

### 3-2-6 Survey of Fishermen's Cooperatives

#### (1) Survey objectives

It is necessary to organize the fishermen of Costa Rica for the modernization of the coastal fisheries, so that the survey aimed to ascertain the present state of the fishermen's cooperatives.

#### (2) Survey method

All the fishermen's cooperatives (including the fishermen's association) in Guanacaste Province were surveyed.

#### (3) Survey results

##### ① Present state of fishermen's organizations

Four of the 12 fishing villages have fishermen's cooperatives, and one has a fishermen's association. These organizations are concerned principally with fisheries production union-type activities, and in most cases cooperative members work on cooperative fishing vessels and are paid a percentage wage. All of these organizations have been in existence only a small number of years, and have only a small membership, so they are rather weak-based.

Table 68

## General Description of Fishermen's Cooperatives

Item		Cuajiniquil	Playas del Coco	Lagarto	Nosara	Carrillo
Date activities began		1984	1987.3	1986.9	1987.2	1985
No. of members		34	15	16	22	48
Vessels owned	boats	-	...	4	7	7
	launches	3	...	-	-	-
Capitalization (colons/person)		...	3,000	2,000 at first, 6,000 at present	...	member- ship, 100 20,000 (five years)

Notes: 1. Playas del Coco is a fishermen's association.

2. The cooperative at Carrillo is operated concurrently with a forestry project.

② General description of membership

All the cooperatives have between 18 and 34 registered members, and in 3 of the 5 cooperatives all the members are engaged in fishing. Eighty-three percent of the members are under 40 years of age, and 42% of these are in their 20s, showing that cooperative members are mostly young.

Of those fishermen who had received instruction (including private, individualized instruction) on fishing, the largest percentage, or 37%, had received instruction on net-making and engine repair, with many having also received instruction on such things as building fishing vessels.

For most of the cooperatives, members each paid in between 1,500 and 5,000 colons when the cooperatives were established, but the amount at Nosara was 21,000 colons, far exceeding the others. There are considerable differences among cooperatives in the amount paid annually after establishment, with the amounts being between 500 and 4,000 colons. Many of the members had been fishing for only a few years, 56% having been fishermen less than 5 years.

③ Principal assets of fishermen's cooperatives.

Table 69

Purchased Amounts of Major Cooperative Assets  
(1,000 colons)

Item		Cuajiniquil	Lagarto	Nosara	Carrillo
Total amount purchased		6,235	7,895	2,249	4,098
Princi- pal classifi- cations	Fishing vessels	4,250	6,050	1,245	1,040
	Outboard motors	42	338	575	806
	Vehicles	900	644	-	-
	Ice machines	-	-	-	1,010
	Ice storage chambers	-	-	-	390

The principal assets of fishermen's cooperatives are the means of production and facilities such as fishing vessels, fishing equipment, and outboard motors. At the Cuajiniquil and Lagarto cooperatives, which have launches, much money has been spent on fishing vessels, while at the cooperatives with pangas and boats, much has been spent on vessels and outboard motors; thus the greater proportion of money is used to purchase vessels and related equipment. The Carrillo cooperative has spent a greater proportion on facilities (Table 69).

④ Business and surplus funds

The business of the cooperatives at Cuajiniquil, Nosara, and Carrillo is the sale of catches. The Carrillo

cooperative purchases and sells members' catches, and the other 2 cooperatives sell their own catches.

The volume handled annually is most for Cuajiniquil (60,588 kg). Those for Nosara (36,000 kg) and Carrillo (38,034 kg) are smaller, being only about 60% of Cuajiniquil.

Since all the cooperatives have been operating only a few years, only 3 of them have accumulated surplus funds. At Cuajiniquil (175,000 colons) and Lagarto (215,000 colons) funds are used for depreciation, and at Carrillo (102,000) it is an education fund.

#### ⑤ Gratis financial aid and loans

Funds from international organizations make up most of the gratis aid at 98% of the total, and another 1.5% comes from religious organizations such as the Catholic Church.

Domestic financial institutions provide most loans at 67% of the total, followed by 6% from international financial institutions, and 4% from religious organizations.

Annual interest rates for loans are between 10 and 18%, with most being between 12 and 15%. The repayment term is generally 5 to 10 years, and payments are usually made once a month (Table 70).

Table 70  
 Gratis Financial Aid and Loans  
 (1,000 colons)

Item	Cuajiniquil	Lagarto	Nosara	Carrillo
gratis financial aid		6,090	2,339	125
loans	6,000	50	585	4,553

(6) Raising funds

Operating capital for 4 cooperatives totals 21,100,000 colons, and this is obtained in the proportions of 53% from loans, 41% from gratis aid, and 6% from owned capital. While Cuajiniquil and Carrillo rely mainly on loans, Lagarto and Nosara rely mainly on gratis aid (Table 71).

Table 71  
 Types of Capital

Item	Cuajiniquil	Lagarto	Nosara	Carrillo	Total	%
Total amount	6,690	6,616	3,099	4,678	21,083	100.0
Self-owned capital	690	476	175		1,341	6.3
Loans	6,000	50	585	4,553	11,188	53.1
Gratis financial aid		6,090	2,339	125	8,554	40.6

(4) Characteristics and problems of fishermen's cooperatives

① Characteristics of fishermen's cooperatives

Cooperatives in the survey region have been active only a few years (even the oldest one began operating in 1984), and they are small in scale with about 20 to 30 members each. The fishermen's association at Playas del Coco is a voluntary organization composed of self-supporting vessel owners, and it conducts no cooperative business. The characteristics and problems of these cooperatives are as follows.

- A. Since all of these cooperatives were founded only a few years ago, they have no business achievements as yet. In addition, the greater proportion of the members are employee fishermen with few years of fishing experience, and many of the members are young.
- B. Except for the Carrillo cooperative, fishing vessels, outboard motors, and vehicles account for 87% of the total purchased cooperative assets. When including assets such as ice machines and ice storage facilities, the percentage at Carrillo reaches 80%.
- C. All the fishermen's cooperatives engage in production only, and engage in none of the activities generally aspired to by "cooperatives," such as credit, purchasing, utilization, and instruction.

D. All the cooperatives have an extremely small percentage of owned capital, with loans (Cuajiniquil, Carrillo) or gratis aid (Lagarto, Nosara) accounting for outstandingly high proportions.

(2) Problems of fishermen's cooperatives

According to the results of the second survey, all 4 of the fishermen's cooperatives in Guanacaste Province are all running deficits, and the Cuajiniquil cooperative cannot even pay the interest on its loans. A summary of the opinions expressed by informants in the third survey reveals the following.

- A. Cooperative officers, including managers, have insufficient experience in business administration and management due to the short histories of the cooperatives, and thus analysis and management of operating plans, maintenance, and repair are all inadequate.
- B. They depend upon antiquated fishing methods and equipment.
- C. Due to the recent great increase in pangas and boats, coastal stocks are declining, but they are unable to make the switch to fishing for offshore midwater and demersal fishing by launches.



D. They depend upon the middlemen for catch sales.

E. They do not make effective use of Chatarra (mixed species of small fish).

E. They depend upon the middlemen to provide fishing supplies.

### 3-2-7 Survey of consumer preferences

#### (1) Survey objectives

To ascertain the consumption patterns of Costa Rican consumers, particularly with respect to marine products, as well as household income and expenditures.

#### (2) Survey method

This survey involved interviews with 1,103 households of laborers, self-employed business proprietors, public employees, and others.

(3) Survey results

① Survey content

Table 72

Scale and Characteristics of Surveyed Fishing Cooperatives

(No. of households)

Item		Total		San Jose		San Ramon	
		Number	Proportion (%)	Number	Proportion (%)	Number	Proportion (%)
Total households surveyed		1,103	-	801	-	302	-
Occupation of householder	Laborer	271	24.6	202	25.2	69	22.8
	Self-employed	258	33.4	156	19.5	102	33.8
	Public employee	348	31.5	269	33.6	79	26.2
	Other	226	20.5	174	21.7	52	17.2
	Total	1,103	100.0	801	100.0	302	100.0
Age of householder	Less than 30	162	14.7	131	16.4	31	10.3
	30 to 39	313	28.4	236	29.4	77	25.5
	40 to 49	308	27.9	198	24.7	110	36.4
	50 or more	320	29.0	236	29.5	84	27.8
	Total	1,103	100.0	801	100.0	302	100.0
Husband and wife from	Both from fishing villages	47	4.3	39	4.9	8	2.6
	One from fishing village	120	10.9	91	11.3	29	9.6
	Neither from fishing village	936	84.8	671	83.8	265	87.8
	Total	1,103	100.0	801	100.0	302	100.0

② Purchasing

- A. Considered when purchasing marine products are, in descending order, freshness, kind, and price.
- B. The survey found that most people determine freshness by color, after which come smell and hardness, in that order. About half of the respondents determine freshness by either color or smell.
- C. In an investigation of the principal buyers of marine products and meat, it was found that, in San Jose, the retail stores within the market purchase both the most marine products and meat, but in San Ramon stores outside the market purchase the most marine products, while those within the market purchase the most meat. Purchases from supermarkets in San Jose are 20% for both marine products and meat, but the proportions are lower for those in San Ramon, at 5 to 10% (Table 73).

Table 73  
Proportion of Major Shopping Purchases

Item	Sea food		Meat	
	San Jose	San Ramon	San Jose	San Ramon
Retail stores in central market	54.8	19.2	46.6	88.1
Retail stores outside central market	22.5	69.9	31.1	7.3
Supermarkets	20.5	9.3	20.8	5.6

D. Forty-eight percent of those in San Jose, and 55% of those in San Ramon, say that the prices of fresh marine products "are higher" than those of meat, and thus these people far outnumber those who think that the prices of fresh marine products "are cheaper" or "the same" (Table 74).

Table 74  
Comparisons of Meat and Fresh Seafood Prices

Item	San Jose	San Ramon
High	47.9	55.3
Low	25.0	12.9
No difference	27.1	31.8

③ Consumption patterns

A. Consumption amounts of marine products and meat

Table 75  
Consumption Comparison of Seafood and Meat

(Units: kg/month/household)

Item		Seafood	Beef	Pork	Chicken	Mutton	Meat total
Cities	San Jose	4.8	6.2	1.2	5.1	-	12.5
	San Ramon	3.5	6.3	1.5	4.5	-	12.9
According to occupation	Laborer	4.2	6.1	1.1	4.9	-	12.1
	Self-employed	4.3	7.0	1.5	5.1	-	13.5
	Public employee	4.7	6.4	1.5	4.7	-	12.5
	Other	4.1	6.1	1.1	5.2	-	12.4
Age of householder	Less than 30	3.9	4.9	1.2	4.1	-	10.2
	30 to 39	4.7	6.0	1.4	4.5	-	12.0
	40 to 49	4.6	7.4	1.5	5.5	-	14.5
	50 or more	4.3	6.5	1.1	5.2	-	12.3
Husband and wife from	Both from fishing village	8.0	6.3	0.3	6.9	-	14.0
	One from fishing village	5.4	6.2	1.6	5.4	-	13.2
	Neither from fishing village	4.2	6.4	1.3	4.3	-	12.5
Average		4.5	6.3	1.3	4.9	-	12.5

The per capita national average of Costa Rica for consumption of fish is 6.76 kg per year (Table 4), but in the large cities of San Jose and San Ramon this amount is about 8 times the national average, and these figures show few marine products are consumed in the inland areas and the farming villages. The characteristics of the marine product consumption amounts for the two cities are as follows (Table 75).

- i Marine products consumption is greater in San Jose than in San Ramon. This is probably because a larger amount of marine products are brought into San Jose, thus making fish easier to obtain.
  - ii There are only small differences among people of different occupations.
  - iii According to age groupings, the survey found that households of people under 30 years of age consume both fewer marine products and meat, and the causes are thought to be income and family composition.
  - iv A look at family member origins shows that families in which "both husband and wife are from fishing villages" consume almost twice the average, and that families in which "one or the other" is from a fishing village consume more than the average. Thus the eating of fish is shown to be strongly influenced by culinary habits.
- B. Fresh items make up the overwhelmingly high proportion of the preferred marine products, followed by canned and frozen foods, but other processed foods (salted and dried fish, smoked fish) account for an extremely low proportion (Table 76).

Table 76  
Favorite Seafoods

(%)

Item	San Jose	San Ramon
Fresh	91.5	80.8
Frozen	2.1	3.1
Canned	3.0	13.7
Other processed products	3.4	2.4
Total	100.0	100.0

C. A very high proportion of people said they eat marine products because they "taste good," but very few people eat them because they "are inexpensive." Less than 10% of the people said they eat fish because it is "a culinary custom" (Table 77).

Table 77  
Reasons for Eating Seafoods

(%: multiple replies)

Reason	San Jose	San Ramon
Tastes good	82.1	84.4
Inexpensive	2.0	7.0
Easy to prepare	15.6	42.7
Accustomed to eating	9.7	7.9
Other	13.5	78.1



Table 78

## Number of Times/Proportions Seafood is Eaten

(\*)

Item	Husband and wife from			Age of Householder			
	Both from fishing village	One from fishing village	Neither from fishing village	Less than 30	30 to 39	40 to 49	50 or more
10 or more times/mo.	21.3	13.3	10.3	8.0	11.2	11.4	12.2
5 or 6 times/mo	48.9	50.0	43.5	45.1	45.0	44.8	43.4
Once or twice/mo.	29.8	31.7	43.1	44.4	40.6	41.2	40.3
On Christmas	-	1.7	0.3	0.6	-	-	1.3
Other	-	3.3	2.8	1.9	3.2	2.6	2.8

Most people said they eat marine products "5 or 6 times a month," followed in descending order by "1 or 2 times" and "more than 10 times." Examination by place of origin shows that, for households in which both husband and wife are from fishing villages, all the households eat marine products "more than once or twice a month," and more than 20%, for a high proportion, eat fish "more than 10 times a month." For households in which either the husband or wife is from a fishing villages the most frequent answer is "5 or 6 times a month," with "more than 10 times" being no higher than the 10 to 20% range. These figures differ little with those for households in which neither spouse is

from a fishing village. Examining the age of the head of the household shows that the greater the age, the more people tend to reply "more than 10 times per month" (Table 78).

D. The average percentage of households in both cities that would "like to increase" consumption of marine products is more than 46%, which is much greater than the 11% that "would like to decrease" such consumption. Table 79, which shows the percentages for both cities, indicates in particular that the percentage of households in San Jose that would like to increase consumption is markedly high. Also, with regard to the age groups of the household heads, all groups "want to increase" consumption except for those in their 50s.

Table 79  
Desired Consumption of Seafoods

Item	By city		Age of householder			
	San Jose	San Ramon	Less than 30	30 to 39	40 to 49	50 or more
Want to eat more	37.1	71.6	51.2	44.2	51.7	41.4
No change	49.3	24.3	38.3	44.2	37.8	47.3
Want to eat less	13.6	4.1	10.5	11.6	10.5	11.3

E. Multiple answers from people in both cities concerning the methods they know of preparing fish shows 90% for pan frying, 87% for deep frying, 73% for cebiche, 68% for soups, and 35% for pickling in vinegar, with pan frying being the most common. The reasons for knowing these methods are learning from one's parents, which was the most common, followed by friends, cook books, and media such as newspapers and television (Table 80).

Table 80  
How and Where People Learned to Cook Fish  
(Multiple Replies)

Item	Age of householder			
	Less than 30	30 to 39	40 to 49	50 or more
From Parents	84.0	87.2	81.2	77.8
From fish stores	1.9	1.3	3.6	2.5
From friends	17.3	13.4	21.4	15.6
At a public lecture	4.3	6.4	6.2	5.3
From a book	13.6	14.7	25.0	19.7
From the newspapers or television	13.0	11.8	22.1	13.1
Other	7.4	6.4	6.8	11.3

④ State of household income and expenses

A. Characteristics of surveyed households

The breakdown of the 1,103 households surveyed is 24.6% laborers, 23.4% self-employed, 31.5% public employees, and 20.5% other, with a comparatively large number of public employees.

Table 81  
 Characteristics of Surveyed Households

Item	Number of house holds surveyed	Number of working house holds	Average members per household			Average no. of working members	
			Male	Female	Total		
By city	San Jose	801	735	2.2	2.4	4.6	1.5
	San Ramon	302	283	2.2	2.5	4.7	1.5
By householder's occupation	Laborer	271	271	2.1	2.4	4.5	1.6
	Self-employee	258	258	2.3	2.6	4.9	1.8
	Public employee	348	348	2.2	2.4	4.7	1.5
	Other	226	141	2.0	2.2	4.2	1.1
Age of householder	Less than 30	162	161	1.8	2.0	3.8	1.4
	30 to 39	313	311	2.2	2.5	4.6	1.4
	40 to 49	308	300	2.4	2.7	5.1	1.7
	50 or more	320	246	2.1	2.4	4.5	1.5
By no. of household members	Less than 4	321	258	1.2	1.4	2.6	1.0
	4 or 5	257	246	1.9	2.1	4.0	1.4
	5 to 7	371	362	2.6	2.8	5.4	1.7
	More than 7	154	152	3.7	4.4	8.0	2.5
By no. of working members	1 or fewer	16	9	0.4	0.6	1.0	
	2	110	78	0.9	1.1	2.0	
	3	196	172	1.4	1.6	3.0	
	4 more	781	759	2.6	2.9	5.4	
Total or average		1,103	1,018	2.2	2.4	4.6	1.5

B. Household income and expenses

i Income

The annual income per household as the average of all households is 367,600 colons; the head of the household earns 264,000 colons (or 72%), and the income of the other household members is 102,900 (28%). The annual income per person for those who have jobs is 245,100 colons.

If the average income for all households is 100, then incomes according to occupation are 99.6 for laborer households, 119.0 for self-employed households, 95.8 for public employee households, and 85.2 for other households, with the income of self-employed households being the highest. Incomes according to the age of the head of the household are 79.8 for those under 30, 102.6 for those between 30 and 39, 113.5 for those between 40 and 49, and 94.7 for those 50 or above, thus indicating that households with heads of household under 30 years of age have the lowest income, followed by those with aged heads of household 50 years or more in age.

Income according to the number of people in the household is 84.7 for households with less than 3 members. Income increases proportionately with the number of members, reaching 116.5 in households with 7 or more members, an amount 37.5% greater than the income of households with less than 3 members.

Income according to the number of people in the household with jobs is 72.0 for 1-worker households. Just as with income according to the number of people in the household, income tends to increase proportionately with the number of working members.

Households with 4 or more working members have incomes that are 47% higher than 1-worker households.

#### ii Expenditures

The annual expenditures per household as the average of all households is 275,700 colons, and the average per-member household expenditures are 59,900 colons. If the average expenditures for all households is 100, then those according to occupation are 96.8 for laborer households, 114.3 for self-employed households, 100.2 for public employee households, and 87.2 for other households, thus showing the same trends as with income.

Expenditures according to the age of the head of the household are 81.2 for those under 30, 104.3 for those between 30 and 39, 113.2 for those between 40 and 49, and 92.4 for those 50 or above, thus indicating that households with young heads of household have the lowest expenditures.

Expenditures according to the number of people in the household and the number of working members tends to rise with the number of members, just as with income.

Households spend the most money on the following items: Food, which accounts for 41.0%, the largest expenditure, followed by housing at 16.1%. These two account for a total of 57.1%. Expenses for clothing are 7.1%, health and medical care are 5.9%, transportation and communications are 5.3%, and other expenses are all under 5%.

Table 82  
Household Income and Expenditure

Item	By city		By householder's occupation				Age of householder				
	San Jose	San Ramon	Laborer	Self-employed	Public employee	Other	Less than 30	30 to 39	40 to 49	50 or more	
Income	Householder (colons)	284,248	212,750	274,086	327,353	263,232	184,043	247,440	297,894	296,422	210,341
	Other (")	108,623	88,030	92,142	110,268	89,014	129,187	45,778	79,445	120,723	137,899
	Total (")	392,871	300,780	366,228	437,621	352,246	313,230	293,218	377,339	417,145	348,240
Expenditures											
	Expenditures (")	282,869	256,728	266,889	315,064	276,339	240,398	225,412	287,459	312,105	254,656
Proportions of expenditures (%)											
	Food/beverages	40.2	43.5	39.7	40.2	41.2	43.7	39.6	39.3	41.7	42.7
	Dwelling	17.2	12.9	19.1	16.3	16.5	11.4	23.3	18.4	14.6	12.2
	Heat/lighting/water	5.0	4.3	4.8	4.6	4.5	5.5	4.6	4.5	4.7	5.3
	Furniture/household goods	2.7	6.3	3.3	4.2	3.5	3.2	3.5	3.4	4.0	3.5
	Clothing	6.9	7.6	7.3	6.6	7.4	6.8	6.2	6.9	7.3	7.4
	Insurance/medical care	4.9	8.7	5.9	5.3	6.1	6.1	5.3	5.3	6.1	6.3
	Transportation/communication	5.4	4.9	4.6	6.3	5.0	5.1	5.0	5.2	5.5	5.1
	Education	3.6	3.4	3.4	4.0	3.3	3.5	1.4	3.7	4.6	3.2
	Culture/entertainment	4.9	3.5	4.3	4.6	4.5	4.9	4.6	4.9	4.0	4.7
	Misc.	3.6	2.3	3.4	3.3	3.0	3.5	2.4	3.3	3.2	3.7
	Emergency Expenses	4.3	1.5	3.0	3.0	3.7	4.8	2.8	3.7	3.0	4.3
	Taxes	1.1	0.7	1.0	0.7	0.9	1.3	1.0	0.9	0.9	1.2
	Household depreciation	0.3	0.6	0.1	0.9	0.4	0.2	0.4	0.5	0.4	0.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0



(4) Characteristics and problems of consumer preferences

① The high price of fish

Consumers feel that fish is more expensive than meat, and in the survey 50% of those interviewed said that the prices of marine products are high. The survey of retail stores indicates the following.

② A preference for fresh items

Over 80% of the consumers prefer fresh items, and 2 to 3% prefer frozen items. As noted in "3-2-5 Distribution survey," a distinguishing characteristic is the strong preference for fresh items.

③ The need to increase fish consumption

Only a very small proportion of people learned how to prepare fish from public lectures about cooking for from fish stores. In order to increase the consumption of marine products it is desirable to rely not only on traditional methods of cooking, but to make use of diverse methods.

### 3-2-8 Fishing Vessel Survey

#### (1) Survey objective

To ascertain the present state of fishing vessels in the main fishing villages along the Pacific coast.

#### (2) Survey method

In addition to performing a survey of the main fishing villages, interviews were conducted with self-supporting and joint-operation households.

#### (3) Survey results

The breakdown of the 250 vessels surveyed is 106 pangas, 86 boats, and 58 launches. Six percent of the vessels are 10 years or more in age, and 94% are less than 10 years old. Fully 75% of them are less than 5 years old, making for many new vessels. The reasons for this are thought to be safety, the diffusion of outboard motors, and increasing vessel size due to the greater remoteness of fishing grounds.

#### ① Boatbuilding yards

Four of the fishing villages have boat carpenters, but their facilities are outdoors, or have a temporary roof. Three to 5 persons build wooden boats and launches. The time required to build a boat (fashioned by hollowing out a single log) is one month with 4 or 5 persons working; it

takes 4 or 5 persons several months to build a launch.

② Materials

The proportion of materials used to build vessels is highest for wood, being over 60% for pangas, boats, and launches. For FRP it is about 30%, and it is extremely low for metal (Table 83).

Table 83  
Fishing Vessels Classed According to Materials

(%)

Item	Pangas/ Boats	Launches
Wood	64.8	69.0
FRP	30.5	27.6
Steel	0.4	3.4
Aluminum	4.3	-
Total	100.0	100.0

③ Vessel length

Over one-half, or 55%, of the pangas and boats are under 6 m in length, and about 90% are less than 8 m long, with most of them being 5 to 6 m. About 95% of the launches are 7 m or more in length, with most being 8 to 10 m. The longest surveyed pangas/boats were 16 m, and the shortest was 3.5 m. The longest and shortest launches were 29 m and 6 m (Table 84).

Table 84  
Fishing Vessels Classed According to Length  
(%)

Item	Pangas/ Boats	Launches
Less than 5 m	23.1	-
5 to 6	32.3	-
6 to 7	21.0	5.2
7 to 8	12.4	25.9
8 to 10	10.2	36.2
More than 10 m	1.0	32.7
Total	100.0	100.0

④ Engine horsepower

About 95% of the panga/boat engines had less than 30 horsepower, and only about 4% had 30 or more horsepower. About 70% of the launches had less than 30 horsepower, and 30% had 30 or more horsepower, showing that the launches have increased their horsepower (Table 85).

Table 85  
Fishing Vessels Classed According to Horsepower

(%)

Item	Pangas/ Boats	Launches
Less than 10 hp	6.6	3.5
10 to 20	27.5	29.8
20 to 30	61.6	36.9
30 to 40	1.6	10.5
More than 40	2.7	19.3
Total	100.0	100.0

The engine manufacturers were between 30 and 40% each for Evinrude and Johnson among the pangas and boats. After these come Yamaha, with these three makes accounting for roughly 85% of the total. For the launches, 52% had Yanmar engines, 10% were Johnson, and Yamaha and Detroit each accounted for 8.6% (Table 86).

Table 86  
Engine Manufacturers

(%)

Item	Pangas/ Boats	Launches
Yanmar	5.0	51.8
Yamaha	14.4	8.6
Johnson	33.7	10.3
Evinrude	36.5	-
Detroit	0.5	8.6
Soget	0.5	-
Other	9.4	20.7
Total	100.0	100.0

⑤ Catch holds

Approximately 70% of the pangas and boats had catch holds of less than 0.5 cubic meter capacity, and 86% had capacities of less than 1.0 cubic meter. The largest capacity found in the pangas and boats was 5.0 cubic meters, but most were less than 2.5 cubic meters.

Most of the launches have 1.0 to 1.5 cubic meters, and about half of all fishing vessels have 2.0 cubic meters or more. The largest capacity seen in the launches was 7.5 cubic meters, but the per-vessel average was 2.0. However, few vessels have insulated holds, and thus cannot be considered adequate to retain the freshness of the catch (Table 87).

Table 87  
Fishing Vessels Classed According to Hold Capacity

(%)

Item	Pangas/ Boats	Launches
Less than 5m <sup>3</sup>	69.4	5.3
0.5 - 1.0	16.6	14.0
1.0 - 1.5	4.9	19.3
1.5 - 2.0	6.7	12.3
2.0 - 2.5	1.8	17.5
More than 2.5m <sup>3</sup>	0.6	31.6
Total	100.0	100.0

⑥ Ice for catch preservation

The greater proportion of the pangas and boats carry less than 100 kg of ice for catch preservation, and about 90% carry less than 500 kg, with the average per vessel being 188.5 kg. Seventy-five percent of the launches carry 500 kg or more, with the average per vessel being 1,006 kg (Table 88).

Table 88  
Fishing Vessels Classed According to  
Quantity of Ice on Board

(%)

Item	Pangas/ Boats	Launches
Less than 100 kg	44.2	1.8
100 - 300	27.9	12.3
300 - 500	15.2	10.5
500 - 1000	11.5	40.4
Over 1,000kg	1.2	35.0
Total	100.0	100.0

⑦ Nautical instruments and fishing equipment

Only a very few pangas and boats have nautical instruments or communications equipment such as compasses, radar, fish detectors, or radiotelephones, and it is thought that these vessels work the shore fishing grounds with traditional techniques which do not necessitate such equipment.

84.5% of the launches have compasses, 50% have radiotelephones, and 53.4% have fish detectors, with some fishing vessels not having the compasses essential for safe operation.



None of the pangas, boats, and launches have the devices necessary for hauling nets and lines, thus depending entirely on human power.

⑧ Fishing equipment used

A. Bottom gill nets

The overwhelming majority of the gill nets are made of #16 nylon monofilament. Floating gill nets and bottom gill nets are the same length, most having 11.4 cm mesh. These are universally used regardless of the fish species sought, or the region.

Most of the nets are hung at 20 to 25%, and 50% of them are less than 500 m in length per roll, with most of them being 300 to 400 m. The overwhelming majority of fishing vessels use 1 or 2 rolls, but those who take snapper in the northern region use 4 or more gill nets.

B. Bottom long lines

Main lines are in most cases made of 3-stranded polyethylene rope or nylon cord (composed of 16 strands) which is 3 or 4 mm in diameter, but thicker lines are sometimes used depending upon the species sought. Most main lines are 300 to 700 m long, but some of the long lines used in taking *Dorado* and *Mero* are over 1,500 m in length.

Branch lines are usually made of 3 twisted nylon strands, nylon monofilament, or #36 to #42 nylon cord. They are 50 to 150 cm in length, with most being 50 to 100 cm. Most often #2 hooks are used for *Dorado*, and #6 hooks for *Mero*.

There are usually 100 to 300 hooks per main line, but some fishermen use over 500. Usually 1 vessel has only 1 basket, with most vessels using 1 or 2. There are more vessels in the southern region that use 2.

#### C. Handlining

Most hand lines are nylon monofilament 1.2 or 1.4 mm in diameter, but there is a limited number of fishermen in the central region who use thicker lines. The length of the hand line varies with the species of fish sought, but most are 300 to 400 m, with differences according to the fishing grounds. Some are over 500 meters. Many branch lines are less than 1 m long, and most are less than 1.5 m. An overwhelming majority of the fishermen make combined use of #5 and #6 hooks. Most sinkers (weights) are 500 g or more, and they are used particularly often in the southern region. Many vessels put out 3 or 4 lines for each person on board, followed by 5 or 6 lines; vessels putting out 7 or more lines per person were rare.

### ⑨ Fishing grounds

#### A. Distance to fishing grounds

The distance from the base of operations to the fishing grounds is, for gill netting, most commonly 10 to 20 km, with over 70% of all such fishermen going less than 20 km. A mere 2.5% of these vessels travel 50 km or more to their

fishing grounds.

Most long lining vessels travel 10 to 20 km, and long liners tend to use distant fishing grounds more often than gill netters.

Just as with gill netters and long liners, many handliners travel 10 to 20 km. Most divers travel either less than 5 km or 10 to 20 km to their fishing grounds, but about 55% operate in fishing nearby grounds less than 10 km away (Table 89).

Table 89  
Distance to Fishing Grounds According to Type of Fishing

(%)

Distance/type	Gill net	Long line	Hand line	Diving
Less than 5 km	10.7	5.9	4.7	30.2
5 - 10	25.0	16.3	16.4	24.5
10 - 20	35.8	32.1	36.2	30.2
20 - 30	15.0	22.2	19.9	13.2
30 - 50	10.0	11.1	17.0	1.9
Over 50 km	2.5	12.4	5.8	-

#### B. Depth of fishing grounds

The depth of fishing grounds normally used are most often 50 to 100 m for gill netting. Long liners and handliners use grounds of comparatively great depth, whereas divers generally work in depths of 10 to 30 m (Table 90).

Table 90

Depth of Fishing Grounds According to Type of Fishing

(%)

Depth/type	Gill net	Long line	Hand line	Diving
Less than 10 m	0.9	-	0.6	9.8
10 - 30	7.9	-	0.6	62.7
30 - 50	16.7	9.0	6.7	27.5
50 - 100	50.0	38.6	41.7	-
100- 200	22.8	34.5	34.4	-
Over 200 m	1.7	17.9	16.0	-
Total	100.0	100.0	100.0	100.0

C. Seabed characteristics of fishing grounds

Many of the fishing ground seabeds for all types of fisheries are either sandy mud or rock, with these types of seabeds found particularly often in gill netting, handlining, and diving fisheries (Table 91).

Table 91  
Kind of Seabed According to Type of Fishing

Seabed/type	Gill net	Long line	Hand line	Diving
Sand	8.6	11.9	4.0	7.5
Oose	17.2	48.1	15.1	8.9
Rock	74.2	40.0	80.9	80.6
Other	-	-	-	3.0
Total	100.0	100.0	100.0	100.0

⑩ Average catch per voyage

The average catch per voyage for fishing vessels in Guanacaste Province is 65 kg per vessel for pangas and boats, and 504 kg per vessel for launches, for a considerable difference. However, the average number of days in a voyage for pangas and boats is 1, and for launches is 4 to 7. Additionally, there are differences in the number of persons aboard and the species of fish sought, thus making it difficult to compare them with respect to vessel types and catches (Table 92).

Each time a middleman purchases a catch from a vessel owner he issues an invoice (Factura de Compra), and must submit a copy of it to the Liberia office of the Fisheries Bureau. When comparing the recorded survey results with these invoices after concluding the second survey, it was discovered that some boat and panga owners had given quite exaggerated reports of their catches, while on the other hand many launch owners had reported smaller than actual catches.

Table 92  
Average Catch per Voyage

Catch	Panga/Boat		Launch	
	No. of vessels	%	No. of vessels	%
10-20 kg	9	4.8	-	-
20-30	10	5.4	-	-
30-50	69	37.1	-	-
50-100	80	43.0	1	1.9
100-200	16	8.6	11	20.4
200-300	2	1.1	15	27.8
300-500	-	-	10	18.5
500-1,000	-	-	11	20.3
1,000-2,000	-	-	5	9.2
Over 2,000kg	-	-	1	1.9
Total	186	100	54	100
Average	≅65kg		≅504kg	

⑪ Procurement of fishing supplies

Fishing supplies such as nets, other fishing equipment, and nautical instruments are in all fishing villages procured mainly through middlemen in Puntarenas (Table 93).

Table 93  
Procurement of Fishing Supplies

(No. of fishing villages)

Where procured /supplies	Fishing nets	Equip-ment	Fuel	Ice	Nautical instruments	Pure water
Locally	-	-	1	3	-	10
Puntarenas	13	12	1	1	8	1
Other	-	1	11	9	1	2
Unclear	-	-	-	-	4	-

Note: Puntarenas fishermen who obtain supplies locally are recorded under "Puntarenas".



Fuel is supplied to the fishermen by the middlemen, who obtain it from inland gasoline stations. While ice can be obtained in Cuajiniquil, El Coco, and Carrillo, the fishermen are dependent upon inland ice plants because of insufficiencies. Fresh water can be obtained locally everywhere except in Puerto Soley and El Jobo.

⑫ Catch Sales

Over 90% of the self-supporting households sell their catches to the middlemen, with the others constituting less than 10%. Most of the Middlemen are local people.

Seventy percent of joint operation households sell their catches to the middlemen through the cooperatives, and 30% sell directly to the middlemen.

The reason there are so few self-supporting households is that in most regions cooperatives have not been established.

Also, it appeared that some of the large middlemen were lending vehicles to the cooperatives in order to transport catches.

#### (4) Characteristics and problems of fishing vessels

##### ① Characteristics of fishing vessels

The launches have a modicum of nautical instruments and communications equipment, but these are rare on pangas and boats. In addition, they are equipped with no mechanical fishing devices, operating entirely under human power.

Many launches are equipped with used engines from scrapped trucks or busses. These provide horsepower that is in excess of what the vessels were designed for, and they also have difficulties obtaining parts, and with high fuel consumption.

##### ② Amount of ice used

For an average catch taken back after a single voyage of 150 to 200 kg, pangas and boats take an average of 188.5 kg of ice, and launches take an average of 1,006 kg, thus using a considerable amount of ice. However, since the catch holds are not sufficiently insulated, the ice efficiency is thought to be rather poor.

##### ③ Fishing equipment used

Most fishing equipment and supplies are procured from Puntarenas and San Jose. Since the dealers are not every enthusiastic about selling, and also since the fishermen

have little will to improve their equipment and supplies, many vessels are using old nets and old equipment.

④ Sales channels of fishermen and cooperatives

Over 90% of the self-supporting fishermen sell to the middlemen, and 70% of the joint operation households sell to the middlemen through the cooperatives; 30% sell directly to the middlemen. Thus both the fishermen and the cooperatives sell to the middlemen or the middlemen.

### 3-2-9 Manufacturing and Processing Survey

#### (1) Survey objective

To elucidate the state of marine product processing plant management and operations.

#### (2) Survey method

A field survey and interviews were conducted at 13 processing plants in the vicinity of San Jose, and in Puntarenas.

#### (3) Survey results

##### ① Processing plant survey

Five or 6 large companies have over half the share in Costa Rica's marine product processing industry, and they control most of the industry through the distribution channel of fisherman-middleman-processor.

Processors can be classified according to 2 major types. One type handles fish (Pargo and Dorado) and lobster, and this group ships quality fresh products to the United States. Excess marine products and low-grade fish are left for domestic consumption. The other group processes shrimp in Puntarenas.

In the preliminary survey we visited the 2 largest companies of those mentioned above, "Coopemontecillos" and

"Expun" (note 5), and requested their cooperation in this survey. Both processing plants mainly pack fresh fish in ice and export them to the United States. They have ice-making and cold-storage facilities (those at Expun are under construction), but since prices of frozen items are low, they do not export frozen foods and do not have freezing facilities.

The domestic distribution of frozen foods is not very highly developed, meaning that in the future when there are increases in the supply of, and demand for, frozen foods, problems are expected to arise in their processing and distribution.

Note 5: Exportadora Pescados Unido S. A. (EXPUN)

## ② Management of plants

With regard to company organization, 11 of the plants are stock corporations, and the other 2 are organized differently.

In each of the decades of the 1940s, 1960s, and 1970s, one plant began operating; the other 10 plants all begin in the 1980s.

In addition, 5 of the plants engage in operations other than processing, the other 8 engage solely in marine product processing. The former 5 plants all began operating in the 1980s.

③ Number of employees, and average annual operating days

The 13 surveyed plants employ a total of 2,220 employees, with 1,581 (71.2%) being permanently employed, and 639 (28.8%) being temporary. Each plant employs an average of 171 persons (permanent, 122; temporary, 49). The largest plant employs 720 (permanent, 420; temporary, 300), and the smallest employs 6 (all permanent). Four of the plants employ no temporary help. Seven of the plants have fewer than 50 employees, excluding temporary help.

The plants operate an average of 266 days per year, with the highest number of days being 365, and lowest, 208. Many of the plants operate more than 300 days.

④ Items processed

Ten (76.9%) of the 13 plants surveyed process only marine products; 1 plant processes marine products and meat, and 2 process marine products and items other than meat. These last 2 plants have the fewest employees, and have been operating for a comparatively few number of years.

⑤ Kinds of marine products processed

The items processed can be generally categorized into 3 types: Fresh marine products, including ice packing; processing of frozen foods; and canning.

The processing of fresh items including ice packing involves mostly fish, whereas it is mostly shrimp that are frozen. Fish canned are sardines, Atun, and yellowfin tuna. Some fish meal is also produced (Table 94).

Table 94  
Numbers of Major Processors by Type of Processing

Item	Fresh (incl. ice packed)		Frozen		Canned	Total
	Shrimp	Fish	Shrimp	Fish		
No. of plants	1	5	4	1	2	13

⑥ Principal equipment and machinery

All the plants possess certain kinds of equipment and machinery, but those that most the plants have, regardless of the kinds of processing they perform, are freezers, ice storage facilities, and cold storage facilities. It appears that the other kinds of machinery depend upon the type of processing at each plant.

Much of the machinery was purchased in the 1980s, but some of the older plants have not replaced their old machinery. There are also some rented machines.

Table 95  
Major Facilities and Equipment

Item	No. of plants	No. of machines
Airblast freezer	4	13
Contact freezer	4	5
Freezer	8	39
Ice machine	7	15
Ice storage chamber	4	9
Cooler	8	15
Fish cleaning machine	1	1
Fish cooker	2	9
Boiler	4	6
Fish meal machine	1	1
Smoked fish machine	1	3
String wrapper	2	10
Retort	2	10
Can washer	2	5
Fish sorter	2	3
Automatic wrapper	5	8
Other machines	7	26



⑦ Amounts of raw materials used

The 13 surveyed plants used about 20,000 tons of raw materials annually; 13,700 tons of this (68%) is purchased, and 6,400 tons (32%) is self-supplied, and thus the greater proportion is ostensibly purchased. However, some of the processing plants in Puntarenas purchase raw materials from affiliated companies or foreign fishing vessels, it would seem that the self-supplied amount is actually greater.

The amounts of raw materials used according to the kind are mostly fish, followed by shrimp. Atun and sardines are canned, and the others are packed in ice or frozen (Table 96).

Table 96  
Quantities of Raw Materials Used

(Units: tons)

Type	Materials purchased	Self-supplied materials	Type	Materials purchased	Self-supplied materials
Atun	5,501	-	Langosta	220	-
Sardina	1,650	1,335	Cambute	36	-
Dorado	11	-	Pulpo	22	-
Bolillo	3	-	Calamar	1	-
Pescado	5,230	962	Moluscos	10	-
Camaron	1,008	4,140	Total	13,692	6,437

⑧ Amounts produced

The amounts produced are trade secrets, and therefore answers could not be obtained from all of the plants, but those that did answer said that 80% of total production is exported.

⑨ Product buyers

Eleven of the 13 plants directly export most of their products; the 2 other plants sell domestically and through other channels. Many of the secondary buyers are domestic wholesalers or retailers, but some plants sell to exporters, or retail domestically themselves.

(4) Characteristics and problems of manufacturing and processing

- ① Though each processor has an average of 171 employees, about 54% of the plants have fewer than 50 permanent employees, and the others all have 100 or more, thereby indicating differences in scale.
- ② There are 3 main kinds of processing, which account for most: Packing in ice (mainly fish), freezing (mainly shrimp), and canning. Others kinds of processing are frozen foods, smoked items, and salted/dried items, but these account for only minor volumes.
- ③ There is little in the way of new equipment and machinery in the processing plants, and there is not much investment in plant and equipment.
- ④ Most of the plants export directly, with 80% of their products being for export.

### 3-2-10 Survey of Companies Based in Puntarenas

#### (1) Survey objective

To elucidate the state of the fisheries enterprises whose operations are based in Puntarenas Port.

#### (2) What the survey covered

This survey involved interviews covering the 10 companies based in Puntarenas which mainly trawl for shrimp (called the trawling group), and the 10 companies which use launches and engage in kinds of fishing other than trawling (called the launch group).

#### (3) Survey results

##### ① A general description of the companies

Most of the 20 companies are individual proprietorships, which account for 70% of the total. The rest are stock corporations (25%) and other types. The launch group companies are all individual proprietorships (Table 97).

Table 97  
General Description of Companies

Item		Trawlers	Launches	Total
No. of companies		10	10	20
Type of organization	Individual operation	4	10	14
	Stock corporation	5	-	5
	Other	1	-	1
Specialize or not	Fishing only	7	10	17
	Fishing and processing	3	-	3
Employees		119	87	206
Average per company		11.9	8.7	10.3
Catch quantity	Shrimp (kg/yr)	284,753	-	284,753
	Other (kg/yr)	381,009	259,944	640,953
	Total (kg/yr)	665,762	259,944	925,706
Vessels used	Launches	3	10	13
	Trawlers	11	-	11
	Total	14	10	24

Note: Among those in the trawler group, one entity uses three launches, and one uses two trawlers.

Note: Among those in the trawler group, one entity uses three launches, and one uses two trawlers.

The launch group companies all engage only in fishing, but 3 of the 10 companies in the trawling group also engage in processing.

A total 206 employees work in fishing, making for a per-company average of about 10 persons.

The annual catch for the trawling group is 666 tons (66.6 tons per company), and 260 tons for the launch group (26 tons per company), with the trawling group having a catch about 2.6 times that of the launch group. Shrimp account for 43% of the trawl group's total catch. The 3 companies which also process use 74% of their total catches as the raw materials for their processing.

(2) A general description of fishing vessels

A. Vessel construction and size

Sixty-four percent of the trawlers are wood and 27% are metal, while 92% of the launches are wood. The trawlers are of greater age, with 73% of the trawlers being 10 years old or more, and 31% of the launches being of such age. In particular, 31% of the launches are less than 5 years old, with more recently built vessels than the trawlers.

The average length of the trawlers is 20.9 m, and that of the launches is 11.1 meters; trawlers have about twice the length. Trawlers have an average horsepower of 302, and the launches 58.5; the trawlers thus have much greater horsepower than the launches (Table 98).

Table 98  
Structural Materials and Sizes of Vessels

Item		Trawlers	Launches	Total (or average)
No. of vessels		11	13	24
Average crew/vessel		6.5	5.2	5.8
Structural materials	Wood	7	12	19
	Steel	3	1	4
	Other	1	-	1
Average length (m)		20.9	11.1	15.6
Average horsepower		302.0	58.5	170.1
Vessel age	Less than 5 yrs	-	4	4
	5 to 10 yrs	3	5	8
	10 to 15 yrs	3	2	5
	15 to 20 yrs	5	2	7

B. Equipage

All the vessels are equipped with radiotelephones, but some of the vessels are not equipped with radar, compasses, NNSS, and fish detectors. All vessels have equipment for the refrigeration or ice preservation of catches.

The catch hold volume per vessel is 19.9 cubic meters for trawlers, and 3.8 cubic meters for launches; trawlers have 5.2 times the volume of launches (Table 99).

Table 99  
Fishing Vessel Equipment

(No. of vessel)

Item		Trawlers	Launches	Total
Navigational and fishing aids	Radiotelephone	11	13	24
	Radar	3	1	4
	Compass	8	12	20
	NNSS	2	-	2
	Fish detector	10	13	23
	Winch	11	-	11
Storage	Freezing	9	-	9
	Ice hold	2	13	15
Average capacity/ vessel (m <sup>3</sup> )		19.9	3.8	-



③ A general description of operations

The maximum distance from the base of operations for fishing grounds is 180 km, which is about the same for both trawlers and launches. The greatest depth of the fishing grounds is about 300 m.

Most trawlers fish in all operating areas described as follows: Area A (from the Nicaraguan border to Punta Blanca, area B (from Punta Blanca to Cabo Velas), area C (from Cabo Velas to Cabo Blanca), and area D (Golfo de Nicoya). The launches operate mostly in areas B and C, and little in areas A and D (Table 100).

Table 100  
Types of Operation

Item		Trawlers	Launches
Greatest average distance to fishing grounds (km)		178.9	177.3
Greatest average depth of fishing grounds (m)		306.2	280.8
Operational regions	Area a (vessels)	8	4
	Area b (vessels)	9	12
	Area c (vessels)	9	13
	Area d (vessels)	9	3
Average days/voyage		11.0	10.5
Average caton/voyage (kg)		2,881	1,413

Both the trawlers and launches put out to sea for an average of about 10 days at a time. The longest voyage is 16 days, and the shortest is 6 days.

The average catch per voyage for trawlers is 2.9 tons, and 1.4 tons for the launches; trawler catches are 2.1 times those of the launches. There are marked differences in catches depending upon the vessel, with the largest and smallest for trawlers being 11.4 tons and 0.9 tons, respectively. The largest catch for the launches is 2.2 tons, and the smallest 0.7 tons. The per-vessel difference in average catch per voyage tends to be greater for trawlers than for launches.

(4) Characteristics and problems of the companies

- ① All the companies were founded since the beginning of the 1970s, and 13 of them (69%) were founded in the 1980s. A high proportion of the companies, or 85%, engage only in fishing.
- ② The 20 companies use 24 vessels. Trawlers are about twice as long as the launches, and have 5 times the catch hold capacity and horsepower. Thus the trawlers are much larger and better equipped.
- ③ Trawlers have an average per-voyage catch that is twice that of the launches, and 43% of the total trawler catch is shrimp.
- ④ The trawlers operate off the entire coast of Guanacaste Province and in Golfo de Nicoya, while the launches operate in smaller areas, off the northern part of Guanacaste and in the Golfo de Nicoya.

### 3-2-11 Questionnaire Survey of Authorities on Fisheries

#### (1) Survey objectives

To determine how authorities on fisheries such as government officials and university professors view "the present state and problems of Costa Rica's fisheries" and "how to improve and develop the country's fishing industry."

#### (2) Survey method

Questionnaires were mailed.

#### (3) Survey results

In formulating a master plan for fisheries development in the Republic of Costa Rica, the cooperation of MAG was obtained, questionnaires concerning the problems and solutions in Costa Rica's fishing industry were sent to 50 authorities on fisheries (local and national government officials; representatives of education, financial, and corporate organizations), principally in the survey region, and replies were received from 31 persons (for a response rate of 62%).

Table 101  
Results of Questionnaire Survey

Principal items	Number of problems	Number of solutions
1. Organizing of fishermen	8	14
2. Education of fishermen (social responsibility, business management, technical instruction, etc.)	21	18
3. Credit and Finance	9	16
4. Fishing equipment and supplies	8	4
5. Extent of infrastructure	14	14
6. Distribution systems	18	13
7. Expanded consumption of seafood	6	7
8. Surveys and utilization of stocks	6	9
9. Fisheries policy, fisheries system (administration, etc.)	12	11
10. Other	6	8

A. Organizing the fishermen

As there are many small-scale fishermen and since individual fishermen have little power, it is important that government aid be used to promote the organization of the fishermen. URCOOPES R. L. (the federation of cooperatives) should be strengthened, and the cooperatives should be provided with a commercial function.

B. Educating the fishermen

There are some fishermen with a low social consciousness (for example, those who do not obey laws, do not repay their debts, are wasteful and do not plan their work), so it is necessary to educate them socially and professionally. Many respondents expressed hopes for the role of INA in educating the fishermen.

C. Credit and financing

There is a necessity for establishing a national bank or a special bank for development aid, and to set up a system for loans.

D. Fishing equipment and supplies

The fishermen should be readily provided with equipment and supplies at reasonable prices, and when purchasing such they should be granted reduced or no taxes.

E. Infrastructure

Priorities should be determined, and then necessary financial backing should be provided. Shipping centers should especially be built in the main fishing villages.

#### F. Distribution

The catch sales network should be improved, and middlemen should be expelled. In addition, it is also necessary to involve public organizations (such as the Ministry of Economic Planning) in order to build a reasonable price structure for fish.

#### G. Consumption of marine products

Government agencies (Ministry of Public Welfare) should conduct a campaign to increase consumption, while at the same time providing for quality control.

#### H. Stock surveys and stock utilization

Controls should be established for fishing equipment, methods, seasons, and grounds based upon a scientific evaluation of stocks. Development for the effective utilization of unused resources should also be promoted.

#### I. Fisheries policies and the fisheries system

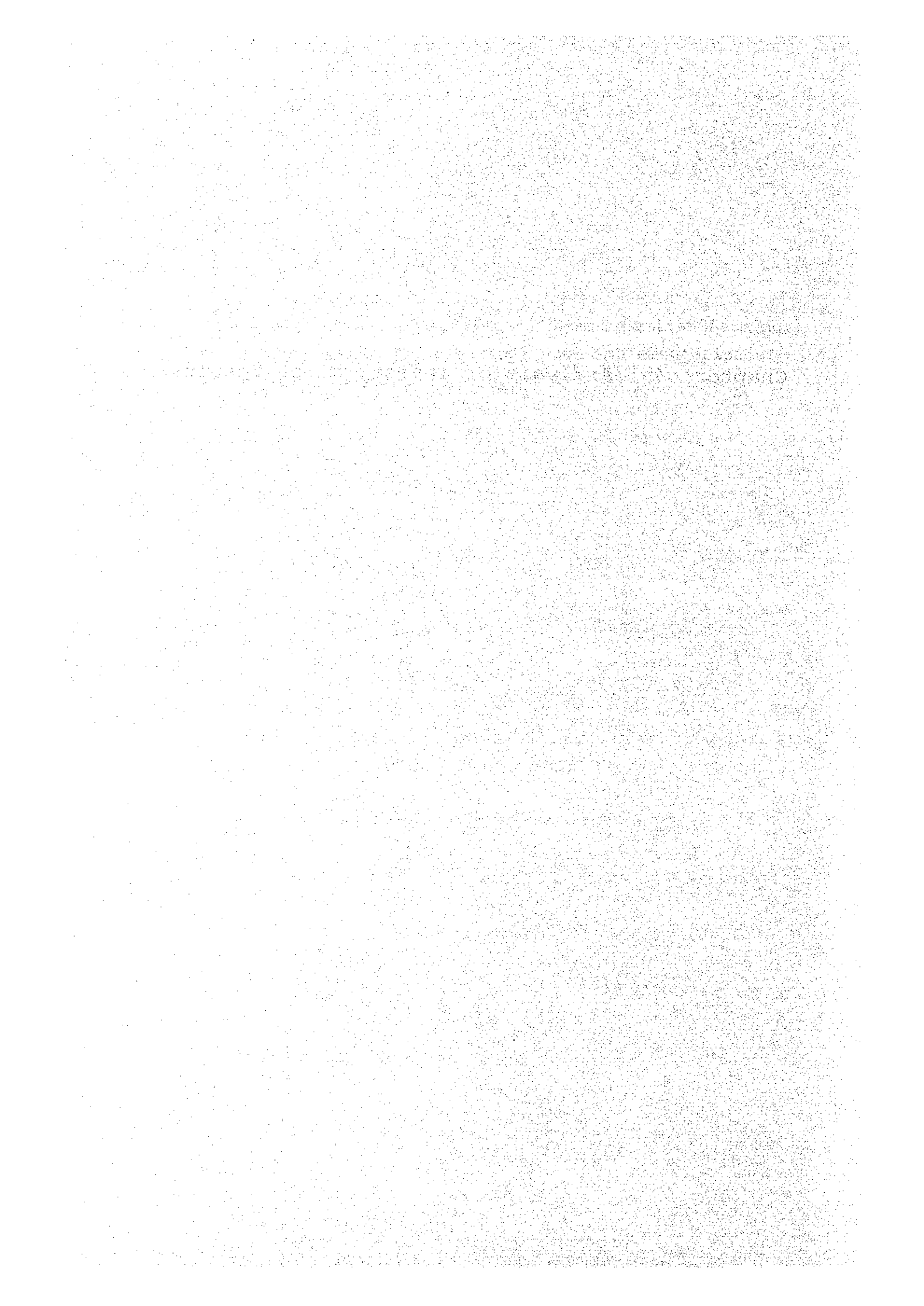
A fundamental plan for the development and fostering of fisheries is lacking. A deliberative committee should be established to provide for coordination with related government policies. Furthermore, there were many expectations expressed for a powerful MAG administrative system for such actions as increasing budgets for fisheries.

J. Other

There were opinions in favor of promoting fish farming, increasing exports, and the continuous implementation of statistical surveys.



## Chapter 4 Analysis of Investigation Results



## Chapter 4 Analysis of Investigation Results

### 4-1 Resource Problem and Countermeasures

#### (1) Present Conditions

##### 1 Demersal Fish Resources

###### A. Total Fish Resources

As a result of four rounds of daytime operations with a single-stern trawl gear over survey areas located between 50- and 500-meter contour lines, the total biomass including about 28 main and other species was estimated at between 21,000 and 60,000 tons. These figures underestimate the actual biomass because the fishing efficiency of the gear is set at 1. The large range given for the estimates is due mainly to the *Peprilus snyderi*, *P. medius*, and *Pleuronectodes* sp., which apparently make seasonal migrations. Although it is not clear, it is believed that the first and the second round surveys may have been carried out while the waters were under the influence of El Niño.

No estimate was made in these surveys of biomass in waters above contour lines of 50 meters. According to surveys with a single-rigged trawl gear under a NORAD/UNDP/FAO programme for estimates of biomass in waters above contour lines of 50 meters were higher than those in deeper waters. The said surveys estimated the total demersal fish biomass in the Pacific off Costa Rica at

14,000 tons, while pelagic resources were estimated at 81,000 tons. In addition, according to our calculation based on the same report, it was found that the fish abundance is shared equally between the waters in the north and the south of Cabo Blanco. Thus, it can be deduced that the actual demersal fish population may be more than twice the estimate from the present surveys for the total population of demersal fish off the Pacific coast of Costa Rica.

According to the NORAD/UNDP/FAO report, catches of bottom fish per fishing hour with a single-trawl gear in waters off Costa Rica were as high as those in waters off Nicaragua and the eastern part of Panama among ten countries in Central America from Mexico to Colombia. This indicates that the density distribution of demersal fish in the Pacific off Costa Rica is relatively high for the waters off Central America. It must be mentioned here that the best fishing grounds in the world in the middle latitudes, like those in Patagonian waters off Argentina and off New Zealand, have higher density distribution than those in the Pacific coast of Costa Rica.

#### B. Biomass by Species

Estimates for the following species remained over 1,000 tons throughout the four rounds of single-rigged trawl operations.

*Pleuronectocodes* sp.

*Peprilus snyderi*

*P. Medius*

*Argentina aliciae*

*Prionotus stephanophrys*

*Merluccius gayi*

The registered species are not highly appreciated in the local fish markets. Biomass of high marketability are scarce.

#### C. Biomass by Depth Zone

In waters at depths between 50 and 150 meters, particularly 50 to 100 meters, species of high marketability were found, but they were not abundant. There are very few marketable species at depths of between 100 to 300 meters. However, there are species which could well become marketable in the future including *Peprilus* sp., *Loligopsis diomedae*, Bothidae (flatfish, flounder), and *Solenocera agasizii* (fidel shrimp) and *Heterocarpus vacarius* (camello shrimp). The important point about all of these is that they exist in large quantities. There are very few species existing below 300 meters, and then only in extremely small in quantity. It has been assumed that each species inhabits a specific layer.

#### D. Biomass by Region

Among Regions 1, 2, and 3, Region 1 has much higher fish biomasses than the other two. Region 1 accounts for 60 to 82% of total biomass, while Regions 2 and 3 have 14 to 17% and 4 to 17%, respectively.

#### E. Test Fishing Other than Trawling

It is noted that large bottom and pelagic fish were caught with the bottom longlining and bottom gill netting experiments (Table 20).

#### F. Fisheries Production

The bottom fish fishery in Costa Rica can be roughly divided into coastal artisanal fishing (angling, gill netting and long lining) and shrimp trawling, with the former selectively catching coastal species of high market values. The landings have been on the increase, but biomass of high-ranked fish of certain species are on the decrease because of suspected overfishing (Table 22). The shrimp landing has also been on the increase. Shrimp fishing has shifted to Pacific fishing grounds from Golfo de Nicoya, and then out to deeper offshore waters. This suggests a decrease in high-ranked shallow-water species and the need to compensate by catching of such deep-sea species as fidel and camello shrimp. There are not always large stocks of deep-sea shrimp, and as the present survey trip showed, accessible fishing grounds are limited. The prospect for shrimp resources for trawlers may not necessarily be good.

G. Summary

- i Distribution zones, distribution densities, and biomass for the main bottom fish species in the survey area were estimated by latitudinal Region and by depth zone.
- ii Density and biomass of bottom fish in the survey area vary with the seasons, but it is estimated that they exist in comparatively large quantities in Central American Pacific waters.
- iii The biomass of highly marketable bottom fish present to a depth of 100 meters were estimated to be small. Considering the current state of fishing, this is probably due to depletion of resources by overfishing.
- iv Species were found in the offshore areas at depths between 100 and 300 meters which may not be marketable now, but which have good prospects for becoming marketable in the future. They exist in large quantities and remain unexploited.
- v In consideration of distribution density of fish resources, there is severe imbalance in utilization of targeted fishing grounds and fish species in the survey areas.
- vi Resource conditions, socio-economic, and other factors have to be taken into consideration when studying and reforming the structure of production in the fisheries industry for effective utilization of resources.

## ② Pelagic Fish Resources

No survey was made of pelagic fish resources in the present survey, but it is indispensable to collect information on pelagic fish resources to develop the fisheries industry in the waters under investigation. The assumptions made below are based on the available survey data and related information obtained recently to deal with pelagic fish resources.

- A. According to average distribution charts for fingerlings of pelagic Scombridae for 1956 through 1981 (Far Sea Fisheries Research Laboratory, 1985), fingerlings of *Auxis* sp. (frigate tuna) and *Euthynnus* sp. (yellowfin tuna) were seen distributed in coastal and offshore waters of Costa Rica at relatively high densities (Fig. 19), indicating that these sea areas are spawning grounds, and therefore adult fish exist.
- B. According to purse seine landings by fishing grounds for yellowfin and skipjack in the East Pacific for 1971 through 1974, high productivity was registered in coastal and offshore waters of Costa Rica (Fig. 28).
- C. Studies on formation of fishing grounds for *Thunnus obesus* in the Pacific indicated that it is difficult for fishing grounds for bigeye tuna to form in the areas in the vicinity of Costa Rica Dome due to insufficient oxygen dissolution.
- D. A FAO survey estimated pelagic resources in coastal



waters of Costa Rica at 81,000 tons.

E. Comparatively good catches of *Thunnus albacares*, *Sarda* sp. and *Auxis thazard* were made in recent bottom long line and bottom flag line experiments.

F. *Coryphaena hippurus* and skipjack were frequently hooked on troll gear of the survey vessel, Nisshin Maru. These fish were also observed jumping in the coastal waters.

G. Because there is a shallow thermocline in the surveyed area, it is assumed that swimming layers for pelagic fish are also not very deep, indicating favorable conditions for formation of good fishing grounds.

H. In Costa Rica, fishing of pelagic fish has not been well developed. This fact accounts for the small pelagic fish yields. The information given above suggests that the country has abundant pelagic resources and there is plenty of room for further development.

#### I. Conclusions

The Pacific off Costa Rica renders good fishing grounds for pelagic species like yellowfish and skipjack which are believed to migrate very close to the coast in large numbers. The waters are considered to offer favorable conditions for migration and fishing. No significant development of industry for exploitation of these pelagic

resources has been undertaken yet, and there are good possibilities for high productivity by introducing large-scale fishing using purse seines as well as more small-scale fishing using trolls, pelagic long lines, and fish shelters (like payaos for dorado and tuna). It is also considered necessary to take socio-economic measures for promotion of domestic fish consumption and exportation.

### ③ Aquaculture

Since there are limited sources of information regarding the status of aquaculture in Costa Rica, a detailed description of present status in this area cannot be given here. It is believed that there are suitable locations for fish farming in Costa Rica with its favorable geographic and oceanographic characteristics like estuaries, high water temperatures, inlets, and bays. The Golfo de Nicoya and areas near Quepos on Osa Peninsula are considered suitable places for breeding shrimp.

It is recommended that analysis of the present status and basic studies of farming be undertaken because of the long-term importance of aquaculture.

### (2) Counterplans (Proposal)

Effective utilization of resources must be improved based on sound policies to support management of resources. From the point of view of effective utilization of fish resources serious imbalances exist in current utilization of resources. There is intensive fishing of certain bottom