

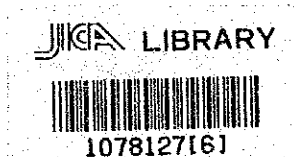
**REPORT FOR
THE FISHERIES RESOURCES SURVEY
OFF THE PACIFIC COAST
IN
THE REPUBLIC OF COSTA RICA**

MARCH 1989

**JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)**

**REPORT FOR
THE FISHERIES RESOURCES SURVEY
OFF THE PACIFIC COAST
IN
THE REPUBLIC OF COSTA RICA**

20/6/88



MARCH 1989

**JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)**

国際協力事業団

20164

PREFACE

In response to the request of the Government of the Republic of Costa Rica, the Japanese Government decided to conduct a survey on Fisheries resources off the Pacific Coast in the Republic of Costa Rica and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Costa Rica a survey team headed by Mr. Kunio Nakamura, Nichiro Fisheries Co., Ltd. from March, 1987 to February, 1989.

The team held discussions with concerned officials of the Government of the Costa Rica, and conducted field surveys. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the Project and to the enhancement of friendly relations between our two countries.

I wish to express my sincerest appreciation to the officials concerned of the Government of the Republic of Costa Rica for their close cooperation extended to the team.

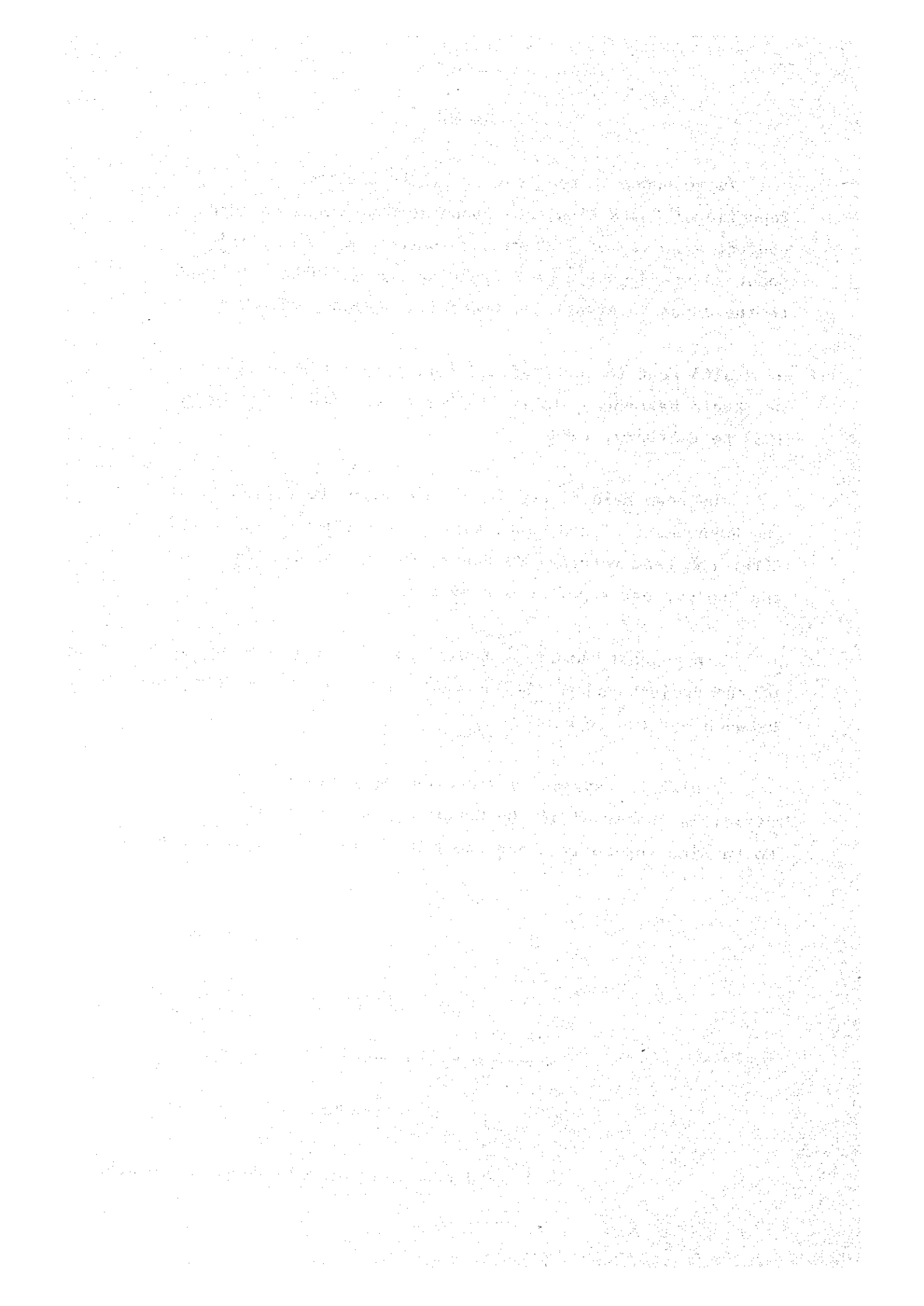
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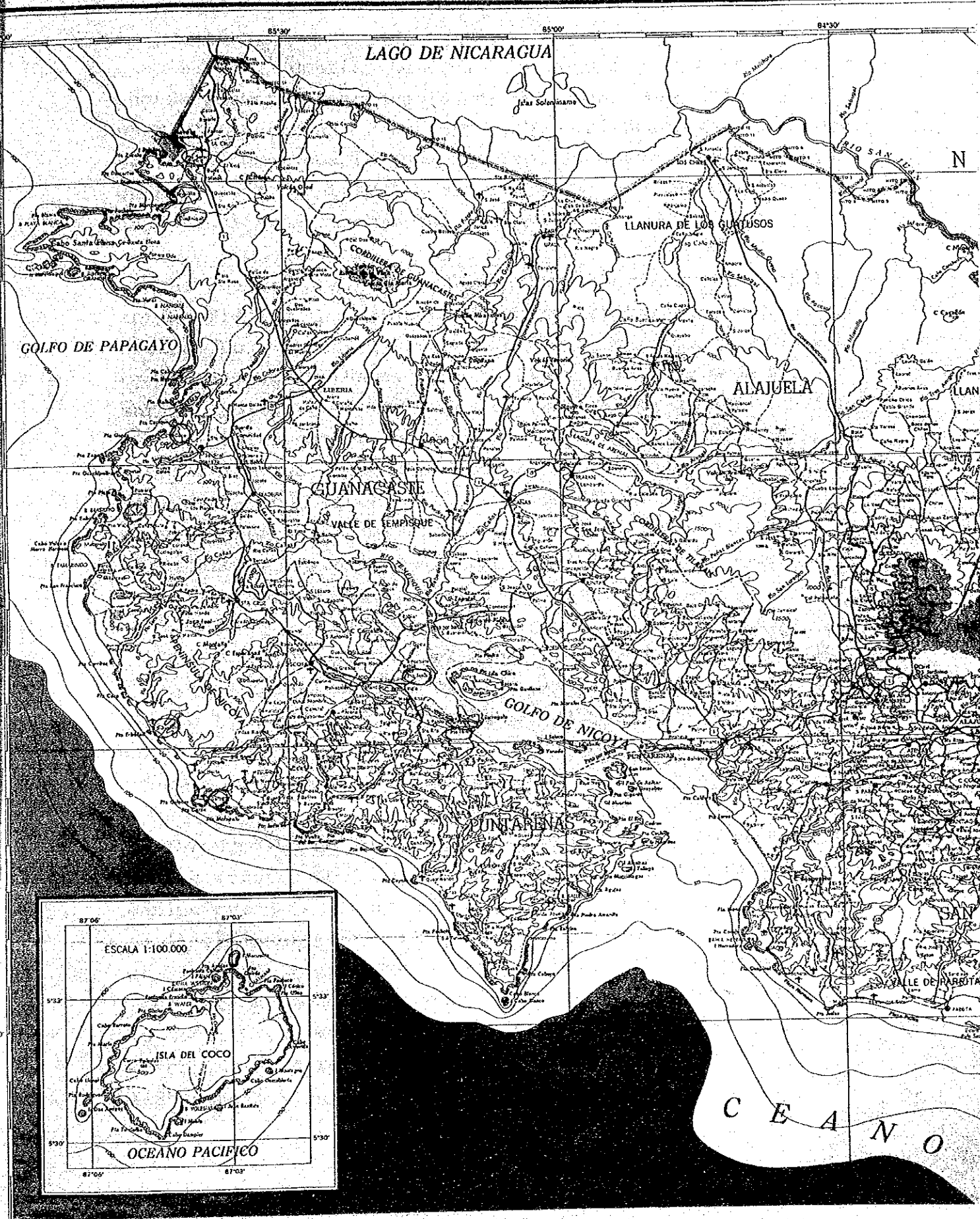


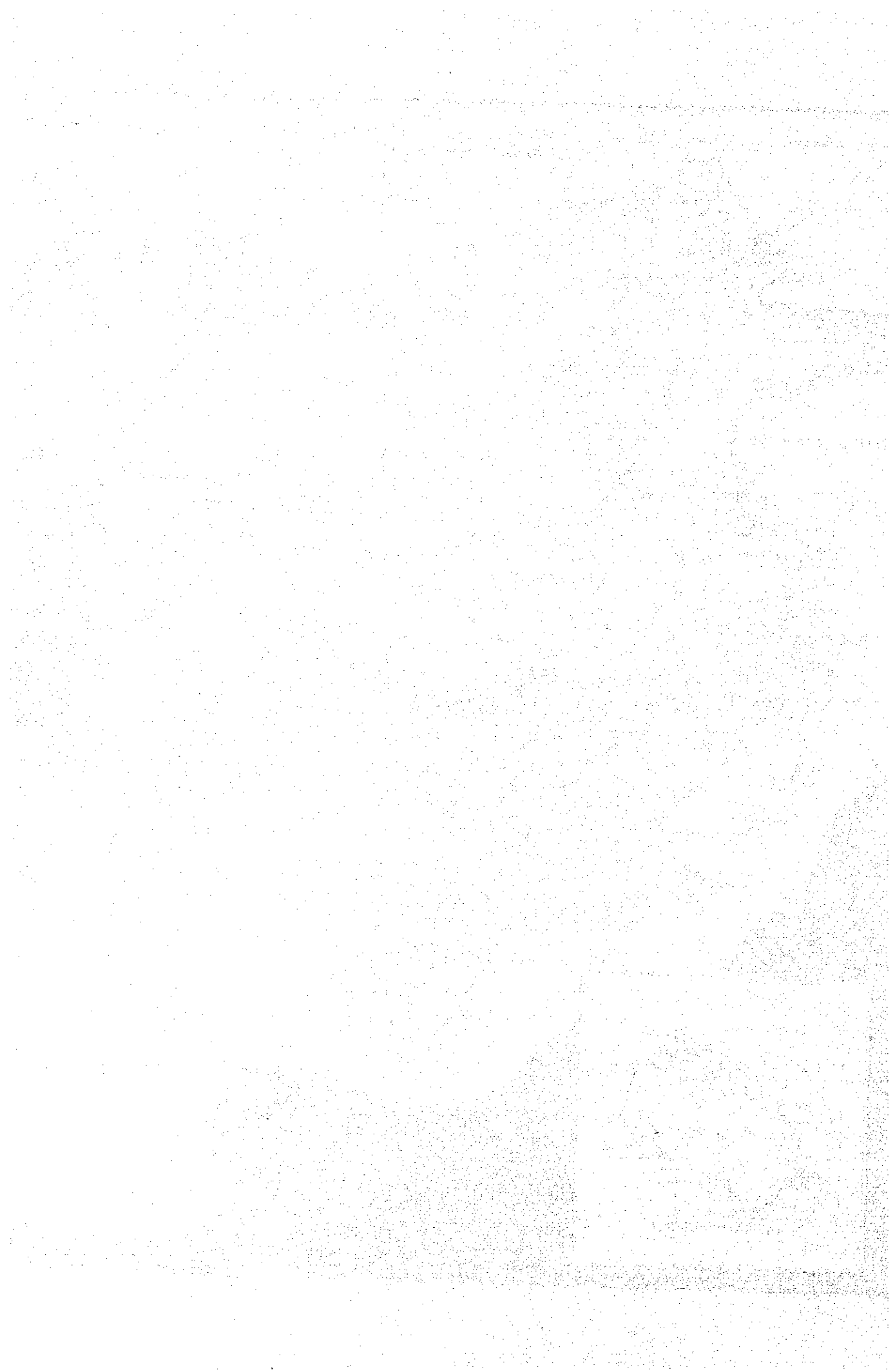
KENSUKE YANAGIYA

President

Japan International Cooperation Agency







Forward

Located in Central America, the Republic of Costa Rica is tucked between Nicaragua in the north and Panama in the east. The northeast coast faces the Caribbean Sea, while the south and west coasts face the Pacific Ocean. Its Pacific Ocean coastline stretches for 1,016 km, and the Caribbean Sea coastline stretches for 210 km.

The country's fisheries basically comprises industrial shrimp fishing and artisanal fishing for various fish stocks. For shrimp fishing, double-rigged trawlers are used to operate at depths of 20 m to 110 m for shallow-water shrimp and 180 m to 300 m for deep-water shrimp. The shrimp catch totaled some 4,355 tons in 1986. For other fish stocks, lanchas, boats, and pangas are used together with gill nets, long lines, etc., to catch sea bream, sea bass, grouper, shark, and other fish. The total catch in 1986 was 16,244 tons, 98.2% of which came from the Pacific Ocean and 1.8% from the Caribbean Sea.

The country's annual per capita consumption of fish is 6.7 kg, a relatively low consumption rate. Most of the choice fish and shellfish caught in Costa Rica are exported to the United States. In 1986, Costa Rica exported 4,360 tons of fish and 3,951 tons of shrimp.

Through its national development programs, Costa Rica is making efforts to increase the country's production of marine products. Program strategies include: equipment and facility investments, the promotion of aquaculture, the utilization of unexploited fish, and the promotion of fish consumption among the people. In order to promote fisheries in Costa Rica, the following goals have been set: to establish an effective research system, to raise the fishermen's technical standards and thereby to increase the

fish catch, to utilize fish optimally and to reduce post-harvest losses, to organize the fishermen into effective cooperatives, to reinforce promotion activities for increasing the national consumption of fresh fish, to reform the marine products distribution system, and to promote aquaculture.

In August 1984, the Government of Costa Rica requested technical cooperation from the Government of Japan for Costa Rica's "Pacific Coast Fisheries Development Project." In response, the government of Japan dispatched a project funding survey team, a contact mission, and a preliminary survey team to Costa Rica. In July 1986, the S/W of this "Pacific Coast Fishery Resources Survey" has been made as described at the end of this report.

The Japan International Cooperation Agency (JICA) divided the Pacific Coast Fishery Resources Survey into the "Fishery Resources Survey" (Work I) which surveyed the commercially viable demersal fish, and the "Fisheries Development Program Survey" (Work II) whose purpose was to formulate the master plan for promoting Costa Rica's fisheries. Survey operation supervisory committee members and the survey team were dispatched to Costa Rica. Upon deliberations with the Costa Rican side, the survey goals, methods, and scope for the Pacific Coast Fisheries Development Project were determined as follows:

The Fishery Resources Survey (Work I) is to cover the northwest coast of Costa Rica from Cape Blanco to Santa Elena Bay. Trawl fishing surveys and oceanographic surveys for this area are to be taken. The distribution of the economically viable demersal fish and the quantity of fishery resources in the area are to be estimated (CIMAR is the counterpart).

The Fisheries Development Program Survey (Work II) is to formulate development programs to reinforce the activities of fishermen and to reform fishery facilities, fishing ports, and the distribution system. This is to streamline the exploitation plan of viable demersal fish resources. (MAG is the counterpart.)

For the Fishery Resources Survey (Work I), the Nisshin Maru No. 201 was used from April 1987 to October 1988 to survey trawling, bottom long line (type 1), bottom long line (type 2), and shrimp pot operations at depths of 50 m to 500 m.

The results of the above survey estimated biomass to be 21,000 tons during the dry season (Nov. - Feb.) and 60,000 tons during the rainy season (June - Oct.). This substantial difference is attributed to the seasonal migration and movement of the *Peprilus* species, *Argentina aliciae*, *Loligo diomedea*, and other species.

For the Fisheries Development Program Survey (Work II), a survey was conducted from March 1987 to September 1988. The survey included interviews of the artisanal fishermen on the northwestern Pacific coast, questionnaires from fisheries authorities, and fact-finding surveys from the survey team.

Through the interviews, many fishermen expressed the desire to expand operations, to join a fishery cooperative and reinforce its activities, to reform financial arrangements and sales practices, to have adequate facilities and infrastructure in their villages, and to receive fisheries education and training.

The questionnaire of the fisheries authorities showed that the number one priority was placed on the development and reinforcement of education and training for the

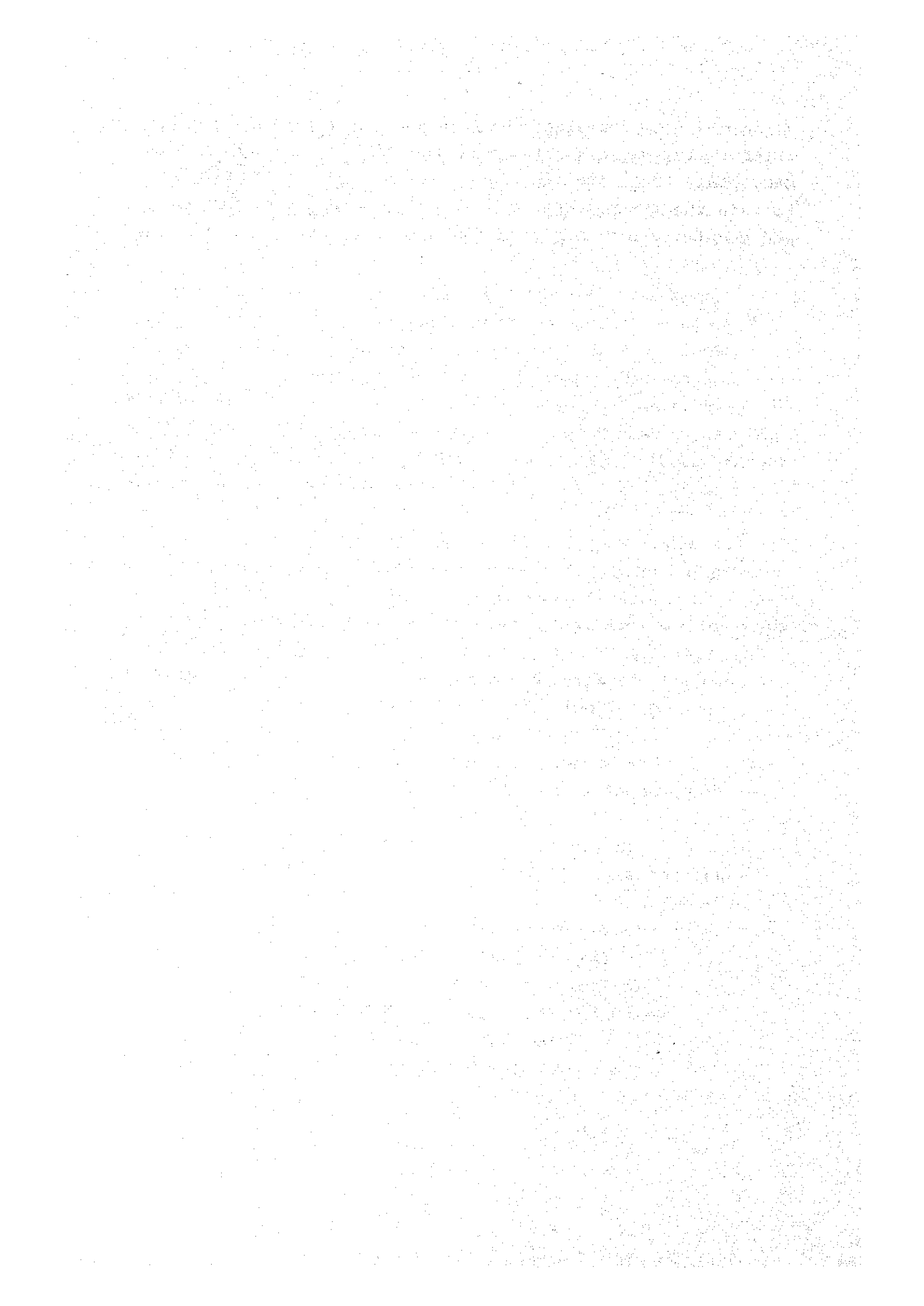
fishermen. Provisions for marine products distribution was the next priority. This was followed by (in order): infrastructure, the reform and invigoration of administrative management, the reform of fisheries financing, and the organizing of fishermen.

This fact-finding survey pointed out the following problems: the lack of economic sense among artisanal fishermen, the lagging organization of fishermen, non-existent infrastructure, outdated fishing equipment and methods, non-existent distribution system and facilities, lack of education and training opportunities for fishermen, low national consumption of fish, and the lack of government assistance to fishermen.

After studying these survey results, it was concluded that the following programs had to be implemented to promote Costa Rica's fisheries. The programs were designated as short-term programs (completion within 5 years), medium-term programs (completion within 10 years), and long-term programs (longer than 10 years). The details of these programs are proposed under the master plan in Chapter 5.

- Model Fishing Village Provision Plan (Short-term)
- Rotational Training Program for Fishing Villages (Short-term)
- Promotion of Fishery Cooperatives (Short-term)
- Commercialization of Unexploited Fishery Resources (Short-term)
- Marine Products Processing Program (Short-term)
- Fishing Village Provision Plan (Medium-term)
- Fishermen Training Center Program (Medium-term)
- Marine Products Distribution Reform (Medium-term)
- Aquaculture Promotion Program (Long-term)
- Fish Cultivation Promotion Program (Long-term)

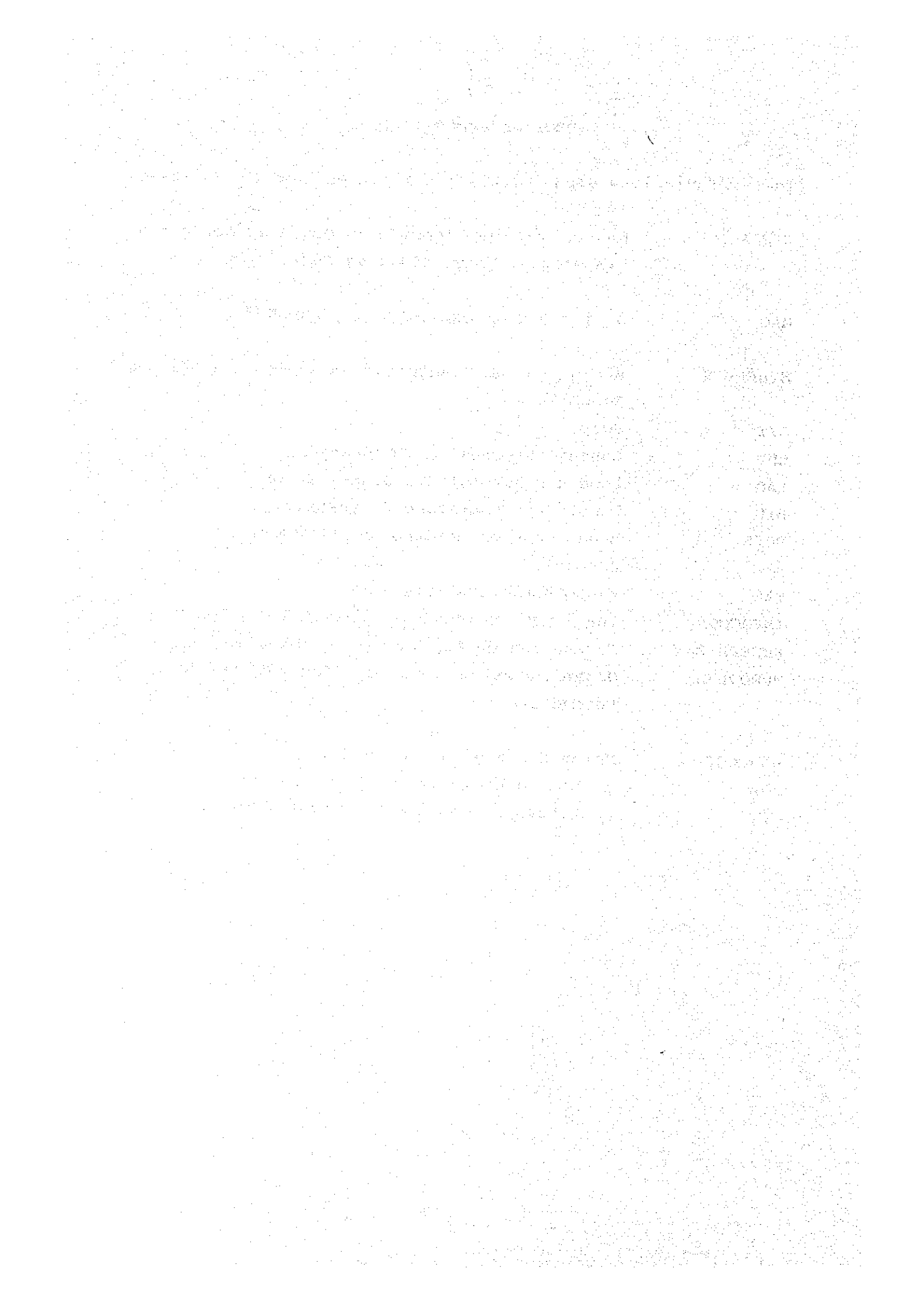
In order to implement these programs expeditiously and effectively, we look forward to the guidance and efforts by MAG, CIMAR, INA, and other government agencies. We also hope to gain the strong support of international organizations and countries with advanced fisheries.



Index of Abbreviations

The abbreviations used in this paper are defined as follows:

CIMAR	Centro de Investigación en Ciencias del Mar y Limnología, Universidad de Costa Rica
MAG	Ministerio de Agricultura y Ganadería
MIDEPLAN	Ministerio de Planificación Nacional Política Económica
S/W	Scope of Work
CNP	Consejo Nacional de Producción
FAO	Food and Agriculture Organization
BID	Banco Interamericano de Desarrollo
BCIE	Banco Centroamericano de Integración Económica
BAC	Banco Anglo Costarricense
INFOCOOP	Instituto Nacional de Fomento Cooperativo
FEDEPESCA	Federación de Pescadores Artesanales
ORCOOPES	Organización Regional de Cooperativas de Pescadores
UNACOOP	Unión Nacional de Cooperativas
INA	Instituto Nacional de Aprendizaje
ICI	Instituto de Cooperación Iberoamericana



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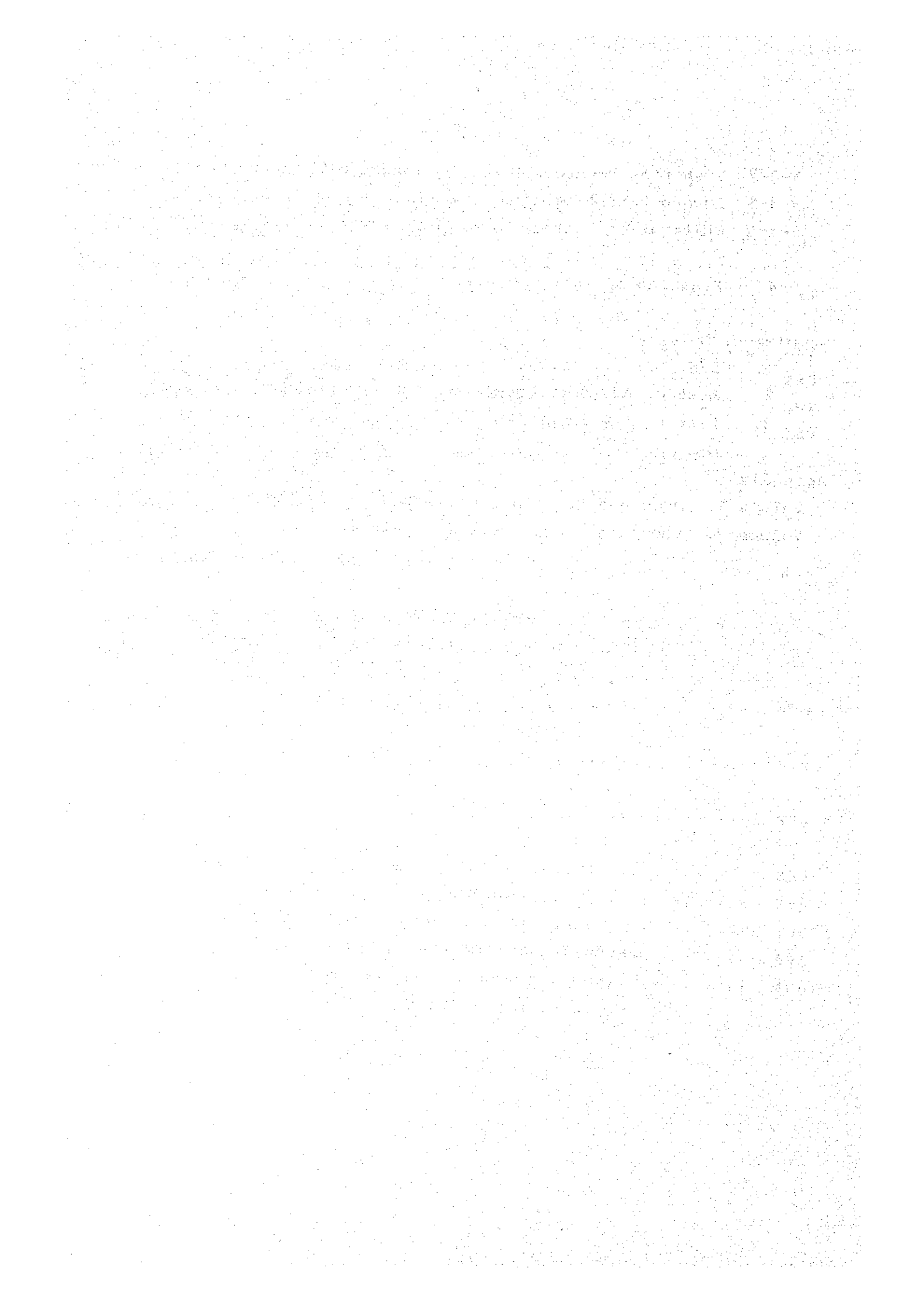
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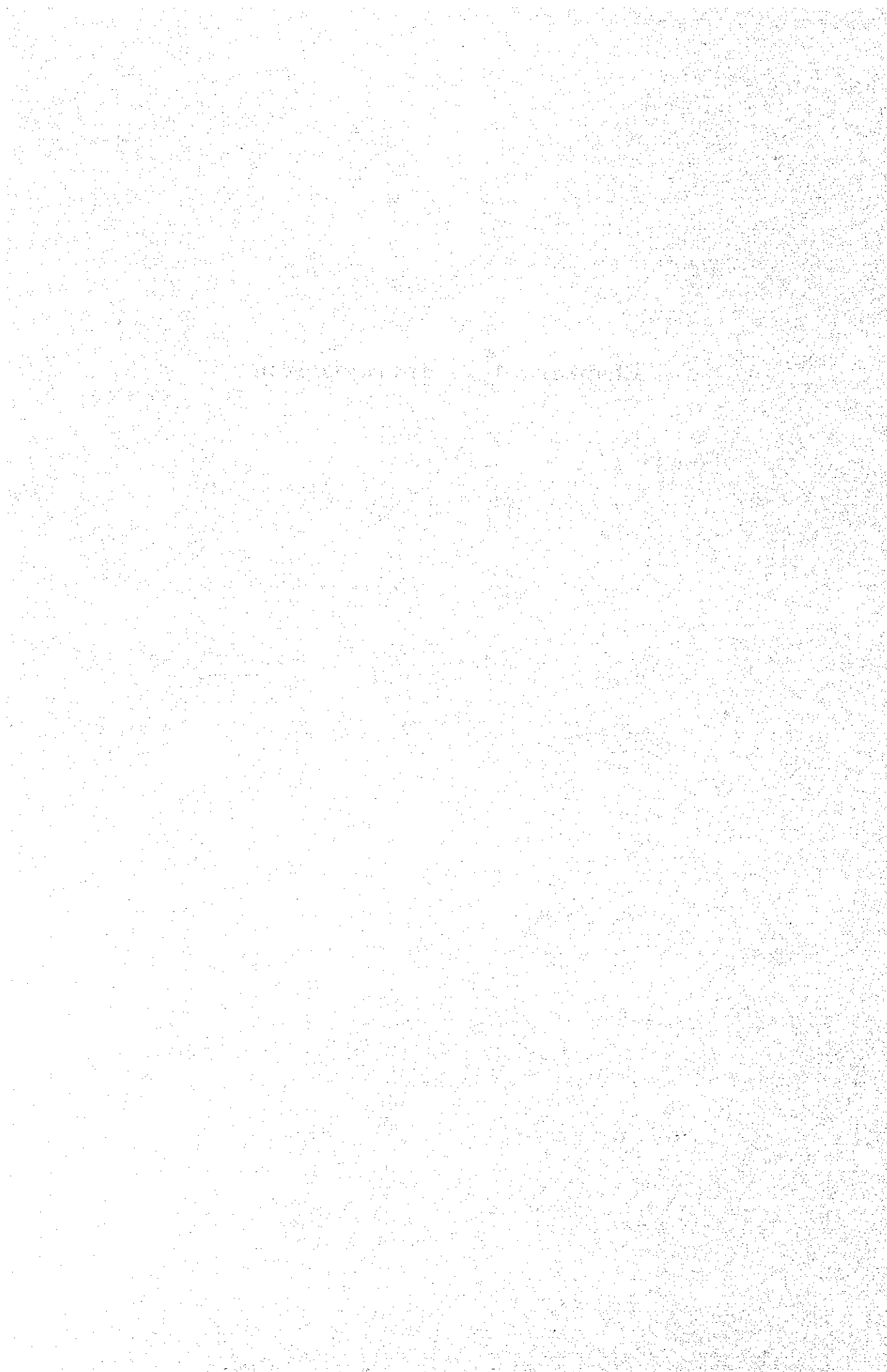
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- Volume 2. Photographs of Costarican Fishes



Chapter 1 Introduction



Chapter 1 INTRODUCTION

The Republic of Costa Rica (referred to below as Costa Rica) is located on the Central American isthmus between the continents of North and South America, between latitudes eight and 11 degrees north and longitudes 82 degrees 30 minutes and 86 degrees west. Panama lies to the east, Nicaragua to the north, while its northeastern coast is on the Caribbean Sea and its south and west coasts are on the Pacific Ocean.

In Costa Rica, mountain range consists of the Guanacaste, Central, Talamanca, and other mountain systems stretching from northwest to southeast, forming between them a plateau in the center of the country 1,000 meters above sea level and 9,000 square kilometers in area.

The coastal areas and lowlands along the Pacific Ocean and the Caribbean Sea have the common high temperature, high humidity characteristics of a tropical climate, while the central mountains and the plateau region have a very comfortable climate with the temperature range in between 22°C and 28°C all the year round. The entire country has two seasons in common, the dry season from December to April, and the rainy season from May to November. These two seasons are particularly distinct in the mountainous region and the plateau area.

Costa Rica is an agricultural country mainly growing coffee and bananas, and it also has a lot of livestock farming. Agriculture accounts for approximately 20% of the

country's GDP and occupies approximately 30% of the working population. The government has put the priority on basic targets in development plans for increasing the productivity of agriculture, livestock, and fisheries industries, and wants to export more of these products to obtain badly needed foreign currency.

Fishing occupies an extremely low proportion of the Costa Rican economy, and accounted for only 0.41% of the GDP in 1984. However, Costa Rica's fishing industry is growing steadily year by year, and the catch has increased from 10,447 tons in 1982 to 16,244 tons in 1986. This rapid increase in the fishing catch has effected the resources of existing fishing grounds.

Costa Rica's highly industrialized shrimp trawl fishing industry is very prosperous, but shrimp resources in shallow areas are decreasing, and the fishing is steadily moving to deeper areas. The small fishery communities along the coast concentrate on fishing for demersal fish, and these demersal fish resources are gradually being depleted. Costa Rica is now faced with the urgent necessity of promoting development of offshore demersal and pelagic fish resources.

The FAO fishing industry investigation team undertook an on-site investigation in Costa Rica from October 1983 for approximately one month, and summarized the results of its investigations in a report submitted to the Costa Rican government in February 1984. This report contained proposals for the following five projects: "Small-scale development plan for catching Pacific pelagic fish",

"Project for estimating and/or determining the latent resources of demersal fish on the Pacific Ocean continental shelf and its slope", "Infrastructure for fishing harbors, etc.", "Distribution system and related facilities", and "Fishermen's organizations and capacities". Unfortunately, these projects require large sums of money and various other resources, and implementation remains delayed.

In August 1984 the Costa Rican government applied to the Japanese government for technical cooperation on a "Pacific Coast Fisheries Industry Development Plan". In response, the Japanese government dispatched the Central and South American Fisheries Cooperation Project Study Team in October of the same year. The Japanese government proposed that along with working together on an acceptance system based on the ideas on cooperation contained in the application, the Japanese would also be happy to cooperate in a "Fisheries Resources Study" and a "Fisheries Industry Development Plan Study". Subsequently, a response was received to the effect that Costa Rica would like to have a "Pacific Coast New Demersal Fishing Ground Development Study", and the Japanese government dispatched a contact mission in February 1986 to confirm the basic items for the study and those in the original application.

As a result of discussions between this contact mission and the Costa Ricans (MIDEPLAN, MAG and CIMAR), the following points were agreed on.

- ① A study would be undertaken on demersal fish in the Pacific coast northwest ocean region, and estimates would be drawn up of resource distributions and quantities.
- ② To contribute to rational use of the usable resources revealed by the study, concomitant to the resource study, further studies would be undertaken on fishermen's techniques, improving distribution systems, developing fishing harbor infrastructure, and other related issues. Development plans for all of these would be drawn up.

The broad outlines were set up for a wideranging, in-depth study, in order to conclude the S/W, a preliminary study team was dispatched to Costa Rica in July 1986. As a result of their discussions, the following agreements were reached on the goals and range of this study.

- o The study should develop estimations (MSY calculation will not be performed) of quantities of usable demersal fish resources and their distributions in the ocean region including the Pacific Ocean continental shelf off northwestern Costa Rica, its slopes inclines, and neighboring banks.
- o The study would also propose fisheries industries development plans with recommendations on fishermen's techniques, improving distribution systems, fishing harbors, and infrastructure generally, as well as other related issues keeping in mind the main goal of finding rational methods for exploiting the usable demersal fish resources.

According to these general guidelines, it was decided to divide the study into the "Fisheries Resources Survey (Work I)" focusing on study of usable demersal fish resources, and the "Survey on the Fisheries Development Program (Work II)" focusing on proposals for a fisheries industry development master plan.

- o The "Fisheries Resources Survey" was to take the area along the northwest coast of Costa Rica from Cape Blanco to the Gulf of Santa Elena as a model ocean region. It was assigned the task of studying "a stern trawl fishing" in that ocean region, besides the general oceanographic study. Investigating the distribution of economically usable demersal fish resources within this region, the study would also develop quantitative estimates (counterpart is CIMAR).
- o The "Survey on the Fisheries Development Program" would consider rational ways of exploiting the usable demersal fish resources, improving fishermen's techniques, and improvement of equipment for fishing harbors and distribution systems, and would draw up a development plan covering all of these (counterpart is MAG).

To reach these goals, the following studies were conducted in 1986 (the experimental survey).

- o The Fisheries Resources Survey (Work I) was positioned as a preliminary study to promote effective implementation of the overall study. An oceanographic survey and fish

catch experiments, and other studies were undertaken from April 1 to June 1, 1987 using the Nishin Maru No. 201.

- o A foundation study was undertaken as the primary on-site study to promote efficient operation of the overall Survey on the Fisheries Development Program (Work II) from March 7 to April 15, 1987.

Year-round survey (first phase)

- o For the Fisheries Resources Survey, trawl operations were conducted between October 1987 and March 1988 for the oceanographic observation and determination of distribution of usable demersal fish resources, as well as estimation of resource quantities for the main study.
- o For the Survey on the Fisheries Development Program, studies of the structure and operations in the fishing villages and of distribution, consumption, etc., in the cities were conducted between October 1987 and January 1988.

Year-round survey (second phase)

- o For the Fisheries Resources Survey, applying the results of the secondary study to ocean regions where trawl operations were impossible, bottom longline (type 2), gill netting, and shrimp basket surveys were undertaken between June and October 1988.
- o For the Survey on the Fisheries Development Program,

supplementary and followup studies of the primary study were conducted from June to September 1988.

Intermediate study results were analyzed for the studies from the experimental survey to the year-round surveys, and a draft final report was produced. Meetings were held to discuss these findings with the Costa Rican counterparts in January 1989.

This report contains analyses of the results of the studies described above, and summaries of the master plan and other proposals judged to be appropriate for promoting the fisheries industry in Costa Rica. The members of the study groups, the personnel of the Costa Rican government authorities involved, and other details on the on-site study schedules and minutes of the meetings are recorded at the end of this document, while study materials are enclosed in a separate document.

Chapter 2 Study Background

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for consistent and reliable data collection processes to support effective decision-making.

3. The third part of the document focuses on the role of technology in data management and analysis. It discusses how modern software solutions can streamline data collection, storage, and reporting, thereby improving efficiency and accuracy.

4. The fourth part of the document addresses the challenges associated with data management, such as data quality, security, and integration. It provides strategies to overcome these challenges and ensure the integrity and availability of data.

5. The fifth part of the document discusses the importance of data governance and compliance. It outlines the necessary policies and procedures to ensure that data is handled in a responsible and lawful manner, in accordance with applicable regulations.

6. The sixth part of the document explores the benefits of data-driven decision-making. It illustrates how data analysis can provide valuable insights into organizational performance, identify trends, and inform strategic planning.

7. The seventh part of the document discusses the role of data in customer relationship management (CRM). It explains how data analysis can help organizations better understand their customers, personalize their marketing efforts, and improve customer satisfaction.

8. The eighth part of the document addresses the importance of data security and privacy. It discusses the risks of data breaches and the measures that can be taken to protect sensitive information and maintain the trust of stakeholders.

9. The ninth part of the document discusses the role of data in human resources management. It explains how data analysis can help organizations optimize their workforce, improve employee performance, and enhance the overall organizational culture.

10. The tenth part of the document discusses the role of data in financial management. It explains how data analysis can help organizations monitor their financial performance, identify cost-saving opportunities, and make informed investment decisions.

11. The eleventh part of the document discusses the role of data in supply chain management. It explains how data analysis can help organizations optimize their supply chain operations, reduce costs, and improve delivery times.

12. The twelfth part of the document discusses the role of data in risk management. It explains how data analysis can help organizations identify potential risks, assess their impact, and develop effective risk mitigation strategies.

13. The thirteenth part of the document discusses the role of data in innovation and research and development. It explains how data analysis can help organizations identify new market opportunities, develop new products, and improve their research and development processes.

14. The fourteenth part of the document discusses the role of data in sustainability and corporate social responsibility (CSR). It explains how data analysis can help organizations measure their environmental and social impact, identify areas for improvement, and enhance their overall sustainability performance.

Chapter 2 STUDY BACKGROUND

2-1 Fisheries Industries Information

2-1-1 Fisheries Industry

(1) Introduction

Costa Rica has approximately a total of 1,226 km of coastline, 1,016 km on the Pacific coast (83%), and 210 km on the Atlantic coast (17%). The continental shelf is approximately 18,000 square km in area, 96% of which is off the Pacific coast and 4% off the Atlantic coast. Costa Rica has specified an exclusive economic zone up to 200 nautical miles (the area exceeds 500,000 square km). Large scale fishing is not well developed, and the main activity is coastal fishing. On the Pacific coast, fishing is concentrated principally on shrimp and demersal fish, while lobsters are the main target on the Atlantic coast. Almost all of the expensive catches is exported to the US market.

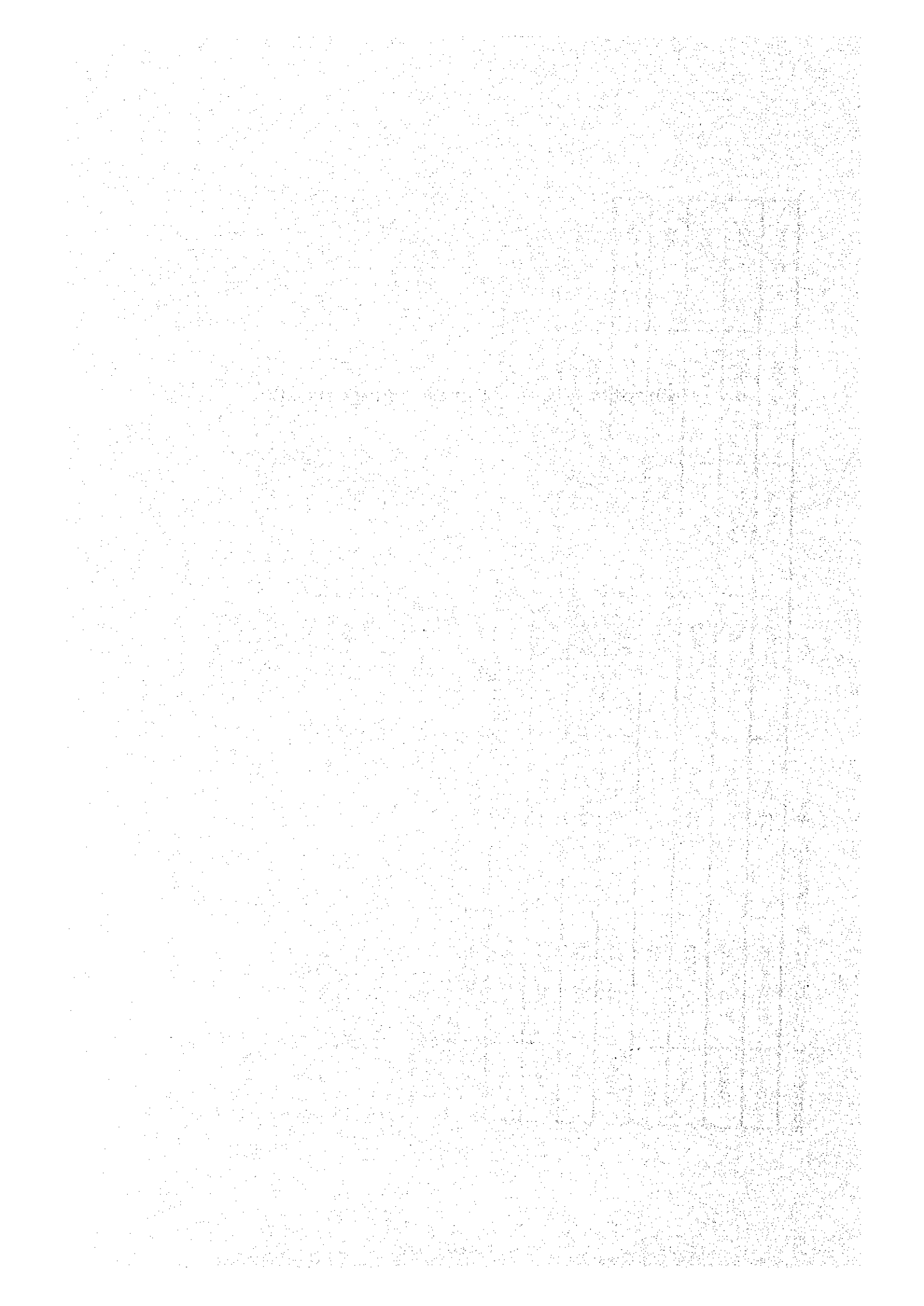
(2) Fisheries Industry Positioning

In the Costa Rican economy agriculture, livestock farming, and fisheries account for approximately 20% of the GDP, but fisheries occupy a very low proportion, less than 1%.

TABLE 1: CHANGES IN FISHERIES INDUSTRY PROPORTION OF GDP
(Unit: Million colon)

Year	GDP (A)	Agriculture, Stock Raising, and Fisheries Gross Product (B)	Fisheries Gross Product (C)	(B)/(A) %	(C)/(A) %	(C)/(B) %
1975	16,805	3,418	27	20.3	0.16	0.78
1976	20,676	4,213	38	20.4	0.18	0.90
1977	26,331	5,763	40	21.9	0.15	0.70
1978	30,194	6,164	58	20.4	0.19	0.94
1979	34,584	6,399	86	18.5	0.25	1.34
1980	41,406	7,271	86	17.6	0.21	1.16
1981	57,103	13,145	132	23.0	0.23	1.01
1982	97,505	28,884	327	29.6	0.34	1.37
1983	128,314	28,446	328	22.0	0.25	1.15
1984	158,675	33,014	653	20.8	0.41	1.98
1985	197,920	37,340	1,225	18.9	0.62	3.28
1986	247,752	52,224	1,487	21.1	0.60	2.85
1987	282,940	53,244	1,927	18.8	0.68	3.62

Source : Costa Rica Central Bank



(3) Species of Fish, Quantities of Catches, and Fishing Grounds

① Pacific coast

A. Shrimp

Shrimp is the most important fish resource in Costa Rica. There are 83 shrimp fishing boats. They operate all along the Pacific coast, and the total annual catch is 4,350 tons (1986). At first they mainly fished for white, brown, and pink shrimp tails down to a depth of approximately 80 meters, but in the 1970s fidel shrimp was discovered at a depth of about 200 meters. Presently the fishing grounds are being fished up to a depth of around 300 meters. At this depth is also found camello shrimp. More than 55% of shrimp catch are deep-water species, mainly fidel (*Solenocera*), other types include *Penaeus stylirostris*, *P. occidentalis*, *P. vannamei*, *P. californiensis*, and *Heterocarpus* sp. and others.

B. Sardines

These are mainly three types in the *Opisthomema* family. The catch in the middle of the 1970s was in excess of 7000 tons, which has been a great support to the very important canning industry in Puntarenas. However, probably due to the influence of El Niño, at the beginning of the 1980s the catch had fallen to less than 3000 tons. In 1986 the catch fell further to 1,300 tons. Consequently, the number of sardine boats has diminishes every year. Presently,

however, there seems to be evidence that the resource of sardine is recovering.

C. Tuna

The tuna fishing industry in the offshore regions of the eastern Pacific area off Costa Rica has a long history, and this region is an important fishing ground. Puntarenas Bay is an important transshipment base for fish catches. It is also a center of supply of fishing tackle, fuel, fresh water and foodstuffs, and a popular location among fishing boat crews for rest and recreation.

In the 1960s small local fishing boats delivered tuna to the two canning factories in Puntarenas, and the catch remained comparatively small until 1978. In that year a joint venture between the United States and Costa Rica built a large number of fishing boats. Subsequently, the catch increased to almost 9000 tons, 15% of which was canned for domestic consumption, while the rest was exported to the United States. In 1981 US tuna-fishing boats' illegal fishing was disclosed to Costa Rica, which applied severe punishment. The US government retaliated by prohibiting imports of tuna from Costa Rica, and this cooperative fishing ended in 1982. Since then the catch has decreased, and in 1985, Costa Rica had only two fishing boats for tuna.

At the time of this writing, no Costa Rican tuna vessel is operating on commercial basis.

The catches for yellowfin and skipjack from the eastern Pacific region of Costa Rica are listed in Table 2. The catch of yellowfin and skipjack from the Atlantic side is negligible.

According to statistics published by the International Tuna Commission, the total catch in Costa Rica's territorial waters between 1972 and 1981 was in the range of 20,000 to 32,000 tons.

TABLE 2 YELLOWFIN AND SKIPJACK LANDING BY COSTA RICA
(Unit: Ton)

	1980	1981	1982	1983	1984	1985	1986
Joint operations boats	4,100	3,900	300	*	3,300	3,700	*
Costa Rican fishing boats	*	*	963	143	307	196	39
Foreign fishing boats	*	*	*	*	506	1,303	1,385

Note: * figures unknown

D. Demersal Fish

The important demersal fish for the Costa Rican market are croakers (Sciaenidae), snappers (Lutjanidae), and groupers (Serranidae). Annual catches for these fishes exceed 1,200 tons, 60% of which is taken by small vessels, the remainder being brought in by shrimp trawlers, and the small size fish are almost all discarded.

E. Shark

Sharks (Carcharhinidae and Triakididae) live off the coast of Costa Rica, and artisanal fishermen catch approximately 600 tons of these each year.

② Atlantic Coast

The continental shelf of the Costa Rican Atlantic coast has an area of 2370 square kilometers, and it is rather narrow. These are basically fishing grounds for artisanal fishermen. The main items of the catch here are spiny lobsters (*Panulirus argus*) and turtles (*Chelonia mydas*). The largest annual catch in the period from 1960 to 1982 was 1,437 tons (1,397 tons of which were lobsters), the lowest catch was recorded in 1969 at 39 tons (of which 33 tons were lobsters), and this shows the tremendous variation in the catch. In 1986 the catch was 299 tons (60 tons lobsters, 180 tons turtles).

This considerable fluctuation in the annual lobster catch on the Atlantic coast appears to be due to high variability in lobster migration patterns. There is a stringent management program for the "green turtles". No export is allowed but consumption is admitted only to local people. Other turtle species are forbidden to catch.

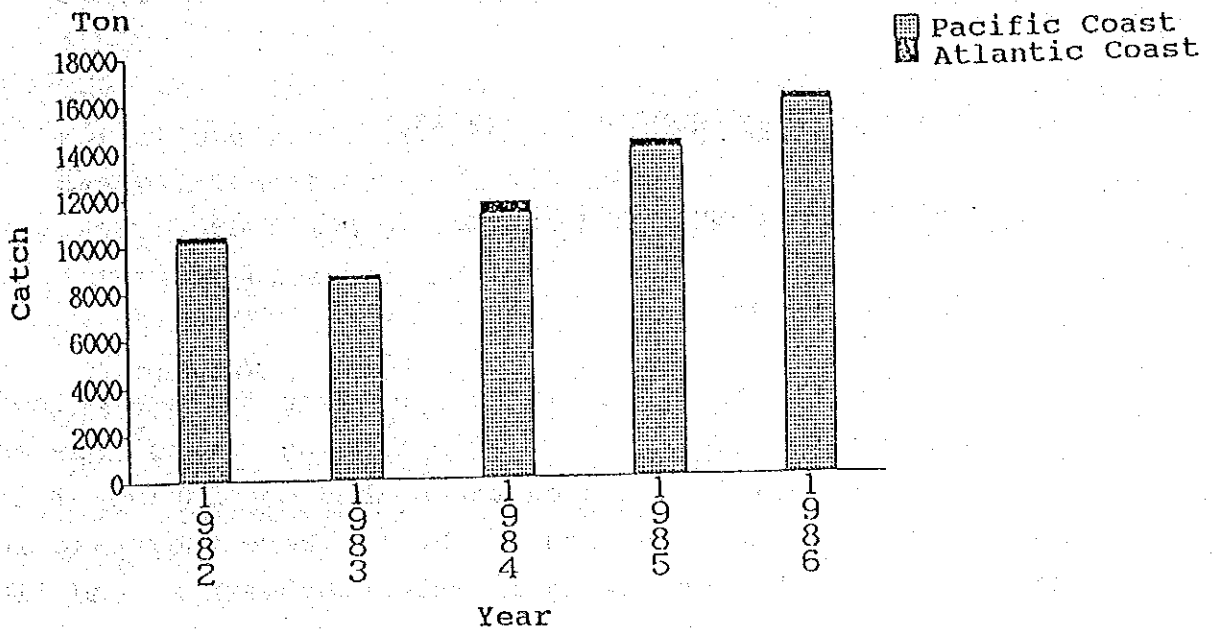
③ Catch

The fish catch of Costa Rica has increased year after year: 1.6 times from 10,447 tons registered in 1982 to

16,244 tons in 1986. Breaking down the 1986 catch by ocean region, we find that the Pacific accounted for 98.2% or 15,946 tons, while only 1.8% or 298 tons was brought in from the Caribbean Sea.

The principal components of the catch in Costa Rica are fish, shellfish, and mollusks with shrimp at 4,355 tons (92.7%), lobsters at 220 tons (5.04%), and turtles 188 tons (2.26%).

FIG. 1 TRENDS IN ANNUAL CATCH



(4) Fishermen

It is estimated that there are approximately 6,000 artisanal fishermen working on the Pacific coast and 600 work in semi-industrialized fishing. They are generally young, between 20 and 30 years old. It is impossible unfortunately to grasp an accurate figure for the number of people working in the fishing industry because many people incline to switch from agriculture to fishing.

Over on the Atlantic coast it is estimated that there are approximately 150 fishermen, along with about 600 people engaged in fishing part time (the number can actually vary from 100 to 1000 people depending upon the size of the lobster catch).

(5) Fishing Techniques and Vessels

① Fishing Techniques and Gears

A. Pacific Coast

Double-rigged trawlers with a four-seam net are being used for shrimp fishing. The main fishing grounds are on the northern Pacific coast on the seabed consisting of the mud and sand of the continental shelf. Here they take in shallow-water shrimps living in waters between 20 and 110 meters and deep-water shrimps living in deep water between 180 and 300 meters.

The main gear for artisanal fishing are bottom gill

netting, surface gill netting, bottom longlines, surface longlines, and hand lining, as well as diving for lobsters and mollusks.

Gill netting is done by panga/botes and lanchas, with bottom or surface gill nets used to depths between 5 to 100 meters. Net meshes have lengths generally between 9 and 15 cm, and net lines of nylon filament are between 0.5 and 1.2 mm thick, while net lengths are usually in the range 500 to 600 meters.

Longlines are mainly used on lanchas with sardines, mackerel, and squid as bait for catching sea bream, sea bass, groupers, sharks, and conger-eels. The longline consists of a main line and branch lines. The former is a 4mm rope of 3 plies or an interwoven strand of 8 plies of same size. The branch lines are each 2mm thick and 0.5 to 1 meter long and fitted with a fish hook of No.4 to No.6. A basket, a unit of gear, normally holds a main line of 1,000 meters, to which are suspended about 300 branch lines at intervals of about 3.5 m.

Hand lining is mostly done with rods 9 to 15 m long for snappers, and they are used to catch fish at depths of 50 to 100 meters. Normally three to eight people share a boat, and sardines, mackerel, kohinoba, squid, and shrimp are used as bait.

B. Atlantic Coast

The main fishing gear used are baskets for lobsters, harpoons for sea turtles, and angling gear for fish. Other

gear used includes throw nets, gill nets, and beach nets. To the south of Puerto Limon there is a lot of diving for fish. Lobsters are caught in the area north of Puerto Limon to the Martina River estuary 15 miles north at depths of between 20 and 50 meters on the continental shelf. Snapper are found at depths between 70 and 150 meters.

② Fishing Boats

A. Pacific Coast

Apart from shrimp, fishing in Costa Rica is basically artisanal fishing, and on the Pacific coast the main target is demersal fish using long lines, gill nets, and hand lining. Fishing boats include one- to two-ton canoe pangas with outboard motors for one-day voyages, carrying crews of two to three persons; wooden and FRP (fiber-reinforced plastic) botes with inboard motors and total tonnage of between two and ten tons, holding four to seven crewmen; and FRP lanchas with inboard motors used for voyages of three to ten days. The canoes and botes account for about 63% of all the fishing boats. Recently, on the Pacific coast, many of the lanchas have been fishing for pelagic fish like dorado, skipjack, and yellowfin with surface long lines, and drift gill nets.

B. Atlantic Coast

On the Atlantic coast there are only pangas and boats with outboard motors working the lobster beds.

The number of fishing boats varies with the conditions of the catch and socio-economic factors. In 1968, 477 fishing boats were recorded in Puerto Limon, but by 1983 this had dropped to 258. However, the total number of fishing boats including those outside Puerto Limon comes to about 360 vessels. Of these, 30 vessels are fishing year round, and the remainder are only used for fishing in the lobster fishing season (October to February).

Thirty fishing boats are licensed for fishing in the sea turtles (June to August). There are two types of fishing boats; are canoes and pangas. One type has a total length of five to six meters and it a small wooden canoe, it is propelled with oars, and used for diving, while angling is done from the beaches. The other type have lengths between nine and twelve meters, widths between 1 and 1.2 meters and are wooden canoes with outboard motors of between 50 and 20 ps, and they are used for catching lobster and sea turtles.

TABLE 3: NUMBER OF FISHING BOATS BY REGION
(Unit: Number of boats)

Boat Type / Region	National Total	North Pacific	Central Pacific	South Pacific	Atlantic
Panga and boat	1,648	434	489	367	358
Small lancha	590	76	457	57	-
Medium-sized lancha	58	10	20	26	-
Shrimp trawler	83	-	83	-	-
Sardine boat	3	-	2	1	-
Bonito and tuna boat	2	-	1	1	-
Total	2,384	520	1,052	454	358

Source: Marine Products Bureau of the Ministry of Agriculture, August 1988

Remarks: North pacific here refers to the region to the Chorotega region south of the border with Nicaragua (Guanacaste Province and the Nicoya peninsula pacific coast of Puntarenas Province.)

(5) Infrastructure

① Pacific Coast

Puntarenas Harbor is the most important center of the fisheries industry in Costa Rica, and it has the most highly developed infrastructure. Besides one large shipbuilder in the harbor, there are many medium-size and small-scale boat builders. There is also supply equipment, ice factories, and stores for selling supplies and equipment for fishing, and as one part of a multipurpose harbor terminal facility project, construction of a fishing boat mooring for small fishing boats has been in progress since 1987.

Puntarenas has 83 shrimp trawlers based in the harbor. Large shrimp fishing companies have their own private wharf. There are ice factories, processing plants, and refrigerator facilities all owned by the large shrimp fishing companies. Puntarenas is approximately 120 kilometers from the capital San Jose, and there are good road and telecommunications connections. Fish brought into the port can be delivered to the capital the same day so it is well placed for supplying the consumers in the capital, San Jose, metropolitan area and for exporting fish.

A fishing terminal is being built at Cuajiniquil in the Guanacaste Province, but the only supplies to local fishing boats are pure water and flake ice, while fuel supply is restricted to the local coast guard. Because of problems with personnel and other difficulties, the facilities are

often closed, and the local boats in general only can use the facilities for resupply of pure water at the wharf, while ice has to be delivered from the nearest ice factory.

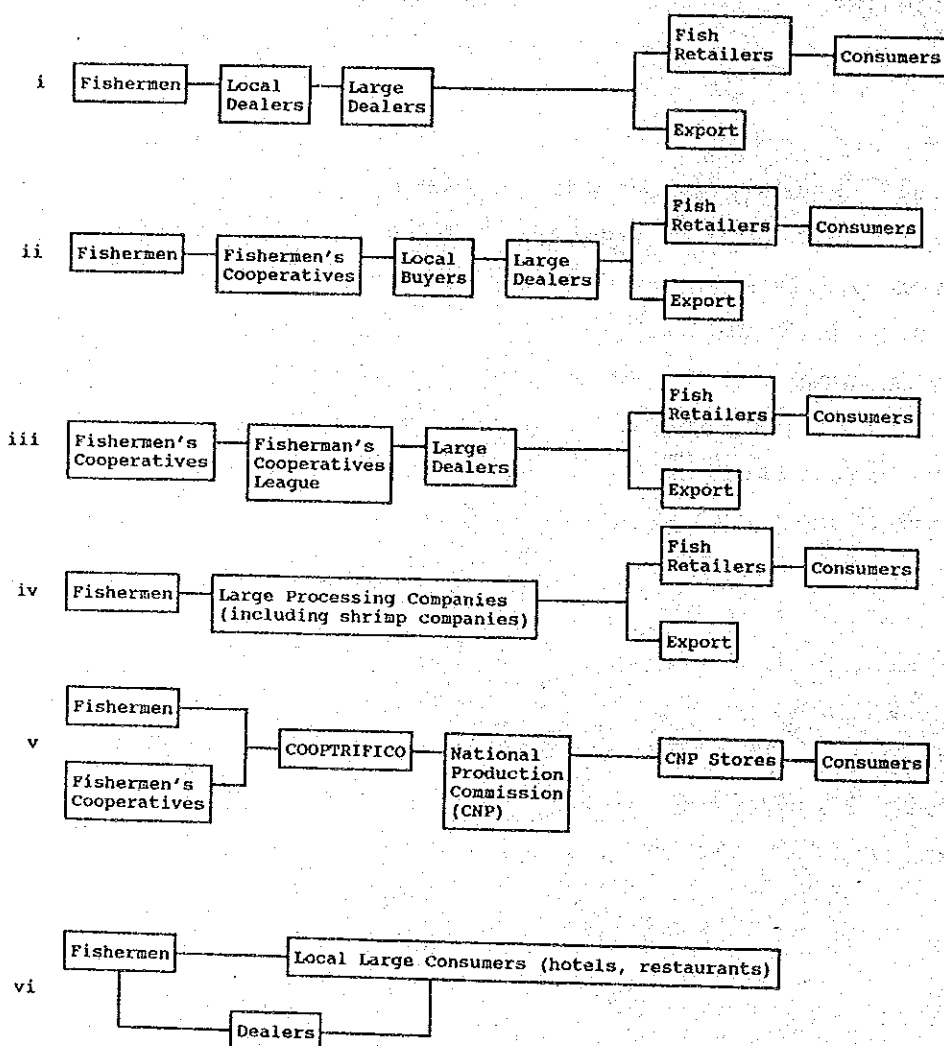
② Atlantic Coast

Puerto Limon has processing, freezing, and refrigeration facilities operated by the local fishermen's cooperative, COOPESLA.

2-1-2 Distribution

① Distribution Routes

Marine products distribution in Costa Rica is characterized by the facts that production locations are dispersed, and the system connecting the local production markets to the consumer markets (apart from the central market of San Jose) is not well established. Costa Rica's marine products distribution routes can be classified into the following six types, and at present the main routes are I and II.



Quality and price of marine products are very important factors in marketing, but they are not the only decisive criteria. In fact other transaction conditions, principally personal relationships, have a big influence. What happens is that the fishermen borrow money for living expenses and materials from the dealers, and then sell their catch to those dealers, which makes for an extremely strong connection between fishermen and the dealers.

② Domestic Consumption

Costa Rican consumption of marine products has been traditionally low. Domestic consumption of beef is extremely high, and beef is followed by chicken and pork in the consumption statistics. There is far less interest in fish than in meat.

The annual consumption per head of marine products in Costa Rica of frozen fish and fresh fish is 4.15 kg, of shellfish, it is 0.84 kg, and of canned products, 1.77 kg, making a total of 6.76 kg (1982, Costa Rica University Economics Research Institute).

The following reasons can be given to explain the low level of consumption of marine products in Costa Rica.

- i. Traditionally taste for meat has been high, and interest in fish has been low.
- ii. The high price of fresh fish and seafood and canned marine products has been a serious obstacle to expanding

consumption.

iii There is no cold chain in place, and fish caught from the ocean are not much sold inland (with the exception of the cities).

iv Marine products processing technology is not well developed.

TABLE 4: INDIVIDUAL ANNUAL FISH CONSUMPTION

Parameters		National Total	Cities	Countryside
Population (persons)		2,270,610	1,064,536	1,206,074
Fish	Total annual consumption (kg)	9,425,953	6,986,319	2,439,634
	Individual consumption (kg)	4.15	6.56	2.02
Sea-food	Total annual consumption (kg)	1,898,615	1,681,910	216,705
	Individual consumption (kg)	0.84	1.58	0.18
Canned products	Total annual consumption (kg)	4,008,467	2,079,181	1,929,286
	Individual consumption (kg)	1.77	1.95	1.60
Total individual consumption		6.76	10.09	3.80

Source: Costa Rica University Economic Survey Center, 1982

(To July 1981)

③ Consumer Tastes

The lowland climate of Costa Rica is characterized by high temperature and high humidity, and the fact that production locations are dispersed may also be a factor, but maintaining a high degree of freshness of the fish in the middle of Central America requires large amounts of ice. The cold chain is not completely established, fish prices are high, and, in addition to all of this, eating habits in the country do not involve eating much fish. Nevertheless,

fresh fish is well liked, and consumers are very particular about certain types of fish. They like shrimp, shellfish, and corvina, and flatfish (plaice, sole, etc.) when available.

④ Marine Products Trade

A. Export

With the help of US capital from the latter half of the 1970s, Costa Rica was operating yellowfin and skipjack purse seine fishing, and frozen products are exported to the United States. Unfortunately, however, this type of fishing stopped in 1982. Subsequently, these products have not been exported to the United States. Exports of fresh and frozen shrimp and fish and of canned goods have varied considerably from year to year, although there is a general trend to expansion (Table 5, Table 6).

TABLE 5: EXPORT VOLUMES OF MAIN FISH PRODUCTS

Year	Bonito and Tuna		Other Fish		Shrimp		Lobster		Canned Products	
	Tonnage	Index	Tonnage	Index	Tonnage	Index	Tonnage	Index	Tonnage	Index
1980	3,272	100	841	100	1,282	100	76	100	869	100
1981	2,466	75	1,199	143	1,836	143	12	16	969	112
1982	-	-	2,949	351	2,275	177	8	11	499	57
1983	-	-	2,223	264	1,430	112	50	66	749	86
1984	-	-	1,705	203	2,918	228	67	88	1,303	150
1985	-	-	2,460	293	4,149	326	214	282	763	88
1986	-	-	4,360	518	3,951	308	255	336	602	69
1987	3	-	5,051	601	1,955	152	156	205	1,500	173

Source: Fisheries Trade (1979 to 1980 edition and 1981 to 1984 edition), published by the Marine Products Bureau of the Ministry of Agriculture

TABLE 6: VALUE OF EXPORTS OF MAIN FISHERIES PRODUCTS

(Unit: US\$1000)

Year	Bonito and Tuna		Other Fish		Shrimp		Lobster		Canned Products	
	Amount	Index	Amount	Index	Amount	Index	Amount	Index	Amount	Index
1980	3,641	100	1,642	100	4,663	100	775	100	1,699	100
1981	1,631	45	1,395	85	3,769	81	45	6	1,677	99
1982	-	-	2,534	155	3,988	86	37	5	779	46
1983	-	-	3,561	217	2,513	54	593	77	1,263	75
1984	-	-	5,405	329	8,935	192	922	119	2,167	128
1985	-	-	6,261	381	14,420	309	2,254	291	1,030	61
1986	-	-	11,294	688	13,906	298	2,994	386	581	34
1987	7	-	13,955	850	10,073	216	2,148	277	956	56

Source: Same as Table 5

B. Import

Imports in terms both of volume and monetary value of fresh, frozen, and salt-dried, smoke-processed fish and shellfish as well as canned products and other products such as fish meal, seaweed, and fish oil decreased from 1981 to 1982, but since then imports have been gradually increasing.

TABLE 7 - IMPORT VOLUMES OF MAIN FISHERIES PRODUCTS

Year	Seafood		Canned Products		Fish Powder, Other	
	Tons	Index	Tons	Index	Tons	Index
1980	2,083	100	762	100	4,478	100
1981	179	9	1,296	170	316	7
1982	863	41	40	5	713	16
1983	2,529	121	61	8	1,943	43
1984	4,523	217	583	77	2,370	53
1985	4,970	239	71	9	2,097	47
1986	4,897	235	-	-	-	-
1987	5,066	243	54	7	33	1

Source: Same as Table 5

TABLE 8 MAIN FISHERIES PRODUCTS IMPORTS VALUES

(Unit: US\$1000)

Year	Seafood		Canned Products		Fish Powder, Other	
	Tons	Index	Tons	Index	Tons	Index
1980	1,505	100	975	100	1,887	100
1981	176	12	650	67	205	11
1982	592	39	21	22	262	14
1983	2,004	133	142	15	901	48
1984	3,704	246	784	80	1,040	55
1985	3,395	226	111	11	631	33
1986	3,534	235	-	-	-	-
1987	3,901	259	96	10	39	2

Source: Same as Table 5

2-1-3 Processing

Marine products processing in Costa Rica is divided into freezing and canning. Only a small proportion of the catch apart from shrimps and sardines is processed.

Fish for export are first processed into round or dressed styles, and then frozen to be packaged in 40-kg curtain boxes. Sardines are canned with tomato sauce, oil, and spices, tuna are oil cleaned and then canned. Among the other species mackerel, squid, clams, and seaweed are canned, but this is all for domestic consumption.

There are four first-class shrimp processing companies in Costa Rica. The shrimps are cleaned and deveined, frozen, and then packed in 5-kg curtain cases and exported to the United States. Table 9 lists the principal processing companies.

TABLE 9 MAIN PROCESSING COMPANIES

Type	Company Name	Production Capacity	Raw Material	Fishing Boats owned by Company
Canned Goods	COMPANIA ENLATADORA NACIONAL	15,000 ton/yr	tuna, sardines	Four boats for tuna and sardines Two boats for other fish
	COMPANIA MAR DEL SUR, S.A.	7 ton/day	sardines, clams, tuna, sea weed	One boat for tuna
	SARDIMAR, S.A.	8,000 ton/yr	sardines, tuna mackerel	
Frozen Shrimp	COMPANIA TALMANA	Frozen: 12 ton/day Refrigerated: 70 tons	shrimp	Seven shrimp trawlers
	COMPANIA FRIGORIFICOS DE PUNTARENAS	Frozen: 6 ton/day Refrigerated: 114 tons	Shrimp	
	EXPORTADORA DE MARISCOS, S.A.	Frozen: 4.5 ton/day Refrigerated: 27 tons	Shrimp	
	FEBRERO, S.A	Frozen: 1.4 ton/day Refrigerated: 12 tons	Shrimp	One shrimp trawlers
Other	COOPEPECLA, R. L.	Frozen: 2.7ton/day Refrigerated: 13.6 tons	Demersal sea fish, turtles, lobster	

Source and year: Depend on the survey 1987-1988