

AGENCY FOR INTERNATIONAL DEVELOPMENT WASHINGTON, D. C. 20523 BIBLIOGRAPHIC INPUT SHEET	FOR AID USE ONLY
---	-------------------------

1. SUBJECT CLASSIFICATION	A. PRIMARY Agriculture
	B. SECONDARY Fisheries

2. TITLE AND SUBTITLE
Artisan fisheries: characteristics, problems, needs, and relationships to aquaculture

3. AUTHOR(S)
Marshall, Nelson; Adriasola, Luis; Griffin, James; Lampe, H.C.; Pollnac, R.B.

4. DOCUMENT DATE 1975	5. NUMBER OF PAGES 58 p.	6. ARC NUMBER ARC
---------------------------------	------------------------------------	-----------------------------

7. REFERENCE ORGANIZATION NAME AND ADDRESS
University of Rhode Island, International Center for Marine Resources Development, Kingston, Rhode Island 02881

8. SUPPLEMENTARY NOTES (*Sponsoring Organization, Publishers, Availability*)

9. ABSTRACT

A portrayal of artisan fisheries with elaboration on Costa Rica, Chile, Tanzania, and South Vietnam. Common denominators of artisan fisheries also are discussed. In the concluding section, it was seen that artisan fisheries and aquacultural development have the following goals: 1) to provide additional high-quality protein at lower prices; 2) to improve incomes of artisan fishermen; 3) to provide additional employment; and 4) to earn foreign exchange through exports. To achieve these goals, three aspects of development were found to merit special consideration: 1) resource assessment and fishing technology; 2) marketing and distribution systems; and 3) institutions, organization, and management. These three areas are detailed in the final chapter.

10. CONTROL NUMBER PN-AAC-704	11. PRICE OF DOCUMENT
12. DESCRIPTORS Aquaculture Rural Industries Rural sociology	13. PROJECT NUMBER
	14. CONTRACT NUMBER CSD-2455 211 (d)
	15. TYPE OF DOCUMENT

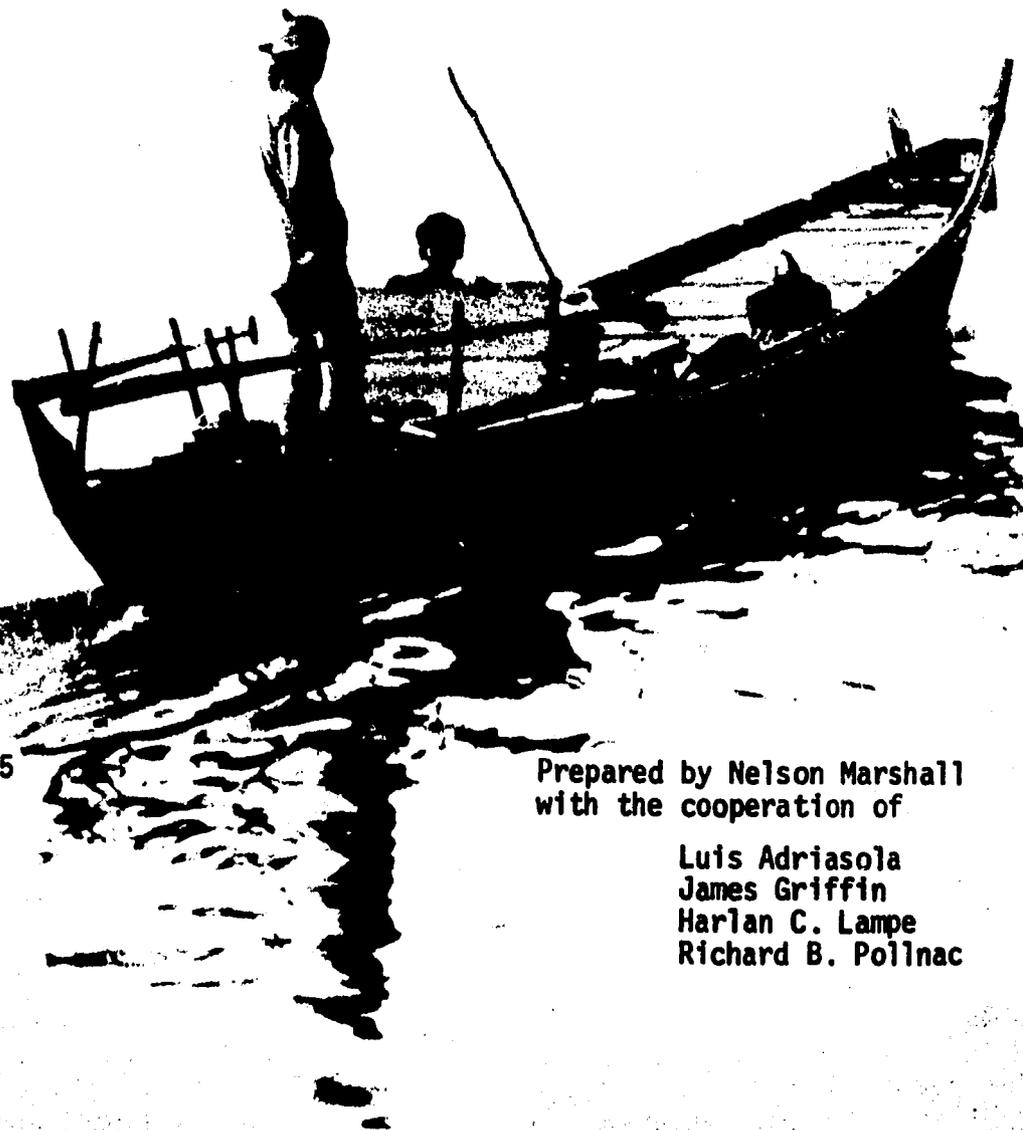
CSD-2955-20013

FN-AAC-04

International Center for Marine Resource Development

University of Rhode Island

ARTISAN FISHERIES: CHARACTERISTICS, PROBLEMS, NEEDS AND RELATIONSHIPS OF AQUACULTURE



January 1975

Prepared by Nelson Marshall
with the cooperation of

Luis Adriasola
James Griffin
Harlan C. Lampe
Richard B. Pollnac

ARTISAN FISHERIES
CHARACTERISTICS, PROBLEMS, NEEDS
AND RELATIONSHIPS TO AQUACULTURE

Preliminary Analyses

by the

International Center for Marine Resource Development
University of Rhode Island

1975

Quotes on Small-Scale Fisheries

Indonesia*

About 2 million people involved.
Responsible for 98 percent of the fisheries catch.

Senegal*

1/10 of the country's population is involved.
Responsible for 80 percent of the fisheries catch.

Worldwide*

25 million people involved.

* Statements at the 1974 meeting of the FAO Committee on Fisheries submitted respectively by the delegates from Indonesia, Senegal and Sweden

Contents

	<u>Page</u>
I. Introduction	1
II. Representative Artisan Fisheries	6
III. Common Denominators of the Artisan Fisheries	
IV. Needs for the Development of the Artisan Fisheries and Related Aquaculture	45

I. Introduction

Characteristically, the artisan fisheries of the coastal areas play a dual role, providing essential protein and serving as a principal source of employment. In such areas, bulk food requirements may be met in part through simple agriculture, while the fishing harvest complement the crops, especially in supplying protein needed to relieve malnutrition. Also agriculture and fisheries may complement each other in sustaining employment or occupational alternatives to populations that could not make ends meet on either activity alone.

In thinking of the world's capture fisheries, we are inclined to picture the industrial fisheries of relatively large, heavily-capitalized boats, labor saving rather than labor intensive in their operations. In so doing we are prone to overlook the little man who uses simple methods and who has negligible financial resources as he operates marginally above the subsistence level. Actually, however, a substantial share (some suggest as much as half) of the world catch of food fish is taken in the relatively small-scale fisheries which, though ill-defined, are commonly referred to as the "artisan fishery." Worldwide there may be as many as 15 million* fishermen in this category. In addition, the fishermen's families and all those involved in the infrastructure must be included in a tally of the people directly dependent on this segment of the economy.

Individual productivity is low in the artisan fishery due to the lack of equipment and skills combined with difficulties associated with remoteness from markets and a lack of transportation. Such relatively simple shortcomings are amenable to significant change through assistance programs having a far-ranging impact on nutrition and overall health and providing a broad-based uplifting of the economy.

These possibilities were often overlooked in the past as assistance was focused on the industrial fishery where it is easier to concentrate efforts and to invest development funds. This emphasis has probably run its course, especially in areas where such fishing, largely farther

* Reliable figures are not available. Estimates range from 10 million to 25 million. From an unpublished compilation of FAO data, 10-12 million is suggested by Hilmar Kristjonsson (personal communication) as a conservative estimate.

offshore than the artisan activity, does little more than add to the pressure on stocks also fished by boats from distant lands. Often little or nothing is to be gained from such competitive harvesting.

A shift of attention to the artisan fishery, on the other hand, must involve working with a diffuse activity, widely scattered along the world's coastlines, including a great diversity of fishing practices and of cultural and political entities. The obvious approaches to assistance endeavors in the face of such diversity are:

--to deal with each case separately, i.e., country by country or at least subregion by subregion,

--to deal with subsets of the conditions encountered, dividing them into groupings based on environmental characteristics and based on socio-cultural criteria,

--to select and pursue those problems which are common to many of the artisan fisheries, thus seeking advances that can be readily transferred to specific locales.

The desirability of interrelating elements of all such approaches is obvious.

One should not assume from the above that developed countries have altogether failed to show an interest in assisting the artisan fisheries of the LDC's. The Norwegian project with India, focusing on small fishing villages, their equipment needs, and on-shore facilities, dates back twenty years. India thinks very highly of this undertaking but notes that wastage continues because of processing and marketing problems. Both Senegal and Ghana point with satisfaction to the assistance the Canadian government renders to their artisanal fishermen. The fact that about 70 percent of the catch in Ghana* comes from the small-scale fishermen makes it easy to understand their appreciation of this assistance. The same applies in Senegal* where 80 percent of the catch comes from small-scale fishermen with 1/10th of the population engaged in fishing. The FAO fisheries effort in Panama also focusses largely on the artisan

* Data on Ghana and Senegal are from statements by the country delegates at the Committee on Fisheries meeting, 1974.

fishery. Recently FAO* set the following guidelines for its assistance programs, generally regarded as quite helpful:

"The most pressing need of the Fisheries Sector in Panama is the improvement of distribution facilities in order to stimulate a greater demand for the finfish resources which, to a marked extent, remain under-utilized. Improvement of marketing is also a necessary condition for one of the other main aims of development policy-- the improvement of the status of artisanal fishermen through the introduction of cooperatives and by introducing more advanced technology."

Rather than elaborate further on such illustrations of assistance in the artisan sector in the past, we stress the new awareness and expanding interest in this sector. The LDCs, faced with combined needs relative to the nutrition, general health and employment of crowded populations, recognize the importance of the small-scale fishery. Undoubtedly, they also appreciate that moves to develop industrial fisheries with large vessels may thrust them into competitive high seas endeavors of little promise.**

This LDC interest, reported in the recent writings of FAO, was verified in the country endorsements of small-scale fisheries programs proposed at the FAO Committee on Fisheries meetings in October, 1974. Interest in the artisan fisheries is also evident in recently announced policies by the UNDP, the World Bank, and Regional Development Banks (FAO, 1974***). Further, several developed countries with a record of assistance to the fisheries have growing plans to assist in this sector. At the risk of omitting some key groups, we list Sweden, Norway, Canada, Japan and the Netherlands. There are indications that the United States will help swell

*Undated FAO release, presumably 1971

**If the current Law of the Sea Conference awards economic controls to 200 miles offshore, as is expected, each LDC may be in a position to control the inroads of distant water fleets in those regions. While this may help individual coastal countries, no increase in the world's food supply can be expected from those areas where sustainable yields are already harvested.

***FAO, 1974. Small-scale fisheries. Item 5 of the Provisional Agenda, Committee on Fisheries, COFI/74/9.

this growing interest, although, as we understand it, AID is still in the process of finalizing key policies for the fisheries sector.

It is important to point out that the new worldwide thrust in support of the artisan fisheries should be linked inseparably to any well-conceived growing interest in aquaculture. The same peoples are involved, at least along the coastal areas. The effort is not concentrated as in the industrial fisheries where landings are limited to major ports. The artisan fisheries and aquaculture have broadly overlapping needs for improved processing, marketing and overall attention to an infrastructure operating without the geographic focus of the industrial effort. As broadly overlapping ventures affecting the same people, these two subsectors of the same industry should be handled jointly. Generally speaking, we can often assist the artisan through advances in his fishing techniques, at the same time offering aquaculture opportunities in relatively simple form, often more in the order of husbandry, avoiding more sophisticated culture practices.

It is interesting to reflect on the relative interest in the artisan fisheries and aquaculture. Some of our more sophisticated fisheries leaders are projecting great things for aquaculture. In fact, one even hears the term "blue revolution," implying culture efforts that might alone relieve starvation, however, in absolute terms, even the more optimistic projections place the growth of aquaculture below the potential for increases in the capture fisheries (see, for example, Lampe *et al.*, 1974*). Further, those who are reticent to share in an optimistic outlook for the capture fisheries are generally focusing on certain high seas operations where, as noted, heavy exploitation has already occurred. They are not referring to potential new sources, particularly in the LDC areas and particularly in the artisan sector. To put aquaculture and to capture fisheries in perspective, we might refer to Indonesia--noted for its intensive activity in aquaculture. Best estimates available suggest that there are about half-million people active in aquaculture there (Donovan D. Moss, personal communication), while approximately two million are

*Lampe, H.C., N. Marshall, J.G. Sutinen, L.O. Vidaeus and D.T. Westin. 1974. Prospects for fisheries development assistance. Univ. R. I. Marine Tech. Rept. Series No. 19, 41 pp.

engaged in the artisan fishery.

Generally speaking, and wisely, the LDC leaders have been reserved in their expectations from aquaculture. They tend to expect more through helping their little fisherman so immediately amenable to assistance. One of the major opportunities open to the developed countries is to assist LDCs in fostering the linkages between artisan level aquaculture and the artisan capture fisheries.

II. Representative Artisan Fisheries

Realizing that the artisan fisheries differ appreciably from one locale to the next, we have elected to portray them by elaborating on activities in Costa Rica, Chile, Tanzania and South Vietnam. We consider these to be representative, and we have some first-hand familiarity with these countries' fisheries. In the final sections, III and IV, we will refer to common characteristics as well as problems and issues needing attention in the artisan sector and related aquaculture.

II. A. Artisanal Fisheries in Costa Rica*

Information assembled by Dr. Richard B. Pollnac

Introduction

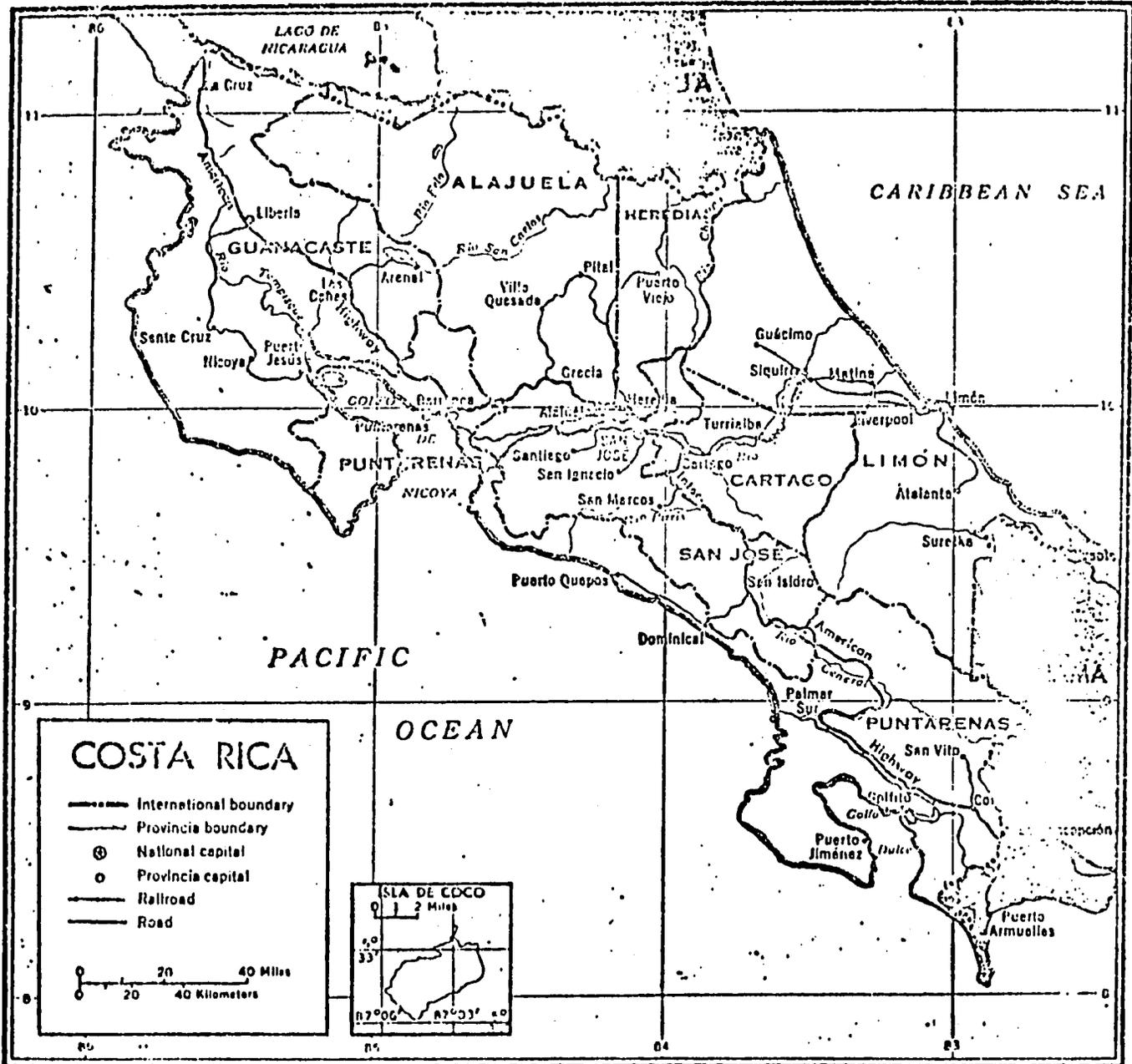
Costa Rica is the second smallest country in Central America with an area of approximately 51 thousand square km and with 1230 km of coastline, 210 km on the Atlantic and 1020 on the Pacific. Approximately 70 percent of the population of almost two million is concentrated in the central plateau where the capitol, San Jose (population 423,028 in 1972) is located. Puntarenas (population 32,891), the major population center on the Pacific coast, is 109 km from San Jose. Traveling time from San Jose by train is over four hours; by bus, about two hours, and by airplane, 15 minutes. The main port on the Atlantic coast, Limon (population 39,217), is located 165 km from San Jose by train (six hours traveling time). A new all-weather road is being completed which will reduce this travel time by more than one-half. Flying time to Limon is 20 minutes.

Physical Features of the Coastal Waters

The continental shelf off the Pacific coast has an area of approximately 4,400 square miles. Muddy bottoms are found in the Gulfs of Dulce, Nicoya, and Payagayo. Most of the shelf off Quepos, located between Punta Llorena and Punta Judas, and the edge of the shelf off the Nicoya Peninsula are also muddy. The rest of the Pacific platform is made up of a mixture of rocks and sand.

The area of the continental shelf on the Caribbean is approximately 520 square miles and is extremely narrow. It extends to a maximum of 8 miles and a minimum of 2 miles with indentations of submarine canyons offshore of the Matina River, northeast of Isla Uvita, and south of Punta Mona.

*Information contained herein is from first-hand observations plus the references listed at the end.



Artisanal Fishing Methods

Information concerning artisanal fishing methods in Costa Rica is relatively scanty. "White" fish (see section on species utilized) are captured with throw nets, gill nets and handlines on both coasts. Sharks are taken with handlines and gill nets, with a preference for using handlines. On the Pacific coast the boats used are usually 8 to 10 m long with either inboard or outboard motors; and on the Atlantic, 8 to 12 m long, usually dugouts with outboard motors.

Artisanal fishermen obtain lobsters by diving or with lobster traps on both coasts. Mollusks are collected by hand, except for squid which are captured in small gill nets.

Turtles are captured on the Atlantic coast with the use of either harpoons or large handmade mesh nets. When nets are used, a turtle-shaped decoy carved from wood is placed where it will attract turtles into the net. In interviews in 1974, artisanal fishermen in Limon reported that they used only harpoons to capture turtles. According to one account three men in an outboard motor powered dugout, travelling approximately 30 miles to the hunting area and with the use of harpoons, can capture as many as eight or nine turtles per day.

Personnel in the Artisan Fishery

Ninety percent of the marine products for Costa Rica are produced on the Pacific coast. There are about 400 small craft on this coast (approximately 50 percent mechanized) producing about 500 tons of mixed "white" fish annually. Most of these Pacific coast artisanal fishermen are concentrated at the port of Puntarenas in the Gulf of Nicoya. A cooperative in the formative state in Puntarenas had approximately 100 members and 36 motorized boats in mid-1974. It was reported that there were 250 artisanal fishermen outside the cooperative. Additionally, there is a small concentration of shark fishermen at Golfito in Golfo Dulce who operate about 40 boats. Other small concentrations of artisanal fishermen can be found at numerous locations along the Pacific coast.

There are approximately 100 permanent and 90 part-time artisanal fishermen concentrated around the Puerto Limon area. It is estimated that 100 boats are active during a good lobster season with a minimum of 20 operating year round.

Species Utilized, Total and Artisan Harvest

While industrial fisheries account for most of the marine products produced in Costa Rica and are specifically responsible for the tuna, thread herring and shrimp fisheries catches, artisanal fishermen greatly outnumber those in the larger vessels of the industrial sector and produce a significant amount of fish classified as "white" fish (*pesca blanca o de consumo*) including: croaker (Sciaenidae), snappers (Lutjanidae), mero (Serranidae), snook (Centropomidae), grunts (Pomodasidae), flatfish (Cynoglossidae), and sharks, lobsters, mollusks and turtles.

The artisanal fisheries of Costa Rica provided 33 percent of the "white" fish during the years 1960 to 1970, while the industrial fisheries produced most of the balance. The average total production of "white" fish for the years 1968 to 1970 was 1490 metric tons on the Pacific coast and 12 metric tons on the Atlantic for both artisanal and industrial fleets combined.

In terms of abundance, price, demand and acceptance in national markets, the most important fish is the croaker, followed by sharks, then mero and snappers. The average production of sharks, largely artisanal, was 328 metric tons on the Pacific coast from 1968 to 1970, and on the Atlantic, 42. During this same period the Pacific and Atlantic coasts produced yearly averages of 5.5 and 66 metric tons of lobsters respectively. Important lobster species, also primarily an artisanal catch, are *Panulirus gracilis* and *Evibacus princeps* on the Pacific coast and *P. argus* on the Atlantic. It should be noted that the yearly catch of lobsters on the Atlantic varied between 13 and 129 metric tons from 1968 to 1970. Variability in capture is clearly demonstrated in data from a longer time period. From 1957 to 1970 the Atlantic coast produced

an average of 126 metric tons of lobsters per year with a range from 13 to 559 tons. The artisanal fishery includes the yearly average of 21 metric tons of mollusks produced from the Pacific coast, and the yearly average of 87 tons of turtle was produced from the Atlantic during this same period. The sea turtle, *Chelonia mydas*, is the most important turtle and is captured along the Atlantic coast.

Marketing and Distribution

In general, the shore facilities for handling and distributing fish caught by artisanal fishermen are inadequate on both coasts of Costa Rica. The fish are landed at numerous beaches along the coast. Generally, fish are not iced while at sea and are beginning to deteriorate when they reach the beaches. In most cases, fish are sold to middlemen who either sell them to fishmongers in town markets or simply hawk them along the streets. Fish are often transported without any cooling facilities, resulting in further deterioration. This method of distribution often leads to depressed prices to the producer and inflated prices for the consumer who is sometimes faced with purchasing either semi-spoiled fish or none at all.

An artisanal fishing cooperative which was being formed in Puntarenas provides a notable exception to this pattern. It was reported that the cooperative has an agreement with an autonomous state operation, the Consejo Nacional de Produccion (CNP), which buys fish at fixed prices and handles further distribution.

Spiny lobsters caught by artisanal fishermen at Limon are sold directly to representatives of three different processing plants: Eugenio Garron e Hijos and Mariscos del Caribe in Limon, and Alta Mar, S.A. in Puntarenas. Those processed in Puntarenas are shipped overland from the Atlantic coast. Only about 2 percent of the lobster catch is consumed domestically.

The processing plants in Limon also purchase turtles from the artisanal fishermen. In mid-1974 fishermen complained that, with only

three buyers, there was a lack of competition resulting in price fixing. A representative of Mariscos del Caribe reported that, after they take the approximately 50 pounds of calipee and choice turtle meat, the rest is distributed gratis to hospitals and local people who request it. Sometimes the fishermen sell turtles directly to fishmongers in the Limon central market where six stalls are set up to sell marine products. In mid-1974, fishmongers at the market complained that the demand for fish and turtles was much greater than the supply.

In sum, except for high priced export products like lobster and turtle calipee, the marketing and distribution networks for artisanal fishery products are underdeveloped in Costa Rica. A notable exception to this generalization was found in the new cooperative in Puntarenas.

Organizations and Institutions

The fisherman's cooperative, mentioned above, being formed in Puntarenas, had approximately 100 members and 36 motorized boats in 1974 and is located in a substantial building on a dock with cold storage tanks, electricity, and running water. Ice was obtained from an ice company, with a 20-ton per day capacity, located close to the cooperative building. An electric-powered cold storage room for fish was being constructed in the cooperative building.

It was reported that shark fishermen in Golfito were organized into a cooperative, but at present we have no further information on this organization.

No cooperatives were in existence on the Atlantic coast in mid-1974. Fishermen interviewed during a recent URI survey expressed interest in forming a cooperative but suggested that other fishermen would oppose such a plan.

No data are available concerning equipment ownership patterns on the Pacific coast. In a survey of the Puerto Limon area, it was reported that, among the permanent fishermen, approximately 43 percent own their boats while 25 percent rent, and 32 percent are salaried workers. Among the part-time fishermen, they report that approximately 32 percent own and 14 percent rent boats, while 54 percent are salaried workers.

Plans, Programs and Government Involvement

A proposed FAO/IDB project should have considerable impact on the artisanal fishery on the Pacific coast of Costa Rica. This project is concerned with three important areas: 1) development of artisanal fisheries, 2) construction of a fish terminal; and 3) development of the distribution and marketing network.

With respect to the artisanal fisheries, the project will involve considerable upgrading of the fishermen's cooperative at Puntarenas with 47 31-foot fiberglass, three-ton-capacity boats with 40 horsepower motors and necessary auxiliary equipment. Nets, lines and hooks will also be supplied. The fish terminal will serve to collect, process and distribute the fish landed by independent artisanal fishermen, cooperative members, and vessels of the industrial fisheries. It is projected that the terminal will result in better prices for both consumer and producer. The terminal is supposed to have an annual capacity of 6000 tons by the third year of the project. Distribution will be augmented by establishment of improved distribution networks, and processing performed at the terminal will also enhance distribution. In addition, a marine product promotion campaign will be conducted using the mass media.

Potential for Development

The proposed FAO/IDB project will facilitate development of artisanal fisheries around the Gulf of Nicoya. The project's marine product promotion campaign may stimulate demand to such an extent that it will exceed production. Further development of cooperatives including the one started and to be improved at Puntarenas, plus others on a smaller scale, would probably enhance the development of artisanal fisheries at other sections of the Pacific coast and help satisfy the increased demand. Establishment of an artisanal fishing cooperative with technical assistance and a minimum of processing and distribution equipment would probably help increase production of marine products on the Caribbean coast where demand already exceeds supply, especially since restrictions have been placed on the capture of turtles. The all-weather road to

Limon, which should be completed soon, will open up new markets for Caribbean marine products, thus increasing the desirability of developing the proper exploitation of available resources from that coast.

Further potential for development is seen in the area of mariculture. Experiments in mussel culture carried out in Costa Rica have been quite successful, and a follow-up project of mussel culture on a commercial scale is planned for the Gulf of Nicoya. Additional research investigating the culture potential of numerous species could be carried out in salt and brackish waters along both coasts. Establishment of successful mariculture projects could lead to improved nutrition among coastal populations either through direct consumption or by enhanced purchasing power gained from exporting fishery products to other regions.

References

- Ellis, R.W. *et al.* 1971. A Description of Fishing Activity on the Atlantic Coast of Costa Rica with Observations on the Resources Available. Boletin Tecnico Vol. 4, No. 2. CCDP/FAO/PNUD, San Salvador.
- FAO. Undated. Fishery Country Profile: Costa Rica.
- FAO. 1972. Regional Project for the Development of Fisheries in Central America: Terminal Report (Second Draft). FAO, Rome.
- FAO. 1974. Perspectivas para el Desarrollo y la Integracion de la Agricultura en Centroamerica. FAO, Guatemala.
- FAO/BID. 1972. Programa de Desarrollo Pesquero en Costa Rica. FAO/BID, Washington, D.C.
- Vidal, J. and B. Rosetti. 1971. Resumen de las Exploraciones Demersales en el Pacifico de Centroamerica. Boletin Tecnico Vol. 5, No. 6, CCDP/FAO/PNUD, San Salvador.
- Vidal, J. *et al.* 1971. Recursos pesqueros marinos de Costa Rica Evaluacion y Proyecciones. Boletin Tecnico Vol. 6, No. 2. CCDP/FAO/ PNUD, San Salvador.
- Windley, D. 1968. The Spiny Lobster Industry of Latin America. Foreign Fisheries Leaflet No. 171, U.S. Dept. of Interior, Washington, D. C.
- Yesaki, M. and M. Giudicelli. 1971. Resumen de las Operaciones de Pesca Exploratoria del R/V *Canopus* en el Mar Caribe Occidental. Diciembre 1968 a Junio 1970. Boletin Tecnico Vol. 4, No. 5. CCDP/FAO/PNUD, San Salvador.

II. B. Artisanal Fisheries in Chile*

Information assembled by Luis A. Adriasola and James J. Griffin

Introduction

Chile ranks seventh in size among the South American countries. Its 756,230 square km surface stretches over 4500 km, providing nearly 5000 km of coastline plus the coasts of the islands of the southern archipelago. Chile's average width is 180 km, ranging from a minimum of 96 km to a maximum of 320 km.

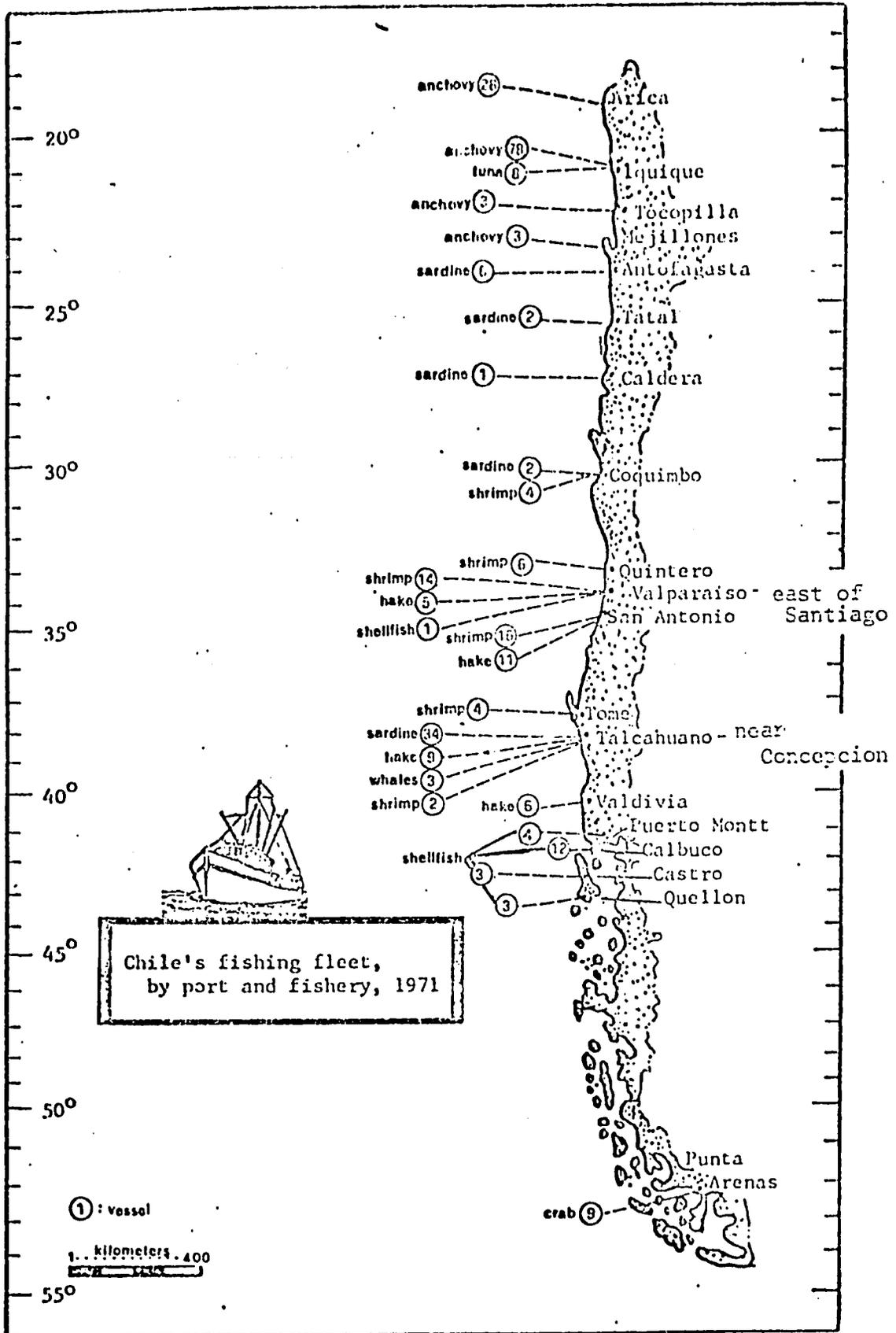
The principal physical features of the country are the Andes Cordillera, which constitutes a natural eastern boundary separating Chile from Bolivia and Argentina, and a coastal range of lower mountains which divide the coastal slope from a central valley. From north to south there is a desert region, followed by a region of valleys trending east-west, which leads into a large central depression. To the south a lakes region dissolves into the southernmost archipelago.

Chile's total population in 1970 was 9,809,000. This is principally concentrated in the central area in and around Santiago and in the environs of the port city of Valparaiso to the east of Santiago. The port areas of Concepcion, about 400 km to the south, and Antofagasta, over 1000 km to the north of Santiago, are also major urban areas.

While the Chilean population is concentrated more or less centrally--the central inland zone has 33 percent of the population with an additional ten percent located along the central coast--the remaining 57 percent is spread along the full length of the country, with about 20 percent in smaller towns and the rest in rural areas.

Shipping lines, electric railway and highways provide transportation along the coast. Transportation networks also link coastal and inland areas, particularly in the central zone. While travel along the

*Information contained herein is based on first-hand observations plus the references listed at the end.



coast is time consuming, transportation time inland from the coastal ports is seldom more than four hours by rail.

Physical Features of the Coastal Waters

Predominant characteristics of the Chilean offshore region are the extremely narrow continental shelf and the southern end of the 3000-meter-deep Peru-Chile trench, which closely parallels the shore.

Typically the northern and central Chilean shelf ranges between eight and 16 km wide. Along the southern 1600 km of the coastline, where there is an elaborate system of islands, inlets, sounds and fjords, the shelf extends a little farther off the coast.

The major current system, the Peru or Humboldt Current, is a broad languid flow moving northward along the west coast of the continent to within a few degrees of the equator. In the narrow belt between this oceanic current and the coastline, the flow is broken into irregular patterns, with both diurnal and seasonal variations often affected by the wind systems. It is in this region close to shore that considerable upwelling occurs enriching the fisheries productivity. The upwelling is best known to the north and is especially famous off Peru. Equally famous are the prolonged interruptions of upwelling and the accompanying drop in productivity, generally caused by warm currents flowing southward off Peru and northern Chile and known as the *El Nino* phenomenon.

In the southern Chilean archipelago area, density stratification sets up a typical estuarine circulation--high salinity inflow along the bottom and low salinity outflow on the surface. This pattern is complicated somewhat by the presence of icebergs spawned from local glaciers. This also is a region of great tides and swift tidal currents.

Artisanal Fishing Methods

The most typical fishing gear used by artisanal fishermen is the long line, consisting of setting hundreds of yards of line to which

smaller lines with baited hooks are attached at intervals of about one meter. Every 200 meters or so, floats are used to keep the line at the desired depth and to indicate whether fish have been caught. Other gear frequently used include gill nets, traps and hand lines.

Fishing operations are carried out from vessels that range from 20 to 54 feet and are powered by oars (50 percent), sail (40 percent), or motors between 15 and 40 hp (10 percent). Larger boats are used to collect fish or shellfish from the smaller boats from which the fishermen operate.

Shellfish are taken by divers who may simply collect along the shore or use varied equipment, including modern skin diving gear, as they gather mollusks off the coast.

Handling of fish on board and in trans-shipment to other boats, shore, trucks and fish merchants is carried out under conditions that are most inadequate for enhancing the shelf life of the product. Often the fish are killed by hitting their heads with a stick; they are then thrown into a pile on the middle of the boat where they lie in the sun, sloshing in their blood and bilgewater. Often the fishermen have to step on them in moving from one end of the boat to the other.

Marketing and distribution methods are equally inadequate, and the fish, once displayed, are in a condition with little appeal to the aesthetic senses of the consumer.

Personnel in the Artisan Fishery

Nearly 15,000 artisanal fishermen operate out of the 188 fishing coves (*caletas*) spread along the Chilean coast. Their geographic distribution with the distribution of fish and shellfish catch is the following:

<u>Zones</u>	<u>Provinces</u>	<u>Percentage of Chilean Artisanal Activity</u>	<u>Percentage of Chilean Artisanal Catch</u>	
			<u>Fish</u>	<u>Shellfish</u>
South	Llanquihue-Chiloe	19	3	69
Central/South	Concepcion-Arauco	26	36	11
North/South	Atacama-Coquimbo	12	6	4
Central	Valparaiso-Aconcagua	10	12	4
North		8	28	2
		<u>25</u>	<u>15</u>	<u>10</u>
		100%	100%	100%

The harvesting operations of the artisanal fisheries are organized to some extent around fishermen's cooperatives; in fact, it is estimated that over one-fifth of the artisanal fishermen belong to some form of cooperative.

Species Utilized, Total and Artisan Harvest

Since the industrial fisheries, particularly for anchovy to be converted into meal, dominate the Chilean harvests, the importance of the artisan activity and of fish for direct human consumption tends to be overshadowed in overall production data. This anchovy harvest, primarily to the north, has peaked close to a million metric tons (a poor second to the great fishing off Peru) but has also suffered the well-known setbacks associated with the *El Nino* phenomenon and apparent overfishing. Pilchard, jack mackerel, langostinos and shrimp also loom large in the industrial fishery.

The artisanal catch is in the order of one-tenth of the gross, amounting to nearly 100,000 tons annually in proportions as follows:

<u>Fish</u>	<u>Percent</u>	<u>Shellfish</u>	<u>Percent</u>
merluza (hake)	21	cholgas (mussels)	30
jurel (hard tail jack)	10	chorito (mussels)	16
sierra (snake mackerel)	23	almeja (clams)	13
bonito (bonito)	7	loco (limpet)	8
congrío (cusk eel)	12	enzo (sea urchin)	6
corvina (corvina)	7	macha	5
other species of lesser importance	<u>20</u>	other	<u>22</u>
	100%		100%

Over 95 percent of the artisanal catch is used for human consumption, constituting over two-thirds of the fresh fish supply and over one-third of the entire domestic supply of fish food products. Per capita consumption of fish in Chile is over 16 kg per year.

Marketing and Distribution

Over the years artisanal cooperatives, initially formed under the sponsorship of the Instituto de Desarrollo Agropecuario (INDAP) and the Corporacion de Fomento (CORFO) as a means for channelling government aid to the artisanal fishermen, have come to offer their associates' services related to consumption and marketing. Fresh fish marketing organizations have evolved in response to governmental intervention in a drive to replace the traditional middleman (*remitentes*). It is expected that these organizations will be placed under some form of cooperative system.

Because of the lack of adequate equipment and processing facilities, the marketing channels that handle the artisanal catch lack flexibility. As a result, only a fraction of the potential edible catch reaches the markets in suitable condition and then at a competitive disadvantage in the face of other sources of protein available to the consumer.

Organizations and Institutions

The Chilean government has charged INDAP, which is a division of the Ministry of Agriculture, with the responsibility for overseeing the development of the artisanal fisheries, while the Instituto de Fomento Pesquero (IFOP), under the Ministry of Economy, is in charge of fishery research, and the Comité Sectoral Pesquero is in charge of the operation of marketing channels for fish products.

There are at least ten other governmental agencies with functions that relate to the fishing activity at all levels. In addition, there are some ten or more academic and research organizations that pursue different and sometimes overlapping activities relating to the fisheries.

Plans, Programs and Government Involvement

Realizing that the greatest potential for improving the fisheries lies in making better use of what is caught, the fishery research institutions and government agencies have directed attention to processing and marketing. To a lesser extent they have focused on improving the harvesting technology of both the industrial and the artisanal fisheries. Limited efforts in freshwater fish culture and utilization of under-utilized species have been made.

The most important programs currently underway or considered for implementation are:

FAO support has been approved for.

- a two-year effort, cooperatively with INDAP, to develop inland marine fisheries of the archipelago area in southern central Chile for both commercial and recreational use;
- a development project to set up a regional advisor on fish processing and marketing.
- a development project to set up, with IFOP, a quality control program for canned fish products.

Other projects under consideration cover:

- development of an efficient and flexible fisheries planning organization;
- fish food product development and quality control, with IFOP, including fish handling, on-board refrigeration, etc.;
- a processing and marketing fishery products project, proposed jointly by the Universidad Catolica de Valparaiso and the University of Rhode Island.

IBRD (World Bank)

- a loan is being provided to the Chilean government to carry out preinvestment studies, coordinated by CORFO, in projects aimed at expanding exports and saving foreign exchange expenditures in areas that include nutrition and fisheries.

Potential for Development

It is clear that the conventional fishery resources off the Chilean coast are being exploited near the limit of their capacity. Potential improvement of the benefits from the fishery resources lies then in improving the utilization of current catch, exploiting under-utilized species, and expanding the resources via fish culture techniques. Programs toward the first objective--including the development of fish products from nonconventional species--are well underway.

Most of the efforts to develop aquaculture have been directed toward freshwater hatcheries. The development of brackish water fish culture seems to be an appropriate line to investigate. The potential for shellfish farming along the coast may hold great promise for the artisan. Especially spectacular, though perhaps unrealistic, is the suggestion that salmon runs may be introduced to serve as intermediate feeders to harvest the Antarctic krill resource.

References

- Campleman, G. 1972. Preliminary Report on Fisheries Development and Planning in Chile. Unpub. ms., Santiago.
- FAO, Dept. of Fisheries, Field Projects 1972, 1973.
- FAO. Fishery Country Profile. Chile. WI/C5742.
- Folsom, William B. 1973. Fisheries of Chile, 1971. Foreign Fisheries Leaflet, No. 73-21, NOAA/NMFS.
- Gallardo, V. 1974. Technology transfer in marine affairs to developing countries: the case of Chile. Unpub. ms., Univ. R.I., Kingston, R.I.
- Gross, H., Valenzuela, E. Corbalan, A. Sepulveda, J. Torres and D. Downey. 1970. Diagnostico de la Pesca Artesanal Chilena 1968. Instituto de Desarrollo Agropecuario-INDAP, Santiago.
- IBRD Press release. 1974. No. 74/6, Washington, D.C.
- Ministerio de Agricultura, Division de Pesca y Caza, Servicio Agricola y Ganadero, Chile. Anuario Estadistico de Pesca, 1971.
- U.S. State Department, American Embassy, Santiago Chile. 1973. Chile's Fishing Industry. No. A-104.

II. C. Artisanal Fisheries in the United Republic of Tanzania*
(excluding inland lake fisheries)

Information assembled by Dr. Richard B. Pollnac

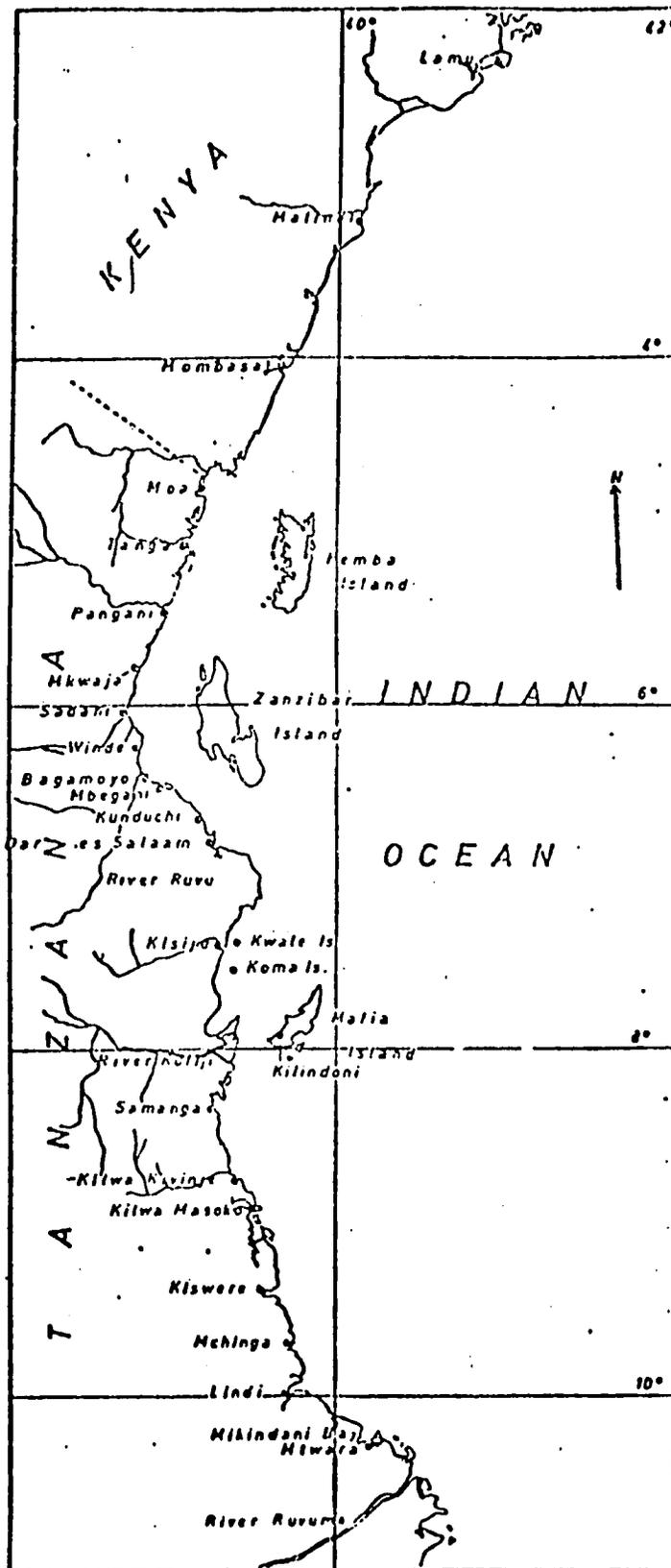
Introduction

The United Republic of Tanzania, located on the east coast of Africa, has an area of 939,703 square km and a mainland coastline of 840 km facing the Indian Ocean. Three major islands are located about 30 to 40 km off the coast: from the north--Pemba, which is about 40 by 24 km; Zanzibar, which is about 90 km long and 40 km wide at the widest point, and Mafia, about 60 by 20km. The total population was estimated to be 14 million in 1972. The capitol, Dar es Salaam, has a population of approximately 300,000 and Zanzibar Town has about 70,000 inhabitants. Other important coastal towns are Tanga (population about 61,000), Mtwara (about 25,000), and Lindi (about 13,500). Areas of high population density are fragmented and dispersed. Most large population clusters are in peripheral areas of the country, while much of the interior is thinly populated. The main coast road more or less parallels the coast between major population centers, but access to most fishing villages is by dirt roads which are often impassable during the rainy season.

Physical Features of the Coastal Waters

The width of Tanzania's continental shelf varies, with a maximum of 60 km and a minimum of 6 km. Relatively narrow portions are located from the Kenya border to Pangani, offshore from the Dar es Salaam area, and south of the Rufiji Delta. Relatively wide areas are found south of Pangani where the shelf reaches out, encircling Zanzibar, and south of Dar es Salaam where it includes Mafia Island off the Rufiji

*Information contained herein is from first-hand observations plus the references listed at the end.



Delta. Coral reefs and outcrops are found all along the coast resulting in an almost continuous chain of small offshore islands. Extensive areas of sand bottom are found between coral outcrops, with mixed sand and mud at rivermouths.

The major ocean currents off the coast vary from one time of the year to another. During the southwest monsoon (April to September) the East African coastal current is swift and narrow, flowing northward at speeds as high as seven knots. This current reverses direction and flows southward in December and January as a result of the northeast monsoon which lasts from October to March. Close to shore the current tends to be much more varied and not as swift.

Important natural harbors exist at Tanga, Dar es Salaam, Lindi and Mtwara. The Rufiji River manifests a complex delta system opposite Mafia Island, and important estuaries are formed by the Pangani, Wami, Ruvu and Ruvuma Rivers.

Artisanal Fishing Methods

Most of the fishing along the Tanzanian coast is carried out with the use of non-motorized vessels. It is reported that only 3.7 percent of the 3,113 vessels used by coastal fishermen are motorized-- 103 have outboard motors and 12 have inboard. Recently acquired mechanized vessels are of foreign design, generally imported and in some cases of steel construction. The dugout canoe, catamaran, outrigger canoe and dhow are the major types of non-motorized vessel. Outrigger canoes are the most common, comprising approximately 60 percent of the total. The dhow is the only vessel of native construction which might be effectively motorized.

Important artisanal fishing techniques include the use of hand lines, nets and traps. Dynamite and a fish poison prepared from a local plant are also used. Almost 2000 longlines and 2000 handlines, all usually made of synthetic fibers, were in use in 1971. A total of 6648 nets were in use in 1972, again usually made of synthetic fibers. Of these, about 60 percent were gill nets and 30 percent were shark nets

based on a traditional type of net known as a *majarife*. Seine and cast nets, mostly the former, are also used. Most of these nets are now made of synthetic fibers. About 7500 basket traps and 300 fixed traps were in use in 1972. Legislation has outlawed the dynamite fishing, but it is difficult to control and is still practiced.

In catching pelagic fish, top set nylon nets are sometimes used. Shark nets and longlines are used for a variety of finfish and sharks. *Dagaa* (sardines) are captured with cast nets. Prawn fishing is usually done with fence traps, cast and dip nets, and small beach seines. Mollusks, shells, seaweed and sea cucumbers are collected by hand along the coast or by diving.

Personnel in the Artisan Fishery

There were 8531 artisanal marine fishermen in Tanzania in 1972. This represents a substantial increase over the 4844 reported for 1968. This is, of course, relatively small compared to the complement of about 35,000 fishermen on the large inland lakes to the west. The distribution of fishermen along the coast is uneven and is in general positively correlated with the width of the continental shelf. Overall, in 1972 each fisherman exploited 1.4 km² of shelf area and .098 km of coastline. Average figures for 1970 and 1972 indicate that fishermen exploited an average of 3.0 km² in the area with the greatest expanse of shelf area and 0.25 km² in the area with minimal shelf.

Species Utilized, Total and Artisan Harvest

Total marine production was 28,700 metric tons in 1972 representing 17 percent of the overall fishery which is dominated by the catches of the inland lakes. With the exception of the prawns, the great bulk of the marine catch is by artisans.

The finfish in the total marine production amounted to 27,560 metric tons. This is an increase of almost 32 percent over the previous year's production. Snappers (Lutjanidae) occur most frequently, making

up almost 25 percent of the catch. They are followed in frequency by sharks, wrasses (Labridae) and parrotfishes (Scaridae) (about 8 percent each), rays (6 percent) and kingfish (*Scomberomorus* sp.) (5 percent).

Other major types of fish captured off the coast of Tanzania include tuna (*Thunnus* spp.), runners (Rachycentridae), jacks (Carangidae), horse mackerel (*Caranx* sp.), rock cod (*Cephalopholos* sp.), sardine (*Sardinella* sp.), herring (*Stolephorus* sp.), catfish (*Tachysurus* sp.) and mullet (*Nemipterus* sp.).

Of the marine fish captured, 30 percent is classified as "others," including numerous small species captured in relatively small quantities.

In 1972, 330 metric tons of crustacea were produced. Ninety-two percent were prawns (*Panaeus indicus*, *P. monodon*, *P. semisulcatus*, and *Metapenaeus monoceris*), the rest lobsters (*Panulirus ornatus*, *P. versicolor*, *P. longpipes* and *Thenus orientalis*). (Only 27 percent of the crustacea were produced by artisanal fishermen.) Shellfish collected included mollusks such as the East African oysters (*Crassostrea cucullata*, *Ostrea amasa*); mussels (*Mytilus* sp., *Septifer* sp., *Modiolus* sp.) and ark shells (*Anadara antiquata*).

Marketing and Distribution

Most marine fish landed on the coast are distributed fresh. There are few facilities for preservation and processing of fish and most that do exist are in the Dar es Salaam area, not close to the fish landing centers. As of February, 1974, only five points along the Tanzanian coast had facilities for producing ice and the total daily capacity of these facilities was only 15 metric tons. Fish storage at 0°C was available at seven points, with a total of about 70 cubic meters of storage space. The only freezing plants were located in Dar es Salaam.

This general absence of facilities results in a virtual absence of ice aboard fishing vessels. In areas where cold storage facilities are unavailable, fish which cannot be distributed fresh are generally

sun dried, smoke dried, or grilled. Ninety-five percent of marine fish captured (excluding crustaceans for export) are sold in coastal regions. Demand is high, suggesting that an increase in production could easily be absorbed by the market but, because of regional differences in productivity, this would necessitate interregional distribution and would be unreliable and costly due to the lack of a transportation network and of preservation facilities.

For the most part, fish not directly consumed by the fisherman's family are distributed by individual fishmongers or cooperative organizations. The newly established National Cold Chain Operations (NCCO) is processing and marketing fresh, iced, and frozen fish; however, NCCO prices are prohibitive for low income consumers. The Tanzanian Fisheries Corporation (see note in next section) can do much to improve the marketing sector of the artisanal fisheries.

Organizations and Institutions

The East African Marine Fisheries Research Organization (EAMFRO), located in Zanzibar, coordinates marine research and development in Eastern Africa. The Fisheries Division of the Tanzanian Ministry of Natural Resources and Tourism is directly concerned with the artisanal fishermen of Tanzania. The headquarters of the Fisheries Division is in Dar es Salaam, and it operates the Kunduchi Fisheries Institute and the Mbegani Coastal Fisheries Development Center, both of which function as training centers. The Division also supports trained fisheries personnel in almost all important fishing villages for collecting data and introducing new techniques.

At the level of the fishing community, policy has been directed toward developing fishermen's cooperatives along the coast, and some exist as fully developed *ujamaa* (cooperative-socialist) villages. Attempts toward cooperative formation have been countered by local entrepreneurs (middlemen) in many cases. Reliable data concerning the number of operating fishermen's cooperatives are not readily available.

Most vessels are owner operated, some are owned by nonfishermen. In either case, the vessel owner obtains a share of the catch for the use of his vessel. The same type of share for use of equipment is found in connection with the modern fishing gear such as nylon gill nets.

Plans, Programs and Government Involvement

The government of Tanzania is seriously involved in plans to develop its marine resources. The Tanzania Fisheries Division has been charged with this responsibility. Plans, which are very ambitious and will almost inevitably require assistance if they are to be accomplished, encompass the following: 1) future boat builders and marine engineers will be trained at a major boatyard being developed at Bagamoyo-Mbegani 2) ice-making machines and refrigerated cold rooms are being constructed at many points along the coast, 3) fisheries technicians and officers are being trained at local training institutions and abroad, 4) the Norad/Tanzania Coastal Fisheries Development Project plans a modern fishing harbor at Mbegani and will undertake a resource survey and boatbuilding program, and 5) the newly formed national Tanzanian Fishing Corporation (TAFICO) will begin to develop commercial aspects of fishing, marketing and boatbuilding.

With regard to other programs, UNDP/FAO has suggested, but has not as yet funded, an 11-point development program for the fisheries of Tanzania. Most important among the points for the artisanal fisheries are the following: development of nearshore fisheries and inshore mariculture, management of fisheries for shells and corals, the organization of a regional data center, and improvements in the handling, distribution and marketing of fishery products. Further, the East African Marine Fisheries Research Organization is planning to set up substations at Dar es Salaam and Kunduchi. The Kunduchi substation is reported to have aquaculture among its priorities. Finally, the government of Tanzania is seriously considering establishing, as a personnel and capability back-up for the foregoing, a marine resource studies center at the University of Dar es Salaam. Due to fund limitations, the center will probably be far less in scope than that defined

by the International Conference on Marine Resource Development in Eastern Africa in 1974.

Potential for Development

There is obviously a demand for more marine products in Tanzania, and the problem is to move these products from the ocean to the consumer. This potential can be realized by: 1) detailed assessment of marine resources; 2) improvement of artisanal fishing gear; 3) increased training of both fishermen and infrastructure personnel (e.g., equipment, maintenance men, statisticians, etc.); 4) development of shore facilities for processing, storage and distribution, and 5) development of coastal (inshore) mariculture. Ongoing and proposed programs discussed above will do much to develop the artisanal fisheries of Tanzania.

References

- Alverson, D. 1974. A Programme to Develop the Marine Fisheries Potential of Kenya and Tanzania. Rome, UNDP/FAO.
- Fisheries Division. 1972. Annual Report. Dar es Salaam. Tanzanian Ministry of Natural Resources and Tourism.
- Hayden, J. 1965. Marine Fisheries Tanzania--An Unusual Pattern for Development. Mimeo.
- Kambona, J. 1974. Shore and Reef Fisheries. Proceedings of the International Conference on Marine Resource Development in Eastern Africa. In press. University of Rhode Island.
- Landberg, L. and P. Weaver. 1974. Maendeleo: Economic Modernization in a Coastal Community of Northeastern Tanzania. Rethinking Modernization: Anthropological Perspectives. J. Poggie and R. Lynch, eds. Westport, Conn. Greenwood Press.
- Maembe, T. 1974. Response to Marine Food Science and Technology. Proceedings of the International Conference on Marine Resource Development in Eastern Africa. In press. University of Rhode Island.
- Matthes, H. 1974. Coastal and Estuarine Aquaculture. Proceedings of the International Conference on Marine Resource Development in Eastern Africa. In press. University of Rhode Island.
- Meyer, J. 1974. Fishing Boats and Equipment. Proceedings of the International Conference on Marine Resource Development in Eastern Africa. In press. University of Rhode Island.
- Morris, R. 1974. Priorities in Development of the Shelf Fisheries. Proceedings of the International Conference on Marine Resource Development in Eastern Africa. In press. University of Rhode Island.
- Msangi, A. and J.J. Griffin, eds. Proceedings of the International Conference on Marine Resource Development in Eastern Africa. In press. University of Rhode Island.
- Sankarankutty, C. 1974. Coastal and Estuarine Aquaculture: A Case for Introducing Prawn Culture in Tanzania. Proceedings of the International Conference on Marine Resource Development in Eastern Africa. In press. University of Rhode Island.
- Thomas, I. 1971. Population Density, 1967, in Tanzania in Maps. Graphic Perspectives of a Developing Country. L. Berry, Ed. New York, Africana Publishing Company.

Wijkstrom, U. 1974. Processing and Marketing Marine Fish--Possible Guidelines for Development in Tanzania during the 1975-1979 Period. Proceedings of the International Conference on Marine Resource Development in Eastern Africa. In press. University of Rhode Island.

II. D. Artisanal Fisheries in the Republic of Vietnam*

Information assembled by Prof. Harlan C. Lampe and
James J. Griffin

Introduction

South Vietnam has an area of approximately 170,000 km² with a population of 16 million. The country has 2,571 km of coastline, and an additional island perimeter of 785 km. The coastline borders on the South China Sea and the Gulf of Thailand. These shallow waters offer possibilities for a variety of different kinds of fishing methods, both for shellfish and for various finfish.

The major fishing ports are Phouc Tien, Da Wang, Wha Trang, Pha Thief, Vung Tau, Bac Lieu and Rach Gia, none fully protected from the weather.

In addition to its considerable coastline, Vietnam has about 4000 km of inland waterways which are, to a considerable extent, brackish. These waterways, however, produce very little of Vietnam's present fisheries harvests.

Physical Features of the Coastal Waters

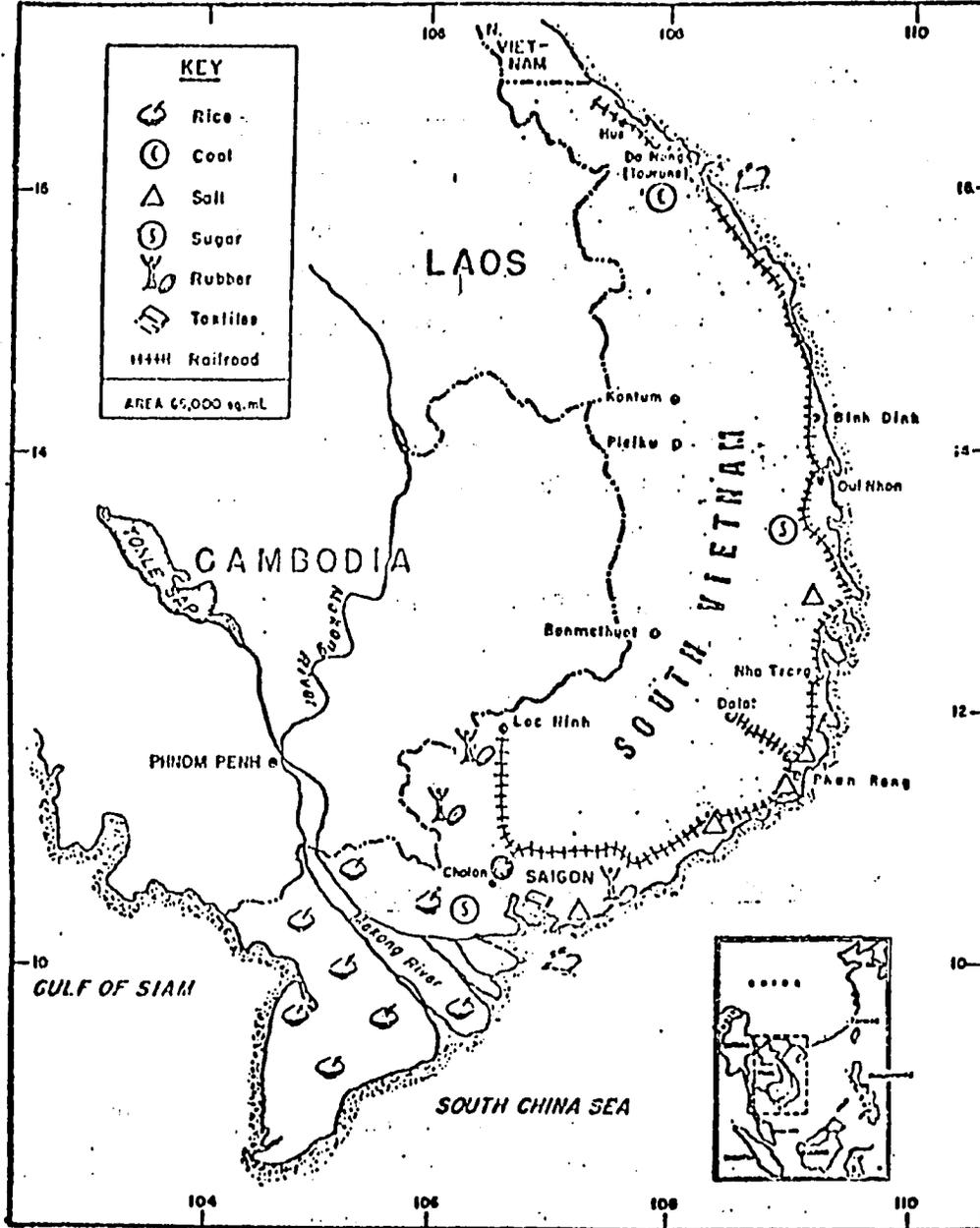
The continental shelf bordering Vietnam's coastline varies in width from just a few kilometers in the north to more than 100 kilometers in the Gulf of Thailand.

The segment of the Gulf of Thailand coast, which includes the Cambodia-Vietnam border and extends to beyond Saigon, includes the intensively cultivated low delta of the Mekong River, the second largest river in the region.

Northeast of Saigon the coast is rugged and rocky with only small streams.

*Information contained herein is from first-hand information plus the references listed at the end.

SOUTH VIETNAM



The continental shelf seaward of the Gulf and off the Vietnam coast exhibits an irregular increase in depth to the shelf break at about 130 m. The surface, particularly northeast of Saigon, is broken by many hills.

The area of the entire Gulf is 320,000 square km, and the average depth is 44 m, while the shelf has an area of 415,000 square km and an average depth of 65 m.

Upwelling, produced by winter winds blowing the surface water away from the northeastern shore, has been shown to occur along the Gulf of Thailand coast. The rise of deep water replaces the surface water and gives rise to seasonal high nutrient content followed by high productivity. Characteristically, the waters of the Gulf are warmer than those of the adjacent open sea at all seasons.

The monsoons greatly affect fishing conditions in Vietnam. During the northeast monsoon fishermen often make extended journeys to the Gulf of Thailand from the central and delta areas of the east. During the southwest monsoon fishing is concentrated off the east coast. These storm systems, along with other oceanographic conditions, result in very strong currents off the delta--in the neighborhood of 3.5 knots.

Artisanal Fishing Methods

Vessels in the fishery range from round-bottom bamboo boats to trawlers in the fifty-foot range. Of the 89,000 boats in operation in 1970, 46,000 were nonmotorized and 43,000 were motorized. The motors ranged from ingenious (if dangerous) outboards made from one-cylinder four-cycle gasoline engines (Briggs & Stratton) to modern diesels. Most motorized vessels have sampan-type hulls and fish with gillnet, seine, or trawl. Almost none have power aboard to handle this gear, accounting for the large crews. Sailboats and small unpowered vessels fish with seines, sometimes with trawls, and also handlines and traps. No navigation equipment or charts are used.

Pair trawling is pursued widely since few vessels have sufficient

power to pull a trawl alone. The trawl gear is generally inefficient and poorly designed. Gillnetting used by the better fishermen is modern and well-designed and is generally more efficient (lower cost per pound of fish produced) than trawling. Most of the finfish catch appears to be taken using these two methods and, while a variety of traps and seines are also used, such methods appear to be declining.

Personnel in the Artisan Fishery

There are 354,894 fishermen in Vietnam, including entire fishing families as well as crewmen and captains. The typical crews are large. In many cases one or two men may own a boat while one or two others own the fishing gear. Larger vessels, perhaps a bit large to be thought of as artisan yet not clearly large industrial craft, tend to be owned by a single man or a partnership and use hired crews. While in general the operation and management of boats is not efficient, there are many exceptions where effective fishing and maintenance have produced profitable operations.

The trend in number of fishermen and boats is shown in Table 1.

Table 1. Number of fishermen and fishing boats in South Vietnam by year

(Thousands)	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Fishermen	254	270	272	277	317
Fishing Boats	65	76	78	82	88
Motorized	17	23	30	39	43
Nonmotorized	48	53	48	43	46

Species Utilized, Total and Artisan Harvest

Of the total Vietnamese catch (1974--713,570 metric tons) over 72 percent are marine finfish, 13 percent freshwater finfish, and the remainder various crustaceans and mollusks. While most is marketed as fresh fish, large quantities are dried, cured or made into fish sauce (*nuoc man*). Production of canned fish has declined over time and is now insignificant.

The list of species caught and utilized is enormous as one would expect in tropical waters. Among the most important are the red snappers (*Lutjanus* sp.), bigeye snapper (*Priacanthus* sp.), lizard fish (*Saurida tumbil*), grouper (*Epinephelus* sp.), pomfret (*Formio niger*), hair tail (*Trichiurus lepturus*), and mackerel-like fishes of the genres *Deoapterus*, *Trachurops* and *Selaroides*. Various Scombroids and Carangids are also important in catches. Fully 60 percent of the edible fish catch finds its way to Saigon.

The South Vietnamese fishing industry has grown significantly during the last decade in terms of catch, employment, and capital investment and was, in 1969, the 24th largest fishing nation in the world in terms of tonnage landed (1970--possibly the 22nd largest). This growth took place despite the fact that some of the most productive coastal areas were closed to fishing by security regulations, that the labor force to a large extent consisted of young boys and older men, and that the development of freshwater fisheries was hampered by internal strife. Growth was spectacular from 1969 to 1970 when landings rose by 24.5 percent due to increases in a number of factors such as the number and size of vessels, motorization, 15 percent more fishermen, as well as better nets.

The increase in the catch during the last four years can be seen in Table 2.

Table 2. Catch of fish and shellfish in South Vietnam by year

(Thousand metric tons)	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Marine finfish	287	319	321	355	411
Shellfish	28	32	37	45	62
Freshwater finfish	65	60	51	64	74
Total	380	411	409	464	547

As indicated in the previous section, a more moderate increase had occurred in fishermen and craft implying increased efficiency with more motorized vessels.

The marine catch is consumed principally by populations centered along the coastal areas as transport of fishery products to inland areas is severely limited by lack of good roads, inadequate facilities for preservation and subsequent distribution of fish, and general lack of security in some areas.

Marketing and Distribution

Typical operations for getting fish from the boat to the retailer are as follows: fish are sorted aboard the vessel and separated there into baskets ranging in size from 15 to 50 kg. at the shore the baskets are moved by foot, by sampan or by carting overland to a middleman or collector's station; the fish is weighed and dumped on the ground for further sorting, then packed into 15 to 250 kg boxes or baskets, iced, covered, and loaded onto trucks; the trucks go to Saigon where they are unloaded; the contents are dumped, sorted again, typically separated from ice, and re-weighed. upon wholesaling, the process is repeated before transport to a retail market. While such systems vary somewhat from port to port, the essential detrimental features are the number of times fish are handled and the heavy pressure on fish at the bottom of the piles stacked in baskets.

An effort has been made in all ports to provide building and wharf space, but in all cases it is not sufficient, considering the growth of the industry.

Organizations and Institutions

The Fisheries Directorate of South Vietnam is under the Department of Agriculture. Administrative officials, including Director and Deputy Director of Fisheries and Chiefs of the Marine and Inland Fisheries Divisions, have offices in Saigon. Each of the 44 provinces

has a Chief of Fishery Service with various field personnel.

The Chanh Hung fish market is the focus of marine fish sales in Saigon. It consists of a large open shed, about 150 m of wharf, office space for market administration, the cooperative (Hai Bang), and cold storage facilities. There are about 55 middlemen in addition to the cooperative. The cooperative charges a lower commission on sales (two percent) than private operators (six percent).

The cooperative's records provide an interesting insight into operations. Since the cooperative operates from commissions, boat owners are not paid until the load is sold. Over 100 small separate transactions may be needed to sell a few tons of fish, requiring a great deal of record-keeping labor. The limited cold storage under the cooperative's control is not used to assist in price stabilization.

Middlemen in Saigon may be representatives of middlemen in the country or independents with country representatives, lending money both to retailers for credit buying as well as to boat owners or to independent middlemen above or below them in the marketing chain. Ample opportunity exists to control fish prices, although the number of operations in the Saigon market probably assures competition.

The range in size of operations is large, from a metric ton per day to 20 on some days. While no one middleman is large enough to buy a large haul of fish, they do perform an important function in accumulating industry capital.

The Saigon market, like many others, has a low price elasticity; it cannot absorb large quantities of fish without reduced returns. Access to cold storage is limited. Water is inadequate. The market's main function may be simply to provide shelter from the rain.

Plans, Programs and Government Involvement

Currently several programs are in effect or have been funded. FAO is carrying out exploratory fisheries work in the South China Sea.

The Japanese are working at Can-Tho University and are carrying out oceanographic work, while USAID funding includes assistance to the Fisheries Directorate. West Germany has recently allocated \$1.7 million for fisheries work in Vietnam (most likely to be used in the field of marketing and distribution) and the Asian Development Bank has given a loan of \$2.5 million for motorization of fishing vessels and building of cold storage and ice-making facilities, plus additional funds for technical assistance related to these programs.

USAID has, over the years, been more involved in fisheries development in Vietnam than any other agency. At the current time, AID prefers to shift its emphasis from marine production (because other agencies seem to be filling that gap) and concentrate in the following areas:

- technical assistance to institutions;
- fisheries management in brackish and fresh water (pond culture);
- ecology (protection of natural resources);
- improvement of the mobile training capacity (by use of trailers, get the equipment and teachers to the fishing centers to train local teachers);
- upgrading the administrative capability of the Directorate of Fisheries.

Potential for Development

The fishing industry is of considerable value to South Vietnam, even though the price of fish is high and the fishermen are not prosperous because of the low catch per individual. Commenting on the industry's significance, we note:

- with a low level of livestock production and with the populations growing two to three percent annually, fishing provides badly needed animal protein;
- with difficult balance of payment problems, the country is saved from spending foreign exchange on fisheries imports and, if the trend continues, fisheries products, particularly crustaceans and mollusks, might become a significant export item;

- the fishing industry is making a significant contribution to the country's economy--the industry not only provides employment to the fishermen but also to the people involved in marketing and distribution and to those involved in producing supplies for the fishing industry;
- the fishing industry in Vietnam is excellently suited to counteracting under-employment in agriculture.

An increase of up to 150,000 metric tons of demersal and pelagic fish could be exploited, most of which would come from coastal areas. Large modern vessels have proven to be uneconomical, and hence attention should be given to the improvement of small to medium sized vessels, broadly overlapping what we might regard as an artisan and an industrial fisheries endeavor. Improvements of 10 percent in the productivity of small and medium vessels would produce over 20 percent of the potential increase. If sought through new investment in a highly industrialized fishery, this increase would require an investment of well over \$5 million and a substantial enhancement of the skills of fisheries personnel with concomitant improvement in educational facilities.

Coastal and inland aquaculture, as now being prosecuted, is hamstrung by the lack of a domestic research and development capability along with a necessary extension in the field. Established experiment stations are not functioning effectively, and new ones are needed in several locations. In view of the extensive brackish marsh area, the potential in this regard seems enormous.

References

- Emery, K.O. and Hiroshi Niino. 1963. Sediments of the Gulf of Thailand and Adjacent Continental Shelf. Geological Society of America Bulletin, v. 74, p. 541-554.
- Holmsen, Andreas A. 1971. Recommendations on Fisheries Program at the National Agricultural Center, Republic of Vietnam.
- Lampe, Harlan C. and Howard L. Steele. Demand and Supply Potentials for South Vietnam's Fishing Industry. Forthcoming publication from the U.S. Department of Commerce.
- Swingle, H.S. and D.D. Moss. 1968. Fish culture Project Report for South Vietnam. Phase I. AID/csd-1581 Project.

III. Common Denominators of the Artisan Fisheries

From the foregoing country descriptions, plus experience, reading and discussions, we attempt a worldwide view of the artisan fisheries and note certain common features as to the environment involved, the character of the fishery, and the socio-economic patterns.

A. The Environment Involved

Almost everywhere the fishery is pursued close to shore, often in lagoons and in the mouths of estuaries. Activity is not well distributed over the available resource areas along the coast.

Often the environments are tropical or subtropical, along coasts bordered with mangroves and frequently rimmed with coral reefs.

Being coastal habitats, the waters of these areas are often brackish and subject to pollution.

These coastal habitats are often highly productive, and the harvestable biota is varied, including macroalgae, various shellfish, shrimps and a variety of finfish. The productivity is often enhanced rather than decreased by the levels of pollution involved.

Many of these environments are well suited for relatively simple, straightforward aquaculture or husbandry practices. Some of the bordering lowlands can be reclaimed for such aquaculture far more readily and more profitably than they can be drained and used for agriculture.

B. The Character of the Fishery

The fishery is labor intensive and there is little or no division of labor.

Equipment used is simple, often quite primitive, with minimal dependence on mechanization.

Fishing methods are comparably primitive.

Some of the equipment and gear is fabricated by the fishermen often using native supplies.

Usually there is a wide variety or multiplicity of species in the catches, a condition not conducive to efficient harvesting and optimum management practices.

Although individual catches are low, there is a high rate of return in proportion to the fishermen's minimal capital investment.

Even the minimal harvests may place a stress on the resources where the fishing effort is concentrated.

Catches are handled very poorly, not only at sea but onshore as well.

Formal catch information systems are virtually absent.

Requirements in the way of shore and harbor facilities are minimal.

C. Socio-Economic Characteristics

Individual capital investment is low and is accompanied by slow capital accumulation and a hesitation to invest further in innovations.

The capital structure tends to be inextricably related to the middleman and his functions. The fact that middlemen have or can accumulate capital has given them strong leadership positions in the industry, not necessarily redounding to the benefit of fishermen and consumers.

The activity tends to be widely scattered geographically, in contrast to industrial fisheries operating out of well-defined fishing ports.

The technical constraints on marketing and distribution are serious impediments to economic efficiency. Lack of small port facilities, poor roads, inadequate transport, and other deficiencies contribute to a more complex and costly market structure with frequent handling of the products.

The typical multispecies nature of artisan fisheries in tropical waters makes efficient processing, distribution and marketing difficult to achieve.

Formal economic information systems are virtually absent.

Low educational levels impede the effective utilization of some technologies and make desirable institutional change more difficult.

IV. Needs for the Development of the Artisan Fisheries and Related Aquaculture

Artisan fisheries and aquaculture development have the following goals:

to provide additional high quality protein at lower prices to the people--particularly to the poor
to improve incomes of artisan fishermen
to provide additional employment not only in the fishery itself but in ancillary activities as well
to earn foreign exchange by exporting high valued products.

In the early stages attention to developing artisan fisheries was usually directed to improving fishing technology or developing related aquacultural techniques. Reflecting even casually on the many facets of the total fishery which need attention, we readily see that such an approach is not sufficient.

On undertaking the desired, more comprehensive approach to these fisheries, the need for institutional and organizational change is receiving much greater attention. Generally the cooperative seems to be the ideal institutional form to apply, particularly to surmount the "middleman-marketing" problem and for communicating with large numbers of individuals. Experience shows, however, that neither technical nor institutional change alone, or pursued unskillfully, can lead to successful development.

We now realize that, for artisan fisheries to be developed, careful consideration must be given to three broad and interrelated aspects of development, namely:

resource assessment and fishing technology (or in aquaculture, the production and harvest technology);
marketing and distribution systems,
institutions, organization and management.

It is obvious that the development of fisheries cannot take place without fish. Adequate information must be generated within the system to provide for conservation and management so that the resource base and capture technology are kept in balance. Since artisan fisheries often involve multispecies harvests, their management is more complex than most industrial fisheries which exploit a limited number of species.

The marketing and distribution system, from producer to consumer, must be construed to include all aspects of production preparation, transportation, marketing, and all influences on price structure. Information that will permit adequate monitoring of performance must be produced. Careful consideration must be given to the integration of fish distribution systems with those of other food products. Attention must be directed to interrelations of state owned, cooperative, and privately held sectors of the system.

A final point relates to public policy and social-cultural considerations. The role of government in financing, training, and management is often the factor upon which success or failure depends. The structure of cooperatives and their various personnel and institutional relationships becomes critical. The cultural problems in technological transfer and the implications of the development process on community and family structure and vice versa can be very significant.

From these insights certain broad needs are identified which must be surmounted in developing artisan fisheries and related aquaculture in LDC's. First is--

The need for a holistic approach encompassing the potential production, the realization of this potential, all aspects of processing and distribution, and the entire complex of socio-economic factors to be considered in order to recognize the issues, blockages and problems to be surmounted in a total development effort.

Since, as noted, early work was limited largely to improving fishing technology and developing aquaculture techniques, a related

need is evident, namely--

The need to close the gap by considering socio-economic factors bearing on projects in which the emphasis has been almost solely on the technology of production.

Stressing the need to consider the entire complex should never be construed as an expression of satisfaction with technology; thus there continues to be--

The important need to continue improvements in technology applicable to the artisan fishery and related aquaculture. Management and conservation techniques, closely tied to the holistic approach, also need attention.

Since nothing can be developed without in-country competency and since this is minimal, even completely lacking, in many LDC's, there is--

The need to develop an LDC in-country capability to perpetuate the development of the fisheries.

Finally, it is obvious that provisions must be developed for the outreach or extension of information contributing to development. This is especially challenging for the widely scattered artisan fishery. Thus, finally, there is--

The need for outreach or extension of knowledge both from the developed countries to the area of development and within these areas as capability is generated there.

The following is a listing, by groups of convenience, representing the kinds of work to be done. Many of the items obviously interrelate and overlap.

Socio-Economics

1. Study costs and returns in marketing and distribution to assay the basic structure and the financial implications of change in structure and organization.
2. Analyze demand to assay the responses of consumers to price changes for fish, other commodities, etc. The effects of changes in the marketing and distribution system on demand should be included.
3. Analyze costs and returns in fishing and aquaculture to identify efficient and workable fishing techniques and the optimum supporting technology.
4. Design and develop wholesale and retail systems and facilities for moving artisan catches into major cities and effecting distribution to more dispersed populations. The latter, however, is usually neither as critical nor as amenable to major corrective steps.
5. Analyze the financial infrastructure supporting the activity and explore desired changes to encourage fisheries and aquaculture.
6. Design effective regulations and efficient pricing and price information systems.
7. Evaluate and compare alternative socio-economic systems for development of the fisheries, i.e., strict private enterprise, cooperatives, socialistic institutions, etc.
8. Investigate linkages between the artisan industry and aquaculture and other sectors of the economy.
9. Analyze cultural blockages to the transfer of improved fishing and aquaculture technologies, to the acceptance of new products, etc.

For much of the foregoing, basic data would have to be obtained in specific countries, often from interviews since secondary sources are virtually nowhere adequate. The basic information when gathered could, however, serve in studies of general principles through modelling, etc.; also many of the suggestions, if carried out, would obviate such a tedious inefficient approach in the future.

Resource Assessment

1. Make first order assessments of the magnitude of the fishery resources available for capture in the existing grounds or over extended areas where development may be encouraged.

While most such efforts must be undertaken locally, certain general principles of productivity and harvest are applicable and, within limits, knowledge of populations in representative areas can be transferred as applicable to like areas elsewhere. For example, Stevenson and Marshall (in press) have recently completed an appraisal from literature sources of the fisheries potential of coral reef and adjacent shallow water areas.*

2. Study the overall potential of the projected economic zone seaward to 200 miles, as anticipated from upcoming Law of the Sea deliberations or unilateral actions, in order to cope with such issues as:
 - the magnitude, character, and potential yield of the stock to be managed;
 - the extent a given country will try to fish the zone with its own fleet,
 - the choice of a given country to fish the extended zone with a substantially upgraded artisan fishery, with an industrial fishery, or a combination;
 - the extent to which foreign fleets will be allowed in the zone and the way these will interact with local fishery development.

*Generalizations on the Fishery Reef and Shallow Water Environments.
Proceedings, 2nd International Coral Reef Symposium.

By observation of the course followed and the consequences in representative countries, general principles of wide application may unfold.

3. Develop catch statistics information programs as basic to management, i.e., for realizing optimum yield and forestalling depletion.

Obviously a production statistics program must be developed for each area of interest, however, through centralized training, capable staff rosters can be developed for service in home regions.

Production

1. Search for unutilized resources and for better use of known resources, particularly curtailing the waste of the by-catch (quantities of edible fish taken incidentally to a focal fishing effort but discarded because of handling inconveniences).
2. Develop low capital, simple technology for coastal husbandry and aquaculture compatible with the artisan fisheries and covering finfish, shellfish, shrimps and prawns, algae, turtles.

The above two items have wide applicability, readily transferred to different areas.

3. Consider adaptations and improvements to extend the range and fishing capability of the artisan fisheries with simple, low-cost motorized boats that can be constructed cheaply and without special facilities.

Such boats must be suited to the specific fishery possibilities of given areas. Nevertheless, certain designs and construction have broad application. In most cases, equipment development (inherently very expensive) is not necessary; the need can usually be met by finding suitable gear already known. In some cases this simply amounts to working out better use of equipment available locally.

4. Consider adaptations and improvements to provide better boat gear, i.e., winches, hauling rigs, fish locating devices and their use, etc.

Adaptations to specific fisheries apply as in (3.).

5. Consider adaptations and improvements in fishing gear, i.e., traps, nets, lines, etc.

Adaptations to specific fisheries apply as in (3.). Gear use also relates to management and conservation: for example, modifications in trap design can lead to escapement of under-sized fishes and a simultaneous increase in desired catches.

6. Plan for improvements in shorefront, docking and small harbor facilities.
7. Investigate fish toxicity, particularly ciguatera common in the tropics where reefs are present.

This is best done at major centers specializing in such problems on a worldwide basis.

Food Technology

1. Develop low cost preservation systems and focus on related aspects of handling fish at sea and on land.
2. Design and develop storage facilities in a variety of forms scaled suitably for marketing and distribution systems that may be geographically dispersed, as contrasted with the major centers common for industrial fisheries.
3. Develop improvements in shipping techniques.
4. Develop new products for human consumption from species presently unutilized or underutilized; for example, squid and bonito.
5. Improve, with new formulations, mixes and processing, the products presently available.
6. Investigate nutritional shortcomings and consequent health problems, considering the utilization of fishery products to alleviate such stress.

Items 1-5 can be approached through centralized programs for later on-site application. Some aspects of item 6 also lend themselves to central research efforts of wide application.

Management and Conservation

1. Investigate institutional structure as related to effective management, utilization and conservation.
2. Develop a generalized model of the artisan fishery and interrelated aquaculture, tested on specific projects but designed to be readily adapted to localized needs.
Such a model would:
 - sort out the components of artisan fishery development, identify and give weight to the needs and thus optimize development steps,
 - serve as an advisory tool as it is adapted to specific locales.
3. Consider conservation and management steps necessary to obtain optimum yields and utilization in the light of the foregoing.

Communications and Advisory Measures

1. Develop guidelines and handbooks, in local language and pictorial form where desirable, for the development needs of the coastal artisan fisheries and aquaculture.
2. Provide appropriate mechanisms for facilitating the transfer of the knowledge gained, including seminars and workshops, professional and more descriptive publications, mechanisms for responding to inquiries, and an active outreach by consultants and advisors.
3. Assist in the development of in-country extension mechanisms effective for the artisan fisheries.