

viii Insufficient government assistance to fishermen.

(2) The master plan based on the fisheries development survey results

Based on the above survey results, the master plan for promoting Costa Rica's fisheries has been formulated as follows:

A. Model Fishing Village Plan

Because of a strong indication of willingness for expanding operations, fishermen from Playas del Coco provide an appropriate group to start a model fishing village as part of this Plan. Such village should be provided with all necessary facilities and a fishery cooperative should also be established to tackle the problems concerning sales routes, financing, education and training. The proposed organization should be unlike existing fishery cooperatives. By fostering this model village as a positive demonstration, other fishing villages would be induced to follow suit to promote fisheries. Since this Plan must be implemented with top priority, it has been devised as a short-term program.

B. Fishermen Training Program Conducted by Appropriate Fishery Technology Institutions with Experience in Fishermen Education and Training Programs

According to the fishermen interviews, many expressed the desire to receive education and training. Even the

questionnaire results from the fisheries authorities declared fishermen education as the top priority. This survey concluded that there was a lack of business sense among the fishermen. Thus, insufficient education and training for the fishermen was quite apparent. This program was therefore formulated to alleviate this deficiency. The implementation of this program should be the responsibility of those institutions with competence in fishery technology training. Since this program had significant importance, it was devised as a short-term program.

C. Promotion of Fishery Cooperatives

Since the present fishery cooperatives in Costa Rica have so many of the characteristics found in a Marine Products Union, the fishery cooperative is unattractive to fishermen. Consequently, in order to promote fisheries in Costa Rica, it will be necessary to promote fishery cooperatives whose primary activities will include fishing, sales, purchasing, credit, counseling, and mutual cooperation. Due to the necessity of this promotion program, it was devised as a short-term program.

D. Fishing Village Improvement Plan

This medium-term provision plan aims to spread the positive results of the short-term Model Fishing Village Plan to be organized in the short-term phase to other fishing villages nationwide.

E. "Fishermen Training Program" of the Fishermen Education and Training Program

In "B. Fishermen Training Program to be undertaken by appropriate institutions," the selected training staff will rotate among villages by boat or by car to train fishermen. It is anticipated that a "Fishermen Training Center" will be established to facilitate the education and training of government employees, fishery cooperative counselors, fishermen, and the general public. This program is therefore a medium-term program.

F. Marine Products Distribution Reform

Since there are no wholesale fish markets in Guanacaste Province, outside brokers buy the fish from fishermen at the fishing ports. In the future, fishery cooperatives will be established. These cooperatives must build wholesale fish markets and introduce an auctioning system. This reform program has therefore been devised as a medium-term program.

(5) Miscellaneous

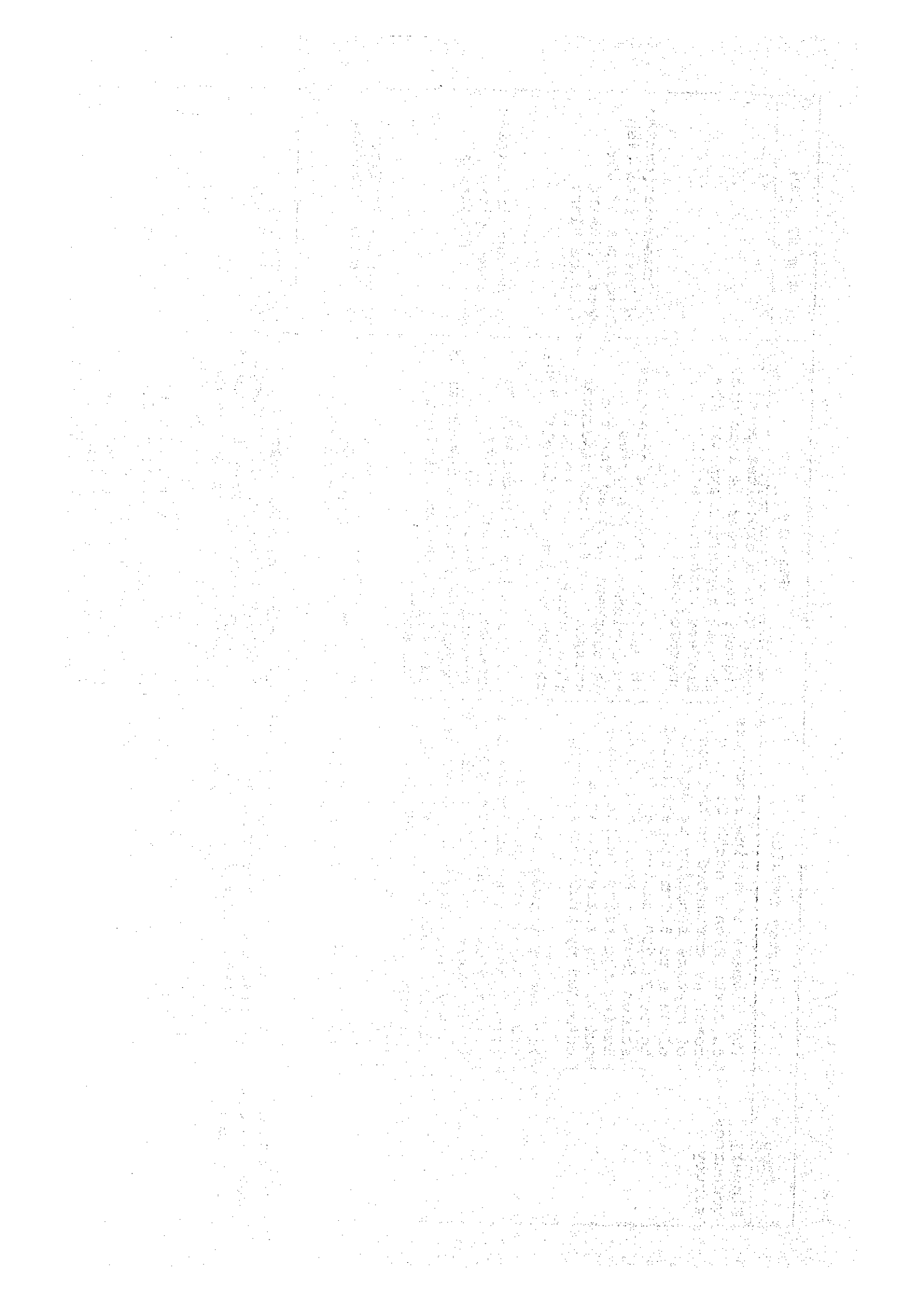
A. Aquaculture Promotion Program

There is a worldwide trend which is shifting from the catching of fish to the cultivation of fish. In Costa Rica as well, it can be surmised that the promotion of aquaculture will attract much interest over the long term.

B. Fish Cultivation Promotion Program

Though fishing techniques continue to improve yearly, the fish and shellfish stock stays almost the same. Thus, if fishing is not regulated, the fishery resources will steadily decrease, leading to the demise of fisheries. In recent years, the seedling of the fish and shellfish has been artificially controlled from egg and hatching stage to the raising of larvae. Once the fish grow to a certain size, they are released into the ocean for natural growth. Concerted efforts should be made in order to demonstrate the appropriateness of fish cultivation programs as a tool for managing fish stocks and for maintaining fisheries as a stable industry. If suitable and justifiable, it will be necessary to implement this program over the long term.

Item	Survey results	Summary	Master plan
Fishery resources survey	<p>The biomass of marine resources on Costa Rica's north Pacific coast as estimated on the basis of daytime sampling at depths of 50 m to 500 m was estimated to be 21,000 during the dry season (Nov. - Feb.) and 60,000 during the rainy season (Jun. - Oct.). The estimates were obtained by trawling surveys.</p> <p>The survey showed that commercially viable marine resources such as shallow-water shrimp were on the decrease, while there was an abundance of langostino, Peprilus, Argentina aliceae, cabrilla, and other resources that are not being exploited by Costa Rica.</p> <p>Also, surveys done by other fishing methods showed that there was much tuna and sarda.</p>	<p>Costa Rica's exploitation of fishery resources is lopsided. It must hereafter exploit the fishery resources still unexploited.</p> <p>It will therefore be necessary to implement a fisheries development program for the unexploited fishery resources. This program is to be part of the Model Fishing Village Plan.</p> <p>It will also be necessary to conduct a survey on the commercialization of unexploited marine resources in Pacific northwest (including the south).</p> <p>It is essential to have a program to develop and commercialize the unexploited marine resources.</p>	<p>-> Commercialization of Unexploited Fish Resources of the Model Fishing Village Plan.</p> <p>-> Commercialization of Unexploited Marine Resources.</p> <p>-> Marine Products Processing Program.</p>
Fisheries development program	<p>For this survey, fishermen were interviewed, questionnaires were taken from fisheries experts, and consultants were surveyed. The survey results revealed that in the fishing villages of Costa Rica's north Pacific coast, the following problems existed:</p>	<p>As a comprehensive measure, Playas Del Coco or one adjacent village which desires to expand operations, will be presented as a model fishing village. It will have an adequate infrastructure and a fishing cooperative that will handle financial matters and offer education and training. The positive results of this demonstration village should be used to induce other fishing villages in Guanacaste Province and the rest of the country to follow suit.</p> <p>The following have been devised as independent countermeasures:</p>	<p>-> Model Fishing Village Plan.</p>
	<p>1) Problems concerning existing fishing cooperatives</p> <p>A. Low membership ratio of fishermen.</p> <p>B. The cooperatives do not handle financial matters (sales, credit, purchasing, etc.)</p> <p>2) The fishing villages lack facilities and infrastructure.</p> <p>3) Many fishermen have a strong desire for improving their operations. However, they have few opportunities for receiving fisheries-related education and training.</p> <p>4) There are problems with marine products distribution.</p>	<p>The establishment of a fishing cooperative that will handle the primary activities of marine products processing, sales, purchasing, credit, counseling, and mutual cooperation.</p> <p>*By promoting the cooperative, the country's fisheries will be promoted.</p> <p>The positive results of the "Model Fishing Village Plan" are to spread on a nationwide scale.</p> <p>Training staff will visit fishing villages to educate and train coastal fishermen.</p> <p>A fisherman training center will also be built to offer high-level education and training.</p> <p>Guanacaste Province has a fish buying scheme, but no wholesale market. Consequently, there is no real middleman, only outside brokers who buy the fish from the fishermen.</p> <p>There is the worldwide problem of overfishing due to the advancement of fishing techniques. Though it is beyond the scope of the survey, countermeasures must be conceived to facilitate the continuation of fishing.</p>	<p>-> Promotion of Fishing Cooperatives.</p> <p>-> Fishing Village Improvement Plan</p> <p>-> Fishermen Training Program by appropriate institutions.</p> <p>-> Fishermen Training Program.</p> <p>-> Marine Products Distribution Reform.</p>
Misc.			<p>-> Aquaculture Promotion Program.</p> <p>-> Fish Cultivation Promotion Program.</p>



5-3 Individual programs

5-3-1 Model Fishing Village Plan (Short-term)

(1) Objectives

In order to promote fisheries on Costa Rica's northwest Pacific coast, Playas del Coco or one adjacent village in Guanacaste Province will be improved with fishery-related facilities and equipment to serve as a model fishing village. The demonstrative effects of this plan are to induce nearby fishing villages to follow suit. Eventually, fishing villages nationwide are to be similarly improved.

(2) Scope of plan

The model fishing village will be provided with improved fishery infrastructure. A fishery cooperative will also be established.

① Fishery infrastructure

The selected village, either Playas del Coco or one adjacent site will be improved in its fishery infrastructure outlined below. These facilities will be managed mainly by the fishery cooperative. Specific procedures for the use, maintenance, cost management, etc., of these facilities will be determined by a steering committee for the facility management and operation organized by the relevant government agencies under the leadership of MAG.

- i A pier properly designed and equipped with fuel and water supply stations and simple cargo handling facilities
- ii Processing factory (with an area for disposal of catches)
- iii Cold storage facility
- iv Freezing facility
- v Ice machine and ice storage facility
- vi Slipway
- vii Fishery cooperative facilities (with a lecture hall)
- viii Supply warehouse
- ix Refrigeration trucks

② Establishment of a fishermen's cooperative

A fishermen's cooperative will be established for the fishermen of the model village. The cooperative will undertake credit services, sales operations, purchasing, manufacturing, counseling, and other activities for the members of the cooperative.

- A. To improve the fishermen's fishing techniques and to foster personal development, the cooperative will

organize through appropriate coordination with already existing institutions, the following education and training courses:

- i Introduction of new fishing methods and equipment, and courses for fishermen's education.
- ii Education for efficient management and use of demersal fish resources.

B. Distribution reform program

- i Selling of all products through the fishermen's cooperative.
- ii To preserve fresh fish and distribute frozen fish.
- iii Commercialization of value-added products.

C. The fishermen's cooperative will undertake purchasing activities for the selling of fuel, fishing equipment and supplies.

D. The cooperative will offer credit services to provide loans to fishermen and accept deposits.

E. Development of unexploited fisheries resources

Trial fishing operations should be conducted to develop unexploited fisheries resources. The surveys should determine the best-suited fishing equipment and methods to

these fisheries resources. Members of the cooperative will also be educated regarding unexploited fisheries.

F. Development and commercialization of value-added products

The cooperative will conduct trial manufacturing of value-added products made from low-value fish or unexploited fish. The trial manufacturing will be done by the cooperative's own processing factory.

③ Fishermen's education and training

A. Visitation by education- and training-related agencies (INA, University of Costa Rica, Colegio de Puntarenas, etc.)

A training vessel or training bus will visit the model fishing village and other fishing villages to educate and train the local fishermen.

B. Fishermen's training center

Fishermen's cooperative officials and members will be sent to the fishermen's training center, which will be discussed under a separate item, to receive education and training.

C. Fishermen's training by the cooperative

As mentioned in "2) A.", the fishermen's cooperative

itself will also educate and train local fishermen.

④ A Development Plan for Unexploited Fisheries Resources

A. Plan of operation

Off the coast of Guanacaste Province, the pelagic fish season is year-round. However, pelagic fish is most abundant from May to November. They include tuna, *Sarda*, *Coryphaena hippurus*, and marlines. Also, at depths of 100 m to 200 m, there are species of potentially high commercial values, such as *Bothidae*, *Epinephelus*, *Merlusa*, and *Peprilus*. In order to develop these unexploited fisheries, trial fishing operations should be conducted aboard appropriate vessels.

To conduct surveys on pelagic fish and deep-sea fish with optimum operation, it will be necessary to have a minimum of 3 operation vessels that will exchange information on catch. Five vessels have been recommended to replace that are grounded for repairs, unloading operation, etc.

The fishing vessels will be managed and operated by the fishery cooperative established in the Model Fishing Village.

5-3-2 Fishing Village Improvement Plan (Medium- and long-term)

The results from the Model Fishing Village Improvement Plan will serve as the primary example. Fishing villages across the country will eventually be provided with similar fishery-related facilities and equipment according to the Pilot Model Fishing Village Improvement Plan. The improvement plan will of course be modified to suit individual fishing villages.

5-3-3 Fishermen education and training programs

(1) Fishermen training program by education and training agencies (Short-term)

① Background

According to the Fisheries Development Program Survey, there is a strong desire for further education and training of fishermen. Therefore, the facilities and equipment of existing education and training institutions should be augmented.

② Objectives

The education and training program should have access to a training vessel (or training bus) visit fishing villages along the coasts of Costa Rica to offer courses and training sessions for fishermen.

③ Plan of operation

The first proposal is to have a training vessel visit fishing villages. The local fishermen will work on the training vessel and undergo on the job training. Relatively easy fishing methods (long lines, gill nets, and pole-and line fishing) will be covered. The training vessel will also be equipped with nautical instruments necessary for coastal operations, such as a gyrocompass, radar, direction finder, and a fish detector.

The second proposal is to have a training bus visit the fishing villages to offer courses and training sessions for the fishermen. The bus will be equipped with video equipment, simulation equipment, nautical instruments, and other equipment for training purposes.

④ Specifications of training vessel and training bus

A. Training vessel

- o Length of training voyage: 1 week
- o Length of FRP vessel: 15 m
- o Main engine:
- o Fishing equipment: Line hauler (convertible to a net hauler by a part substitution)
- o Nautical instruments: Gyrocompass, radar, direction finder, fish detector, radio, speedometer, etc.
- o Fishing nets and gear, auxiliary fishing gear, etc.

B. Training bus

- o Large bus: 1
- o Installed equipment: Television, video deck, simulator.
- o Training equipment: Fish detector, direction finder, radar, radio.

⑤ Equipment to support the training program

- o Teaching equipment: Video deck, television, simulator, overhead projector, copier, word processor, computer, camera.

- o Training machinery: Engines, pumps, freezer, inboard engines.
- o Training items: fish nettings, thread, netting needles, spikes, floats, sinkers, ropes, wires.
- o Training instruments: Testers, mega,
- o Miscellaneous

⑥ Support for resource assessment programs

Oceanographic and fishery survey - evaluation of potential resources

The role of CIMAR

- A. Resource assessment, including biological and statistical analysis in the thrust of a research center.
- B. Resource Management (fisheries administration) is the sole responsibility of the direction of fisheries (MSA).
- C. Any sound attempt to organize (promote) fisheries overall development should be based on an harmonic integration of:
 - o resource management (government)
 - o fishermen and fishery products brokers
 - o research institutions
 - o training programs

(2) Fishermen training program (Medium-term)

① Objectives

Although Costa Rica's educational standards are high, the results of the questionnaire have concluded that the fishermen have a strong desire to receive further education and training. To promote the country's fisheries, a fishermen education and training program to improve the skills of the fishermen will be necessary.

② Program description

A "Fishermen's Training Center" will be built to educate and train fishermen, government employees, fishery counselors, and the general public.

3 Operation plan (tentative)

Target	Training curriculum	No. of participants	Term
Gov't employees	Fisheries regulations, overview of fisheries (industry, manufacturing, aquaculture, fishery resources) maritime law, fisheries civil engineering, boat building, etc.	Around 5	One month during spring and autumn
Fisheries counselors	Fisheries regulations, maritime law, overview of fisheries, fisheries business operation, cooperative regulations, etc.	Around 5	6 months
Fishermen	Basics of fisheries regulations and maritime law, fisheries business operation, and separate courses on fisheries, manufacturing, aquaculture, navigation, etc.	Around 5 for each course	1 week for short courses, 1 month for extended courses
General public	Instruction on fisheries and courses for preparing seafood dishes.	About 50	Once a week
Students	Hands-on training for fisheries, manufacturing, aquaculture, boat riding, etc.	According to demand	Summer and winter vacations

5-3-4 Promotion of Fishermen's Cooperatives (Short-term)

(1) Present state of Costa Rica's fishermen's cooperatives

Costa Rica's association/cooperative law (Stipulation No. 6756, April 30, 1982) prescribes the procedure for establishing a cooperative, the cooperative's operations (credit, sales, purchasing, counseling, etc.), the rendering of outside assistance to the cooperative, and other matters. However, the existing fishermen's cooperatives handle only fishery production operations.

(2) The role of the fishermen's cooperative

① The role of the cooperative in a fishing village

The cooperative is an independent enterprise whose purpose is to raise the economic and social standing of fishermen through fisheries production. The ideal cooperative would incorporate most of the local fishermen and offer various services to benefit its members. The cooperative will collect and sell fish catches for fishermen. It will also serve as a local financial institution by accepting deposits from its members and other local populace and extending loans to fishermen. It will offer financing to the local area's fishery-related industries. Moreover, it will supply fuel, fishing gear, and other necessities to fishermen. It will be a comprehensive economic center for the local communities.

To strengthen and assure rational and optimal utilization

of the local fisheries resources in waters in front of the Model Fishing Village, the cooperative through the efforts of its members will play an active role in the effective enforcement of the regulations aimed at protecting the resources (i.e. gear regulations, effort controls and area closures).

The cooperative will support and participate in monitoring the status of the stocks in cooperation with all other responsible parties, namely, Fisheries Department, and Research Institutions.

Important actions to be taken by the cooperative to optimize utilization of the fisheries resources include:

- a. mariculture programs;
- b. fish propagation; and
- c. artificial reef building.

In doing so, the cooperative will assign special attention to environmental protection programs.

Further efforts should be made aiming to update legislation with the purpose of assuring each fishing village prioritized access to their fishing grounds.

The fishermen's cooperative must develop into an indispensable entity by having the local fishing village and nearby areas prosper through the cooperative's services and activities.

② Fishermen's cooperative services

A. Credit services

The cooperative's credit services will include the acceptance of members' deposits, the extension of loans, and the augmentation of the fisherman's credit standing. As outlined below, at the early stages of fishermen's cooperatives, assistance and cooperation from the government and relevant financial institutions will be indispensable.

i Potential collateral for the cooperative

Since it is difficult for an individual fisherman to secure financing directly from financial institutions, the cooperative will secure the financing and in turn extend the loan to the individual. In order for the cooperative to secure financing from a financial institution, it will mortgage its facilities and equipment. The cooperative will accept a collateral from the borrowing individual member. This collateral will in turn be offered to the financial institution as backup security. Until the cooperative's credit standing becomes firmly established, the government will have to provide assistance for the financing, guarantee, etc.

ii Cooperation from government-affiliated financial institutions

The cooperative may obtain loans not only from private financial institutions, but even more from government-

affiliated financial institutions (i. e. INFOCOOP and BPDC).

Being a cooperative enterprise comprised of fishermen, the fishermen's cooperative offers various comprehensive services, possesses fishery-related expertise and information, and serves a specific geographical area. It will be important to use these characteristics so that the cooperative can advance its credit services and fulfill and develop its financial role.

B. Sales operations

Sales operation will be one of the cooperative's mainstay activities. It will be important to maintain and increase cooperative sales by giving guidance to fishermen and strengthening the bonds between them.

One way the sales operation can be expanded is by having a cooperative affiliate build a fishery products distribution center where the target consumer market is located. This center will become an outlet for local sales.

The cooperative need not limit its sales operations to production areas. The cooperative is to strengthen sales operations at target consumer markets by establishing links with local distributors. This should be done after studying the consumer trends and pricing trends at the target consumer markets and accumulating adequate sales and distribution know-how.

C. Purchasing activities

The cooperative is to purchase fuel, fish bait, fishing nets and gear, and daily necessities. In order to expand purchasing activities, a system to guide and provide various supplies for fishermen's production activities and livelihood must be established. The utilization factor and volume of the provisions must be ensured and increased.

D. Cooperative benefits

The cooperative will offer benefits such as social welfare benefits, comprehensive benefits, seamen welfare benefits, disaster relief benefits, and a fishermen's pension system. The commercialization of these programs and membership participation must be promoted.

E. Guidance activities

The cooperative will engage in guidance activities in the following ways: counseling for the members' business operations and methods, an orientation program to increase people's knowledge about the cooperative, the presentation of fisheries-related data and the protection of the marine resources.

(3) Strengthening the cooperative's operating base

① Strengthening the financial base

In order for the cooperative to adequately fulfill its economic role, it must have a firm financial foundation. If the operation of the cooperative becomes inadequate or difficult to maintain, there will be adverse effects not only on its members, but also on the local society.

Those responsible for the management and operation of the cooperative must be acutely aware of the cooperative's important social responsibility. They must objectively understand the external conditions of the cooperative. While considering the future outlook, the cooperative will have to properly adapt to the changing external environment.

② Organization and personnel development

The cooperatives to be established will be handling many services and activities. Therefore, the cooperative must have a superior organization which includes qualified personnel that can handle and execute the cooperative's various services and activities smoothly for its members.

If it is a small-scale cooperative, regular services and proper management of operations cannot be expected. The future of the cooperative will become doubtful if the cooperative cannot handle credit services, sales operations, etc., due to its inadequate organization and role.

③ Personnel training

As the center of economic activity, the cooperative must be able to respond to socioeconomic changes. It must also oversee fishing resources and fishing grounds, and give proper guidance to its members. Thus, it will be crucial for the cooperative to have qualified personnel who can execute these activities properly.

The cooperative is to be an organization which will pursue its activities with the mutual agreement of its members. Thus, it will be necessary to have a strong organization to facilitate the function of the cooperative.

In order to establish a strong organization, the cooperative must have qualified personnel. And in order to secure qualified people, the cooperative must be an attractive place of employment. The cooperation of appropriate educational institutions will be required to train the personnel. For special fields such as credit services and sales operations, personnel trainees will be sent to the relevant agency or institution for training.

5-3-5 Survey for the Commercialization of Unexploited
Fisheries Resources (Short-term)

(1) Background

The fisheries resources survey revealed the commercially-potential marine resources below. The list also includes stocks already being exploited by Costa Rica, as well as unexploited ones that have potential for future commercialization.

① Trawling survey

- A. *Heterocarpus* sp.
- B. *Peprilus* spp.
- C. *Argentina aliciae*
- D. *Epinephelus* spp.
- E. *Caulolafilus affinis*
- F. *Loligo diomedea*
- G. *Lutjanus* spp.
- H. *Paralabrax loro*
- I. *Brotula clarkae*
- J. *Bothidae* spp.

② Bottom long line (Types 1 and 2)

- A. *Coryphaena hippurus*
- B. *Thunnus albacares*
- C. *Sarda* sp.
- D. *Seriola viooliana*
- E. *Epinephelus* spp.

F. *Lutjanus* spp.

G. *Brotula clarkae*

③ Trapping

A. *Brotula clarkae*

B. *Cyclopsetta* sp.

C. *Callinectes* sp.

(2) The particulars of the above fish stock.

Based on the survey results, the particulars of viable fish stock are as follows.

Fish stock	Main fishing grounds	Season	Estimated Biomass (tons)	Remarks
<i>Peprilus</i> spp	Region 3	June - Oct.	Approx. 3,100	Large fish (over 80. g) during the fattened season. Bottom trawl, frozen or stored on ice.
<i>Loligo diomedea</i>	Region 3	June - Oct.	Approx. 270	Frozen on board ship. Bottom trawl. Egg-holding fish goes to Japan, and the others are used locally as fish bait.
Flatfish	Region 3	Year round	Small quantity	In the shallows of Region 3, large flatfish become caught in the bottom trawl. For domestic consumption. (Stored on ice.)
<i>Argentina aliciae</i>	All Regions	Year round	Approx. 8,000	Can be consumed locally or a portion can go to Japan. Frozen on board. Bottom trawl.
Large reef fish	Regions 2 & 3	Year round	Unknown, but relatively abundant.	In Region 2 especially, large <i>Epinephelus</i> spp, <i>Caulolatilus affinis</i> , <i>Lutjanus</i> spp, etc., are distributed in the shallows. May be marketed domestically and internationally. Pole fishing. Stored on ice.
Tuna	Regions 2 & 3	June - Oct.	Unknown	Tuna approach the shore during this period. For domestic or international consumption. Pole fishing. Stored on ice.

(3) Exploitation possibilities

Most of the commercially potential fish species listed in (2) above are found in depths down to 200 m over the continental shelf. Some of this fish stock, especially the large fish found in the shallows, is being caught locally by lanchas and boats. There are also hitherto unexploited fish such as *Peprilus*, *Loligo diomedea*, flatfish, and *Argentina aliciae*.

If the quality is acceptable, *Peprilus* (especially the large body size of over 80 g) and egg-holding squid can be exported to Japan. Large fish in the shallows can be exported to the United States or directed for domestic consumption. Squid, *Argentina aliciae*, flatfish, can be prepared for domestic consumption or used as bait fish for long line and pole fishing.

(4) Development procedures

① Surveys required

In order to breed interest among the Costa Rican fishermen to develop these fisheries resources, they must be provided with the answers to the following survey questions:

- i. What is the amount of biomass and the maximum sustainable yields?
- ii. Will fish catches be enough for profit?

iii. What are the various best-suited fishing methods (the efficient methods for catching)?

iv. What are the seasonal fluctuations in abundance and fishing grounds?

v. What are the best processing methods?

vi. How marketable are the species?

② Resource survey programs and application of the results to stock assessment.

The transfer of valid information on stock assessment and on survey results to management authorities and to organized fishermen will stimulate their involvement in the development of unexploited fisheries resources.

In order to assure such transfer of information, it is highly desirable to strengthen the role played by CIMAR (Centro de Investigación en Ciencias del Mar y limnología, Universidad de Costa Rica) in the field of fisheries stock assessment and resources survey and monitoring.

In this respect it is appropriate to recall that:

i) CIMAR actively participated in the execution of Work I of the Fisheries Resources Survey, the results of which are presented in this report; and, ii) there is a well established relationship between the Direction of Fisheries (MAG) and CIMAR, through which the latter has undertaken the conduction of fisheries resource assessment projects.

③ Survey methods

The survey vessel will use trawl nets, long lines, and gill nets. A trawl winch and a line hauler (convertible to a net hauler) will be installed on board.

The vessel will also be equipped with oceanographic survey equipment, standard weather observation equipment, and nautical instruments.

For the survey, a maximum of 15 days will be allotted per voyage. CIMAR will also devise surveys that use other fishing methods.

④ Specifications of survey vessel

- o Vessel length: 18 m - 22 m
- o Main engine: 400 ps - 450 ps
- o Nautical instruments: NNSS, radar, fish detector, radio (BHF, SSB), gyrocompass, automatic steering, speedometer, etc.
- o Survey equipment: XBT, salinometer, dissolved oxygen meter, plankton nets.
- o No. of crew: 12

⑤ Augmentation of CIMAR's survey and research equipment

- o Data collection and data analysis equipment (computer, software, copiers.)
- o Precision instruments for experimentation (electron microscope, instruments for gas chromatography, liquid

chromatography, atomic absorption analysis.)

- o General experimentation equipment (microscope for organisms, substances, and tissue cultivation; illumination meter, salinometer, COD measuring instrument, DO measuring instrument, pH measuring instrument, protein measuring instrument, fat measuring instrument, electronic scale.)

5-3-6 Marine Products Processing Program (Short-term)

(1) Present state of fisheries products processing

In the Guanacaste area, the day-trip operation by small fishing vessels (boats and pangas) is the mainstay. Aboard the boats, fishermen discard fish heads and guts of the fish from their catches. When they reach port, they sell the catches to outside brokers. There is no special processing method, and retailers reprocess the fish.

(2) The role of marine products processing

Marine products processing can fulfill the following roles:

A. Marketing

By freezing, drying, canning, and smoking, fisheries products can be processed as foodstuffs. They can also be processed as non-food items, such as fish meal, fertilizer, and pharmaceuticals.

B. Year-round supply

With the respective seasons, the supply of fish varies widely. But by processing the fish, it can be preserved and consumed year-round.

C. Increase in consumption and reduction of distribution costs

Fisheries products can be processed to suit the needs of the consumer, thereby making the product more appealing to increase consumption. Also, by discarding inedible parts and improving preservation methods, the distribution costs can be reduced.

(3) Development procedure for fisheries products processing

① Agency in charge of development

The research center on food technology (CITA) of the University of Costa Rica will conduct research for processing fish (i. e. *Peprilus*, *Loligo diomedea*, *Argentina aliciae*, flatfish, etc.) to be harvested according to the "Commercialization of Unexploited Fisheries Resources." Also, suitable preparation and cooking methods are to be developed and introduced. In these ways, the commercialization of unexploited fish can be advanced.

② Development procedures

Each of the unexploited fish will be processed on a trial basis so that the trial products will be delivered to the

dining rooms of government agencies or hospitals. Questionnaires are to be given at the same time. The feedback received will be used to perfect the products. Thereafter, product recipes, cooking methods, and packing and preservation methods will be made public to private enterprise.

③ Equipment required

- o Canning lines for trial manufacturing
- o Fish-processing equipment (choppers, mixers, agitators.)
- o Hot and cold smoking test line
- o Banding machines
- o Food inspection equipment

5-3-7 Fisheries Products Distribution Reform (Medium-term)

(1) Present state of Costa Rica's fisheries products distribution system

On Costa Rica's northern Pacific coast, there is no fish market where the catch is brought in. Therefore the individual fishermen have no choice but to sell their catches to outside brokers. There is no auctioning for fish.

(2) The role of the wholesale fish market

The wholesale fish market is to serve as a collection point (for a wide variety and quantity of fish), a distribution point (for quick distribution to many small retailers), and a price setter (quick and fair pricing by auction, based on supply and demand). It must also settle accounts (prompt and accurate settlement of sales bills) and collect and provide information concerning supply and demand. Since fish can deteriorate easily, they must be distributed quickly. Thus, it is imperative to have a place for distribution where the catch is brought in.

It is natural for the fisheries cooperative to establish a wholesale market at the production areas. An ideal system would be to have fishermen consign selling of their catches to a cooperative who will sell the fish by auction to middlemen and buyers. However, in Costa Rica, since there is no market facility where catches are brought in, the cooperative, for the time being, should incorporate wholesale activities (mainly for distribution) while

reinforcing its sales operations.

(3) Reform of storage and transportation means

A simple cold storage facility will be installed in the fishing village. The use of refrigeration trucks must also be encouraged to promote a low-temperature distribution system.

(4) Reform of distribution system

Distribution costs are to be minimized by increasing the transportation capacity. Also, by organizing fishermen into a cooperative, cooperative sales and direct sales can be introduced to reform the distribution system at each step.

(5) Pricing system

In the future, an auctioning and bidding system will be ideal. However, for the time being, the cooperative will provide fishermen with information concerning market conditions of the catches and the consumer market (including overseas). The fish will then be sold at current market prices.

(6) Increasing the consumption of fisheries products

To increase the consumption of fisheries products, economy-conscious agencies will set up a public relations organization to promote the superb qualities of fisheries products as compared with animal meats. It will also

popularize and give advice on cooking methods for fisheries products.

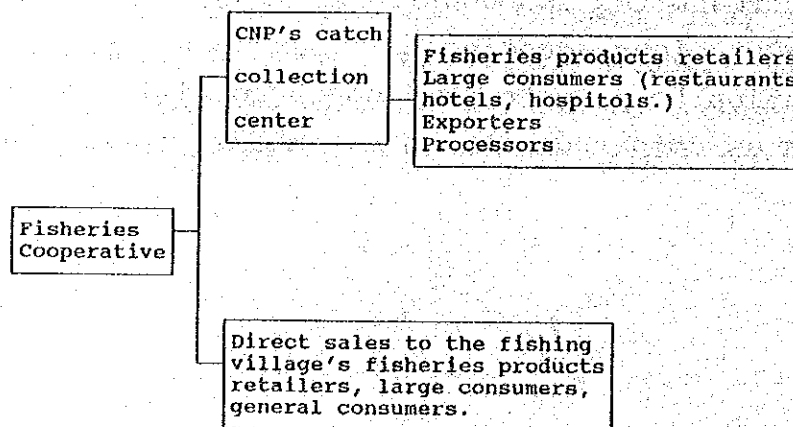
(7) The middlemen and the cooperative

The cooperative is to establish a wholesale fish market at the fish landing areas and have the current outside brokers serve as the wholesale market's middlemen. It will be necessary to effectively utilize the expertise and experience these brokers have. The fish are to be sold by auction. It would be ideal for the prices to reflect current market rates.

(8) Diversification of distribution routes

In order to maintain product freshness and minimize distribution costs, the distribution route from the fish harvesting area to the consumer markets should be as simple as possible. To this end, the consumer markets must be augmented and expanded. Fish will be delivered and sold to the consumer markets through the fishermen's markets.

Direct sales can also be made to large consumers, as shown in the diagram below. By incorporating this distribution route as well, the profit ratio can be increased.



5-3-8 Aquaculture Promotion Program (Long-term)

(1) Objectives

To diversify Costa Rica's fisheries industry, the responsible government agencies and organized fishermen could incorporate aquaculture practices as a means to reduce pressure on fisheries resources. Also, by promoting aquaculture, exports of aquacultural products, domestic supply, and employment opportunities will be increased.

(2) Program description

The program will be implemented mainly by the Aquaculture Division of the Ministry of Agriculture. The program will promote Costa Rica's mariculture programs (mollusk and shrimp) and freshwater aquaculture (trout, tilapia, carp) through the following major activities:

- ① Promotion of aquaculture programs,
- ② Production of seeds for marine and freshwater stocks, and sales of seeds to aquaculture farms.
- ③ Visitations by fishery counselors to aquaculture farms to offer advice and guidance.
- ④ Production of fish feed and propagation of fish disease treatment methods.

(3) Aquaculture promotion procedures

Aquaculture technology must first be developed. The technology developed will then be adopted or transferred to fishermen's cooperatives and private aquaculture farms. The

aquaculture technology must be settled. To this end, the following will be necessary: selection of species for cultivation, development of a fish feed compound, and research on fish diseases and treatment drugs and methods.

Programmed production of aquaculture is relatively easy. However, if the production is left to the aquaculture farmer's individual discretion, it will be difficult to suit the market supply and demand. Therefore, a programmed production system based on supply and demand, and supervised by the Fisheries Bureau and firmly guided by the fishery cooperative, should be established.

In response to the distribution and consumption trends of aquacultural products, the aquaculture species will be increased and a cooperative sales system run by the cooperative will ship products at fixed prices in fixed lots.

(4) Promotion methods

① Selection of aquaculture farm places

As mentioned in 2-1-4, Costa Rica has many places where aquaculture farms can be established. These places are to be surveyed, and the locations of aquaculture farms are to be determined. Infrastructure at the selected locations will be necessary.

② Production of seeds

A portion of the seeds for marine shrimp, fish, and shellfish will come from the Fish Cultivation Center set up by the Fish Cultivation Promotion Program.

③ Visitation by aquaculture counselors

Talented fishery counselors from the Fishermen Training Center will be selected to be educated and trained on fish feed, treatment for fish diseases, and other aquacultural subjects. They will then become fisheries promoters and visit aquaculture farms to offer guidance and advice.

④ Fish feed production and drug development for fish diseases

The nutritional requirements for fish and shellfish are to be researched. Based on the findings, the best-suited fish feed compound is to be developed for each fish species and shellfish species. The fish feed compound will then be sold to aquaculture farms. Also, the Fisheries Research Center will conduct research on fish diseases and prevention/treatment methods.