by fishing gear and by species
- biological data (length frequency, scale and spine studies, gonad maturity index)
- socio-economic data (prices, costs, earnings, marketing, fishermen's characteristics...)

This study will bring more precision on existing knowledge about ecology, biology and biometry of main species, more information to enable understanding of possible landing fluctuations not due to socio-economic constraints.

IV.4. Conclusion:

The analysis of all these findings will enable us to determine the level of total allowed catches, taking into account statistical, biological, socio-economic and hydro-climatic data.

V. Project Context

This project can be considered as a part of the research programs undertaken by CRODT.

V.1. Programs relevant to environment:

- Hydrology of the Senegambian continental shelf: the findings of the study have already been published by CRODT.
- Environmental factors of "small coastal area" (between Dakar and Joal): conducted by CRODT with the participation of the University of Dakar.

· hydrology	· seagrass and sea weeds
· sedimentology	· zoobenthos
· phytoplankton	· zooplankton

Research operation already underway:
- Hydrology and phytoplanktonic biomass study (by assessing chlorophyl a) in southern Senegal, between Gambia and Guinea.

Research operation underway within CRODT:

- Hydrology and phytoplanktonic biomass study using remote sensing techniques on the Senegalese south coast. This operation is undertaken by CRODT in collaboration with ESA (European Space Agency) and ORSTOM (Office de la Recherche Scientifique et Technique Outre-Mer); and CRODT is also processing satellite views from Nimbus 7 and Meteosat.

Research operation underway:

- Mapping of surface temperature using aerial radiometry (will begin in April 1983).

V.2. Programs relevant to biomass assessment:

- Since 1973; biomass assessment using echoprospection techniques all over the Senegambian continental shelf. Two annual cruises (one during the cold season and one during the warm season) are carried out by research vessels from several countries (Spain, France, Norway, Soviet Union). The results have been published.

- Since January 1983, quarterly cruises have been carried out all over the Senegambian continental shelf for biomass assessment using echointegration techniques. This program is carried out by CRODT with echointegration equipment available on the research vessel "Laurent Amaro". This research operation is part of a regional program with Mauritanian research and French collaboration.

V.3. Programs relevant to catch and fishing effort:

For several fish stocks exploited by industrial and semi-industrial fisheries, the results have been published (Sardinella, soles, shrimps, cephalopods, bluefish, grouper, common pandora, gilt head bream, croaker).

Thorough inquiries will be made, taking into account:

- artisanal fishery
- environmental factors
- socio-economic data

This study needs:

a) the gradual setting up of a team of observers; currently 7 observers are operating in the southern coast and two of them are based in Mbour and Joal, within the project zone

b) the acquisition of results on the ecosystems working

c) the setting up of the socio-economic team in CRODT.

Among all the recently published findings, one may mention two production models concerning small coastal pelagic fish and shrimp. These models include fishing effort and important environmental parameters (wind component including upwelling, rainfall).

VI. Project Organization

VI.1 Operation 1 and 2

a) a one week cruise per quarter all along the coastline to do environmental measurements and echointegration by contracting transects between Gambia and Guinea.

duration: 2 years. To be repeated.

b) a precise survey of environmental factors in Djiffer, every 15 days.
- a 3 day trip for hydrology and phytoplankton measurements
- a 2 day trip for zooplankton study
- a 2 day trip for echointegration study

duration: 2 years. To be repeated.

VI.2. Operation 3

Installation:

a) of an observer moving between Dakar and Mbour
b) an observer in Djiffer
c) two mobile observers in the Casamance area

duration: 2 years. To be repeated.

VII. Resources Required and Costs (for 2 years)

VII.1. Resources made available by CRODT

VII.1.1. Personnel

1 physicist
1 phytoplanktologist
2 fishery biologists (with one expert in echointegration techniques)
1 socio-economist
1 echointegration specialist
2 observers

VII.1.2. Equipment

1 24 meter long offshore research vessel
1 8 meter long in-shore research vessel
sampling equipment: "Niskin bottles, multianalysis sounding lead Andera currentmeter, reversing thermometers, spectrophotometer, Turner fluorometer, salinometer
computation facilities: IBM Computer 4331 and HP 9845.

VII.2. Resources needed from outside

VII.2.1. Personnel (for 2 years)

1 zooplanktologist	
1 fishery biologist (specialist in echointegration techniques)	
1 biometrician	
4 observers	$US 44,000
1 driver	13,000
1 security guard in Djiffer	8,000

VII.2.2. Equipment

3 Niskin bottles and 3 protected thermometers and 3 non-protected thermometers	$US 6,000
1 Anderea currentmeter	11,000
10 plankton nets	2,000

Echointegration equipment

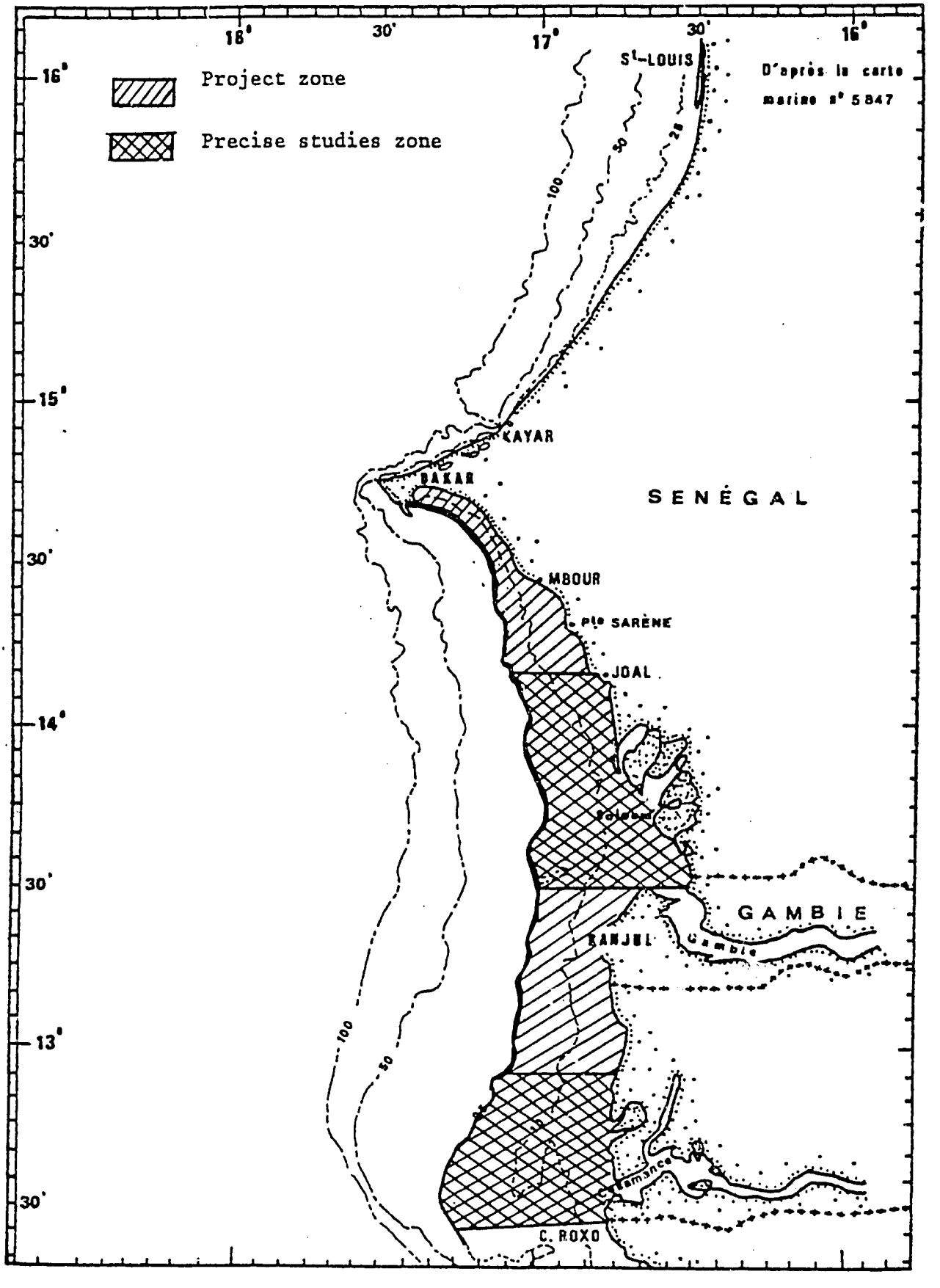
- high frequency option for existing echo sounder	12,000
- high frequency transducer (400 Hz)	3,000
- towing sled	1,000
- miscellaneous	5,000
Acoustic test basin (10 m depth)	20,000
1 four wheel drive vehicle	16,000
2 motorcycles	2,000

VII.2.3. Operating Costs

-24 meters research vessel	60,000
- 8 meters research vessel	40,000
- vehicle and motorcycles	5,000
- computation, typing of reports	20,000
- contribution to CRODT general expenses	10,000

VIII. Desired Collaboration

- Biosonics Company
- University of Washington State


Project zone
Precise studies zone
D'après la carte marine n° 5 847
St-LOUIS
KAYAR
DAKAR
SENÉGAL
MBOUR
Pte SARÈNE
JOAL
Saloum
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BANJUL
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50
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18°
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Project Proposal for Collaborative Research with United States Universities on Stock Assessment Studies in Palk Bay and Gulf of Mannar Areas of Sri Lanka

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31st May 1983

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INTRODUCTION

The National Aquatic Resources Agency (NARA) is evolved from the old Fisheries Research Station of the Ministry of Fisheries. NARA came into being in September 1981 and is the principal national institution charged with the responsibility of carrying out and co-ordinating research, development and management activities on the subject of aquatic resources.

NARA welcomes foreign collaborations in local projects in order to build up local capabilities and expertise for efficient utilization of the resources of the aquatic environment.

The project for stock assessment Collaborative Research Support Programme (CRSP) given in this document would give NARA an opportunity to develop tropical stock assessment methodologies, train local scientists in this field as well as providing a chance for scientists from the United States to further their knowledge on the tropical environment.

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PROJECT TITLE: STOCK ASSESSMENT STUDIES IN PALK BAY AND GULF OF MANNAR AREAS OF SRI LANKA

1. Fishing Industry of Sri Lanka

1.1 General:

Sri Lanka is a tropical island and has a coastal line of 1760 km and an EEZ of 256,410 sq. km. Except in the north, the continental shelf is relatively narrow averaging little over 22 km and there are about 120,000 ha of coastal estuaries and mangrove forest. Over one hundred rivers and numerous streams radiate seawards from the central mountainous region and there are approximately 140,000 ha of inland fresh water bodies. The fishing industry contributes around 61 percent (1980) of the animal protein in Sri Lanka. This also represents about 1.6 percent of Sri Lanka's economy.

The Ministry of Fisheries of Sri Lanka is responsible for policy making, co-ordination, financial control, programming, planning and development of fisheries. NARA is an institution under the Ministry of Fisheries with responsibilities to research and develop aquatic resources.

The total number of people involved in all sectors of the industry is around 79,000 with 58,000 active fishermen. However, there are a further considerable number of part-time employees and nearly three quarter million of dependents of fishermen.

The 1979 to 1983 Five Year Master Plan to develop the fishing industry in Sri Lanka has a total production target of 300,000 tons by 1983, while simultaneously increasing annual per capita fish consumption from the late 1970's level of near 13.5 kg. to 19.8 kg. The level of fresh fish production in 1981 was 203,586 tons and the corresponding per capital consumption was 14.4 kg.

1.2 Sri Lanka Fisheries

Fishery takes place all along the coastal line of Sri Lanka. For convenience of arrangement, the marine fisheries are divided into three sectors:

a) The coastal sector, extending up to 40 km from the coast and including lagoons and estuaries.

b) The off-shore sector, between 40 and 100 km from the coast.

c) The deep-sea sector, beyond 100 km from the coast.

Practically all the fishing is done by small-scale fishermen in the coastal waters with about 21,000 craft, of which 56 per cent are mechanized. Fifty-nine percent of the landings were from mechanized craft engaged in coastal fisheries.

A summary of craft population by varieties for 1982 is given below:

11 m and above (offshore and deep sea)	..	50
9 m- 3 1/2 ton boats with 30 HP inboard engines	..	3300
6 m fibre glass boats with 6-15 HP outboard engines	..	8900
Non-mechanized traditional craft (planked, dugout, logcraft, outriggers, etc.)	..	9400

The most important gear used in catching fish is the gill net accounting for over 70 percent of total catch. Mesh sizes range from 60 mm to over 175 mm. Beach seine nets, cast nets (most used in lagoons), hand lines, pole and line, long lines, and traps are the other major types of gear used in the marine and inland sectors. Different types of gear are directed to exploit different varieties of resources. Small pelagic fish are exploited by beach seines, small mesh gill nets, and cast nets; large pelagic fish are caught by large gill nets, long lines, troll lines and by pole and line; and demersal species are exploited by bottom set nets, long lines, bottom trawls and traps. In addition, lobsters, pearl, oysters, ornamental fish, chanks, shells, beche-de-mer (sea cucumbers) are harvested manually by divers.

Island-wide fish landing and effort data are collected by the Statistics Division of the Ministry of Fisheries for development and management purposes. The data have been collected by field samplers who are stationed in every major fishing centres of the island. Annual fish landings by major groups of fish and other official statistics are estimated from these sample data. Annual production and effort estimates are published in the Fisheries Administration Report.

The 1981 fresh fish population of 203,586 tons includes 172,318 tons (85%) from coastal waters, 2,144 tons (1%) from offshore and deep sea, and 29,124 tons (14%) from freshwaters, respectively. Marine fish landings consist of 94 percent fin fish and 6 percent invertebrates. Annex 1 shows imports and export figures of fisheries. Earnings from invertebrate exports were mainly from prawn, and in 1981 was 348.4 million rupees (US $ 17.5 million). The imports in 1981 were valued at 119.6 million rupees (US $ 6 million). The annual growth rate of fish production since 1977 has been around 10 percent. Annex 2 gives the 1981 fish production figures for fish varieties. Small pelagic fish contributed the highest percentage at 37 percent of all landings, tuna fish were next at 19 percent. Although invertebrates contributed less than 5 percent most are exported and earn valuable foreign exchange.

The offshore fishery in Sri Lanka is negligible and the deep-sea fishery is almost nil at present with the exception of some foreign vessels fishing from time to time under royalty agreements with the

Sri Lankan government. In recent years, the Ministry of Fisheries has moved towards developing the offshore and deep-sea fishery. As a result, forty or more large mechanized vessels (above 11 m.) have been introduced under foreign aided projects. These vessels fish mostly along the west coast using drift nets and long lines.

The 1981 production figures indicate that the main production areas are Palk Bay (32.5 percent), Negombo (11.2 percent), Puttalam (8.5 percent) and Trincomalee (8 percent). Correspondingly, the craft population is also high in these areas.

As mentioned earlier, the Five Year Master Plan aims to reach a target of 300,000 tons by increasing production in all sub-sectors of the fisheries. The level of production in the offshore and deep-sea sectors is planned to increase from 2000 tons to 30,000 tons, inland fisheries from 30,000 tons to 50,000 tons and coastal fisheries are targeted to increase from 172,000 tons to 220,000 tons.

The present level of production of demersal fish is around 30,000 to 40,000 tons. From the Fridjoft Nansen surveys, it is evident that there is a scope for development of this fishery to reach the potential maximum yield of 70,000 tons. The present level of exploitation of coastal pelagic fish, is however, already near maximum, giving little hope for further development. The offshore and deep-sea fishery could be developed to provide substantially increased production from these sectors. However, the cost of operating deep-sea vessels would limit intensive development in these sectors. The inland fisheries production could be increased by including small tanks in the fingerling stocking programme.

1.3 Fish Resources of Sri Lanka:

1.3.1 Potential yield from coastal water: The Norwegian research vessel Fridjoft Nansen did three acoustic surveys with experimental bottom trawling and bottom long lining from 1978 to 1980 on the continental shelf around Sri Lanka beyond 10m depth and excluding the shallow areas of Palk Bay. Their surveys indicated a possibility of obtaining, maximum sustainable yield of 250,000 tonnes per annum, comprising 80,000 tonnes of demersal fish and 170,000 tonnes of pelagic fish from an estimated standing stock of about 700,000 tonnes. Re-analysis of their demersal resources assessment data by Sivasubramanium (1983, personal communication) suggest an MPY of 45,000 tonnes from areas other than Palk Bay and that 25,000 tonnes of this belong to the bigger valuable varieties of lethrinids, lutjanids, Serranidae, and Caranx. By adding to the 45,000 value, a conservative figure of 25,000 tonnes as a possible value of Palk Bay demersal resources, the total demersal potential yield is now more realistically estimated at 70,000 tonnes per annum.

1.3.2 Prawn: The commercially important marine species of prawn found in Sri Lanka are:

(1) Penaeus indicus

(2) Penaeus semisulcatus

(3) Penaeus monodon

(4) Penaeus merguiensis

(5) Penaeus dobsonii

and (6) Parapenaeopsis stylifera

The fresh water species are:

(7) Macrobrachium rosenbergii

and (8) Macrobrachium malcomsoni

M. rosenbergii is now being cultured by private enterprises in Sri Lanka. The penaeid prawns that are found in soft sand and mud banks are distributed in shallow Palk Bay, plus in the narrow coastal stretch extending from Colombo to Udappu at depths 6 to 18 m and in areas around Mullativu at depths 15 to 24 m. Out of the large penaeid prawns [(1) to (4)] P. indicus is more abundant in the southern sector of Sri Lanka while P. semisulcatus is more abundant in the northern sector. P. monodon is found all around the island, but lesser in number. Attempts are now being made to culture large penaeid prawns in Sri Lanka. The research vessel Fridjoft Nansen (1978 to 1980) reported the presence of deep-sea prawns in the Gulf of Mannar.

A number of research studies have been carried out on penaeid prawns. The Balapitiya lagoon prawn fishery (Sivalingam, 1956), seasonal availability of post larval and juvenile prawn in Negombo lagoon (Samarakoon and Raphael, 1972), distribution of prawn around Sri Lanka (De Bruin, 1965, 1971), estimating the abundance of prawn from catch data in Chilaw (Siddeek, 1978), growth and maturity studies of commercially important prawn from Mutuwal to Chilaw (Jayakody, 1979) are few to mention.

1.3.3 Spiny lobsters: There are six species of lobsters found in Sri Lanka that are commercially important. They are:

- Panulirus homarus
- Panulirus versicolor
- Panulirus ornatus
- Panulirus polyphagus
- Panulirus penicillatus

and - Panulirus longipes

The lobsters are mainly distributed on the east, south, south-west and west coasts of Sri Lanka. On the west coast, the

dominant species is P. homarus, while on the east coast and on the north-west coast it is P. versicolor. De Bruin (1960 to 1970) studied the fishing methods, species composition, distribution, the subtrata preference and related oceanographic parameters.

1.3.4 Coastal pelagic fish: Coastal pelagic fish consist of fish belonging to families of -

- Clupeoidae
- Beloniformes
- Sphyraenidae
- Trichiurus spp
- Chirocentridae
- Engraulidae

to mention a few. They are captured mostly by small gill nets and beach seines and are found all around the island with their abundance fluctuating seasonally.

Canagaratnam (1956, 1965) studied the beach seine fishery since late 50's, especially the production, catch composition and catch per effort. Beach seining is a labour intensive fishery. It consistently gave a fair share of 35% in fish production before 1960. However, after 1960, the mechanized fleet has slowly overtaken it. Apart from this, the small gill net fisheries were studied by Dayaratne and Jayasuriya (to be published). These studies were mainly confined to production estimation and identifying the species composition and seasonal occurrences in the catch.

1.3.5 Coastal demersal fish: Coastal demersal fish are comprised by mainly the families of Lethrinidae, Lutjanidae, Serranidae, Carangidae, Arridae, Leiognathidae, Sciaenidae and Sparidae. The families Leiognathidae and Sciaenidae are mostly found on the sand and mud banks of north of Jaffna peninsula, Palk Bay, Gulf of Mannar and the narrow soft sand and mud stretch of shallow depths from Udappu to Colombo. These fish are small in size and are not highly valued. The fish belonging to families Lethrinidae, Lutjanidae and Serranidae prefer rock bottoms, which are found in the deeper regions of the continental slopes. Specific areas rich in rock fish are Hambantota banks and Great and Little Basses in the south (according to Fridjoft Nansen Survey Report). The larger sizes of these fishes make them highly valued. In the 60's, Sivalingam (1966, 1969) studied the demersal catches from Wadge Bank (now under Indian EEZ), and Pedro Bank (two-thirds of the area comes within Sri Lanka's EEZ). He observed the depth-wise size stratification of Lethrinidae in Wadge Bank with young fish prefering shallow areas. There have been several experimental fishery surveys undertaken around the island to assess the demersal fish resources since the 1920's. As a result, a vast amount of data has been collected.

1.3.6 Deep sea and offshore pelagic fish: Deep-sea and offshore fish consist of Spanish mackerel (Scomberomorus spp.), Indian mackerel, (Rastrelliger kanagurta), flying fish (Exocoetidae), squid and cuttle fish. Eastern little tuna (Euthynnus affinis), skipjack tuna, yellow fin and big-eye tuna, sharks, spearfish and marlins.

They are mostly caught in the deep-sea of west, south-west, south, south-east and north-east Sri Lanka. Sivasubramaniam (1978) estimated a potential yield of nearly 30,000 tons of large pelagic fish from offshore and deep sea areas. Dayaratne (1978) studied the species composition of squids and cuttle fish caught in Wadge Bank. The potential yields of squids and cuttle fish are not known. Sivasubramaniam (1971 to 1972) studied the catch rate, catch composition, length frequencies, fishing methods and distribution of tuna. The skipjack and tuna stocks are probably shared with the Maldive Islands and India.

1.3.7 Non-finfish resources: Beche-de-mer (Holothuria spp) and pearl oysters (Pinctata vulgaris) have been harvested in the north-west coast of Sri Lanka for centuries and are presently exported. A considerable amount of information is available on the biology and occurrence of fauna and flora of Pearl Banks. Noteworthy contributions came from Herdman (1903 to 1906), Pearson (1913), Malpas (1926) and Sivalingam (1961).

Studies on Holothuria were undertaken by Satchithananthan (1974, 1975) in the 70's and described occurrences, species composition and post-harvest technology.

Crabs, cuttle fish and squids are the other important resources available around Sri Lanka from the export point of view. Large edible crabs are found in the lagoons while sea crabs, cuttle fish and squids are mostly caught in Palk Bay and other prawn grounds. Studies reporting on these resources are limited. Annex 3 gives the production and export particulars of some non-finfish resources.

1.3.8 Coral resources: Coral reef infringes all around the island excepting the river mouths and estuaries. The live corals are found on subfossil coral, sandstone, granite and laterite. Important reefs are found off Silavathurai, Colombo, Hikkaduwa, Weligama, Hambantota, Batticaloa, Pasikuda, Foul Point, Trincomalee and Nilaveli. A number of species of ornamental fishes are now being captured from the coral habitats. The capture fishery of food fishes on coral habitats is less developed except for sport fishing and lobstering. In the late 70's there was an outbreak of predatory starfish (Acanthaster planci) on the reefs off Trincomalee and Foul Point which were brought under control employing manual removal by skin divers (De Bruin, 1972). No systematic fishery studies have been undertaken so far on the food fish resources of the coral habitats, except for lobsters (De Bruin, 1963-1969).

2. PALK BAY AND GULF OF MANNAR

2.1 Study Area:

Palk Bay area has a shallow flat bottom, averaging 9 m depth (Annex 4), has soft and muddy bottoms in most places, and is suitable for prawn trawling. The entire area of Palk Bay, the small area north of Pearl banks and a few square nautical miles in deep waters off the Gulf of Mannar are areas suitable for prawn and finfish trawling in Sri Lanka. Berg (1971) carried out investigations into the bottom conditions and possibilities of marine fish and prawn trawling on the north and east coasts, including the Pedro Bank and Palk bay. The study indicated the availability of 3000 sq. km. of soft mud bottom in Mullativu and Palk Bay, and 5000 sq. km. of hard bottom on the Pedro Bank and the region north of Pedro Bank for trawling. The exploratory surveys carried out in the deep of the Gulf of Mannar by the Soviet Union research vessel Optimist discovered deep water (200 to 350 m depth) trawling grounds. The extent of these beds was later estimated to be small (Fridjoft Nansen 1978 to 1980).

2.2 Fishery:

The fishery in Palk Bay and the Gulf of Mannar is artisanal and multi-gear; fishing trips by any craft take less than a day. An interesting feature of this fishery is that of seasonal migration of craft from other areas during fishing season. The important fish landing sites are situated in Talai Mannar, Mannar, Vidathalthivu, Jaffna, Karainagar, Delft Island and Iranathivu. During the active fishing season, nearly 250 3 1/2 ton craft with 30 HP inboard engines trawl for prawn on the shallow banks and 100 to 200 craft of the same category fish in the deep waters employing large mesh drift nets, bottom long lines and handlines.

There are over a thousand 6 m category fibre glass boats with 6 to 15 HP outboard engines and over a thousand traditional craft without engines engaged in small mesh and large mesh drift net fisheries as well as bottom long line and handline fisheries (these figures exclude the number of craft from Indian coast).

The predominant species of prawn is Penaeus semisulcatus with a smaller number of Penaeus indicus, Penaeus merguiensis, Metapenaeus burkenrodi, and Penaeus monodon with large quantities of by-catch pony fish, and a fair amount of squids, cuttle fish and crabs. The low-valued small fish are usually converted into dry fish or fish meal. A conservative estimate of potential annual yield of prawn from Palk Bay is 2000 tonnes, while the figure for pony fish is 25,000 tonnes. The finfish fishery consist of clupeoids, carangids, lethrinids, scombrids, stromateids, tuna fish, snappers, sharks and skates. In addition, varieties of traditional fishing techniques (cast net, beach seine, stake seine, push net, drag net and trap) are employed in shallow areas to catch prawn, shallow-water fish, crabs and lobsters. Beche-de-mer, chanks and pearl oysters are also harvested manually by divers. Annex 5 gives 1981 fish production figures for the Mannar area. The figures from Mannar district amount for a fraction of Palk Bay production, with the remainder coming from the Jaffna district and the

Indian coast.

2.3 Past Work:

The report by Malpas (1926) on major trawling exercises carried out around the island gives a good account of the ecology, biology and fisheries of the resident demersal and semi-demersal fish. These trawling exercises were carried out to identify suitable grounds for commercial trawling, and Palk Bay was one of the areas identified for trawling. However, the finfish catch obtained from Palk Bay was of low quality small fish. A number of resource surveys have been undertaken in this region in the past, the latest involving the use of hydroacoustic techniques (Medcof, 1963, Berg, 1971, Report of Optimist, 1972, Report of Hoya Maru, 1975, Report of Fridjoft Nansen 1978 to 80).

These investigations indicated the availability of good resources of commercially important prawn and by-catch, the latter consisting mainly of pony fish in the shallow region of Palk Bay, and deep water finfish, prawn, lobsters and crabs in the deep region (200 to 350 m) in the Gulf of Mannar.

Oceanographical studies in this region are scanty. Drift bottle experiments were conducted in 1920's in the Gulf of Mannar (Malpas, 1926) and salinity and surface temperature studies were made in Jaffna lagoon (Sachithananthan, 1969). Vertical temperature studies were undertaken towards the end of the monsoon (Samarasinghe, 1975) and hydrographical information was occasionally collected in the deeper region off the Gulf of Mannar by research cruises. The resource surveys undertaken in collaboration with foreign research organizations were limited to waters outside this region, because its shallowness inhibits access of big research vessels. As a result, resource assessment data is lacking for the Palk Bay and Gulf of Mannar.

3. RATIONALE AND BENEFITS:

3.1 Justification:

Even though Palk Bay and the Gulf of Mannar region produce high yields in finfish and shellfish, little work has been done on the biology, oceanography and population dynamics of the important resources. Lack of knowledge of the resources potential will hinder optimal development and management of fisheries in this region.

In Sri Lanka, mechanized craft with gear are subsidized by the State. This has encouraged the overgrowth of the craft population. Adding to this problem, the lack of knowledge about resource potential and distribution has led to haphazard distribution of fishing effort in different fishing grounds, resulting in overall reduction in the per boat return. In recent years, the government has seriously considered curtailing the entry of new craft in regions where fishing pressures are high. In order to do this, knowledge of the extent of the fisheries resources and their distribution is necessary.

The stock assessment research program for the Palk bay region presented here was drawn up with the above problem in mind.

Preliminary surveys in late 1982 towards this end have already been done. The CRSP project in this region would be helpful in undertaking in-depth studies of major fisheries.

3.2 Benefits:

The Palk Bay and Gulf of Mannar areas contributed over 30 percent of the total fish landings in 1981. The benefits of CRSP project in this major fishing area are:

(i) The resources assessment studies would aid in effective planning for rational exploitation.

(ii) The methodologies for tropical fish stock assessment as developed from this project would serve to enhance our knowledge on tropical fish stock assessment in other tropical regions.

(iii) The proposed project will train young Sri Lankan scientists in stock assessment methodologies.

(iv) The proposed project will give US scientists an opportunity to work in Sri Lanka in tropical stock assessment.

4. OBJECTIVES:

The general objective of this project is to formulate rational development and management policies for the multi-species, multi-gear artisanal fishery in Palk Bay and the Gulf of Mannar. The specific objectives are the following:

(i) To review past data on the Palk Bay fishery, identifying areas with shortcomings in order to develop methods of collecting information to fulfil these shortcomings, to collect information and use stock assessment techniques on data.

(ii) To identify essential environmental and oceanographic information necessary for predictive purposes, collect and use such information for prediction.

(iii) To undertake surveys to assess the biomass of commercially important resources and develop methods to determine the maximum potential yield.

(iv) To develop multi-species assessment techniques including consideration of distributional and essential ecological and biological parameters of important commercial species.

(v) To study the selectivity of different types of gear and determine if gear regulations are applicable.

(vi) To study the socio-economic sector of small-scale fisheries.

5. SCOPE AND METHODOLOGY:

The project can be divided into different sub-investigation units. The time frame for each unit is given in Appendix 6.

5.1 Investigation of Past Data and Preliminary Surveys to Identify Problems

The past data on catch, effort and biology from exploratory fishery surveys and commercial fishing in this region and from the adjacent Pedro Bank and Wadge Bank can initially be looked into to assess their suitability for being used in traditional stock assessment models (e.g. Schaefer Model) in order to assess the state of fisheries and identifying shortcomings in these data. In the next stage, a survey scheme to enhance the data base will be developed. These studies could be accomplished during the first six months. Within this period, preliminary surveys in the region could also be undertaken to identify general stock assessment problems on the community level or on major species (prawn and by catch, sardines, carangid, snappers, bream, pomfret, shark and skates crab, beche-de-mer) level.

5.2 Oceanographic Studies:

Important hydrological, environmental and productivity parameters such as physical qualities of water, salinity, nutrients, phytoplankton and zooplankton need to be studied for establishing correlations with fish and shellfish production and identifying the causative factors for changes in abundance. This aspect of the project should be started in the seventh month and continued for one year. Study of benthos and bottom type and topography of the habitat would assist in understanding the substrata affinity and pattern of distribution of different species.

5.3 Study of Catch, Effort, Socio-Economic Statistics and Biological Data:

Catch and effort statistics are collected from regular samples taken all around the island. This production data is not descriptive enough to use in stock assessment study (e.g. growth, mortality, distribution, abundance etc.,) which is vital for fishery development and management purposes. Descriptive records are available from research cruises but are not regular. A multi-disciplinary sampling design to collect catch, effort and length (age) data is needed.

A biological sampling program will also be worked out to collect data from landings and periodical exploratory surveys. This exercise would involve identification of species, aging, gut analysis, fecundity estimation, larval and fry studies, and plankton studies. Biological data is needed to study the inherent biological and ecological characteristics of the population at the species level and at the community level, besides being used for stock assessment purposes.

Tagging experiments to study migration pattern, growth, mortality, and interaction of different types of fisheries will be started in the second year.

Socio-economic studies of fisheries with respect to cost, benefits, infra-structure facilities, disposal of the harvest, quality of life, and conflict between different types of fisheries and communities in exploiting a common resource will be undertaken for a period of one year. This study would help in identifying means of developing and managing the fisheries in harmony with the fishing community.

These aspects of the study will be started in the seventh month and continued for the full period of the CRSP project.

5.4 Resource Surveys:

New methodology will be explored in order to use acoustic techniques from small craft to assess the biomass of standing stock in the shallow region from small craft. The validation of acoustic estimates as well as species-wise refined estimates will be performed by undertaking statistically designed trawl and other appropriate fishery surveys.

These surveys will be started in the second year of the project. One survey each, during south-west monsoon, inter-monsoon, north-east monsoon and inter-monsoon periods will be ideal. Each survey could be completed within 2 to 3 weeks.

5.5 Study of Selectivity of Gear:

It is useful to study gear selectivity for regulation and standardization of effort. This study will be undertaken in the second (or third) year for a full year period. This study will also be directed to assess the impact of different types of gear on the multi-species community.

Specific studies on selected species of prawn, by-catch, small pelagic fish, demersal fish, beche-de-mer, squid, cuttle fish, and crab will be undertaken after the first year's general study of the whole fisheries.

5.6 Continuation of the Programme:

The first half of the fourth year of the project will be spent on monitoring the whole fishery and continuing specific population studies. The second half of the fourth year will be spent on writing up reports and papers and planning out further investigations on problems emerging from the first three and a half years' studies.

6. INSTITUTIONAL CAPABILITIES:

6.1 Expertise Available:

The Marine Biological Resources Division, Oceanographical Division

and the Data Processing Division of NARA have only about seven qualified scientists (i.e. with post-graduate training in fishery science), the rest are junior science graduates although some have short term FAO training experiences on stock assessment methodologies. There are few scientists from the Universities who are engaged in research activities on aquatic resources. In addition, there are two to five scientists from private organizations who are involved in research and development activities on aquaculture and ornamental fisheries, and a few scientists from other countries also avail themselves of NARA's facilities.

The following is a list of tentative figures of number of scientists involved at present on fisheries and oceanographical research:

	Statistics Socio-Economics:	Brackish & Fresh Water:	Marine	Oceano-graphy	Not Classified:
NARA -	2	8	12	2	
Kelaniya University -					4
Sri Jayewardenepura University -					2
Colombo University -					3
Jaffna University -					2
Ruhunu University -					2
Others -					5

6.2 <u>Marine Fisheries Research Project Undertaken by NARA</u>:

Work on the following projects in the Marine Biological Resources Division has started in the middle of 1982:

- Tuna Fisheries Project
- Prawn Fisheries Project
- Beach Seine Fisheries Project

Many preliminary studies have begun on the following projects:

- Palk Bay Fishery Project
- Small Mesh Fishery Project

So far, land-based catch, effort, and biological data have been collected from the sea fisheries. In the lagoon fisheries, on the other hand, hydrographical information is being collected in addition to land-based information.

6.3 Field Stations:

NARA intends to run fully equipped field research stations at important fishing centres around the island. For this purpose, lands/buildings have already been purchased. The stations at Trincomalee and Kalpitiya are to be commissioned soon. Land/Buildings at Pesalai near the Palk Bay region have already been allocated for the construction of a field station.

7. PERSONNEL AND EQUIPMENT:

7.1 Personnel:

NARA will initially provide the following personnel for the project:

2 Research Officers: (Stock Assessment and Fishery Statistics, Fishery Biology)

2 Research Assistants

When expertise in relevant fields is not available, NARA will negotiate for participation of local University scientists and experts outside NARA. However, a scientist with post-graduate qualifications in stock assessment and with a number of years of field experience will lead the NARA team.

7.1.1 Staff to be recruited locally:

2 Research Officers for Oceanography and Socio-economics

10 Data Collectors on contract

2 Drivers

7.1.2 US Participation:

Senior Research Scientists (or Post-Doctoral Students) in the following fields is required from US Institutions:

1 for Statistics and Design of Sampling -

1 for Finfish Biology -

1 for Crustacean Biology -

1 for Plankton Studies

(Number of graduate and post-graduate students from Sri Lanka and USA could be added to this tentative list at later stages of project development.)

7.2 Equipment:

The list of equipment relevant to stock assessment studies available at NARA are given in Annex 7. A number of equipment need to be purchased for the following aspects of studies (three to six months time period is required to purchase these items):

1. Water quality (conductivity meter, plankton samplers, Nansen Bottles, spectrophotometer, current meters.)

2. Data Analysis (programmable calculators.)

7.3 Vehicles:

2 Wheel Drive Jeeps (To be purchased)

4 Motorcycles (To be purchased)

10 Push Bicycles (To be purchased)

8. OUTPUT:

A semi-annual progress report of the Projects will be submitted. It is useful to publish research papers and technical reports of special findings locally. It is also useful to organize Seminars/Workshops locally and internationally on tropical stock assessment methodologies and management.

9. EXPENDITURE:

9.1 Capital:

		US $
Equipment	..	50,000
2 Jeeps	..	40,000
4 Motor Cycles	..	6,000
10 Push Bicycles	..	1,000
Equipping the Field Station (Closer to Palk Bay)	..	40,000
Computer Time and Accessories	..	10,000
Total	..	147,000
Contingencies (20%)	..	29,400
GROSS TOTAL:	..	176,400

9.2 Recurrent (Annual)

Salaries of 2 Research Officers	..	4,000
Salaries of 10 Data Collectors and 2 Drivers	..	7,500
Fuel	..	6,000
Running Cost of Bigger Craft (60 Days)	..	30,000
Running Cost of Smaller Craft (100 Days)	..	10,000
Foreign Travel/Study Tours	..	40,000
Miscellaneous	..	20,000
Total	..	117,500
Contingencies (20%)	..	23,500
GROSS TOTAL:	..	141,000

Salaries, subsistence and data of local participants and US participants are not included.

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Imports and Exports of fish and fish products

Nets and nettings 1980 - 1981

Imports of fish and fish products	Quantity (tons) 1980	Value (Rs.)	Quantity (tons) 1981	Value (Rs.)
Maldive fish	231	4,306,948	95	1,309,189
Sprats dried, not salted	225	2,729,313	503	8,270,339
Fish dried, not salted	840	13,999,127	207	3,198,307
Fish dried, salted	10195	116,407,076	2877	44,717,542
Prawns	53	1,262,322	-	-
Prepared and preserved fish	10545	153,456,460	3143	50,122,267
Cod liver oil	-	-	-	-
Fish (alive, boiled or frozen)	0.1	109,116	0.6	40,442
Others	294	5,672,398	76	1,146,006
Total (fish and fish products)	22384	297,942,760	6903	108,804,092
Fishing nets and nettings				
Fishing nets and nettings	1916	21,107,326	not available	10,843,899
Total imports	22576	319,050,086	-	119,647,991
Exports of fish and fish products				
Fresh fish alive, chilled or frozen	181	18,412,113	136	30,752,539
Prawns	1706	182,632,472	2139	257,823,087
Lobsters	147	15,941,570	165	25,594,615
Shark fins and fish maws	52	11,266,994	395	10,487,380
Beche-de-mer	77	10,814,372	71	13,930,529
Other crustaceans and molluscs	140	7,997,331	98	6,268,744
Chank and shells	92	2,854,880	100	2,222,664
Others	-	-	9	1,332,396
Total	2397	249,919,732	2760	348,411,954

Value in Rupees (1 US = Rs. 22)

Estimated Marine Fresh Fish Production by Varieties 1981

	English name	Species	Weight in tons	Percent
1.	Seer	*Scomberomorus* spp.	4,470	2.6
2.	Travellies	*Caranx* spp.	10,162	5.9
3.	Skipjack tuna	*Katsuwonus pelamis*	13,543	7.9
4.	Yellowfin and big eye tuna	*Thunnus* spp.	7,542	4.4
5.	Frigate tuna and bullet tuna	*Auxis* spp.	11,222	6.5
6.	Shark	Laminiformes	9,639	5.6
7.	Skate	Rajiformes	10,998	6.4
8.	Large rock fishes	Epinephelus, Lutjanids, Lethrinids	8,975	5.2
9.	Small rock fishes	Epinephelus, Lutjanids Lethrinids (juvenile)	8,271	4.8
10.	Small shore seine	Clupeidae, Engraulidae Leiognathidae, Sciaenidae, etc.	63,436	36.8
11.	Large shore seine varieties	Sphyraenidae, *Trichiurus* spp. Beloniformes, *Chorinemus* spp. etc.	12,692	7.4
12.	Lobsters	*Penulirus* spp.	580	0.3
13.	Prawns	*Penaeus* spp., *Metapenaeus* spp.	5,175	3.0
14.	Crabs	*Neptunus pelagicus* *Scylla serrata*	1,311	0.8
15.	Squid and cuttle fish	Teuthoidea and Sepoidea	438	0.3
16.	Turtle		227	0.1
17.	Chank and shells		29	0.02
18.	Beche-de-mer	Holothuroidea	71	0.04
19.	Others		3,537	2.1
		Total	172,318	

CRABS

Year	Production (tons)	Export (Kg.)	Value (Rs.)
1977	1812	-	-
1978	1706	-	-
1979	1834	595	11,900
1980	1422	212	3,875
1981	1311	5219	148,439

Squids and Cuttle Fish

Year	Production (tons)	Export (Kg.)	Value (Rs.)
1977	583	-	-
1978	853	-	-
1979	656	240	17,325,791
1980	1069	140	7,997,331
1981	1100	98	6,268,744

Beche-de-mer (for export)

Year	Production (tons)	Value (Rs.)
1976	94	3,247,068
1977	51	1,727,047
1978	68	6,449,253
1979	60	6,278,453
1980	78	10,814,372
1981	71	13,930,529

Chanks and shells (for export)

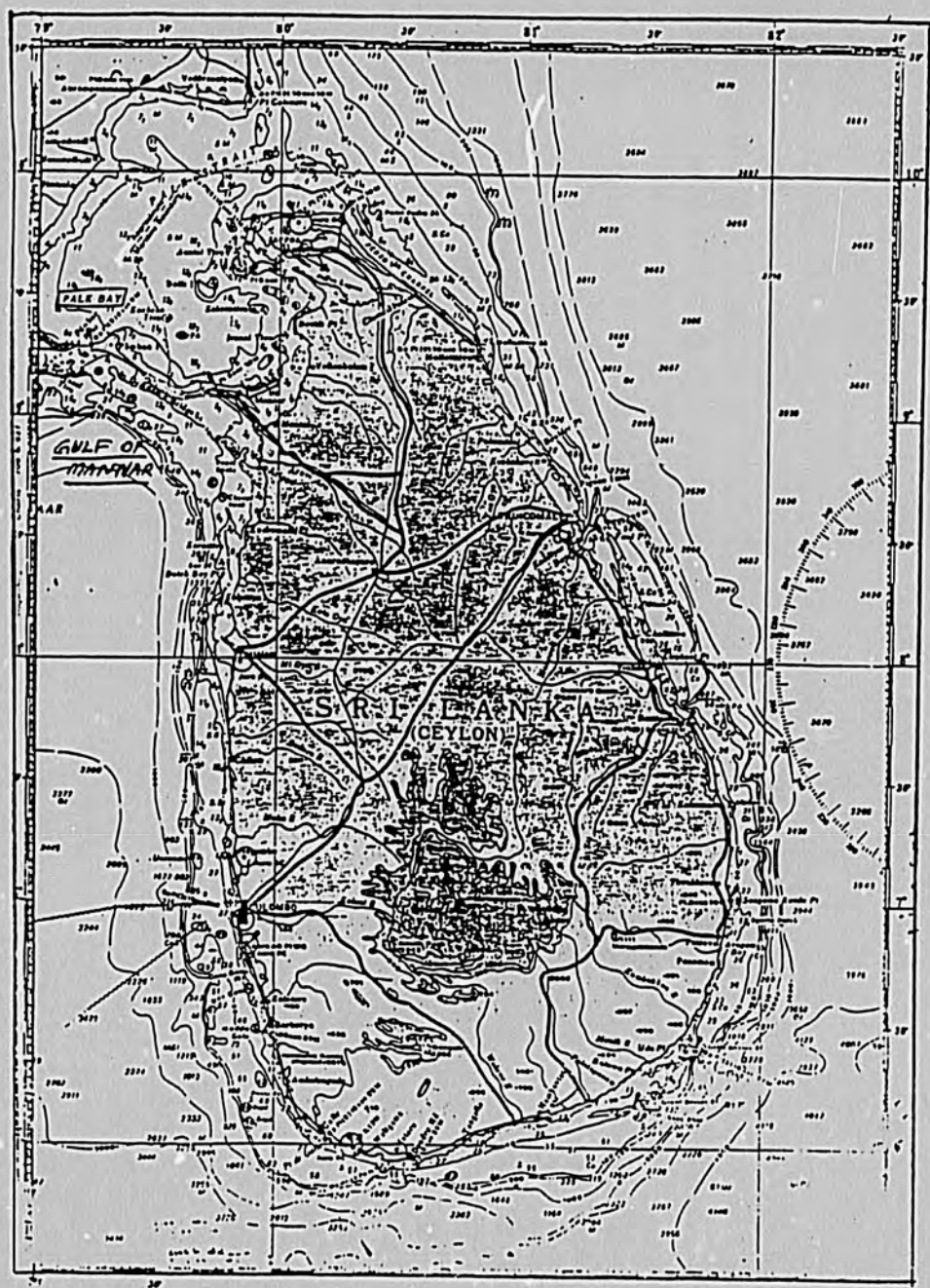
Year	Production (tons)	Value (Rs.)
1976	44	277,596
1977	31	237,867
1978	58	587,415
1979	130	2,043,434
1980	92	2,854,880
1981	100	2,222,664

Prawn

Year	Production (tons)	Export (tons)
1977	3864	1281
1978	4814	1934
1979	3338	2321
1980	3250	2483
1981	5175	2139

Lobsters

Year	Production (tons)	Export (tons)
1978	635	272
1979	230	212
1980	201	147
1981	580	165


PALK BAY
GULF OF
MANNAR
SRI LANKA
(CEYLON)

Annex 5

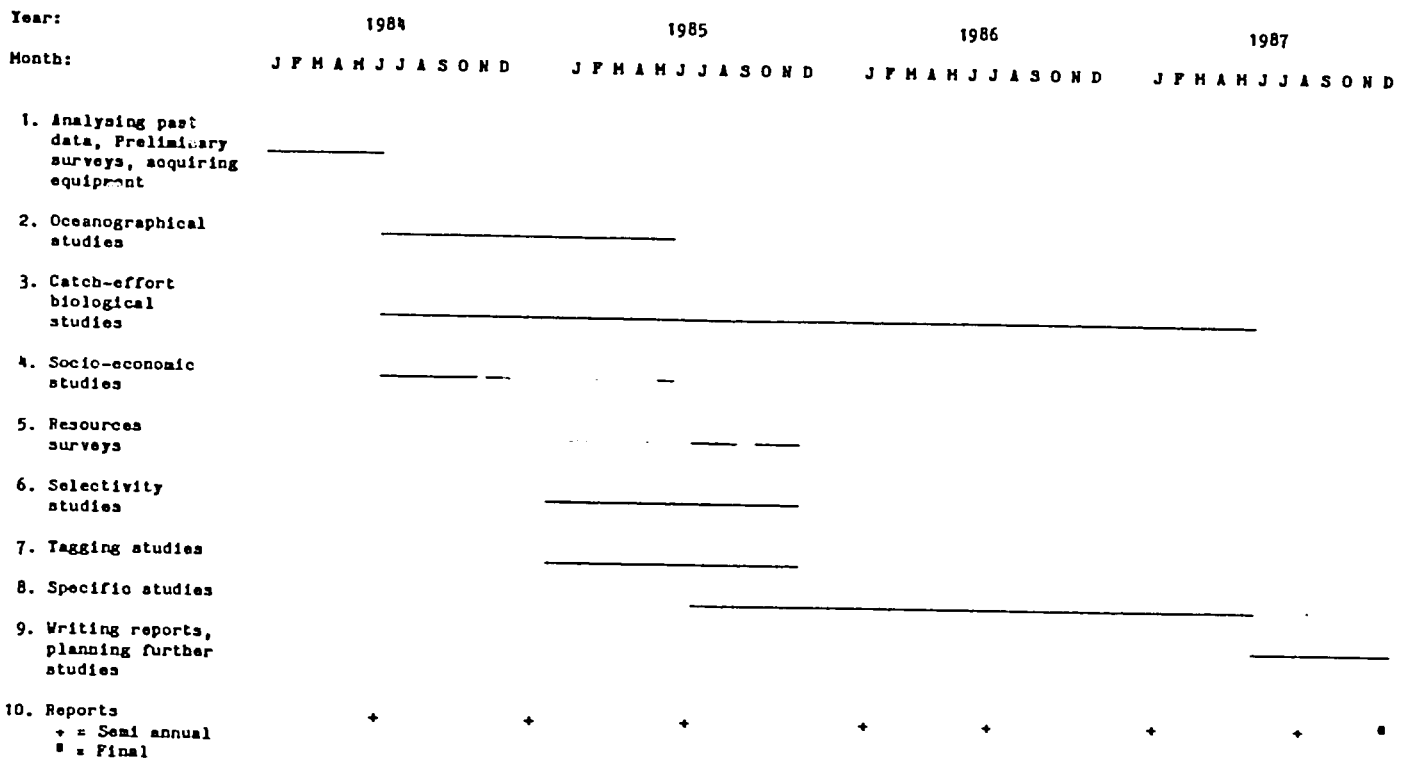
Fish Population in Mannar district in 1981

	Varieties	Mannar (tons)
1.	Spanish Mackerel	113
2.	Carangids	705
3.	Skipjack tuna	175
4.	Yellowfin tuna	56
5.	Small tunas	242
6.	Shark	1137
7.	Skate	2716
8.	Rock fish (large)	937
9.	Rock fish (small)	366
10.	Large pelagic fish	369
11.	Small pelagic fish	3610
12.	Lobsters	02
13.	Prawns	11
14.	Crabs	126
15.	Squid & Cuttle fish	+
16.	Turtle	-
17.	Chanks & shells	02
18.	Beche-de-mer	+
19.	Other varieties	1215
	Total	11782

+ Figures not available

Annex 6

TIME FRAME FOR STOCK ASSESSMENT CRSP PROJECT IMPLEMENTATION



Annex 7

Equipment and Vessel available at NARA

(Items relevant to stock assessment work are listed)

Equipment:

1. Nansen bottles
2. Refractometer
3. Spectrophotometer
4. Grabs (large and small)
5. Binocular microscopes
6. Monocular microscopes
7. Dissection microscopes
8. pH meters (Chemtrix type- 4)
9. Portable Echo-sounders (Furuno FG-200) Mark-3, Max. depth 87 m.
10. Precision balance-analytical (0.001 g.)
11. Electrical pan balances (0.001 g.)
12. Current meters
13. Sighting compass
14. Anemometer
15. Zooplankton net
16. Flow meter
17. Measuring boards
18. Measuring tapes
19. Verniner caliper
20. Barometer
21. Haemocytometers
22. Field spring balances (5 kg-1, 10 kg-2, 50 kg-1)
23. Conductivity meter (Chemtrix 700)
24. Binocular 10 x 70 MT (Fuji Meibo)
25. Portable generators (2.8 k VA-3.5 k VA)
26. Camping equipments
27. Diving gear
28. Plastic and glasswares
29. Outboard motors. (Yamaha-8hp. 15hp., 25hp.)
30. Fibre Glass boats (4-6m)
31. Rubber dinghy (4-6 capacity)

Computer: Computer time for use of Mini-Computer HP-4000 at FAO Tuna Secretariat in Colombo could be obtained by negotiation.

Vessels: Balaya II
Total Length-14 m, Beam 4.4 m, Gross ton 22, power 110 HP
Accommodation - 7
Radar (Furuno - 40 km.)
Echosounder (Furuno-24 V-DC, Max-depth 710 m.)
Transducer
Radio direction finder, Compass, Line hauler
Refrigeration plant
(Suitable for gill net and line fishery).

STOCK ASSESSMENT CRSP PROJECT SPECIFICATION

Proyecto:

PROGRAMA PILOTO PARA EL DESARROLLO PESQUERO EN AREAS SOMERAS DEL AFLORAMIENTO PERUANO

Coordinator: Juan Tarazona
Instituto de Ciencias Biológicas ANTONIO RAIMONDI,
Departamento de Biología, Universidad Nacional
Mayor de San Marcos, Apartado 1898, Lima-100,
Perú

Investigadores principales:
- Cesar Acleto (Museo de Historia Natural JAVIER PRADO)
- Marco Espine (Instituto del Mar del Perú y Universidad de San Marcos)
- Carlos Paredes (Instituto de Ciencias Biológicas ANTONIO RAIMONDI, Universidad de San Marcos)
- Juan Tarazona (Instituto de Ciencias Biológicas ANTONIO RAIMONDI, Universidad de San Marcos
- Abelardo Vildose (Dirección General de Extracción, Ministerio de Pesquería)

Duración: 2 años

Objetivos del proyecto:

Evaluar las poblaciones de los principales peces de fondo, crustáceos, moluscos y algas de importancia económica en la Bahía de Ancón, Perú, a su vez que obtener un conocimiente adecuado de sus interrelaciones con otros componentes del ecosistema.

Esto nos permitirá dar recomendaciones para el desarrolo de la pesca artesanal en áreas someras del afloramiento costero peruano, y posibilitará el posterior establecimiento de un "Centro Científico- Técnico de Asesoramiento al Pescador Artesanal y Maricultor", en coordinación con el Ministerio de Pesquería.

BREVE PLAN DE TRABAJO:

Se pretende ampliar los estudios de investigación que viene realizando el grupo DePSEA (grupo para el desarrolo pesquero en áreas someras del ecosistema de afloramiento) en la Bahía de Ancón y alvrededores, con la finalidad de evaluar los principales recursos bentónicos (crustáceos, moluscos y algas) y peces de fondo.

Los primeros 2 meses estarán dedicados a la implementacion y la selección de las áreas de muestreo. En los 18 meses siguientes se realizarán muestreos quincenalas de 2 días cada uno, a fin de cumplir con las actividades de las 5 líneas de trabajo. Los últimos 4 meses estarán dedicados a la elaboración del informe final.

Las líneas de trabajo son:

1. Evaluación de las poblaciones de los principales peces de fondo y sus relaciones alimenticias:

   Se evaluará las poblaciones de *Menticirrhus ophicephalus* "Mismis", *Paralichtys adspersus* "Lenguado de boca chica" y *Cheilodactylus variegatus* "Pintadilla", estimando el tamano del stock, estructura y dinámica de las poblaciones, distribución de huevos y larvas en el plancton, ciclo de reproduccion y fecundidad, contenido estomacal y distribución cuantitativa del bentos enlas áreas de pesca, a fin de estimar la selectividad del alimento.

2. Evaluación de las poblaciones de mariscos de importancia económica y sus relaciones alimenticias:

   Se evaluará las poblaciones del cangrejo *Plathyxanthus orbignyi* "cangrejo violado" y del gastrópodo *Thais chocolata* "Caracol",

identificando las áreas de distribución de las poblaciones naturales, la estructura y dinámica de la población, la distribución espacial y temporal de las larvas en el plancton, ciclo de reproducción y los hábitos alimenticios.

En los muestreos se utilizará fundamentalmente el buceo autónomo y trampas.

3. Evaluación de las poblaciones de macroalgas de importancia económica:

Se evaluará las poblaciones del alga roja *Gigartina chamissoi* "Cochayuyo", estimando la magnitud del recurso en biomasa, la estructura y variación estacional de la población.

4. Analisis de las características físicas y químicas del agua de mar y fondos asociados a las poblaciones:

Se tomarán datos de temperatura, salinidad, régimen de corrientes, concentración de O_2 disuelto en el agua, y las características topográficas y granulométricas del fondo.

5. Estadística y diagnóstico situacional de la pesca artesanal en la Bahía de Ancón:

IMPORTANCIA PARA EL DESARROLLO DE LA PESCA ARTESANAL:

Es conocida la elevada productividad en las áreas de afloramiento, pero después del colapso de la pesquería de la anchoveta peruana, se ha producido una aguda crisis en el sector pesquero, debido principalmente a la escasa información científica sobre el stock de los recursos alternativos, como peces y mariscos de aguas someras, que son explotados inadecuadamente por los pescadores artesanales.

Debido a este grave problema, en 1981 se formó en la Universidad de San Marcos un grupo multidisciplinario y multi-institucional, Grupo DePSEA (Grupo para el desarrollo pesquero en áreas someras del ecosistema de afloramiento), a fin de realizar investigaciones que permitan dar pautas para el desarrollo de la pesca artesanal y plantear estrategias alternativas de manejo de los recursos someros en anos con Fenómeno "El Nino". Además hacer posible el establecimiento de un "Centro de Asesoramiento Científico-Técnico al pescador artesanal y Maricultor".

PRESUPUESTO:

1.	Salarios (bonificaciones a 5 investigadores principales y 10 asociados, contratos eventuales)	$ 38,000
2.	Equipos (lancha, camioneta, ecosonda, aparejos de pesca, equipos de buceo, materiales de vidrio y plástico, etc.)	125,000
3.	Viajes de muestreo (viáticos, combustible, repuestos de vehículo, seguro de vida)	48,560
4.	Gastos en expertos y becas (8 expertos extranjeros por un total de 16 meses; 8 becas para el extranjero por un total de 24 meses; y 10 becas para tesistas nacionales)	170,000
5.	Apoyo administrativo y secretarial	18,440
	TOTAL	$400,000

FACILIDADES (contraparte peruana):

1. Apoyo logístico:

- 5 laboratorios equipados
- Asistencia del Centro de Computación Electrónica de la Universidad de San Marcos
- Una biblioteca especializada
- 1 omnibus Volvo
- 2 Choferes
- 1 empleado de servicio
- 6 buzos SCUBA científicos

2. Equipos:

Balanza analítica eléctrica, pH-metro, Incubadora Elconap Electric, Micrótomo, afilador de cuchillas de micrótomo, criostato, microproyectores Bausch & Lomb, juego de tamices estandard, Desionizador de agua Rovic, homogenizador de tejidos, centrífugas, bombas de vacio, refrigeradoras, microscopics compusestos binoculares y monoculares, microscopios estereoscópicos, autoclave, espectrofotómetro, balanzas, etc.

3. Salarios:

El 30% del tiempo de trabajo estará dedicado al proyecto.

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Stock Assessment CRSP Project Specification

Project:

A PILOT PROGRAM FOR THE FISHERY DEVELOPMENT OF SHALLOW AREAS IN THE PERUVIAN UPWELLING

Coordination:

Juan Tarazona
Instituto de Ciencias Biológicas ANTONIO RAIMONDI,
Departamento de Biología, Universidad Nacional
Mayor de San Marcos, Apartado 1898,
Lima-100, Perú.

PRINCIPAL INVESTIGATORS:

- Cesar Acleto (Museo de Historia Natural JAVIER PRADO, Universidad de San Marcos).
- Marco Espino (Instituto del Mar del Perú y Universidad de San Marcos).
- Carlos Paredes (Instituto de Ciencias Biológicas ANTONIO RAIMONDI, Universidad de San Marcos).
- Juan Tarazona (Instituto de Ciencias Biológicas ANTONIO RAIMONDI, Universidad de San Marcos).
- Abelardo Vildoso (Dirección General de Extracción, Ministerio de Pesquería).

DURATION: 2 years.

PROJECT OBJECTIVE:

The populations assessment of principal bottom fishes, crustaceans, molluscs and seaweeds with economic importance in Ancon Bay, including an exhaustive knowledge of their relation with others components of the ecosystem.

All these will permit us to give recommendations for the artisanal fishery development in the shallow areas of the coastal upwelling, and to the possibility of a future establishment of a "Technical-Scientific Center of advice to the artisan fisherman and shellfish farmer", in coordination with the Ministry of Fishery.

BRIEF WORK PLAN:

We pretend to enlarge the research studies, that are realizing the DePSEA group (Group for the fishery development in shallow areas of the upwelling ecosystem), in Ancon Bay, with the aim of evaluating the principal benthic resources (Crustacea, molluscs, and seaweeds), and bottom fishes.

The first two months will be dedicated to the implementation and to the sampling areas selection. In the next 18 months, semi-monthly sampling (2 days each one) will be done, in order to carry out the five work line activities. The last four months will serve for the final elaboration of the inform.

In general, it considers the following work lines:

1. Evaluation of populations of the principal bottom fishes and their trophic relations:

We will assess *Menticirrhus ophicephalus* "mis mis", *Paralichthys adspersus* "lenguado", and *Cheilodactylus variegatus* "pintadilla" populations, judging the stock, population dynamics and structure, the distribution of eggs and larvae in the plankton, fecundity and reproductive cycle, feeding patterns and food quantitative distribution in fishery areas, in order to evaluate the feeding selectivity.

2. Evaluation of the shellfish populations with economic importance and their trophic relations:

The assessment of the crab *Plathyxanthus orbignyi* "cangrejo violado" and the gastropod *Thais chocolata* populations, identifying the stock distribution, the population dynamics and structure, the temporal and spatial larvae distribution of the plankton, the reproductive cycle, and feeding behavior.

For the sampling, we will use traps and autonomous diving.

3. Evaluation of seaweed populations with economic importance:

We will evaluate the red seaweed *Gigartina chamissoi* population in order to judge the biomass magnitude, and the structure and seasonal variation of the same.

4. Evaluation of seawater and bottom physical and chemical characteristics related to populations:

We will take data on: temperature, salinity, currents, dissolved O_2, bottom topography and granulometric characteristics.

5. Statistical and situational diagnosis of the artisanal fishery in Ancon Bay.

IMPORTANCE FOR ARTISANAL FISHERY DEVELOPMENT:

It is known about the highest productivity in upwelling areas, but after the Peruvian anchovy fishery collapse, an acute crisis in the fishery sector has occurred, due mainly to the scarce scientific information about alternative resource stocks (fishes and shellfishes from shallow waters), that are exploited inadequately by artisanal fishermen.

Due to this acute problem, in 1981, a multi-disciplinary and multi-institutional group, DePSEA group, was formed in San Marcos University in order to realize researches. That will permit to improve the management strategies for the artisanal fishery development and to plan alternative strategies for the management of shallow resources in years with "El Nino" events. Also to make possible the establishment of a Technical-Scientific Center of advice to the Artisan Fisherman and Shellfish Farmer.

BUDGET:

1.	Salaries (Allowance for 5 principal investigators and 10 assorted investigators, eventual contracts).....	$ 38,000.00
2.	Equipment (Boat, 4WD wagon, echo-sounder, fishing gears, plastic and glass materials	125,000.00
3.	Trips for sampling (viatics, fuel, vehicle's spares, insurance).....	48,000.00
4.	Experts and scholarship expenses (8 foreign researchers by 16 months, 8 training scholarships by 24 months, 10 national scholarships).....	170,000.00
5.	Secretarial and administrative support.....	18,000.00
	Total	400,000.00

FACILITIES (Peruvian counterpart):

1. Logistic support:

-5 laboratories with adequate installations for the project execution.
-Assistance of the Electronic Computation Center of the University.
-1 bus (Volvo).

-2 drivers.
-1 service employee.
-6 SCUBA divers.

2. Equipment:

(Sartorius) analytical balance, (Bechman) pH-meter, (Elconap Electric) incubator, (820 Spencer) microtome, knife sharpener, cryostat (Lipshaw Electric), (Bausch & Lomb) microproject, Standard sieve set, ionic water purificator (Rovic), homogenizertissue, centrifuges, vacuum pump, refrigerators, monocular and biocular microscopes, stereoscopic microscopes, autoclave, spectrophotometer, balances and others.

3. Salaries:

30% of work time to project.

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SURVEY OF ARTISANAL FISHERIES ON THE NORTH COAST OF PERU

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PROJECT :

STUDY OF ARTISANAL FISHERIES IN CONSTANTE VILLAGE (Piura, Peru).

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UNIVERSIDAD NACIONAL DE TRUJILLO

Departamento de Ciencias Biologicas

Seccion de Recursos Acuaticos

San Martin 356

Apartado 952

TRUJILLO

By:

Ms. Alvaro Tresierra-Aguilar

Fishery Biologist

TRUJILLO-PERU
1,983

This is a project for the Stock Assessment Collaborative Research Support Program (Stock Assessment CRSP) to be funded by U.S. AID.

This project was made by Alvaro Tresierra-Aguilar, who is a teacher at the National University of Trujillo, Peru, Section of Aquatic Resources.

This project proposes to study the Artisanal Fisheries in Constante Village in order to improve the economical and social condition of the fishermen in this community.

SURVEY OF ARTISANAL FISHERIES ON THE NORTH COAST OF PERU

1. NAME OF THE PROJECT: Study of Artisanal Fisheries in Constante Village (Departamento de Piura, Peru)

2. LOCATION:
   - 2.1. GEOGRAPHICAL AREA: The survey area is located in Constante Village (05° 40'S, 80° 51'W), which is in Sechura Bay. (Fig. 1)
   - 2.2. RESEARCH CENTER: Section of Aquatic Resources of the National University of Trujillo (San Martin 356, Trujillo, Peru).

3. JUSTIFICATION OF PROJECT

3.1. BACKGROUND

3.1.1. GENERAL INFORMATION ON PERUVIAN FISHERIES

In Peru, the industrial fishery for fish meal, mainly from anchovies and sardines, is highly developed. Another important role is played by the sardine fishery for producing canned fish. Both fish meal and cans are produced only for export. The "Instituto del Mar del Peru" (IMARPE), the governmental fisheries investigation department, is responsible for the study of the marine resources of Peru and has to give management recommendations to the Fishery Ministry.

3.1.2 ARTISANAL FISHERIES IN PERU

Artisanal fisheries are spread along the whole Peruvian Coast. They are an important factor in the supply of the coastal population with fish products. Very little is known about the extent of the artisanal fisheries in Peru, about the quantities of the landings, the species composition and the sizes of stocks.

Most information of the artisanal fisheries is related to the description of the gear. Salas (1969), described the gear and the methods used on the Coast of Tumbes. Zelada (1970), reported the gear on the Coast of La Libertad. Moran (1975), studied the gear in Tumbes River Estuary. Castillo (1975), reported the gear in Puerto Nuevo y Colan (Paita). Carrion (1975) and Sanchez (1975) studied the economic and social situation of the artisanal fishermen in Huanchaco Village (La Libertad), and also the gear used by fishermen.

The "IMARPE" is engaged mainly in studying the industrial fishery and carries out stock estimates of anchovies, sardines and the hake. Furthermore, the "IMARPE" is located in Callao (Lima) and everything is, therefore, very much centralized in Lima. For these reasons, very little attention is paid to the artisanal

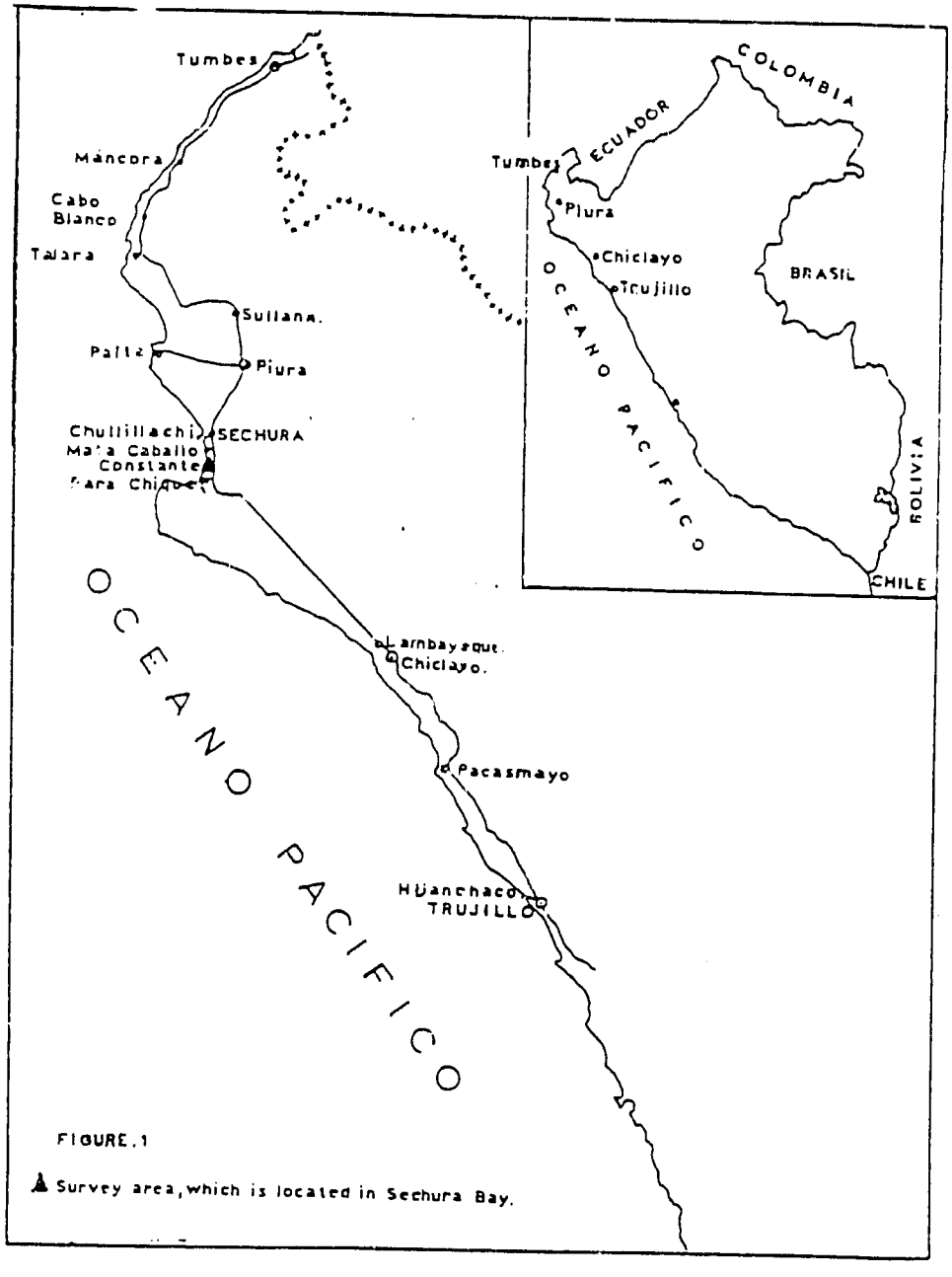

FIGURE.1

▲ Survey area, which is located in Sechura Bay.

fisheries from the scientific, economic and social points of view.

3.1.3. CONSTANTE VILLAGE

Constante Village is a village with about 50 families. The economic situation of these families is very low. Their houses are made of adobe, electricity is not available and fresh water has to be transported to the village from the outside. The population depends totally on their fishing activities. They catch mainly elasmobranchs. The fishes are dried and sold to intermediary agents who come with their trucks from outside of the village (Figs. 2, 3).

3.1.4. ARTISANAL FISHERIES IN CONSTANTE VILLAGE

Not much is known about the species composition of the catches, the size of the stocks and the usefulness of the fishing gear. The fishery is based on elasmobranchs such as: Pacific guitarfish (*Rhinobatos planiceps*), Eagle ray (*Myliobatis peruvianus*), Sting ray (*Urotrygon spec*), Angel shark (*Squatina armata*). The fishermen use small boats without engines and operate gillnets and beach seines. The fish are dried in the sun (Figs. 4, 5, 6, 7).

4. OBJECTIVES AND GOALS OF PROJECTS

4.1. SCIENTIFIC OBJECTIVES

- Collection of basic data on biology and population dynamics of the most important species.
- Establishment of a management plan on the artisanal fisheries of Constante Village.
- Improvement of the fishing performance of the fishermen by better fishing gear and methods.
- Improvement of the fish processing.

4.2. ECONOMIC AND SOCIAL GOALS

- To increase the catch per unit effort
- To keep a permanent fish resource
- To offer a better fish product
- To increase the profits of the fishermen
- To improve the economic and social situation of the population of Constante Village

5. DURATION OF PROJECT

1. Phase: Basic investigation about fish resources, catches, species composition, gear used, fish processing and economic and social situations of the artisanal fishermen in Constante Village (6 months)

Figure 2. Fishermen are working with their nets

Figure 3. Agents with their trucks are buying dry fish

Figure 4. The drying fish process in Constante Village.

Figure 5. The drying fish process in Constante Village

Figure 6. The drying fish process in Constante Village

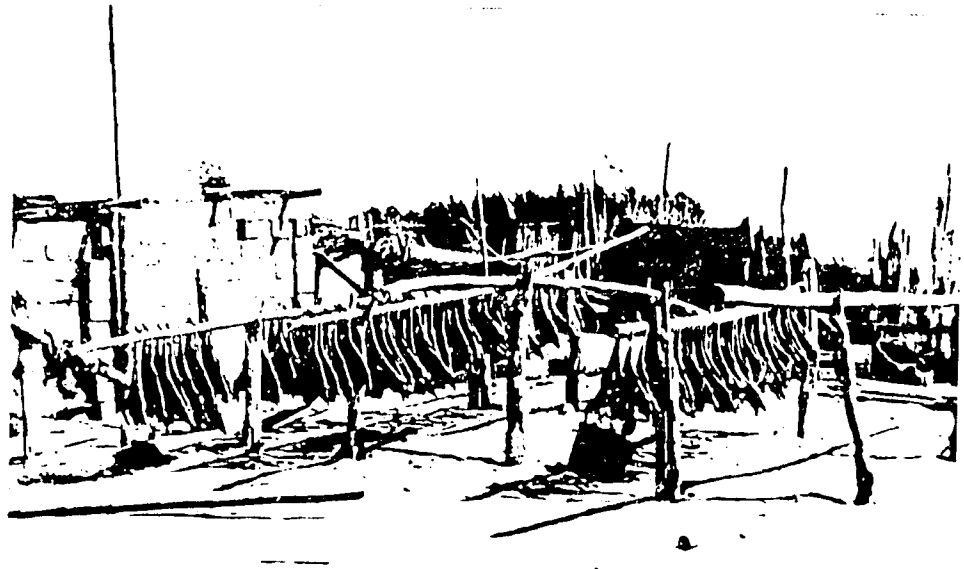

Figure 7. The fish are dried in the sun.

2. Phase: Collection of basic data on biology and population dynamics of the most important species; establishment of a management plan on the artisanal fisheries of Constante Village; improvement of the fishing performance of the fishermen by better fishing gear and methods; improvement of the fish processing (4 years)

Optional Phase: Depending upon the funds available, the project could be amplified and include more fishing communities in the vicinity of Constante Village. In this case, the project in Constante Village, could be considered as PILOT PROJECT.

6. STRATEGY FOR RESEARCH

6.1. It is assumed that the stocks of elasmobranchs in the area fished by the fishermen of Constante Village are underfished. The fishermen probably do not use adequate fishing gear. The drying process is made in poor conditions.

It is necessary to assess the stocks by biological investigations in order to understand the dynamics of the population and to determine the amount of fish that can be captured by the fishermen.

Also, it is necessary to evaluate the fishing effort and to experiment with other types of gear in order to improve the fishing capacity.

The drying process must be improved by other technologies.

6.2. PROBLEMS INVOLVED

We are aware of the particular difficulties involved in the study of fisheries for elasmobranchs, for instance: that elasmobranchs cannot be aged easily and that stock and recruitment are closely related to each other. That means that many of the basic methods of stock assessment are not readily applicable to elasmobranchs and that the close relationship between stock and recruitment makes elasmobranchs very vulnerable to fishing.

6.3. RESEARCH LINES

6.3.1. Life History
- A) Age and growth determination
- B) Sex, maturity and fecundity
- C) Food and feeding

6.3.2. Population (Stock)
- A) Distribution and fishing areas
- B) Structure
- C) Population dynamics
- D) Stock assessment

6.3.3. Exploitation
- A) Evaluation of gear and boats in use now
- B) Experimentation with other types of gear and boats
- C) Selectivity of gear
- D) Catch per unit effort

6.3.4. Technology

A) Evalution of the process in use now

B) Introduction of other processing methods

7. LOGISTICS

7.1. STAFF

<u>From the National University of Trujillo, Peru</u>

- Prof. Alvaro Tresierra-Aquilar
  Coordinator of the Project and study of life histories of fish

- Prof. Jorge Correa-La Torre
  Fishing technology

- B.P. Jorge Oliva-Nunez (To be hired)
  Population dynamics and stock assessment

- B.P. Wilmer Carbajal-Villalta (To be hired)
  Distribution of fish and fishing areas and structure of fish population

Every year, 30 students terminate their studies in Fisheries by carrying out a practical project in fisheries which lasts a minimum of 6 months.

Every year, up to 10 of these students could do their practical project within the framework of the project proposed here.

<u>Necessary Involvement of American Universities</u>

Scientists from American universities are needed for advice in the following subjects:

- Population dynamics and management of elasmobranch stocks
- Fishing technology
- Fishing processing
- Optional: Advice on how to improve the economic and social situation of the fishing community.

7.2. COORDINATION WITH OTHER INSTITUTIONS

It is necessary to coordinate the project with the Regional Fishery Direction I (Piura) and with the leader of the Constante Village fishermen in order to get support for the collection of basic data. We would like to establish contacts to the following American universities: Dr. Howard Horton, Department of Fisheries and Wildlife at Oregon State University, Corvallis, Oregon; Department of Quantitative Fisheries at the University of Washington in Seattle, Washington; or the University of Rhode Island who are working on the same problems as we.

7.3. TRAVELS

A regular scientific sampling schedule has to be established in Constante Village. Samples must be taken every month for about one

week.

7.4. EQUIPMENT, MATERIAL AND OTHER

7.4.1. Laboratory materials

7.4.2. Laboratory equipment

- Scales
- Microscopes
- Stereoscopes
- Typewriter
- Pocket calculators
- Furnace
- Refrigerators
- Deep Freezer

7.4.3. Other equipment

- Light truck
- Speedboat
- Fishing equipment
- Fish processing equipment
- Tent and camping equipment

7.4.4. Office material

7.4.5. Literature

8. REPORT AND PUBLICATIONS

8.1. REPORT

A report will be presented every six months

8.2. PUBLICATIONS

To be determined.

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PROJECT PROPOSAL

STOCK ASSESSMENT OF THE PENAEID SHRIMP IN CILACAP, THE SOUTH COAST OF CENTRAL JAVA

I N D O N E S I A

M. UNAR

RESEARCH INSTITUTE FOR MARINE FISHERIES

J A K A R T A

1982

1. OVERVIEW OF THE INDONESIAN SHRIMP FISHERY

The important role of the shrimp fishery in the Indonesian fishery is unquestionable. Statistical data shows that Indonesian penaeid shrimp production was 130,000 metric tons in 1979, while the annual global catch of tropical penaeid shrimp amounts to 700,000 metric tons (Rothschild and Gulland, 1982). Shrimp is the leading fisheries export commodity, its value increases every year. In 1968, the value of shrimp exports constituted just 29% of the total value of exported fisheries products but had increased to 90.6% by 1979 and was worth US $200.5 million (CBS, 1980).

The shrimp fishery has developed rapidly since trawling for shrimp began in 1966. The steady rise in both the demand and price of shrimp products has become a stimulus for national and foreign capital investment in the shrimp fishery. These investments were not only for catching shrimp at sea but for the inshore shrimp processing facilities as well.

It is known that penaeid shrimp are fished in almost all coastal areas of Indonesia. The most important species supporting the Indonesian shrimp fishery belongs to the family Penaeidae. The fisheries exploit more than 40 species with the most important species being: banana (*Penaeus merguiensis*, *P. indicus*, *p. chinensis*), tiger (*P. monodon*, *P. semisulcatus*), king (*P. latisulcatus*), endeavour (*Metapenaeus monoceros*, *M. ensis*, *M. elegans*) and rainbow (*Parapenaeopsis sculptilis*, *P. coromandelica*) and pink (*Solenocera crassicornis*, *S. Koelbeli*). *P. merguiensis*, *M. ensis* and *Parapenaeopsis* spp constitute the bulk of the catch.

The major shrimping grounds are on the west coast of Sumatra (Meulaboh, Sibolga, Air Bangis, Air Aji, Bengkulu), the Malacca Strait, the east coast of Sumatra (Riau, Jambi, South Sumatra, east coast of Lampung), Lampung Bay, the south coast of Java (Pangandaran, Cilacap, Gombong, south Jogjakarta, Pacitan and Nusa Barung), the north coast of Java (from Banten Bay to Madura Strait), off Kalimantan (West, Central, South and East), South Sulawesi (West coast and Gulf of Bone), Aru Island in Molluccas, the Arafura sea (West Coast of Irian Jaya) and Biak area (north coast of Irian Jaya). The Arafura sea, a remote fishing ground, is considered to be one of the most productive and extensive shrimp fishing grounds in the country.

There are two groups of gears employed in the shrimp fishery, i.e. the traditional group such as the tidal trap, lift net, bottom gill net, Danish seine, beach seine, push net, and the modern group such as the trawl net.

Traditional fisheries exploiting the shrimp stocks have been in operation for a long time. Inshore, a beach seine (arad) and a bottom gill net (ciker, klitik) fishery exploit shrimp in modest quantitites. In estuarine waters, various kinds of gear are taking "rebon", a mixture of several kinds of shrimp belonging to the Penaeidea, Caridea, and Mysidacea. Tidal traps like sero's - V - shaped dry stake traps - and bubu's - bamboo - screen traps - are the most important gears. The other type of tidal traps are bubu and cici which are generally conical in shape and made from synthetic twine. The mouth of the trap is placed between two poles set in the bottom of the sea and nets are placed in depths between 2 and 6 meters so they can fish when the tide is flooding or ebbing. These kinds of traps are employed on the east coast of Sumatra and in the coastal areas of Kalimantan.

Although trawling was introduced as early as the 1950's for experimental purposes, the commercial operation was started in 1966. It is well known that a wooden stern trawl fishery in Indonesia was developed in Bagansiapiapi area in the Malacca Strait of Sumatra, which seems to have been greatly influenced by the development of the trawl fishery in West Malaysia. These trawlers, in Java are well known as Bagansiapiapi or Cung King type.

The Strait of Malacca is becoming the most heavily exploited trawling ground with the number of trawlers increasing rapidly up to over 800 in 1971. The catch rates had been dwindling rapidly. About 50 trawlers moved their operation to the north coast of Java. In 1972, some trawlers moved to Sibolga on the west coast of Sumatra and to the south of Sulawesi in 1973. It is a surprising fact that the number of trawlers based at Bagansiapiapi area in 1976 was only 227, whereas the number of trawlers that had spread to other areas was more than 2,000.

The development of "baby trawlers" in West and East Kalimantan is not dependent on the growth of the trawl fishery in Sumatra and Java. The trawl fishery in those areas was developed by fishermen of Chinese origin and the fishery was greatly influenced by the development of the trawl fishery in Sabah - East Malaysia.

Double rig shrimp trawlers of 100-600 G.T. were developed by joint-venture companies between Indonesia and foreign (mainly Japanese) companies. In 1968, a company with Japanese capital obtained a license for shrimp fishing in the waters of West and Central Kalimantan with 13 vessels. In 1969, three Japanese fishing companies started operations in the Arafura sea and adjacent waters. With a recognition of richness of shrimp resources in the area, the number of shrimp trawlers has rapidly increased; by the end of 1982, 125 of shrimp trawlers were employed.

Table 1 gives marine shrimp catches by island for the year 1973-1979 as reported by the Provincial Fisheries Service. Sumatra is the leading producer of marine shrimp with over 40% of the Indonesian marine shrimp catch and is followed by Kalimantan. The catch is dominated by small shrimp, i.e. Parapenaeopsis spp and Metapenaeus spp. Mollucas and Irian Jaya produce over 15% of the Indonesian marine shrimp catch, which is dominated by larger (exportable size) Penaeus and Metapenaeus, while Cilacap in the south coast of Java, with a limited shrimping ground, produces almost 10% of the national shrimp catch.

Shrimp is the most important commodity for export. In 1979, 34,721 metric tons of shrimp were exported and worth more than US $200.5 million. This represents 61% of the volume and 91% of the total value of fisheries exports. The bulk of the shrimp exports is fresh frozen, amounting to 93% of the exported shrimp weight and 99% of its value. A tendency of decrease in the shrimp export is shown at the end of 1980 and 1981 when it dropped to 31,858 metric tons and 24,700 metric tons, respectively, and its associated value dropped to US $185.1 million and US $162.7 million. The sudden decrease was associated with the latest trawl regulation where the number of trawlers in the entire waters of Indonesia was reduced from 3,500 trawlers to 1,000 trawlers.

Since October 1980, trawling has been totally banned in Java and Bali and by January 1981, in Sumatra. By July 1981, the number of trawlers that fish outside the waters of Sumatra, Java and Bali was reduced to 1,000 and by the

end of 1982 trawling was totally banned.

2. RESEARCH AREA

2.1. Determination of the research area

South coast of Java with Cilacap as its main base for the shrimp fishery was chosen as the research area, based upon the following considerations:

- The Cilacap's area as a potential shrimp ground, its yield contributes about 10% of the national shrimp catches (in 1979 prior to the trawl ban).

- This area is quite crowded with the traditional fishermen. In the period before the trawl ban, trawl net was the main gear employed in this area. More than 95% of the shrimp and the fish landings were from the trawler's catch.

- There is a quite large brackish water lagoon, Segara Anakan (±4,000 ha.), westward to Cilacap, surrounded by 24,500 ha. of mangroves, the largest mangrove area that still remains in Java, and is the main shrimp nursery ground in the south coast of Java.

Cilacap is located in the south coast of Central Java, about 475 km from Jakarta, it can be reached by land (bus, railroad) and by air (with a frequency of twice a week).

2.2. Description of the research area and its shrimp fishery

The shelf along the south coast of Java is generally very narrow. Its widest extension is found in the Cilacap area, where a plain reaches the ocean (Figure 1). In the western part of this plain is a brackish water lagoon (about 4,000 ha.), the Segara Anakan, surrounded by mangrove covered wetlands (about 24,500 ha. plus 4,000 ha. of tributaries, ECI, 1975). The lagoon receives its fresh water from various rivers, among which the Citanduy is the most important, and its saline water from the open ocean via two connections.

In the east, it is connected to the Penyu Bay while in the west to the Penanjung Bay. The two bays are the main shrimp grounds in the Cilacap area. To the east of the Penyu Bay, a narrow strip of shrimp ground is also found in the vicinity of Gombong and Yokyakarta waters.

Fishing for shrimp mostly takes place within 25 km from the shore at depths ranging from 3 m to about 100 m, but usually from 15-65 m. The total surface area of the fishing grounds (up to the 100 m isobath) is estimated at about 5,200 km^2.

More than twenty species mainly belonging to the family Penaeidae (Crustacea, Decapoda) support the Cilacap shrimp fishery, which also catches incidentally a wide range of fish species. Only six shrimp species, however, constitute the economic basis of the fishery.

Following the imposition of the trawl ban in 1980, some traditional gears such as the beach seine and trammel net became important and

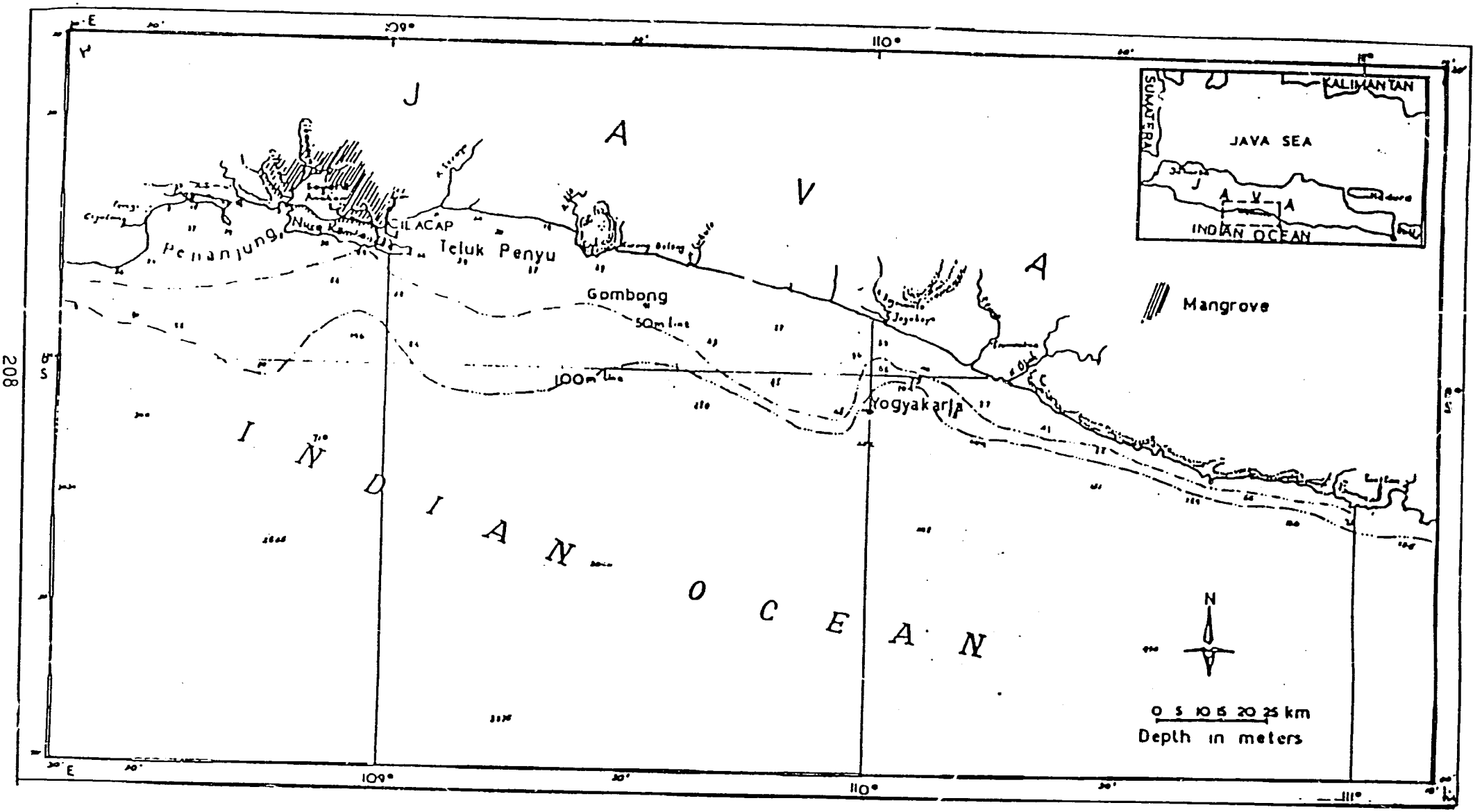

Figure 1. Map of the shrimp fishing grounds : Penanjung, Teluk Penyu-Gombong and Yogyakarta.

started to replace the trawl net in catching the shrimp resources.

3. PROBLEM AREAS

Fast development in the shrimp fishing industry in the past had invited the government to impose management measures. The measures were not necessarily aimed at the shrimp stock only but rather for the general fishery resources. The measures were imposed in 1976 (Ministerial Decree No. 607/Kpts/Um/9/1976) but due to the lack of enforcement, the measure was not so effective and as a result, trawling was totally banned in 1980.

It is unfortunate that the measures were not strongly based on the research information. Information related to the dynamics of the shrimp resources that will be useful for the management are still far from complete and the following are the key problems faced by assessment biologists:

(1). Statistics

The shrimp fishery in the Cilacap area developed very rapidly in the last decade and, prior to 1980, the catches came mostly from the trawl fishing. With the ban of trawl fishing, the catches dropped down and the catches have been from traditional gears such as the trammel net and bottom gill net. The catches from these gears are difficult to record because the fishermen can land their catches in almost any place and not necessarily in the landing places that were mostly used by the trawl fishermen. This causes uncertainty in the catch statistics as some of them must be estimated through personal interviews.

(2). Multitude of species

Shrimp catches belong mostly to the family Penaeidae and in general *Penaeus* and *Metapenaeus* are the dominant genera. *Penaeus merguiensis* is the main species especially for export since they reach a larger size than those of the genus *Metapenaeus*, the latter may consist of more than 3 species (Van Zalinge & Naamin, 1975). In addition to the multitude of species, shrimp are generally caught together with other demersal fishes which themselves consist of many species. Inter-relationships among the species of the shrimp resources is not known, nor between shrimp and the demersal fishes. Such a study is needed if we want to come up with sound management measures.

(3). Stock recruitment

Although *Penaeus merguiensis* was considered the main species in the catches, no study has been made to understand the relationship between stock and recruitment in this species. Potential for doing this in the Cilacap area seems to be high because of the special location of the nursery ground in the lagoon which is separated from the open ocean only by two openings.

(4). Mangroves

The area of mangroves in the vicinity of Segara Anakan lagoon, located west of Cilacap, reaches 24,500 ha. (ECI, 1975). This area was

reduced to 14,000 ha. in 1982 due to activities related to agriculture, forestry, settlement and others (report from P.N. Perhutani Banyumas). The importance of mangroves to the shrimp fishery has been recognized (McNae, 1974; Martosubroto and Naamin, 1977) but the real support of the mangroves in the Cilacap area to the shrimp fishery has never been studied thoroughly.

The silting process in the Citanduy River has been the cause of the shallowing process in the Segara Anakan lagoon and, in the long run, it will reduce the area of the lagoon (ECI, 1975). Whether this will have an impact to the shrimp fishery as a whole is still requiring further study.

(5). Stock assessment

Lack of basic information for assessing the shrimp stock has forced scientists to apply simple models such as the total biomass Schaefer model (Van Zalinge & Naamin, 1975). Although analytical models of Beverton and Holt can eventually be applied to *Penaeus merguiensis*, no attempt has been made due to the unavailability of certain parameter estimates. Basic information on the interaction pattern between major species in the fishery should be studied to understand the entire dynamics of the shrimp resources in the area. Such information is needed for further action in fishery management.

4. PERIOD OF THE PROJECT

Since considerable information is needed for understanding the resources and fisheries, the project should cover 5 years with the first two years as the basic program. The program can be broken down into the following steps:

First year

- examine multispecies data
- define recruitment experiment in terms of laboratory work/enclosures study
- design fisheries data collection

Second year

- refine fisheries data : catch and effort
- collect multispecies data through food study
- set up recruitment experiment

The next three years would cover the same subject but with more emphasis on certain aspects to come up with assessment models.

5. BUDGETING

U.S. contribution		$ 500,000
Indonesia contribution		$ 125,000
	Total	$ 625,000

Personnel

U.S. contribution (Univ. & USAID)	1 co-project leader 1 graduate student
Indonesian contribution:	- 1 project leader - 2 biologists - 1 biologist from the University

6. FACILITIES

- office space - RIMF Jakarta
- boat of 30 tonnage (U.S. contribution)

7. REFERENCES

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Table 1. Marine shrimp catch in Indonesia, 1973 - 1979 (in 1,000 tons).

Coastal Area	1973	1974	1975	1976	1977	1978	1979
Sumatra	20.8	22.9	24.1	66.5	73.6	74.1	74.8
- West coast			1.4	1.2	1.1	1.0	1.3
- Malacca Strait			20.6	62.8	66.5	70.0	68.2
- East coast			2.0	2.5	5.0	3.1	5.3
Java	5.9	4.7	9.8	13.3	22.3	17.9	17.5
- North coast			6.7	10.3	17.4	12.7	11.3
- South coast			3.1	3.0	4.9	5.2	6.2
Kalimantan	11.6	7.9	11.7	13.1	16.6	19.7	24.9
- South & west			7.5	8.2	10.9	11.9	14.1
- East coast			4.3	4.9	5.7	7.8	10.8
Sulawesi	5.1	3.5	3.2	3.4	4.1	5.2	5.2
- South Sulawesi			2.5	3.3	4.0	5.2	5.1
- North Sulawesi			0.2	0.1	0.1	-	0.1
Bali and Nusa Tenggara	0.3	0.5	0.3	0.1	0.1	0.1	0.1
Molluca and West Irian	9.4	10.3	9.3	8.9	8.8	9.0	10.2

Source: Fisheries Statistics, Directorate General of Fisheries (1973-1979).

Note : Until 1975 landings were not specified by coastal area.

Stock Assessment CRSP Project Specification

Edgard Valdivia

Evaluacion De Los Recursos Costeros Extraidos Por La Pesqueria Artesanal En Las Principales Zonas Del Litoral Peruano

1. OBJETIVOS DEL PROYECTO

- Determinar la abundancia relativa y estimar tasas de explotación por especie de las principales poblaciones de peces que soportan la pesquería artesanal en las 7 más importantes zonas del litoral peruano.

- Estimar los principales parámetros biológicos y poblacionales que permitan la aplicación de modelos matemáticos para la evaluación de peces costeros.

2. ANTECEDENTES

El aporte de las especies capturadas por la pesquería artesanal as altamente significativo ya que aunque las estadísticas de desembarque no reflejan la totalidad de las capturas por la falta de un buen sistema para obtenerlas, y por la inadecuada infraestructura con la que se cuenta, las cantidades desembarcadas alcanzaron en los ultimos años entre 150,000 y 200,000 tons por año; es decir, el 30% de los productos marinos que se destinan para el consumo humano.

Esta pesquería está constituída por 20,000 pescadores, los cuales utilizando alrededor de 5,000 pequenas embarcaciones, capturando 20 a 30 especies de peces de los cuales 15 son emineneemente costeras, destancando el machete Ethmidium maculata chilcae, lisa Mugil cephalus, lorna Sciaena deliciosa, pejerrey Odonthestes regia, cabinza Isacia conceptionis, suco Paralonchurus peruanus, tollo Mustelus whitneyii, y cachema Cynoscion analis. Estas especies son desembarcadas en 75 puertos y caletas del litoral peruano.

EL IMARPE a partir de 1977 al crear el Area de Evaluación de Recursos Costeros, ha venido realizando estudios biológicos y pesqueros de las especies arriba señaladas. Así, en 1980 realizó un estudio sobre el el sistema de obtención de estadística de desembarque de la pesquería artesanal con el asesoramiento del consultor FAO, M. Walsh, y se propuso un nuevo sistema para la obtención de estadísticas. Este nuevo sistema se puso en operacion a nivel piloto a fines de 1981 en al litoral norte.

Desde 1979 a 1981 se realizaron encuestas sobre embarcaciones, artes y pescadores de la pesquería artesanal en las zonas de Callao, Pisco e Ilo. En 1982 se preparó un trabajo sobre el estado actual de la pesqueria artesanal en el litoral peruano, en el cual se hace una descripción relativa a pescadores, embarcaciones, artes de pesca, desembarcos, mercadeo, organización, apoyo gubernamental, capacitación, etc.

Finalmente, desde 1977 en el Area de Recursos Costeros se realizaron estudios sobre reproduccion, edad, credimiento, alimentación, factor de condición, longitud, peso, proporción de sexos, distribución y concentración y datos de captura y esfuerzo, principalmente de las zonas

de Callao, Pisco, y en menor proporción en Paita, Chimbote e Ilo.

3. ORGANISMOS RESPONSABLES, EJECUTOR Y DE ASESORAMIENTO

Del Proyecto	: Instituto del Mar del Perú
De su ejecución	: - Area de Evaluación de Recursos Costeros - Laboratorios Costeros - Responsables de obtención de datos estadísticas de desembarque y biológicos en las zonas de Parachique, Santa Rosa, Salaverry, Huacho, Callao, Pisco e Ilo.
De asesoramiento	: Investigadores de universidades de Estados Unidos.

4. NATURALEZA DEL PROYECTO

El proyecto, mediante la aplicación de un nuevo sistema de obtención de estadísticas de la pesquería artesanal así como de obtención de datos biológicos y poblacionales, permitirá contar con los parámetros fundamentales para ser aplicados en los modelos de evaluación de poblaciones de peces.

Si se tiene en cuenta la magnitud de esta pesquería en el litoral peruano como se señala bajo antecedentes, se comprenderá la necesidad de realizar un estudio integral, a fin de proporcionar al Gobierno las pautas necesarias que le permitirán manejar adecuadamente este problema asi como para su politica crediticia con los pescadores artesanales.

5. BENEFICIOS QUE SE PREVEEN

Considerando que los recursos costeros son extraídos por:

a) embarcaciones pequeñas y la mayoría de ellas construídas mucho tiempo atrás,
b) que los aparejos de pesca que utilizan son de armado empírico y baja captura,
c) que no cuentan con equipos mecánicos y de orientación que faciliten este trabajo, y
d) que las pocas prospecciones realizadas en embarcaciones mejor equipadas, evidencian la existencia de buenas concentraciones de recursos costeros;

se comprenderá fácilmente la siguiente hipótesis de trabajo:
Los recursos costeros extraídos por la pesquería artesanal están actualmente sub-explotados.

La realización de este proyecto proporcionará los elementos de juicio que a través de recomendaciones del Gobierno, le permitirá dar mayor apoyo a esta pesquería mediante la construcción de embarcaciones y artes de pesca, introducción de equiposde detección acústica, y la implementación de infraestructura en tierra (cámaras frigorificas, camiones isotérmicos), los cuales conllevarán a elevar el status económico y

social de los pescadores así como de las 30,000 personar que están conexas e esta pesquería.

De otro lado, se podrá disponer de mayor cantidad de proteína animal de bajo precio y óptima calidad, tanto al mercado nacional como para la exportación, contribuyendo de esta manera a reducir la desnitrición del poblador peruano y a general divisas.

6. RELACION DEL PROYECTO CON PROGRAMAS EN MARCHA

Esta investigación está estrechamente relacionada con el Area de Evaluación de Recursos Costeros del IMARPE, con la Dirección General de Apoyo a la Pesca Artesanal del Minsiterio de Pesquería y con la Dirección de Estadísticas y Economía del IMARPE.

7. PLAN TECNICO DE TRABAJO

El trabajo se desarrollaría en la siguiente forma:

Durante el primer mes se efectuarian las acciones para contratar al personal responsable de la toma de datos en las 7 zonas elegidas y entrenarlos en la obtención de estadísticas de desembarque, muestreos de longitudes y muestreos biológicos. En este mes también será necesaria la presencia de un consultor de EE.UU. para discutir los aspectos técnicos del trabajo a realizarse.

A fines del primer mes los encargados de la obtención de datos se establecerán en los puertos y caletas que se les asigne y se les dará en el terreno las instrucciones necesarias para el adecuado desarrollo de su labor.

En los meses sucesivos, se obtendrán los datos estadisticos de captura pos embarcación y arte de pesca de las embarcaciones tipo que se hayan elegido en cada puerto y/o caleta como representativos de la flota. Asimismo, se obtendrá informacion sobre longitud, peso, sexo, estadío sexual y colección de otolitos y/o escamas de 7 especies: lisa, suco, cachema, lorna, machete, pejerrey y cabinza.

En el laboratorio central cada mes se irán tabulando y graficando los datos enviados por los encargados en las 7 caletas, asimismo, se profundizarán las lecturas de otolitos y escamas.

Con los datos procesados durante el primer año se procederá a aplicar modelos globales de evaluación, para lo cual será necesaria la participación de un experto.

En los 2 años sucesivos se seguirá la misma metodología del primer año con las correcciones que fueran necesarias. Al final del tercer año, además de aplicar los modelos globales, se podrá aplicar el modelo analitico de la población victual ya que para ese tiempo se tendran listas las edades de las especies mencionadas y la serie de datos de desembarque de los 3 años.

Sera necesario realizar viajes bimensuales de inspeccion a las 7 zonas con una duración de 2 semanas en cada viaje a fin de supervisar el trabajo de los encargados de obtención de datos.

Se realizaran 2 prospecciones en el mar al año para evaluar acústicamente mediante una ecosonda SIMRAD EY-M científica con grabadora de ecos a fin de introducirlos en el ecointegrador del IMARPE.

Los investigadores involucrados en el proyecto tendrán reuniones de coordinación cada 3 meses a fin de discutir los datos analizados, plantear sugestiones y discusiones.

Al finalizar cada año se prepararán reportes de avance, y al finalizar el proyecto se preparará un informe final con los resultados de la investigación.

Se prevee que al finalizar el proyecto, el IMARPE o el Ministerio de Pesquería contratará al personal de las 7 caletas para continuar con al trabajo.

Se estima que el proyecto se desarrollaría entre 1984 y 1986.

8. PERSONAL

En la actualidad el IMARPE disponedde 2 profesionales y un técnico para participar en el proyecto, siendo necesaria la contratación de 3 profesionales y otras 7 personas quienes tendrán bajo su responsabilidad la obcención de datos en las 7 caletas mencionadas. También se necesitaría una Secretaria Bilingue.

9. EQUIPOS Y FACILIDADES

EL IMARPE dispone de las siguientes facilidades y equipos:

- 1 laboratorio central con sede en Chucuito-Callao
- 4 laboratorios costeros en Paita, Chimbote, Pisco e Ilo
- 1 fotocopiadora
- 1 embarcacion de 34 pies de eslora
- 1 computadora Hewlett Packard 1000
- 2 calculadoras programables
- 1 microscopio compuesto
- 1 estereoscopio
- 1 balanza de precisión
- ictiometro
- formalarios
- 1 balanza de 15 Kg de capacidad
- 1 ecosonda SIMRAD EY-M
- 1 interfase
- 1 ecointegrador

UNIVERSIDAD NACIONAL SAN LUIS GONZAGA DE ICA

DEPARTAMENTO DE PESQUERIA

PROYECTO

ESTUDIO BIOECOLOGICO DE LA CONCHA DE ABANICO *Chlamys argopecten purpurata* (MOLLUSCA - BIVALVIA) Y SUS POSIBILIDADES DE CRIANZA EN LA ZONA DE PISCO

PRESENTADO POR : DR. VICTOR ALAMO VASQUEZ

PISCO - PERU

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I. INTRODUCTION

Una de las principales recomendaciones del primer Panel de Moluscos del Perú, organizado por el Ministerio de Pesquería en el año 1981, fue la de iniciar exaustivamente los estudios Bio ecológicos y experimentes de cultivos de las principales especies comerciales en nuestr país, las cuales se explotan sin un previo estudio que permita una racional explotación.

Las estadísticas pesqueras nos demuestran que la zona de Pisco es la de mayor extracción de maríscos en nuestro país, especialmente de las moluscos bivalves Aulacomya ater "Charo", Chlamys argopecten purpurata "Concha de abanico", Semele solida "Almeja" etc. debide a su alta productividad y a que estas especies se alimentan preferentemente de fitoplancton y que son mucho mas premiserias en la producción de Proteínas de las cuales se puede mejorar su calidad si se aplican métodes apropiados para su cultivo artificial.

De las recursos anteriormente mencionados, solamente el Mytilidae Aulacomya ater ha side estudiado y actualmente se encuentra en desarrello un Proyecto de Investigación ejecutado per un convenio entre International Development Research Centre (Canadá) y la Universidad Nacional Agraria, teniendo como objetivo les estudios sobre reproducción y estudio de técnicas para su cultivo en diferente medios.

Las limitaciones económicas de nuestro país y por ende de nuestra Universidad, pose a existir laboratorios parcialmente equipados así como personal Técnico especializado en este tipo de estudios, nos han permitido avanzar a un ritmo muy lento el conocimiento de les recursos mencionados.

Dada la importancia económica de la "concha de abanico" que constituyo un renglón primordial en la riqueza pesquera de nuestro literal y las enormes posibilidades que puede alcanzar en el future, se plantea la realización del presente proyecto.

El conocimiento de sus aspectos biológicos interesa lógicamente para fundamentar su explotación racional y científica que a la postre constituyo el primer paso hacia la perduración de la especie y los experimentos de su cultivo estan orientados a entrenar a los artesanos dedicados a la extracción de estos recursos, quienes mas adelante podrán elevar su nivel socio-económico.

II. RESUMEN DEL PROYECTO

El proyecto plantea la continuación del estudio Bio-ecológico de la especie Chlamys argopecten purpurata en diferentes medios : naturales y artificiales. Se enfocarána estudios sobre su morfología, alimentación, comportamiente y maduración sexual. Adicionalmente a elle se realizarán los estudios sobre captación de larvas en su medio natural y desove inducido. Asimismo se estudiarán las características favorables del medio ambiente que permite y facilita el desarrollo de sus respectivos bancos naturales : determinando sus características biológicas, físicas, químicas y meteorelógicas (productividad, afloramientos, plácton, salinidad, exigen disuelto, Ph, nutrientes, temperatura del agua, transparencia y color, fondos marinos, corrientes marinas locales, vientes, etc). Estudio de la extracción y dinámica poblacional.

A continuación de estos estudios se experientará con el cultivo en diferentes medios : tratando de reproducir las condicione s óptimas estudiadas, cen la finalidad de obtenar la técnica adecuada de cultivo en estructuras flotantes y de fondo.

III. OBJETIVOS

Les objetivos principales del presente proyecto sen:

- Contribuir al conocimieto bio ecológico de la "concha de abanico", así como de las condiciones del medio y para lograr su racional explotación, se hará una síntesis de la extracción y dinámica poblacional de les bancos.

- Estudio de la crianza que analice las diferentes técnicas utilizables y defina las modalidades de aplicación de la tecnica major adaptada a las condiciones locales y más rentable desde el punte de vista económico.

- Entrenar a les artesanos dedicados a la recolección de maríscos, en las técnicas de cultivo, asi como en la utilización de las áreas costeras, para impulsar el desarrollo de la maricultura en Pisco.

- Crear actividades productivas ne tradicionales y con elle contribuir a la generación de nuevas fuentes de trabajo.

IV. PROYECCIONES

4. - IMPORTANCIA ACTUAL Y FUTURA

El estudio de la concha de abanico, tal come se plantea en el presente proyecto, nos permitirá orientar las actividades de extracción hacia una racional explotación, asi come también propondorá a la propagación de la especie con la creación de nuevos bancos naturales semi-controlades y al establecimiento de cultives de producción.

Además debemes señalar que la especio es muy apreaciada en la alimentación por su alto valor nutritivo, pero el mercado presenta una demanda insatisfecha no solo en Lima si no en el reste del País, demostrando este comportamiento un mercado asegurado para el proyecto. Consideramos también que motivaría la renovación de la tecnología industrial aprovechando la óptima calidad de la materia prima obtenida.

V. ANTECEDENTES

En nuestro pais, se han realizado trabajos referentes a esta especie, como:

- Aspectos Biológicos de la Concha de abanico (Chirichigno y Vildoso-Pesca y Caza- Ministerio de Agricultura 19)

- Recursos Malacológicos de las Bahías Pisco e Independencia (Alamo, Victor - Anales VI Congreso Biología 1980)

- Cultive de las conchas de abanico, estudio de pre-factibilidad (Ministerio de Pesquería 1977)

Les estudio sobre su crianza se iniciaron en el año 1975 como parte de las actividades del Proyecto Redes Trampas Fijas del Ministerio de Pesquería en la zona de punta Ripic (Bahia de Paracas) teniendo como objetivo el de conocer les parámetres que efectan el desarrollo de las conchas, para le cual se emploé una bal sa de cañas de bambú cen 8 fletadores de cilindros y utilizando el sistema de conos. Les resultados no fueron alentadores.

En 1979 la Compania Pan Mar, en la misma zona y utilizando la misma metodología anteriermente descrita llegaron también a les mismos resultados.

Desde 1979 se viene practicando el cultivo en forma práctica en la zona denominada el Sequién (Bahía de Paracas) utilizando el sistema de corral, logrando un crecimiente y desarrollo alentadores.

VI. LOCALIZACION

6.1. Para la ejecución del presente estudio se han considerado des áreas bien delimitadas:

Zena 1 : Limitada per las latitudes 14° 06' y 14° 20', comprende la denominada Bahía Independencia cen un premedio de 15 millas de largo. Aquí se encuentran los bancos más productivos de conchas

Zena 2 : Limitada por las latitudes 13° 47' y 13° 52', comprende parte de la bahía de Paracas y es el lugar donde actualmente se practica el cultive en forma empírica. (Ver anexo N° 2)

6.2. Laboratorio de Hidrobiología y Acuicultura del Departamente Académico de Pesquería

6.3. MATERIAL Y EQUIPO CON QUE CUENTA

Ver. anexo N° 1

VII. PLAN DE ESTUDIO

1.- Biologia y medto Ambiente de Vida de las conchas de abanico
   1.1. Biologia
   1.2. Medio ambiente de vida
      1.2.1. Condicionmes fisico quimicas
         1.2.1.1. Temperatura, salinidad, oxigeno disuelto
         1.2.1.2. Corrientes
         1.2.1.3. Sales minerales
      1.2.2. Factores bioticos
         1.2.2.1. Recursos alimenticios
         1.2.2.2. Enemigos naturales, comensales, competidores, parasitos
      1.2.3. Contaminacion

2..- Estudio de la pesca
   2.1. Estado actual
   2.2. Dinamica de las poblaciones de las conchas
   2.3. Estudio de las tecnicas de repoblacion y proteccion de los bancos

3.- Estudio de la crianza
   3.1. Analisis comparativo de las diferentes tecnica y seleccion de la tecnica mejor adaptada
      3.1.1. Cultivo en vivero
      3.1.2. Cultivo en cuerdas
      3.1.3. Cultivo en plano
      3.1.4. Seleccion de una tecnica de cria
   3.2. Determinacion de las modalibades de aplicacion de la tecnica retenida
   3.3. Imperativos de la comercializacion

VIII. DESCRIPCION DEL PLAN DE TRABAJO

1. BIOLOGIA Y MEDIO AMBIENTE DE VIDA DE LAS CONCHAS DE ABANICO

1.1. Se hará una síntesis de las informaciones ya adquiridas en la zona que nos permitirá determinar las relaciones de la Biología de la especie con les parámetres fundamentales siguientes:

- Tasa de salinidad óptima a diferentes edades
- La tasa de salinidad minima compatible con una autodepuración
- Temperatura óptima a diferentes edades
- Las exigencias de exigene disuelte a diferentes edades.
- Resitencia al hecho de quedar descubiertas durante períodes más e menos largos de tiempo
- Capacidad para su fijación sobre diferentes substrates de larvas y de les adultes
- Duración e intensidad del período de reproducción tante en su medio natural como en acuaries
- Período de repose sexual y su duración
- Factor de condición a le largo de todo el año.
- Fototropismo (para determinar los imperativos de la crianza)

1.2. MEDIO AMBIENTE DE VIDA

Se hará un estudio del medio ambiente que nes permitirá determinar:

- Potencialidad del medio
- Determinación de los imperativos de explotación de los bancos
- Delimitación de las zonas de explotación
- Selección de las técnicas de cria
- Determinación de los imperativos técnicas de cria (contaminaciones, enemigos, parásitos, etc.)

1.2.1. CONDICIONES FISICO QUIMICAS

1.2.1.1. TEMPERATURA, SALINIDAD Y OXIGENO DISUELTO

Para cada uno de estos factores se determinará:

- Les valores límites y los valores medios en el curso del año.
- La velocidad de variación máxima de estos tres parámetros
- Los riesgos de rebasamiento de los valores letales.
- Los valores críticos, su duración.
- Variaciones de estos factores de un año a otro.

1.2.1.2. LAS CORRIENTES

Se estudiará su regimenes en el curso del ano y se intentará determinar si procuran una buena renovación de agua y del alimento y si existe el riesgo de que puedan aportar contaminantes.

1.2.1.3. SALES MINERALES

Se estudiará el tenor del agua en sales minerales nutritivas (nitritos, nitratos, fosfatos, silicatos, Ión amonio) para determinar la riqueza biológica de la zona. Estudiaremos el origen de estas sales minerales, lo que nos conducirá a determinar zonas de afloramiento.

1.2.2. FACTORES BIOTICOS

1.2.2.1. RECURSOS ALIMENTICIOS

Las conchas filtran el agua del mar y se alimentan de las partículas en suspensión, principalmente, fitoplacton, razón por la cual el estudio comprenderá, para el plácton:

- Evaluación de la producción en el curso del año
- Estimación de las variaciones de un año para etro
- Estudio cuali y cuantitativo de las especies o grupos de especies
- Posibles especies tóxicas

Para la materia orgánica disuelta:

- Evaluación de la producción en el curso del año

1.2.2.2. ENEMIGOS NATURALES, COMENSALES, COMPETIDORES, PARASITOS

Se hará un análisis de los animales que se alimentan de conchas. Se hará un censo de las diferentes especies de enemigos naturales, evaluar su importanica numérica actual y los riesgos de proliferacion y proponer medios técnicas de prevención.

Los comensales sen les que viven fijos sobre las valvas, no son directamente necivos, pero acarrean la necesidad de limpiar las valvas le que es muy costoso.
Los competidores, al utilizar les mismos recursos alimenticos que las conchas deberán en la modida de lo posible mantenerlos fuera de las estaciones de cultivo.

Los parásitos, deberán estudiarse detenidamente e inventariarlos y estudiar los métodes para evitar su expansión a zonas aún no contaminadas.

1.2.3. LAS CONTAMINACIONES

Se hará un estudio de las contaminaciones por:

- Alcantarillades
- Riesges de autointoxicación
- Riesges de mareas rojas (algunos dinoflagelados)
- Rieges de contaminación per residues industriales.

2. ESTUDIO DE LA PESCA

2.1. ESTADO ACTUAL

Se hará una estimación cualitativa y cuantitativa de la pesca actual

2.2. DINAMICA DE LAS POBLACIONES DE LAS CONCHAS

Luego de efectuado el censo de los bancos y de la estimación de su productividad

- Se establecerá las cuotas de pesca
- Se determinará las zonas y los periódes de pesca

2.3. ESTUDIO DE LAS TECNICA DE REPOBLACION Y DE PROTECCION DE LOS BANCOS

Se hará un estudio tendiente a reconstruir y proteger los bancos, exterminades por una pesca excesiva o por la proliferación de enemiges naturales.

Estas técnicas se harán en forma paralela a las técnicas de cria.

3. ESTUDIO DE LA CRIANZA

3.1. ANALISIS COMPARATIVO DE LAS DIFERENTES TECNICAS Y SELECCION DE LA MEJOR ADAPTADA

El análisis comparativo, se referirá preferentemente a las siguientes técnicas: Cultivo en cuerdas colgantes y cultivo plano. Se evaluará el rendimento de cada uno de ellos, utilizando la infraestructura existente en la zona.

- La disposición de cada uno de elles tante para individuos jóvenes como para engorde.
- Duración del período de fijación
- Período de siembra

3.1.2. CULTIVO EN CURDAS

Esta técnica es sencilla ya que ha dado resultades positives en otros paises. Se construirán long line y balsas, utilizande diferentes tipes de colectores tales como, sistema de sobre, belsillo, bandejas flotantes, cono aretados, etc. además se utilizará para determinar una técnica de captación de semilla.

3.1.3. CULTIVO EN PLANO

Se harán análisis en terrenos donde las diferentes niveles de marea son cambiantes y en terrenos sumergidos, le que nos permitirá demostrar:

- Zonas utilizables en ambos cases
- Las técnicas de recolección
- Técnicas de lucha contra diferentes tipes de substrate

3.1.4. SELECCION DE UNA TECNICA DE CRIANZA

Esta selección deberá hacerse en función a los criterios siguientes:

- Características del medio ambiente (naturaleza) del fondo, amplitud de las mareas, régimen de corrientes, fuerza del oleaje

- Facilidades de acceso y de explotación
- Posibilidades financieras
- Características de la mano de obra en nuestro país
- Rentabilidad comercial

3.2. DETERMINACION DE LAS MODALIDADES DE APLICACION DE LA TECNICA RETENIDA

El análisis de las diferentes técnicas nos habrá conducide a determinar las modalidades de aplicación en sus grandes líneas.

Para la técnica retenida será necesario precisar estas modalidades y aplicarlas experimentalmente

3.3. IMPERATIVOS DE LA COMERCIALIZACION

- Se determinará las diferentes formas de comercialización del producto (fresco, congelado, etc.)
- Control de calidad del producto (relación carne/volumen total, condiciones sanitarias, sabor etc.)
- Determinación de los períodes de venta (distribución a lo largo del año, períodes críticos etc.)

IX. ORGANISMO EJECUTOR

9.1. Nombre de la Institución

Universidad Nacional "San Luis Gonzaga" de Ica, Departamente Académico de Pesquería

9.2. Nombre de las Personas

Dr. Victor Alamo Vásquez	Decente
Dra. Esther Lime de Cardenas	Decente
Ing° Pedro Talledo Napa	Decente

Además se contratará un (1) Ing° pesquero y un técnico de laboratorio. También se considerará necesario la participación de seis (6) bachilleres quienes elaborarán su trabajo de tesis para optar su titule profesional.

X. ORGANISMOS COLABORADORES

10.1. Nombre de las instituciones

Ministerio de Pesquería - Dirección Regional de Pesquería de la Corporación de Desarrollo de Ica
Ministerio de Marina ° - Capitanía de Puerto de Pisco
Ministerio de Agricultura - Reserva Naciona de Paracas
Instituto del Mar del Perú - Laboratorie Costero de Pisco

XI. DURACION DEL PROYECTO

Tres e más años a partir del momento en que se otorguen los fondes solicitades

11.1. ESTAPAS DEL PROYECTO

1era. Etapa. Iniciación de actividades relacionadas con entrenamiento y fermación del personal técnico, adquisición de material básico de laboratorio y compilación de la información bibliográfica. Solicitamos la participación de un experto en Reproducción de Moluscos.
Duración : 6 meses

2da. Etapa. Realización de los muestreos periódicos considerados en la descripción del proyecto
Duración : 12-14 meses

3era. Etapa. Repetición de los muestreos realizados durante la segunda etapa, y ampliación de las observaciones y aspectos complementarios si se considera necesario.
Inicio de los experimentes de cultivo
Duración : 12-14 meses

4ta. Etapa. Elaboración de los resultados y conclusiones
Duración : 6 meses

5ta. Etapa. Ampliación posible de estos estudios a otras áreas importantes para la explotación de la especie en estudio.

XII. COSTO DEL PROYECTO

PARTIDA :

Remuneraciones

Remuneraciones de personal peruano y venida de un experto en reproducción de moluscos

.....$100,000

Bienes

- Libres y suscripciones
- Combustible, carburantes y lubricantes
- Utiles de escritorio y material para impresión
- Implementos de Pesca y materiales para cultivos marinos

.....$ 20,000

Servicios

- viáticos y movilidad
- Fletes y embalajes
- Impresiones y publicaciones
- Mantenimiento de equipes de laboratorio

.....$ 60,000

Bienes de Capital Nuevos

- Equipos y material de laboratorio
- Equipos oceanográficos
- Compra de una camioneta de doble tracción
- Compra de una embarcación con meter fuera de borda

.....$120,000

COSTO TOTAL DEL PROYECTO $300,000

A N E X O N° 1

MATERIALES CON QUE CUENTA EL LABORATORIO

1.-4 (cuatro) Estereoscopio Wild

2.-2 (dos) Microscópios monocular Wild

3.-1 (un) Microscópio binocular Jena

4.-1 (una) Balanza 0 hans de 2610 gr.

5.-1 (una) Balanza analítica MIN

6.-2 (dos) cámaras Sedgwick rafter

7.-2 (dos) Oculares Whipple

8.-1 (una) Red Plancton de 300 micras

9.-1 (una) Red de Plancton de 250 micras

10.-1 (una) Red de Plancton de 132 micras

11.-2 (dos) Calibradores Vernier

12.-1 (uno) Espectrofotómetro Spectronic mini Bauch y Lomb

13.-1 (uno) Spectrokits de Alcalinity, Oxígene, fesf'to silicate y turbidez

14.-2 (dos) Acuarios Acrilico, de 60 x 50 x 40 cm. y de 80 x 35 x 40 cm. y acceserios

15.-2 (dos) termómetres de superficie graduados 1/10

16.-1 (uno) Batitermógrafo (270 mts.)

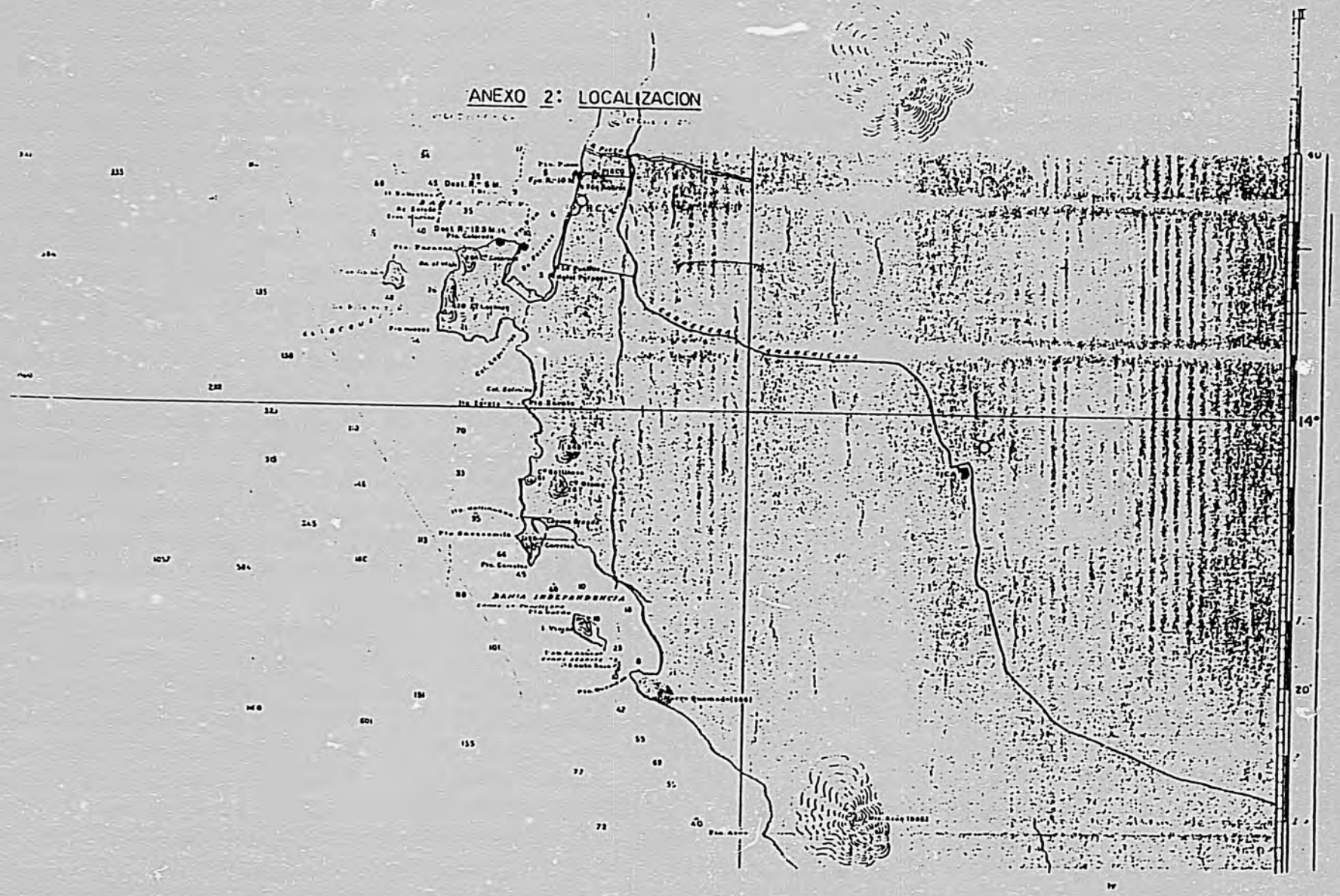
17.- Material de Vidrio
Pipetas, probetas, matraces, erlenmeyers, kitasatos, lunas de reloj, fiolas, buretas, placas petrix.

18.- Reactives para análisis fisicoquimicas de agua de mar por volumetria

19.-2 (dos) Dragas para muestras de sedimentos VAN ESSEN, chicas

20.-4 (cuatro) Dragas para muestras de sedimentos VAN ESSEN, grandes

ANEXO 2: LOCALIZACION



Stock Assessment CRSP Project Specification

EVALUATION AND TECHNICAL, SCIENTIFIC, AND SOCIO-ECONOMICAL DEVELOPMENT OF THE ARTISAN FISHING AT PUCUSANA BAY

Manuel Vegas Velez

1. ABSTRACT

A preproposal is submitted aimed to carry out a project study of the artisan fishery at the fishermen's bay of Pucusana (68 km South of Lima), improvement of the fishing methods, fish handling and its commercialization as well as working together with inhabitants of the zone in order to properly organize their community.

It has been estimated that from three to five years would be needed in order to carry out such a project at Pucusana Bay.

In this opportunity, the work plan and budget for the first year of activities is submitted.

2. BACKGROUND

Marine exploitation in the Peruvian Coast goes back to the pre-Inca epoch (5000 to 6000 B.C.). Given evidence of this are fishing accessories like fishhooks made of bone or copper, fishing nets made of cotton as well as scallop and fish remains which are in profusion, especially at the influence areas of Chimu and Nazca civilizations. Also, at that time, was used coastal dragging fishing based on rustic art; pulled by two "caballitos de totora". That is why settlers of the Peruvian Coast appear as people traditionally devoted to fishing work.

Less than three decades ago has fishing existed at the industrial scale; before that time, almost the total hydrobiological products of marine origin came from artisan fishermen and therefore its contribution is significant, almost 150,000 MT per year. Also some transformation industries, like packing of "bonito", sprat, and mackerel, were supplied and prospered because of capture by curtain nets, carried by no more than 7m. length crafts and operated by three men.

On the Peruvian Coast, at the present time, operate nearly 25,000 artisan fishermen. They constitute small population centers, which social organizational structure is predominantly familiar. This profession is familiarly inherited and, in general, descendants have no other occupation.

The principal kinds of artisan crafts used in Peru are:

	No.		No.
Raft	2,019	Trawler	2,224
"Caballito de totora"	131	Row-boat	689
Canoes	130	Sailing boat	1,204
Chalanas	545		
Total	6,942		

These artisan crafts have a hold capacity which is from 0.5 Ton to 3 Ton, the relation between Number of Fishermen/Craft is 3.6. The three first types are autochthonous, others have been copied from Spanish, Portuguese and Italian models.

Fishing gears used are: fishhook, spinel, "atarraya", curtain, "trasmallo", "chinchorro" and circle net. The scallops and mussels are harvested mainly by diving with diving suit or free diving.

There are 43 harbours and artisan fishing bays of landing, the most important being the following, taking into account capture volume: Paita, San Jose, Chimbote, Huacho, Callao, Pucusana, Pisco.

In 1968, the first approach to fishermen from Pucusana was done in order to prepare a development project and, on that occasion a survey was developed which was very useful in order to know the needs and ambitions of those fishermen. Also two publishing courses were carried out about marine and fisheries biology knowledge which was well received by the fishermen.

Universidad Nacional Agraria "La Molina" through its Academic Fisheries Program has supported development of artisanal fishing through:

a. Coastal fishing of Peru Catalog, which consists of 4 volumes: fishing crafts, fishing tackle, fishing operation and operation bases (1975).

b. Feasibility study of an artisan fishing terminal in Chimbote (1981)

c. Study of artisanal fishing characteristics in Chimbote (1982)

d. Feasibility study of fishing terminal for artisan fishermen in Ilo (1982)

3. PROJECT JUSTIFICATION

Artisan fishermen play an important role in the future that will have efficiency, economic and social considerations, even though the industrial fishing is quickly developing.

In most of the fisheries countries, artisan extractive activity is specialized in time, on capture of fine species of fish and on shellfish extraction for human consumption.

This training is possible because of fishing arts used by artisan fishermen, in contrast to industrial arts, are especially appropriate in order to obtain quality, size and correct preservation of fish, to be converted to a good product for direct consumption.

Besides, use of working factor with high intensity on fishing operations of artisan fishing, make this activity an important source of employment for a considerable portion of the population, at an investment capital cost that is relatively low.

On the other hand, due to technological and cultural delay of artisan fishermen, lack of organization, dependence on commercialization agents, not progressive captures and variability of demand for fishery products as well as due to economical productivity, earnings "per capita" are those of the lowest in Peru.

It is considered, for that reason, of great importance to contribute in solving such scientific-technical, social and economic problems in order to permit the artisan fisherman to improve his life level and to participate in a more active way in the national economy.

It is convenient to point out that this could be the first integral project (study of fishery stocks, fishing methods, fish processing and socio-economical aspects).

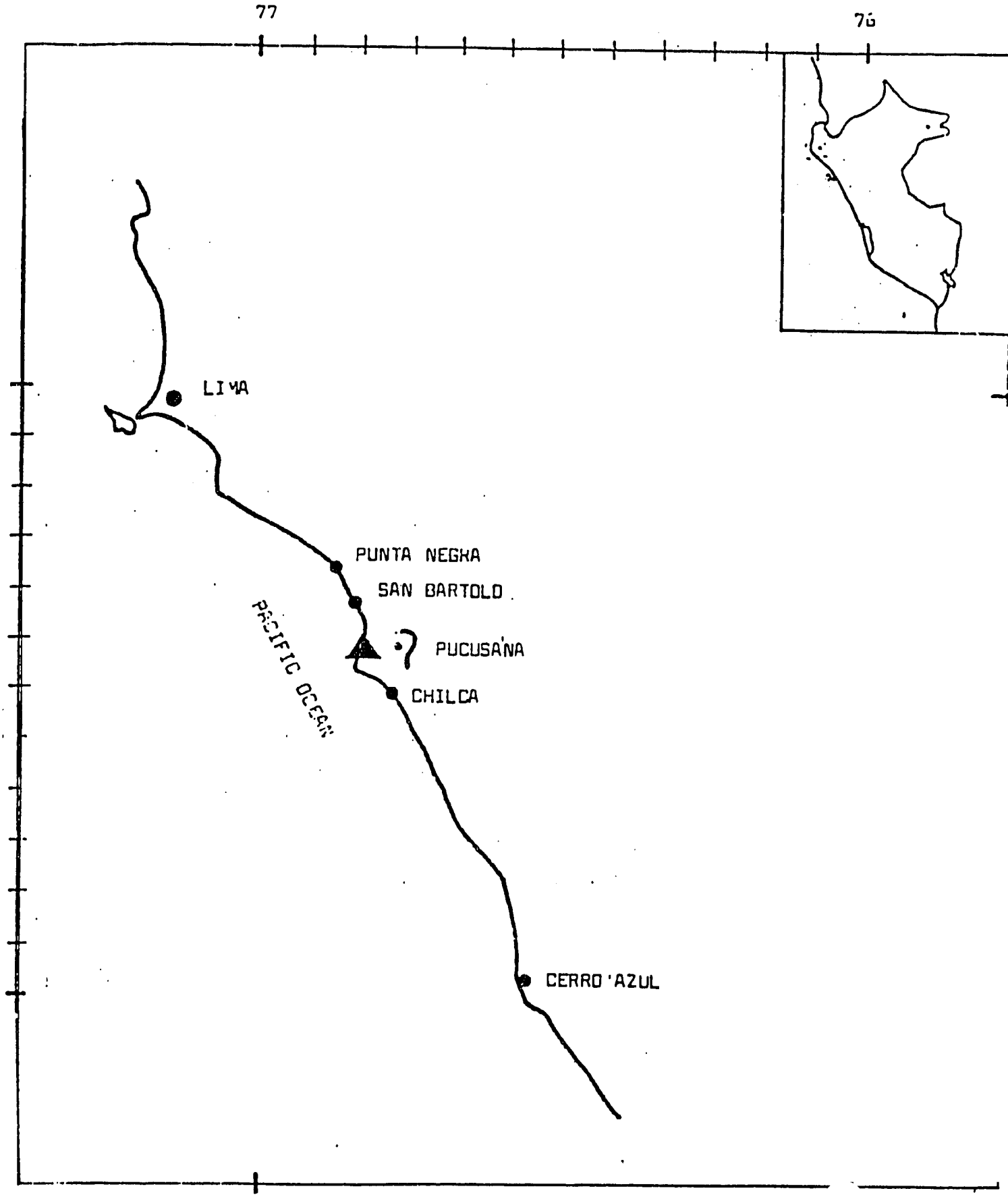
4. PROJECT SITUATION

The project execution zone is Pucusana Bay, which is located 68 km to the south of Lima. It has 4,104 habitants and 600 artisan fishermen. Almost 80% are migrating workers and the rest of them, native people. 45% of the population are less than 14 years old. Nearly 30% of the population are between 20-39 years of age.

Due to the fact that it is an old and important fishery center, the population is concentrated in the central zone. With the exception of residential and hotel areas which are located near the beach, the rest of houses belong to fishermen.

Influence area

Having Pucusana as a Pilot center, the project would have an influence on other adjacent zones where the population numbers nearly 15,000 habitants, with 1,600 of them being fishermen.



LOCALIZATION MAP OF LIMA AND PUCUSANA

Sub-Zones	No. of Fishermen	No. of habitants
San Bartolo	200	1,500
Cerro Azul	200	[illegible]400
Chilca	600	5,000
Pucusana	600	4,104
Total	1,600	14,004

Pucusana zone was chosen for the following reasons:

a. It is near Lima and Universidad Nacional Agraria "La Molina;

b. Large and important fishery populations;

c. With reference to fishing volume between harbours and bays with artisan fishing, it occupies the 5th position; also has fishery terminal with landing facilities.

The first ten places dedicated to artisanal fishing in 1979 were the following: Sechura and Paita (15,000 TM), Santa Rosa/Pimentel (7800), San Juan (7686), San Jose (5457), Pucusana (4897), Chilca (3335), Zorritos (2969), Mollendo (2559), Ilo (2279), Mancora (2061).

d. It is a locality with good water, drainage and electricity services, as well as good high road and communications with Lima and other important cities.

e. It is expected that results could serve for the future work in other places of the Peruvian Littoral System.

f. Contacts in 1968 and 1969 showed a good receptivity by artisanal fishermen.

5. OBJECTIVES

- Contribute to technological improvement in order to obtain a better increment and efficiency of production and of the commercialization process.

- Collaborate to raise socio-economic and cultural level of mentioned fishery center, through technical skills, trade-union and community programs.

- Carry out a study about the following areas of interest:

  a. Evaluation of fishing diversity stock, exploited by artisan fishermen

  b. Feasibility of establishing mechanization of the artisan fleet as a method to improve work conditions aboard.

  c. Detailed study of craft-like models, use of existing gears and motors.

- To improve fish and shellfish handling from the moment of fishing until delivery to customer, bringing in some preservation and processing techniques.

- Train promotors and commoner leaders from the influence of the project with the purpose of having multiple effects in behalf of the fishery population and within community and trade-union organization frame.

- Promote community ways of commercialization of fishery products and those of essential necessity.

6. WORK PLAN FOR THE FIRST YEAR

The work plan for the first year includes some aspects that will be continued during the next two years (points 1 and 2) in order to obtain an appropriate idea about ecosystems and populations constituting it. Others aspects will permit us to carry out analyses about the fishery and socio-economic situation at the bay in order to plan out works for the following years: fishery technology, improvement of commercialization and fish handling, community organization, etc.

1. Hydrography study of Pucusana Bay.
2. Structure and dynamics of benthic and nektonic communities and their relations with organisms of meroplankton.
3. Determination of sexual maturity and reproduction time of exploited species.
4. Evaluation of crafts and fishing riggings used in the zone.
5. Evaluation of handling, preservation and commercialization of fishery products from the zone.
6. Social-economical analysis of the fishery population at Pucusana.

7. PERSONNEL

Personnel will be constituted by seven principal researchers:

Manuel Vegas (CONCYTEC, general coordinator, Julia Arakaki (Fish Technology Department), Carroll Dale (Human Sciences Department), Afranio Livia (Oceanology & Fish Culture Department), Raul Mayta (Oceanology & Fish Culture Department), Mario Pena (Biology Department), Roberto Shirasaka (Fishing Technology Department).

Others who would also participate are seven or ten associate researchers and ten fellowship students, some of them with the purpose of carrying out their professional thesis, others from their last academical cycles in order to receive a better field knowledge.

B U D G E T

(estimated for the first year)

This budget includes some investments that will be done only once (like acquisition of vehicle, craft, local and most of the laboratory equipment, which means an investment of U.S. $195,000.==)

Other investments must be done annually.

	U.S. $
- Vehicle	15,000.=
- Glass material	8,000.=
- Lab equipment (stove, water distiller, microscopes, spectrophotometer, etc.)	55,000.=
- Chemical reagents	11,000.=
- Desk and printed materials	12,400.=
- Photographic material and equipment	10,500.=
- Audiovisual equipment (tape recorder, slides searchlight, videocassette)	11,000.=
- Personnel expenses (researcher's salary and eventual contracts)	87,300.=
- Fellowships for students	14,000.=
- Furniture	4,000.=
- Diving and Safety equipment	10,600.=
- Camp equipment (tents, nets, dredges, siffing, thermometers, Nansen bottles)	60,200.=
- Acquisition and conditioning of local	39,000.=
- Craft (32x9 feet, oil motor HP, wood)	30,000.=
- Two meetings with American researchers at Lima and Pucusana (the first one to discuss the project and the last one to evaluate results for the first year)	8,500.=
- Administration expense (guardianship, accounts secretary)	5,000.=
- Fuel and lubricants	4,500.=
- Vehicle and craft maintenance	2,000.=
- Insurance	10,000.=
- Visits of experts (two month/man)	8,000.=
- Unforseen expenses	40,000.=
Total	$446,000.=

STOCK ASSESSMENT CRSP PROJECT SPECIFICATION

C. Villalobos
Centro de Investigacion en
Ciencias del Mar y
Limnologia.
Universidad de Costa Rica
Costa Rica
March, 1983

OBJECTIVES

A. General

1. To improve the conditions of artisanal fisheries in the Golfo de Papagayo (Pacific) and on the Caribbean coast, through stock assessment and fishery management.

2. To evaluate the fish resources of the waters surrounding the Costa Rican Dome.

B. SPECIFIC

1. To improve the value of exploited stocks through management.

2. To develop methodologies and technologies to address biological, economic and social aspects.

3. To understand population dynamics of fished stocks.

4. To optimize the amount of fishing effort related to domestic fishing processing operations.

5. To establish fishery data - time series - and distribution systems.

6. To develop mechanisms for regional (or bilateral) cooperation in fishery management.

INTRODUCTION (Description)

The Golfo de Papagayo (Fig. 1) is an important fisheries ground, located on the Northwestern part of Costa Rica (10° 30' North and 85° 40' West). The Gulf is an open body of water with a mean diameter of around 20 km and depths that vary from 100 meters on the outermost part to 20 meters just off the coast. The coastline is irregular in extreme, showing extensive sandy beaches, rocky promontories, small bays and a few mangrove patches.

Fisheries in the Gulf have increased substantially in the past few years, primarily due to the finding of valuable stocks of the snapper, *Lutjanus peru*, a high-priced species that is exported to U.S. markets. Other species being caught are the snappers, *Lutjanus colorado* and *L. guttatus*, the mackerel, *Scomberomorus sierra* and "Cabrilla", *Epinephelus* sp. The octopus, *Octopus* sp., the clam, *Megapitaria aurantiaca* and the conch, *Strombus galeatus*, are also commercial species, being common dwellers on the shallow waters of the bays.

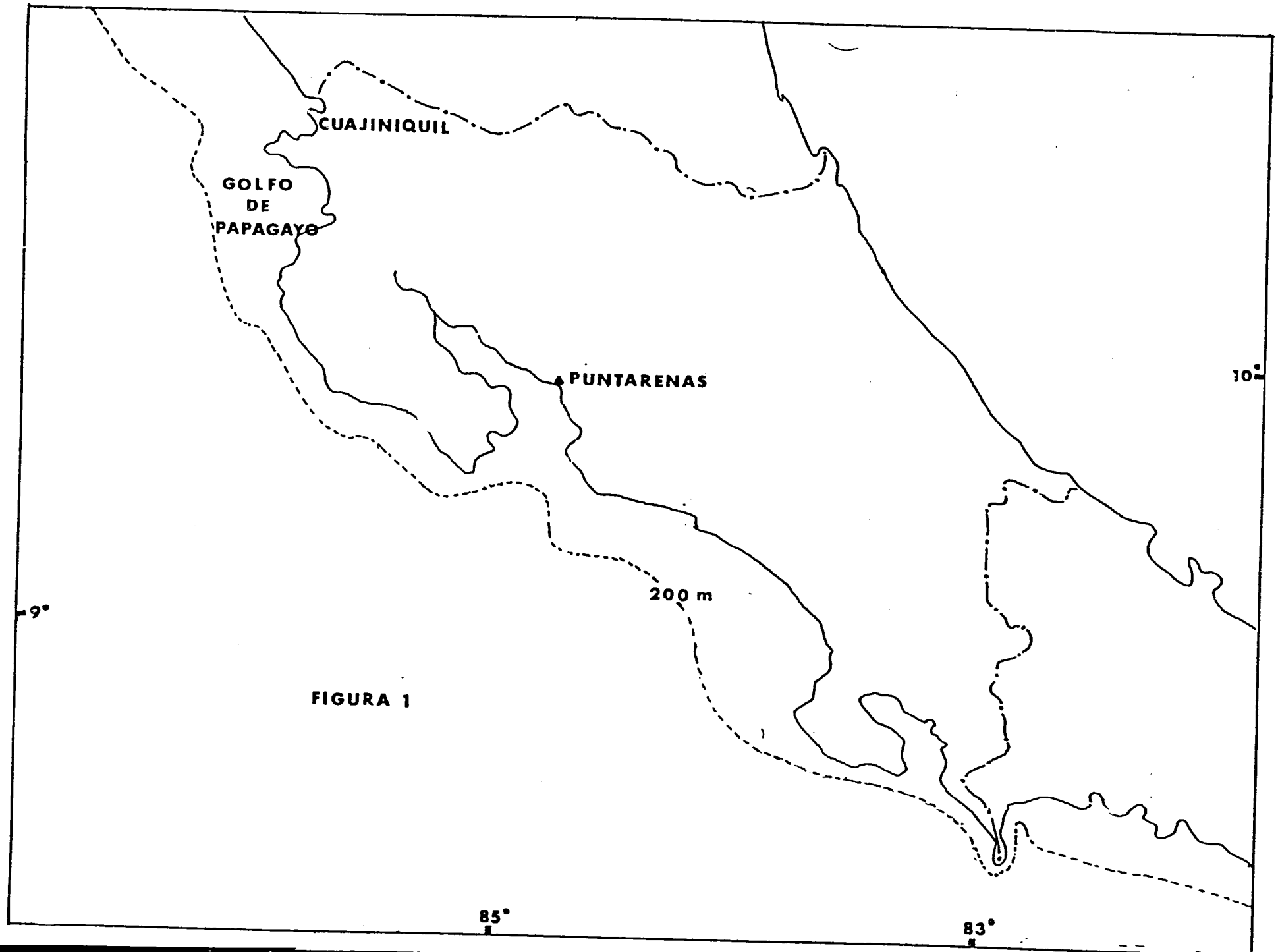


FIGURA 1

Table 1 shows fish landings for the gulf area, including the Cuajiniquil grounds, for 1981. Total landings amounted to 175 metric tons which represents 44% of the total volume caught by the artisanal fleet on the northern grounds. Some 100 small boats are operated in the area by 300 artisanal fishermen. Approximately 25% of total Pacific landings come from these areas.

Most of the product is landed at the port of Puntarenas, mainly due to the lack of appropriate facilities along the coast. A small fishing port is, at the present time, under construction in the Cuajiniquil area. The port will provide fishermen with water, food, fuel, plus landing and marketing space.

In spite of the growing interest in the Golfo de Papagayo area, research on basic aspects such as population dynamics of the fished stocks, reproductive behavior and recruitment is still lacking. Information on fishing effort and optimum sustainable yields is in demand, as a way of optimizing the use of resources.

From the above discussion it seems to be clear that a stock assessment program in the Golfo de Papagayo would be of great significance. In addition, very recently, the possibility of constructing an oil pipeline in Costa Rica, has been brought to discussion again, thus making the assessment even more urgent. In fact, the northwest coast has been suggested as the area in which the Pacific terminal may be constructed. In this context, the information provided by the stock assessment project could be of great value to the Fisheries Department of the Ministry of Agriculture, if specific strategies related to the management of the resources, are to be implemented.

The second study area includes most of the Caribbean coast of Costa Rica (Fig. 1). For a long time is has been assumed that the East coast is fairly poor in terms of the living resources, primarily fish.

Fishing along the coast is seasonal and depends on the availability of lobster (November through January) and turtle (July through September). Because of this seasonality and the fact that fish are only incidentally caught, the production in the Caribbean coast is less than 1% of the total production for the country. The fleet is composed of some 250, 10-12 meter canoes, that operate with outboard motors. A cooperative was established in 1975 to include some 400 artisanal fishermen. Facilities at the port of Limon include a small processing plant, ice and cold storage facilities.

The lack of appropriate information, in terms of the availibility of other resources such as reef fishes and shrimp, has prevented the Government from improving fisheries on the Caribbean coast.

One of the major limiting factors for developing countries is the availability of research centers and qualified scientists capable of conducting stock assessment programs. A fairly good approach to solve this problem has been to establish collaborative research programs, either between national institutions or through the support of foreign institutions. The Research Center of Marines Sciences of the University of Costa Rica (CIMAR) has just begun such an approach, being primarily interested in the characteristics of living resources of economic value. In this context, several projects have been already established with the Fisheries Department of the Government. These include, an evaluation of the by-catch on the

TABLE 1

Fish landings in Kilograms for fishing zones 101 (Golfo de Papagayo) and 102 (Cuajiniquil). 1981.

J	F	M	A	M	J	J	A	S	O	N	D
8556.2	1959.2	11667.6	14666.4	17282.6	11399.4	24965	23852	16395	21916	10287	12705

Pacific (CIMAR-CONICIT-MAG); seed production in clams of economic importance (CIMAR-CONICIT) and shrimp production in the Golfo de Nicoya (CIMAR-MAG).

Personnel available to the project at CIMAR include specialists in the following areas: Fishery Biology, Biological Oceanography, Statistics, Ichthyology (Systematics) and Chemical Oceanography. Desired expertise from a U.S. university must be in the areas of Fishery Management and Modeling.

The Center is located on the main campus of the University of Costa Rica in San Jose. Facilities there include a laboratory for chemical and productivity studies, a computer terminal, a reference collection of fishes and invertebrates and, through an agreement with the National Council for Research (CONICIT), access to the Marine Laboratory on the Golfo de Nicoya. A 35-40 foot research vessel is in the process of being acquired by the Center. In the meantime, research is being conducted with the cooperation of private industry. Basic oceanographic equipment is also available at the Center. During the first year of a proposed three year project, research will be conducted at both Golfo de Papagayo and Cuajiniquil. Oceanographic information will be systematically collected within the 12 mile zone, in addition to information on fish population characteristics such as, distribution, density, length-frequency distributions and so on.

During the second year similar data would be collected in the waters close to the Costa Rican Dome.

The third year should be dedicated to a stock assessment project along the East coast. This will focus on the evaluation of the living resources, primarily reef fish, lobster and shrimp, but also including economic and social aspects.

STOCK ASSESSMENT CRSP PROJECT SPECIFICATION

The Marine and Lagoon Artisanal Fishery Development Project in the Ivory Coast

Soko Guillaume ZABI

1. PROJECT RATIONALE

A relatively important artisanal fishery is practiced along the Ivorian coast line (about 550 km). This activity concerns between 3500 and 4000 fishermen whose annual fish production is around 15,000 and 20,000 tons.

The large lagoon systems covering an area of 1200 km^2 are located in the eastern Ivorian coastal region. The annual artisanal fishery production is also between 15,000 and 20,000 tons.

The whole maritime and lagoon artisanal fisheries represent a little bit more than half the national fish production.

It should be mentioned that certain fisheries, among the more important, sometimes exploit the marine and the lagoon stocks (generally the fishing methods are the same on both sides).

Beside their high productivity, the Ivorian lagoons represent an obligatory step of the biological cycles for many coastal species and so being have probably a fundamental role in sustaining the exploitable stocks. The best known example concerns the rose shrimp Penaeus duorarum, the cycle of which has a lagoon component of three months between the post-larval and juvenile stages (the shrimps being fished at the juvenile stage in the lagoon).

Some other stocks, at a lower degree, are also exploited both in the sea and the lagoon (Elops, Sardinella, Pomadasys, etc...). Generally even when the stock is exploited on only one side, there is a certain dependance between the marine and lagoon stocks.

The sea and lagoon exchanges take place through some outlets which are highly diversified in the Ivory Coast: seasonal or permanent outlets, natural or artificial outlets with important or limited flow.

Using this diversity, this project aims to assess the importance of the interface and the exchange modalities between the marine and lagoon ecosystems for the management of the stocks exploited by an artisanal fishery having an important impact in the country.

2. RESEARCH PROPOSALS

As mentioned above, the implementation of a project concerning the rational exploitation of the coastal marine or lagoon stocks requires a joint study of both ecosystems concerning their bio-ecological and fishing aspects. An emphasis will be made on the interfaces and their hydrological and biological exchanges.

Three of the Ivorian lagoons presenting different aspects of regulation are selected for this study: The Aby, Ebrie and Fresco (or Grand Lahou) lagoons.

The Aby and Ebrie Lagoons are permanently opened to the sea, with limited exchanges and weak fresh water feeding into the first one whereas the second one has more important exchanges and is fed by more continental waters with high seasonal variations. The third lagoon (Fresco or Grand Lahou) will also be studied for its seasonal outlet.

The proposed project takes into account the following research proposals:

- Hydrodynamics of the outlets, marine and lagoon hydroclimate
- Bio-ecology of the coastal and lagoon species
- Fisheries knowledge and exploited stock dynamics
- Socio-economics of the coastal and Lagoon artisanal fisheries.

2.1. HYDRODYNAMICS OF THE OUTLETS - LAGOON AND COASTAL HYDROCLIMATE

This hydrodynamics study, proposed for a better understanding of the exchanges between the sea and the lagoon, also aims to estimate the marine and continental components with their seasonal and interannual variabilities for the elaboration of explicative and predictive hydrodynamics models in relation to the biological aspects (primary production).

The study being circumscribed will be extended to a regional hydrodynamic survey along the project life to provide useful data allowing an accurate description of the fish biotopes.

2.2 BIO-ECOLOGY OF THE COASTAL MARINE AND LAGOON SPECIES

This covers two complementary aspects.

The first one (synecology) will permit a follow up of the stocks' evolution in the different ecosystems. One will search to characterize the stocks structure variations in relation to the environments seasonal and interannual changes. Special attention will be paid to the migrations through the interfaces so that a relationship will be established between the water exchanges and the biological exchanges (movements of pelagic larvae, juveniles and adults). The comparative study of the different interfaces will lead to a better understanding of the mechanisms regulating the movements of the marine coastal and brackish waters stock with regards to the peculiarities of each outlet. The impact of human activities (such as public works, sewage through the outlets, intensive navigation, etc...) on the sea-lagoon exchanges will also be taken into consideration.

The second aspect of this research proposal emphasizes the biology and the autoecology of some economically and/or scientifically interesting amphibiotic species such as Ethmalosa fimbriata, Gerres nigri, Gerres melanopterus, etc... These species are also appropriate for the ecophysiological study of osmoregulation and breeding phenomena.

- The fish, Ethmalosa fimbriata, actually represents the main part of the lagoon fisheries production. This marine species is very euryhaline and can live in a salinity range of 1 to 35°/oo. The first part of its life takes place in the lagoon where the first breeding occurs and then it moves towards the sea. Nevertheless, E. fimbriata is not observed yet in abundance in the landings of the coastal artisanal fisheries. The lagoon stocks depend on a marine recruitment and it is of obvious importance to determine the spawning areas and the breeding modalities.

- The genus Gerres includes two very euryhaline species: Gerres nigri and G. melanopterus. The first species breeds in the lagoon and the second one is never observed in sexual activity during its lagoon stay.

2.3 KNOWLEDGE AND EXPLOITED STOCKS DYNAMICS

The follow up of the marine coastal and lagoon stocks exploitation is the main part of the project. It will emphasize the investigation network implementation on the lagoon and along the coastline in order to collect statistical fishing data (gear recordings, fishing efforts, catches by effort units, total catches, and catch per species, etc...).

Some of the landing areas have been surveyed by the C.R.O. (Centre de Recherches Oceanographiques) which is now processing the data.

The first goal of the program is to provide to the Ivory Coast a precise estimation of the artisanal fisheries catches. From these results and using some historical data it is possible to elaborate population dynamic models of some stocks such as Ethmalosa, Sardinella and Penaeus.

According to the nature of the obtained results, there will eventually be proposed some management measures of the artisanal fishery in order to ensure a rational stocks management.

2.4. SOCIO-ECONOMY OF COASTAL MARINE AND LAGOON ARTISANAL FISHERIES

Many problems will be studied, taking into consideration the economics (fish prices evolution, marketing, income evaluation, direct and indirect employment) and the socio-ethnological aspects. The artisanal fishery in the Ivory Coast is the concern of autochthonous and foreign fishermen. Therefore studies on the ethnic origin, and the social organization, the fishing method of the fishermen and their modalities of sharing the resources or their strategy of occupying the aquatic media in order to elaborate management laws adapted to the social and economical existing structures will be undertaken.

2.5. CONCLUSION

The characteristic of this project is its global approach to the artisanal fishery problem in the Ivory Coast.

There is no interest to discriminate the coastal marine stocks and the lagoon stocks but quite the reverse. It is important to identify the contribution of each of them in stock assessment.

The project will allow an adaption of the laws for a better stock management including the evolution of the fishing techniques. The expected results will give the insurance of production optimum (even the national consumption is not covered) and maintain the fishing along the coastline as a traditional activity.

3. PRACTICAL ORGANIZATION

3.1. IVORIAN INFRASTRUCTURE

The "Centre de Recherches Oceanographiques" (C.R.O.) counts five

scientific departments with about 50 researchers and technicians which are listed below:

- Physical Oceanography
- Hydrobioclimate
- Studies of the marine exploited stocks
- Studies of the lagoon exploited stocks
- Aquaculture

The C.R.O. also has a laboratory for the chemical and biochemical analysis. Since the implementation of the computing center, there is a certain autonomy for the data processing.

The fleet is composed of two boats; one for the sea cruise and the other for the lagoon.

The submitted project will need 10 or 15 researchers and some aspects of the project will be under the responsibility of some other national structures (University, Hydrological Service, Institute of Tropical Geography, Institute of Socio-ethnology).

The statistical investigations network should be implemented in collaboration with the "Direction des Peches Maritimes et Lagunaires". In other words, the C.R.O. is able to completely realize this project.

3.2. PROJECT COSTS

It only concerns the investment evaluation for the scientific material because the detailed figures will be given during the description of the program operations.

INVESTMENT

Common material

- BOATS

  - 1 12 m boat
  - 1 outboard engine boat (140 HP)
  - 3 outboard engine boats (50 HP)

Estimated Price $US 86,000

- VEHICLES

  - 2 break vehicles
  - 1 field vehicle
  - 2 small vehicles

Estimated Price $US 58,000

DATA PROCESSING

The C.R.O. has a Hewlett Packard 1000 computer which needs to be extended by the following equipment:

- 2 Disc Units
- 1 Digital tape unit
- 2 Display terminals
- 1 Central unit
- 256 K bytes

Estimated Price $US 115,000

For the hydrodynamics study there is a need of:

- 4 tide gauges
- 6 Aanderra decoder
- field equipment for temperature, salinity, oxygen, pH, redox

Estimated Price $US 38,000

The bioecological study will require:

- Fishing gears - Trawls, beach seines, gillnets, etc.
- Precision balances, binocular microscopes

Estimated Price $US 43,000

THE TOTAL INVESTMENT IS EVALUATED FOR $US 297,000

MANPOWER NEEDED

Since the scientific operations are not presented in detail it is difficult to evaluate the cost of the required manpower for the project implementation.

GENERAL BUDGET

It concerns the expenses dealing with fuel and other miscellaneous items. More details will be given at a later data.

THE STOCK ASSESSMENT COLLABORATIVE RESEARCH

SUPPORT PROGRAM (STOCK ASSESSMENT CRSP)

ROME, MARCH 7-10, 1983

LA PECHE ARTISANALE MARITIME ET LAGUNAIRE EN COTE D'IVOIRE

par

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I - NATURE ET JUSTIFICATION

Tout le long de la façade maritime ivoirienne (environ 550 km), une pêche artisanale relativement importante est pratiquée. Elle concerne 3500 à 4000 pêcheurs qui produisent chaque année entre 15.000 et 20.000 tonnes de poisson.

Trois grands systèmes lagunaires d'une surface totale d'environ 1200 km^2 sont groupés dans la région est de la côte ivoirienne. La production de la pêche artisanale est du même ordre que la précédente (15.000 à 20.000 tonnes par an).

L'ensemble des pêches artisanales, maritimes et lagunaires, représentent un peu plus de la moitié de la production halieutique de l'ensemble de la Côte d'Ivoire.

Il est à noter que certaines pêcheries, parmi les plus importantes, présentent l'originalité d'exploiter tantôt les stocks marins, tantôt les stocks lagunaires (d'une façon générale, les méthodes de pêche sont les mêmes dans les deux milieux).

Les lagunes ivoiriennes, outre les forts rendements qu'elles permettent, représentent une étape souvent obligatoire des cycles biologiques de nombreuses espèces côtières et, par là, jouent probablement un rôle fondamental dans le maintien des stocks exploitables. L'exemple le mieux connu est celui de la crevette rose Penaeus duorarum dont le cycle comporte une phase lagunaire de trois mois entre le stade post-larvaire et le stade juvénile (stade auquel elles sont exploitées en lagune).

D'autres stocks, dans une moindre mesure, sont également l'objet d'une exploitation mixte mer/lagune (Elops, Sardinella, Pomadasys, etc...). D'une façon générale, même lorsque l'exploitation du stock s'effectue dans un seul milieu, il existe une certaine dépendance entre stocks marins et stocks lagunaires.

Les échanges entre milieu marin et milieu lagunaire se font par l'intermédiaire d'exutoires qui présentent en Côte d'Ivoire une grande diversité : ouverture saisonnière ou permanente, naturelle ou artificielle de débit important ou limité.

En utilisant cette diversité, l'objet du projet est de préciser l'importance de l'interface et les modalités d'échanges entre les milieux côtiers marins et lagunaires dan le cadre d'une gestion des stocks exploités par une pêche artisanale ayant, au niveau du pays, une importance réelle.

II - LES AXES DE RECHERCHE PROPOSES

Comme le montrent ces quelques rappels, la mise en place d'une exploitation rationnelle des stocks marins côtiers ou lagunaires nécessite l'étude conjointe des deux milieux tant pour leurs aspects bio-écologiques que pour leurs aspects halieutiques. Une attention particulière devra, en outre être portée aux interfaces et aux échanges hydrologiques et biologiques qu'elles autorisent.

Parmi les lagunes ivoiriennes il en sera choisi trois de fonctionnements différents : les lagunes Aby, Ebrié et Fresco (ou Grand-Lahou). Les deux premières sont ouvertes en permanence sur la mer, l'une avec des échanges limités et une alimentation en eau douce faible l'autre avec des échanges plus importants et des apports continentaux présentant de fortes variations saisonnières. La troisième lagune (Fresco ou Grand-Lahou) sera également étudiée pour son ouverture plus ou moins saisonnière.

Le projet proposé prend en compte ces différents thèmes de recherche regroupés en quatre grandes rubriques :

- Hydrodynamique des passes. Hydroclimat lagunaire et côtier.
- Bio-écologie des espèces côtières et lagunaires.
- Connaissances des pêches et dynamique des populations exploitées.
- Socio-économie des pêches artisanales côtières et lagunaires.

II.1 - HYDRODYNAMIQUE DES PASSES - HYDROCLIMAT LAGUNAIRE ET COTIER

Une étude hydrodynamique au niveau des interfaces mer/lagune est proposée afin de mieux comprendre les mécanismes des échanges hydriques, d'estimer les parts respectives des composantes marines et continentales en prenant en compte leurs variabilités saisonnières et interannuelles. Cette étude devrait conduire à l'établissement de modèles explicatifs et prédictifs permetant aux biologistes de caractériser le contexte hydroclimatique dans lequel évoluent les organismes qu'ils étudient. Cette étude d'hydrodynamique ponctuelle réalisée au niveau de l'interface devra être complétée par un suivi hydroclimatique régional pouvant inclure l'estimation de paramètres biologiques synthétiques - production primaire). Ces données permettront de caractériser les divers biotopes rencontrés par les poissons au cours de leur cycle biologique. Ces études s'étendront sur toute la durée du projet et permettront de préciser la part des variations intra et interannuelles.

II.2 - BIO- ECOLOGIE DES ESPECES COTIERES ET LAGUNAIRES

Cet axe de recherche comporte à notre sens deux aspects complémentaires.

Le premier, synécologique, doit permettre de suivre l'évolution des peuplements dans les différents milieux d'étude. On cherchera ici à caractériser les variations de structure des peuplements en liaison avec les variations saisonnières et interannuelles de l'environnement.

Une attention particulière sera portée à l'étude des migrations au travers des interfaces. On cherchera à mettre en rapport les échanges hydriques avec les échanges biologiques (mouvements de larves pélagiques, de juvéniles, d'adultes). L'étude comparée des différentes interfaces permettra de mieux préciser les mécanismes de formation des peuplements lagunaires ou côtiers à exploiter en reliant les caractéristiques de ces peuplements aux particularités de chaque exutoire. On tiendra compte également des perturbations provoquées par les activités humaines (grands travaux, rejets d'effluents au niveau des

passes, circulations intensives de bateaux, etc...) sur les échanges mer-lagune.

Le second aspect de cet axe de recherche prend en compte l'étude biologique et autécologique fine de certaines espèces amphibiotiques d'intérêt économique et/ou scientifique comme par exemple Ethmalosa fimbriata, Gerres nigri, Gerres melanopterus etc... De plus ces espèces constituent un matériel de choix pour l'étude écophysiologique des phénomènes d'osmorégulation et de reproduction.

- L'ethmalose, Ethmalosa fimbriata constitue actuellement l'essentiel de la production des pêcheries lagunaires. Cette espèce, bien que d'origine marine est très euryhaline puisqu'elle se rencontre dans des salinités de 1 à 35°/oo. Elle passe une première partie de son existence en lagune où elle effectue sa première reproduction puis migre vers la mer. Cependant, elle n'est jamais observée en abondance dans les débarquements des pêches artisanales côtières. Les stocks lagunaires étant partiellement dépendants d'un recrutement d'origine marine, il serait du plus grand intérêt de préciser les lieux de ponte et les modalités de la reproduction en mer.

- Le genre Gerres comprend deux espèces G. nigri et G. melanopterus également très euryhalines. G. nigri se reproduit en lagune alors que G. mélanopterus n'a jamais été observée en activite sexuelle dans sa phase lagunaire.

II.3 - CONNAISSANCE DES PECHES ET DYNAMIQUE DES STOCKS EXPLOITES

Le suivi de l'exploitation des stocks côtiers et lagunaires constitue le volet principal du projet. Il aura pour but de mettre en place un réseau stratifié d'enquêtes sur les lagunes et sur la façade littorale en vue d'acquérir les paramètres de base des statistiques de pêche (recensement d'engins, efforts de pêche, captures par unité d'effort, captures totales et par espèce, structures en taille). Quelques points de débarquements appartenant à la zone d'étude projettée sont déjà suivis par le Centre de Recherches Océanographiques d'Abidjan. Le C.R.O. assure déjà les traitements de ces enquêtes.

L'objet premier de ce programme est de fournir à la Cote d'Ivoire, une estimation précise des captures issues de la pêche artisanale. A partir de ces résultats et en intégrant certaines données historiques, il sera possible d'établir des modèles sur la dynamique de population de certains stocks : Ethmalose, Sardinelles, Crevettes ....

Selon la nature des résultats obtenus, il sera éventuellement proposé des mesures d'aménagement de la pêche artisanale en vue d'assurer une gestion rationnelle des stocks.

II.4 - SOCIO-ECONOMIE DES PECHES ARTISANALES COTIERES ET LAGUNAIRES

Plusieurs aspects devront être étudies allant de problèmes économiques (évolution des prix du poisson, commercialisation, évaluation des revenus et des emplois directs et indirects), à des problèmes d'ordre socio-ethnologique. La pêche artisanale ivoirienne regroupe des pêcheurs d'origines très diverses, autochtones ou étrangers. Une étude approfondie de l'origine ethnique et de l'organisation sociale de ces pêcheurs, de leur mode de pêche, ainsi que des modalités de partage des ressources et d'appropriation du milieu, est indispensable à l'élaboration d'une réglementation adaptée aux structures sociales et économiques existantes.

II.5 - CONCLUSION

L'originalité de ce projet réside dans l'approche globale du problème posé par la pêche artisanale en Côte d'Ivoire. D'une part, il n'est pas envisageable de dissocier les stocks lagunaires des stocks côtiers. Le projet cherchera à évaluer la part respective des milieux lagunaires et côtiers dans la régulation des stocks. D'autre part, il permettra d'adapter une réglementation permettant une gestion rationnelle des stocks exploités, en fonction des variations des conditions du milieu, des peuplements ainsi que des évolutions sociotechniques des pêcheurs. Les résultats attendus pour la Côte d'Ivoire seront à deux niveaux : l'assurance d'une production optimalisée de poissons (même si elle ne suffit à couvrir les besoins du pays) et le maintien, le long de la façade maritime, d'une activité traditionnelle, la pêche.

III - ORGANISATION PRATIQUE

III.1 - INFRASTRUCTURE IVOIRIENNE

Le Centre de Recherches Océanographiques de Côte d'Ivoire est structuré actuellement en cinq départements scientifiques répresentant une cinquantaine de chercheurs et techniciens supérieurs. Il s'agit des départements :

1° - océanographie physique
2° - hydrobioclimat
3° - études des stocks exploités marins
4° - études des stocks exploités lagunaires
5° - aquaculture

Le Centre dispose d'un laboratoire pouvant assurer les analyses chimiques et biochimiques nécessaires. Depuis la mise en place d'un centre de calcul informatique, le C.R.O. possède une certaine autonomie lui permetant d'effectuer les traitements dont il a besoin. Son parc naviguant est constitué d'une vedetre côtière et d'un bateau lagunaire.

Le projet d'étude de la pêche artisanale maritime et lagunaire de Côte d'Ivoire pourrait concerner de 10 à 15 chercheurs du Centre qui, actuellement, sont impliqués individuellement dans des programmes similaires à ceux décrits ci-dessus. Certains aspects du projet pourront être sous-traités avec d'autres organismes de recherche en Côte d'Ivoire : (Université, Service d'Hydrologie, Institut de Géographie Tropicale, Institut de Socioéthnologie). Le réseau d'enquêtes des statistiques de pêche artisanale serait à mettre en place en collaboration avec la Direction des Pêches Maritimes et Lagunaires. Le Centre de Recherches Océanographiques a donc la possibilité de maîtriser l'intégralité de ce projet.

III.2 - EVALUATION DU PROJET

Le chiffrage détaillé de ce programme ne pourra pas être présenté dans le cadre de cet avant-projet, car il nécessiterait une définition plus précise des opérations à accomplir dans chacun des 4 axes de recherche proposés.

Seule une estimation de l'investissement en gros matériel sera présentée.

A) - INVESTISSEMENT

Celui-ci se répartit en un investissement commun aux différents programmes et en un investissement propre aux axes - hydrodynamique et bioécologie -.

- <u>Matériel</u> commun : naviguant

  . 1 vedette côtière de 12 m. utilisée principalement par les programmes d'hydrodynamique et de bioécologie.

. 1 coque avec un moteur hors bord (140 CV) permettant des liaisons rapides sur l'eau.

. 3 coques équipées de moteurs hors bord de plus faible cylindrée (50 CV)

Estimation : 30.000.000 FCFA

- Roulant :

. 2 voitures breaks

. 1 voiture bâchée

. 2 véhicules légers

Estimation : 20.000.000 FCFA

- Informatique :

Le Centre de Recherches Oceanographiques de Côte d'Ivoire est actuellement équipé d'un ordinateur Hewlett Packard série 1000. Dans le cadre du projet, une extension du système sera necéssaire : 2 unités disques, 1 dérouleur de bande, 2 consoles, 1 unité centrale 256 Koctets, 1 imprimante rapide.

Estimation : 40.000.000 FCFA

- Axe hydrodynamique

. 4 marégraphes

. 6 courantomètres de marque Aanderra

. Un périphérique de décodage des données Aanderra

. Matériel de terrain permettant la détermination in situ des principaux paramètres du milieu (température, salinité, oxygène, pH, redox)

Estimation : 13.000.000 FCFA

- Axe bioécologie :

. Equipement en matériel de pêche : chaluts, sennes tournantes et sennes de plage, ...

. Equipement en matériels scientifiques : balances de précision, loupes binoculaires, ...

Estimation : 15.000.000 FCFA

L'investissement total en gros matériel serait de l'ordre de 120 millions de francs CFA à répartir principalement sur les deux premières années du programme.

B) - BESOINS EN PERSONNEL

Les opérations scientifiques n'étant pas détaillées dans la description de cet avant-projet, il est difficile de définir actuellement les besoins exacts en Techniciens supérieurs, Techniciens et enquêteurs de terrain à recruter pour la durée du projet.

C) - FONCTIONNEMENT GENERAL

Les principaux chapitres du fonctionnement seront ceux du carburant des voyages-missions, des frais de terrain et des salaires moyennant les recrutements réalisés. Dan l'état actuel du projet, il ne nous est pas possible de définir ce budget de fonctionnement.