

ECONOMIC SURVEY OF KLONG KRIANG KRAI  
FISHING VILLAGE IN  
CENTRAL THAILAND

by

PADH TAVARANUSORN

A THESIS

submitted to

OREGON STATE COLLEGE

in partial fulfillment of  
the requirements for the  
degree of

MASTER OF SCIENCE

June 1961

APPROVED:

Redacted for privacy

---

Associate Professor of Agricultural Economics

In Charge of Major

Redacted for privacy

---

Head of Department of Agricultural Economics

Redacted for privacy

---

Chairman of School Graduate Committee

Redacted for privacy

---

Dean of Graduate School

Date thesis is presented August 1, 1960

Typed by Patricia Malango

## ACKNOWLEDGMENTS

I express sincere thanks to Dr. C. V. Plath, who has played a significant guiding role since the beginning of my thesis work. This began with his chairmanship of the Committee of the Department of Fisheries of Thailand, assigned to carry out the economic survey at Klong Kriang Krai fishing village in central Thailand, in 1958. His assistance in arranging with the Council on Economic and Cultural Affairs in the United States is deeply appreciated. The Council has kindly sponsored me with a fellowship for my graduate training at Oregon State College.

I also acknowledge a debt of gratitude to Dr. Grant E. Blanch, who arranged for me the program of the post graduate studies. He has been unselfishly generous in clarifying for me many of the doubts, problems, and misunderstandings that occurred in the pursuit of my lessons, although most of them are not included in his instructional schedule.

Dr. G. B. Wood, Head, all professors, and staff members of the Department of Agricultural Economics; Dr. Charles B. Friday, Head, and other professors of the Department of Economics of Oregon State College, have been kind and helpful to me throughout my period of training here. Some of them were my instructors who energetically conducted the classes. Such a conducive climate has

#### ACKNOWLEDGMENTS (Continued)

encouraged me in my studies. I, therefore, am grateful to all these people.

This last section is reserved for recording my gratitude to Mr. Boon Indrambarya, Fisheries Director of Thailand, for his previous training on how to write a good report. While I have not been aware of what sort this thesis will be, in the eyes of the readers, his training has, at least, helped alleviate my difficulties and made easier for me the editing of this thesis.

Padh Tavaranusorn

## TABLE OF CONTENTS

Chapter	Page
I INTRODUCTION .....	1
Hypothesis .....	4
II FISHERY INDUSTRY OF THAILAND .....	5
Marine Fisheries .....	6
Marine Fish .....	6
Marine Fishing .....	7
Inland Fisheries .....	9
Fresh Water Fish .....	9
Inland Fishing .....	10
Culture Operations .....	11
Fresh Water Fish Culture .....	11
Brackish Water Fish Culture .....	13
Mollusk Culture .....	14
Fish Culture .....	14
The Department of Fisheries .....	15
III RESEARCH METHODOLOGY OF THE ECONOMIC SURVEY OF THE KLONG KRIANG KRAI FISHING VILLAGE, CENTRAL THAILAND .....	23
IV ANALYSES OF DATA FROM THE SURVEY .....	25
Fishing Operations .....	25
Gear Used .....	29
Cost of Fishing Operations .....	29
Income from Fishing .....	32
Price of Fish .....	36
Amount and Value of Catch .....	40
Analysis of Fishing Operations .....	42
Comparison of Groups with High and Low Income and Efficiency .....	50
Findings from the Analysis .....	52
Causes Effecting Efficiency in the Fishing Operations .....	52
Culturing Operations .....	59
Bamboo Kachangs: Cost and Size .....	59
Wooden Kachangs: Cost and Size .....	60
Findings from the Analysis of Culturing Operations .....	67

# TABLE OF CONTENTS (Continued)

Chapter	Page
V RECOMMENDATIONS AND SUMMARY .....	70
Recommendations .....	70
Recommendations for Adjusting Fishing Operations to Improve the Fisher- men's Incomes .....	70
Recommendations for Improving the Culturing of Catfish So As To Im- prove the Culturists' Incomes .....	71
Summary .....	72
Fishing Operations .....	73
Culturing Operations .....	75
BIBLIOGRAPHY .....	79

# LIST OF TABLES

Table		Page
1	Kinds of fish that have been successfully cultured in Thailand .....	12
2	Estimate of the water areas suitable for stocking of propagated fish in Thailand in 1955 .....	13
3	Estimated kingdom tonnage and value of commercial fish and shell-fish landing, Thailand 1950-1957 .....	17
4	Number of boats registered for fishing, Thailand 1950-1957 .....	18
5	Commercial fishing equipment licenses and fees collected, Thailand 1950-1957 .....	19
6	Number and area of fish ponds by geographical zones, Thailand 1957 .....	20
7	Fish fries distributed to fish culturists by inland fisheries stations, Thailand 1950-1957 .....	21
8	Wholesale fish market receipts and average wholesale prices, Bangkok, Thailand 1950-1957 .....	22
9	Frequency distributions of family sizes at Klong Kriang Krai village, Thailand, 1959...	25
10	Number of families engaged in fishery occupation at Klong Kriang Krai village, Thailand, 1957 .....	26
11	Number of fishing families using each type of fishing gear and equipment at Klong Kriang Krai village, Thailand, 1957 .....	29
12	Frequency distribution of total cost for fishing operations in one year per family at Klong Kriang Krai village, Thailand, 1957...	30
13	Frequency distribution of net income per family from fishing operations at Klong Kriang Krai village, Thailand, 1957 .....	33

# LIST OF TABLES (Continued)

Table		Page
14	Frequency distribution of net income/cost ratio from fishing operations at Klong Kriang Krai village, Thailand, 1957 .....	35
15	Frequency distribution of price of catfish fries at Klong Kriang Krai village, Thailand, 1957 .....	37
16	Amount and value of fish caught by fishing families at Klong Kriang Krai village, Thailand, 1957 .....	41
17	Gear and Equipment used by fishing families having net income of 4,000 bahts and above at Klong Kriang Krai village, Thailand, 1957 .....	43
18	Gear and equipment cost and use by fishing families having net income below 900 bahts at Klong Kriang Krai village, Thailand, 1957 .....	46
19	Gear and equipment cost and use by fishing families having net income/cost ratios below 9, at Klong Kriang Krai village, Thailand, 1957 .....	48
20	Frequency distribution of the annual cost of bamboo kachangs in Klong Kriang Krai village, Thailand, 1957 .....	56
21	Frequency distribution of volume of bamboo kachangs at Klong Kriang Krai village, Thailand, 1957 .....	57
22	Frequency distribution of volume/cost ratio (volume per cost of 1 baht) for bamboo kachangs at Klong Kriang Krai village, Thailand, 1957 .....	58
23	Frequency distribution of annual cost of wooden kachangs at Klong Kriang Krai village, Thailand, 1957 .....	61



# LIST OF TABLES (Continued)

Table	Page
24 Frequency distribution of volume of wooden kachangs at Klong Kriang Krai village, Thailand, 1957 .....	62
25 Frequency distribution of volume/cost ratio (volume per cost of 1 baht) for wooden kachangs at Klong Kriang Krai village, Thailand, 1957 .....	63
26 Number of families culturing catfish, number of cultured fries, and their value at Klong Kriang Krai village, Thailand, 1957 ...	65
27 Number of families reporting period of cul- tivation of catfish in kachangs at Klong Kriang Krai village, Thailand, 1957 .....	66
Chart 1. The Department of Fisheries of Thailand ...	16

# ECONOMIC SURVEY OF KLONG KRIANG KRAI FISHING VILLAGE IN CENTRAL THAILAND

## CHAPTER I

### INTRODUCTION

"Klong Kriang Krai" is the name of a fishing village situated in the District of Muang Nakorn Sawarn, Province of Nakorn Sawarn, Central Thailand. Klong Kriang Krai is also the name of a canal where the fishing village is located. The village is about 350 kilometers inland from the Gulf of Thailand, therefore it is too far to be reached by the sea water. Thence, Klong Kriang Krai is truly an inland fishing community.

It can be said that this fishing village has some distinctive characteristics which are distinguished from most of the inland fishing villages in the following aspects.

1. This village has a fair concentration of fishermen in contrast with most fishing villages. The fishery operation is fairly intensive, as is evidenced by the data obtained from the economic survey made on this village in April, 1958, by a committee of the Department of Fisheries. Among the 169 families interviewed out of the total 200, 143 of them had 259 fishing boats (paddle and row boats), and owned a large amount of fishing and fish culture equipment.

2. This village has been famous for being the source

of supply of catfish fries and fingerlings (*Panagasius sutchi* and *P. larnaudii*) for the fish culturists in the same village, who do not catch the fries themselves, and the nearby provinces. The contiguity of Klong Kriang Krai with some swamps and flooded rice fields has made this canal abound with the natural stock of catfish fries. It is probable that natural stock of catfish fries has never been found elsewhere as abundantly as at this canal.

3. Culturing of catfish fries has become a common practice at this village as is obvious from families having 186 kachangs (underwater cages in which fish are fed and grown) during the studied period (April 1, 1957 - March 31, 1958). Practically, because it is a difficult and exhaustive task, people in Thailand generally have not yet operated fish culture in ponds or in kachangs to the extent they should, although the Department of Fisheries has persistently encouraged the practice.

When the fishermen catch the catfish fries, some of them sell their fries to fish culturists immediately. Some of them do not want to sell their fries, but culture them in kachangs to grow them to market size in the interest of the better price because of a strong demand for such fish. Some of the fishermen culture, for the same purpose, the rest of the fries after selling a part of them to the fish culturists.

4. The natives of this village have the opportunity of multiple choices of careers. They can earn their living by the following occupations: fishing, fish culture, processing of fish products, raising of swine, fruit and vegetable gardening, and trading; or they may operate the combination of some or all of them.

The economic survey was made for the period of April 1, 1957 to March 31, 1958, and the method of survey used was a personal interview of each household. The enumerated 169 families consisted of 770 persons, so the average number of persons per family was 4.6. Eighty-seven families had ownership of land, while 18 rented. These 169 families had 165 floathouses, 21 stilthouses, and 186 kachangs. One hundred and forty-three of them reported owning 259 non-mechanized fishing boats, 98 fish brush piles, and 62 fish traps (chorn). Forty-four families reported owning 44 seines, 74 owning 100 cast nets, and 70 having 70 long line sets. Evidently, at least 143 families that owned 259 fishing boats were either full-time or part-time fishermen, while it might be said that, practically, the rest of them were subsistence fishermen who operated fishing or fish culture for home consumption.

The annual average net income per family from fishing was 2,500 bahts, or \$119.05 (21 bahts = \$1.00), with an average cost of production of 190 bahts, or \$9.05. So, the

average net income from fishing, per family, was higher than the national average net farm family income of \$70.00 (2, p. 1).

The survey furnished further information that 37 families raised swine. The average net income per family from swine was 1,236 bahts, or about \$58.00, with a cost of production of 3,762 bahts, or \$179.00.

Twenty-seven families reported operating fruit and vegetable gardens. The average net income per family from gardening was 1,471 bahts, or \$70.00. Their cost of production was 428 bahts, or approximately \$20.00.

It is a fact that the higher the income, the better the livelihood that the earner will achieve, provided that certain levels of social welfare are available to meet one's fundamental needs.

#### HYPOTHESIS

The economic status of the fishermen of Klong Kriang Krai Village can be improved through adjustments in their fishing and fish culturing operations, so as to improve the family income of the fishermen.

## CHAPTER II

## FISHERY INDUSTRY OF THAILAND

Thailand, a constitutional monarchy, is situated at about the center of the Indo-Chinese Peninsula, in the south-east of Asia, within the latitudes 6 to 20 N. and longitude 97 to 106 E. It is bordered on the north-west and west by Burma, on the north and east by Laos, on the south-east by Cambodia, on the south by the Gulf of Thailand and the Federation of Malaya. The area of Thailand is about 513,000 square kilometers (one square kilometer = 0.3861 square mile) with a population of about 23 million (4, p. 125).

The balance of this chapter was derived from "Agriculture in Thailand" (4, p. 68-91, 83).

In Thailand, the importance of fisheries is next to agriculture and forestry, both in extent and value. Fisheries have a three-fold importance: as a source of protein food, as the means of livelihood for a large proportion of the population, and as an important source of national revenue.

It was estimated that the annual fishery production in 1957 was approximately 533,984 tons, worth about 2,704.1 million bahts (5, p. 18). About half of the total volume was consumed fresh and the rest was processed into salted

dried products, sauce, pastes, etc., either for domestic consumption or for export.

The value of fishery products in 1957 was 2,705.1 million bahts against 14,516 million bahts of agricultural and forest products. Total value of agricultural, forest and fishery products in 1957 was 16 percent (5, p. 18).

### Marine Fisheries

Marine fishing grounds consist of three-fourth of the coastal waters of the Gulf of Thailand, which is 350 kilometers (one kilometer = 0.6214 mile) wide at its constricted mouth and 800 kilometers in maximum length, and a portion of the eastern shore of the Indian Ocean between Malaya and Burma with the total length of 2500 kilometers. The Gulf of Thailand abounds with fish as it is rather shallow and suitable for fish life. These waters provide tremendous amounts of aquatic products which are of extensive use for domestic consumption and for export.

Marine Fish. Living in the coastal waters are a vast number of fish. Among them are some fish of the tropical seas which are found in great abundance and are of economical importance to the country. They are as follows: Herring, Clupea (known locally as "pla lang kio" and "pla ok kalae"), Dussumieria ("pla luk kluey"), Pellona ("pla lek" and "pla

taluck"), and *Chirocentrus* ("pla dablae"). The above fish are found in great abundance, and are largely consumed domestically, but are also exported in dried salted form.

*Engraulidae* (anchovy) and *Stolephorus* ("pla katug") are used as the significant ingredient in the preparation of high grade fish sauce. This sauce is a widely used condiment in South East Asia.

*Cybium* ("pla insee") or Spanish mackerel and *Rastrelliger* ("pla lang" and "pla thu") are among the mackerel family. Due to its spectacularly great amount of catch, the latter has been economically a valuable fish, as it has met the requirement of sea food of the majority of the population all over the country at low price, and also has played the most important role in the dried salted fish export.

*Mugil* (mulletts), *Sphyraena* (barracudas), *Polynemus* (thread-fins), *Stromateus* (promfret), *Sciaenidae* (drums), *Caranx* (crevalles), various soles, and flat-fish are prominent in the catch and have a good demand as popular sea food in the market.

Porpoises, sharks, rays, saw fish and hundreds of other species are also abundant in the Thai coastal waters.

**Marine Fishing.** Fishing is done along the entire coast, generally, but the commercial fishing operations are intensively centered around the estuarial areas where the main



rivers meet the sea. The marine fishing industry employs approximately 35,000 persons, and yields a large volume of sea food for domestic consumption and for export.

An outstanding feature of the marine fishery is the stake-traps ("poh") made of bamboo and timbers installed in both shallow and deep water. There are about 1,250 such traps in operation annually. Their predominant catch is mackerel or "pla tu" (*Rastrelliger*). Other kinds of fish are also caught by these traps.

A kind of bag net known as "pong pong" is another important marine fishing gear. They are generally installed either along the coast or in estuarial areas. Shrimp are usually caught by this kind of gear. They are also captured by shrimp trawlers.

One of the very common marine fishing gear is seines of great varieties in size, mesh and method of fishing. Among them are purse seines, which are specifically used to catch mackerel. Other kinds of seines are employed to capture other species in considerable volume.

Trawl lines and long lines are extensively used in the fishing of rays, sharks, and bottom fish, generally.

Some kinds of trap and a special kind of bottom net locally called "uan yaw" are used for reef fishing.

Fishing on soft and muddy flats is made possible by using wood sleds as equipment, with one person kneeling on

it and driving it by paddling on the mud with one foot. In this way, the fisherman can move around the muddy surface to collect mollusks, shrimp, crabs and other fish which are encountered there.

### Inland Fisheries

Inland fishing grounds include many large and long interior rivers, innumerable canals --particularly in the central part of the country-- many lakes, a great number of swamps and streams, in all of which tremendous amounts of fresh water fish are found.

Fresh Water Fish. The inland waters of Thailand produce fresh water fish in great varieties and abundance. Many kinds of them have high food value and palatable flavors. Some of them have their own peculiar characteristics and habits which have made themselves recognized throughout the world, such as fighting fish, shooting fish, and climbing fish.

Fresh water fish that are most numerous as to both species and individuals are the members of the carp family (Cyprinidae).

Next in importance is the group of catfish. They are *Clarias* ("pla duk"), *Wallagonia* ("pla khao"), *Ompok* ("pla nua on"), *Macrones* ("pla kot"), and *Pangasius* ("pla tepo" and "pla sawai"). These fish are of large number of

species, very abundant, and are consumed in enormous quantity with great appreciation.

The serpent-heads or murrels (*Ophicephalidae*) are one of the marked families, with palatable flesh either in fresh or dried salted forms.

Some of the *Anabantid* family, such as goramy (*Osphronemus goramy*) and climbing perch (*Anabas testudineus*) are the interesting labyrinth fish of Thailand. "Pla salid", a member of the genus *Trichogaster*, is a popular pond fish and is famous for its dried salted product for domestic consumption and for export. The kissing goramy (*Helostoma temminckii*) is also common.

Two species of featherbacks (*Notopterus*), locally known as "pla chalat" and "pla krai" are the other common fresh water market fish. A large eel "pla lai" (*Pisodonophis*) and gobies ("pla bu") include the largest member of this group.

**Inland Fishing.** Fishing is generally operated in the canals, rivers, swamps and lakes all over the country. The types of gear used depend upon the kinds of fish sought and the nature of the water. Common gear used for inland fishing are bag nets ("pong pong"), various kinds of seines and gill nets, cast nets, dip nets, scoop nets, traps, lines and spears. About the end of the rainy season, where lakes

and swamps discharge through narrow passages, various types of barriers are installed to trap fish which come along with the current toward the barriers.

The consumption of fish in the peasant families is high. The great importance of fresh water fish is to provide a cheap, nutritious animal food to the millions of farm family members and low income class people.

### Culture Operations

Fresh Water Fish Culture. A program for the development of fish culture was initiated by the Fisheries Department some two decades ago. With the establishment of the eleven inland fishery stations in various parts of the country, the program has been developed with steady progress.

TABLE 1

Kinds of Fish That Have Been Successfully Cultured  
in Thailand (4, p. 78)

Group	Common Name		Scientific Name
	Thai	English	
1	pla salid	Sepat Siam	Trichogaster pectoralis
	pla mortan	Kissing goramy	Helostoma Temmincki
	pla rat	Giant goramy	Osphronemus goramy
2	pla sawao	Cat fish	Pangasius sutchi
	pla tepo	Cat fish	Pangasius larnaudii
	pla kapong	Sea bass	Lates calcarifer
	pla naunchan	Milk fish	Chanos chanos
3	pla nai	Common carp	Cyprinus carpio
	pla morted	Tilapia	Tilapia mossambica
4	pla chao-hue	Grass carp	Otenopharyngodon idellus
	pla lin-hue	Silver carp	Hypophthalmichthys molitrix
	pla soong-hue	Big-head carp	Aristichthys nobilis

Group 1 are native species which can reproduce under cultivation.

Group 2 are native fish that are not found to spawn in ponds. Their fries and fingerlings are collected from wild stock in the natural water.

Group 3 are exotic fish introduced to pond culture in Thailand.

Group 4 are also exotic fish which do not spawn in the ponds. Their fries and fingerlings are imported mainly from Hong Kong.

TABLE 2

Estimate of the Water Areas Suitable for Stocking of  
Propagated Fish in Thailand in 1955  
(4, p. 79)

Types of Water	Area Suitable for Stocking of Propagated Fish (hectare)	
	Total Possible Area	Area Already Converted or Stocked With Fish
Ponds	2,500	1,500
Water ditches of vegetable and fruit farms	5,000	50
Swamps and lakes	300,000	50,000
Paddy fields	150,000	50
Tidal flats and mangrove swamps	100,000	10
Irrigation tanks	20,000	5,000
Total	577,500	56,610

Brackish Water Fish Culture. Although Thailand has approximately 162,000 hectares of mangrove swamps, tidal lands and lagoons, most of which

are adaptable for brackish water fish culture, unfortunately not more than a few ponds have been used for the culture of fish. The vast areas suitable for such culturing purposes have been left without being utilized.

**Mollusk Culture.** Some are shell farming and the culture of sea mussels (*Mytilus smaragdinus*) are operated along the muddy flats off the coast and in estuarial areas of Petchaburi Province. In addition, several small primitive oyster farms are in operation.

**Fish Culture.** Through private development, some fish species that have promising possibilities for brackish water culture are sea bass (*Lates calcarifer*), milk fish (*Chanos chanos*), mullets (*Mugil sp.*), spade fish (*Scatophagus argus*), a large shrimp (probably *Penaeus monodon*), and the big oysters of Prachuab Province.

Just a few people have been culturing the above mentioned aquatic animals. These cultures are not popular to the extent that the vast coastal areas suitable for such practices are used very much. This is because most people do not realize the proper method of culturing the respective fish and are not sure they will receive a fair return. So, the Fisheries Department, through the Klong Wan Brackish Water Fisheries Station, Prachuab Province, has been experimenting with the culture of such fish to ascertain

the proper method of culture that will insure the culturists of the maximum output at the least cost of production.

So far, experiments on culturing of milk fish have been very promising. In spite of the poor physical and chemical conditions of the new ponds, the milk fish fries have grown to 280 m.m. in overall length and 153 grams in weight within eight months.

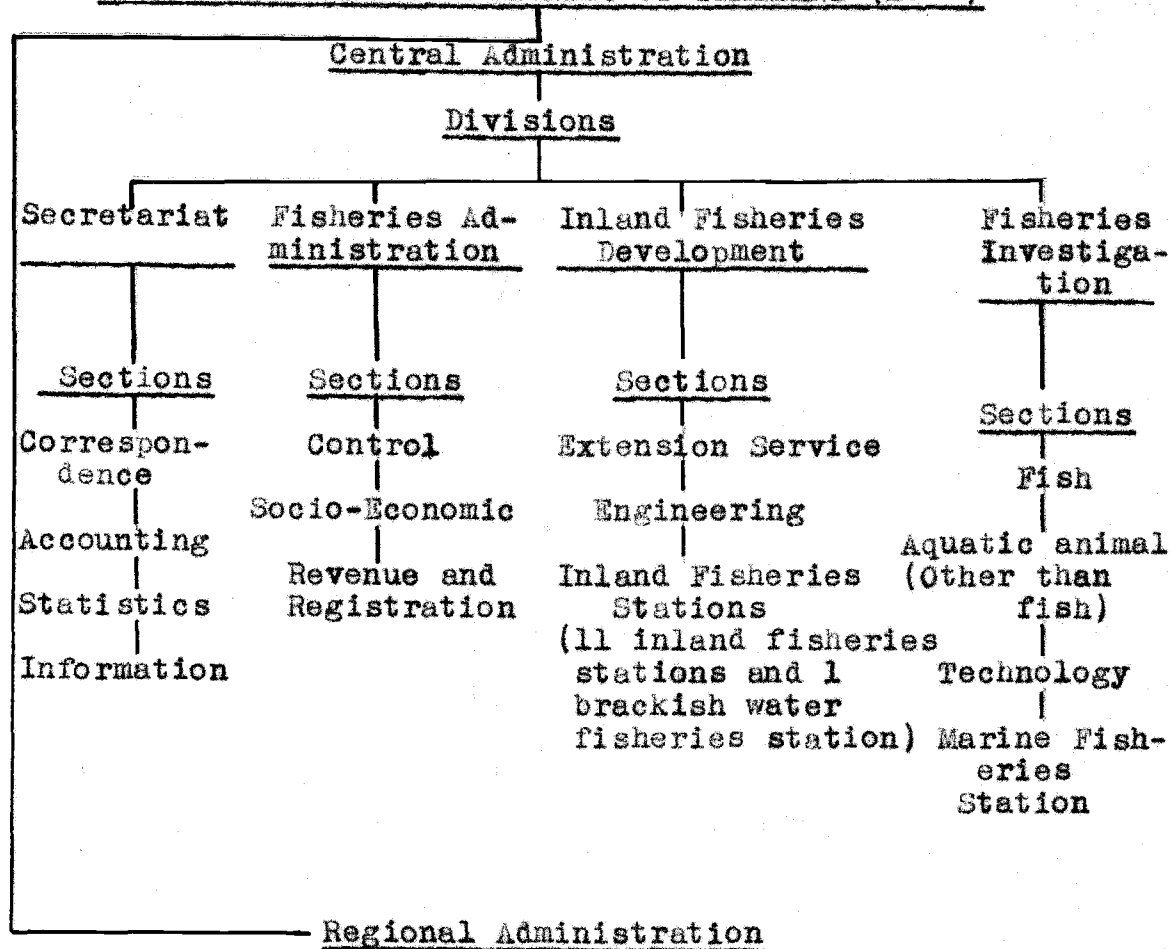
Such experiments take time and require expenditure appropriated from the government budget, which so far has never been adequate. When the results of the experiments become ascertained, they will be made known to the interested people and, thereafter, progress of brackish water fish culture can be anticipated.

#### The Department of Fisheries

The Thai Department of Fisheries has been established since 1926, under the Ministry of Agriculture, to direct and develop the fishing activities of the nation. At the beginning, Dr. Hugh M. Smith, United States Commissioner of Fisheries, who was invited to serve as Adviser in Fisheries from 1923 to 1935, together with a few officers who graduated in the field of fisheries from the United States have been assigned the important functions of the Fisheries Department. These people have organized an efficient team in developing the Department to its present status.



CHART 1 (4, p. 93)

THE DEPARTMENT OF FISHERIES OF THAILAND (1960)

16 fishery branches in 16 provinces

TABLE 3

Estimated Kingdom Tonnage and Value of Commercial Fish and Shell-fish Landing  
Thailand 1950-1957 (5, p. 79)

Year	Kingdom Landing					
	Marine Fish		Fresh Water Fish			
	Quantity	Value	Quantity	Value	Quantity	Value
A.D.	(1,000 Tons)	(Million Bahts)	(1,000 Tons)	(Million Bahts)	(1,000 Tons)	(Million Bahts)
1950	116	-	42	-	158	556
1951	141	-	46	-	187	724
1952	138	428	53	324	191	752
1953	149	507	56	313	205	820
1954	166	581	63	347	229	928
1955	151	604	62	372	213	976
1956	152	684	66	462	218	1,146
1957	171	735	64	455	235	1,190

TABLE 4

Number of Boats Registered For Fishing  
Thailand 1950-1957 (5, p. 80)

Year	Motor Vessels		Other Vessels		Total	
	Number	Gross Tonnage	Number	Gross Tonnage	Number	Gross Tonnage
A.D.						
1950	269	5,404	3,101	15,103	3,370	20,507
1951	395	7,772	3,260	15,724	3,655	23,496
1952	493	9,289	3,273	18,208	3,766	27,497
1953	430	8,474	2,968	18,001	3,338	26,474
1954	586	11,001	2,936	18,182	3,522	29,183
1955	645	12,098	3,355	19,960	4,000	32,058
1956	1,082	14,232	2,068	15,557	3,150	29,789
1957	1,531	19,540	1,582	10,166	3,113	29,706

TABLE 5

Commercial Fishing Equipment Licenses and Fees Collected  
Thailand 1950-1957 (5, p. 81)

Year	Bamboo Stake Traps	Bag Nets	Wing Set Nets	Chinese Purse Seines	Trawl Nets	Other Kinds of Nets	Collections for Fishing Permits
A.D.	(Number)	(Number)	(Number)	(Number)	(Number)	(Number)	(1,000 Bahts)
1950	1,047	1,891	626	59	122	3,379	3,934
1951	1,122	1,260	435	71	93	2,370	4,742
1952	1,254	2,240	591	126	127	4,247	4,988
1953	1,334	2,238	827	121	138	4,537	4,827
1954	1,460	2,318	988	170	176	5,819	5,288
1955	1,393	2,269	844	139	175	6,244	6,015
1956	1,579	2,390	764	185	196	6,435	6,069
1957	780	1,501	639	204	105	6,450	5,400

TABLE 6

Number and Area of Fish Ponds By Geographical Zones  
Thailand 1957 (5, p. 82)

Geo- graphi- cal zones	Private Ownership		Government Ownerships (ponds of various fishery stations)		Total	
	Number	Area (in 1,000 sq. meters)	Number	Area (in 1,000 sq. meters)	Number	Area (in 1,000 sq. meters)
North	3,656	645.1	45	42.5	3,701	687.6
North- East	892	1,655.3	69	64.0	961	1,719.3
Central	465	430.1	138	91.5	603	521.6
South	154	38.0	12	12.5	166	50.5
Total	5,167	2,768.5	264	210.5	5,431	2,979.0

TABLE 7

Fish Fries Distributed to Fish Culturists By Inland Fisheries Stations  
Thailand 1950-1957 (5, p. 83)

Year	Fish Fry Distribution				
	Tilapia	Common Carp	Chinese Carp	Others	Total
A.D.	(1,000 Fry)	(1,000 Fry)	(1,000 Fry)	(1,000 Fry)	(1,000 Fry)
1950	2	86	449	89	626
1951	5	48	662	49	764
1952	307	187	405	147	1,046
1953	3,977	147	420	51	4,595
1954	4,434	330	656	59	5,479
1955	7,259	276	489	83	8,107
1956	5,049	363	240	176	5,828
1957	1,888	382	508	286	3,014

TABLE 8

Wholesale Fish Market Receipts and Average Wholesale Prices  
Bangkok, Thailand 1950-1957 (5, p. 84)

Year	Receipts		Total	Wholesale Price Per Kilogram	
	Fresh Fish	Dried Salted Fish		Fresh Mackerel	Dried Salted Mackerel
A.D.	(1,000 Tons)	(1,000 Tons)	(1,000 Tons)	(Bahts)	(Bahts)
1950	40.8	27.3	68.1	0.90	2.08
1951	23.9	22.7	46.6	0.94	2.51
1952	26.6	21.3	47.9	0.96	2.12
1953	32.9	19.0	51.9	1.83	2.28
1954	43.9	29.2	73.1	1.83	2.40
1955	38.4	24.9	63.3	2.77	2.06
1956	46.8	15.5	62.3	2.16	2.54
1957	44.7	9.9	54.6	2.04	2.20

## CHAPTER III

RESEARCH METHODOLOGY OF THE ECONOMIC SURVEY OF THE KLONG  
KRIANG KRAI FISHING VILLAGE, CENTRAL THAILAND

## Economic Objectives of the Survey:

1. To appraise the economic situation of the fishermen.
2. To propose ways and means of improving their economic status from fishing enterprises.

Organization Conducting the Study: Department of Fisheries, Ministry of Agriculture, Bangkok, Thailand.

Place and Time of the Survey: The survey was made at Klong Kriang Krai fishing village, District of Nakorn Sawarn, Province of Nakorn, Sawarn, Central Thailand, during April 22-29, 1958.

Method of Study: Complete personal interview survey of the fishing families. Number of fishing families enumerated was 169. In economic analysis, later on, empirical data of only 86 families were reliable enough for use.

Period of Study: From April 1, 1957 to March 31, 1958.

Questionnaire: The questionnaire was successfully drawn up about the latter half of March, 1957, by a committee set up by the Thai Department of Fisheries, comprised of C. V. Plath, then Visiting Professor of Kasetsart University,



Bangkok, Thailand, Chairman; Sawaeng Kulthongkham, Chief, Agricultural Economics Division, Ministry of Agriculture of Thailand; Kamol Janlekha, Head, Department of Agricultural Business Administration, Kasetsart University; and Padh Tavaranusorn, Head, Socio-Economics, Department of Fisheries of Thailand. After three long discussions, one pretest at the Klong Kriang Krai village, and the final revision of the questionnaire, it was ready for field use.

Enumerators: Six students of the School of Agriculture, three students of the School of Fisheries at Kasetsart University, and an official of the Division of Agricultural Economics in the Ministry served as enumerators.

Three days before the survey was made, orientation for the enumerators was given by Kamol Janlekha.

Compilation and Tabulation of Data: The Department of Agricultural Business Administration, School of Agriculture, Kasetsart University, undertook the preliminary compilation and tabulation of the collected data. However, they made no economic analyses and the report from this first compilation has not yet been published.

Empirical Data Used in the Analyses in this Thesis: The mentioned raw and tabulated data are essentially applicable, and are used in the economic analysis in this thesis in the interest of testing the hypothesis.

## CHAPTER IV

## ANALYSES OF DATA FROM THE SURVEY

Fishing Operations

According to the demographic census valid on the days of the survey, the Klong Kriang Krai Village was comprised of 200 families, out of which 169 families, with a population of 770, were engaged in fishing occupations. The average family size was 4.6 (Table 9).

TABLE 9  
Frequency Distribution of Family Sizes at Klong  
Kriang Krai Village, Thailand, 1959

Family Size	Frequency	Total Members
One person household	3	3
Two person family	21	42
Three person family	34	102
Four person family	35	140
Five person family	27	135
Six person family	21	126
Seven person family	13	91
Eight person family	7	56
Nine person family	6	54
Ten person family	1	10
Eleven person family	1	11
Total 169	169	770

Mean family size 4.6 persons.

Median family size 4.0 persons.

Table 10 shows that 169 families, or 100%, do some fishing as a means of livelihood. One hundred and thirty-two families (78%) cultured catfish fries in kachangs.

TABLE 10

Number of Families Engaged in Fishery Occupation  
at Klong Kriang Krai Village, Thailand, 1957

Total Number of Families	Engaged in Fishing	Engaged in Culturing
169	169	132
Total	169	132
Percentage	100	78

Sixty-two out of 132 families (47%) caught their own fries for culturing, and 70 families (53%) reared purchased fries (Table 26). Only nine families, or 7%, sold all or part of their cultured fish, while the rest did not report having sold their fish, although they had cultured them in the widespread period of from one month to three years. Without information as to when the fish were sold and their weight at that time, the growth or the increased weight of the fish at a certain period of cultivation cannot be determined. Moreover, some factors of the cost of culturing were not reliable. For example, the cost of feed estimated

necessary for a given amount of fish showed a very wide variation. Regarding the cost of labor for culturing fish, only two families reported in monetary terms, but they differed widely, even though the number of fish being cultured was the same --270 bahts and 600 bahts for 1,000 fish each. There was no specification of the period of culture. Few of the rest reported cost of labor in terms of units of manpower (for example, one or two men), and of number of months of employment (such as one to twelve months). Information or records such as these do not help in making reliable estimates of cost of labor. A few families must also be eliminated from the tabulation, as the dimension of the kachangs were not recorded with a specific unit of measurement. All these problems impede the ability to perform economic analysis of the culturing practices carried out by these fishermen, as cost of production and income cannot be precisely appraised. However, economic analysis with respect to culturing of catfish will be attempted as far as the reliable data are available, such as average price per catfish fry; frequency distribution of the cost of bamboo kachangs and wooden kachangs; frequency distribution of the volume of bamboo and wooden kachangs; frequency distribution of the volume/cost ratio of bamboo and wooden kachangs; the number of families culturing catfish, the number of cultured fries, and their value.

Among the 169 fishing families, records from 20 families, or 12%, fishing in the concession grounds must be discarded as the concession payment figures were not reliable. Most of them were very much higher than the money value of the fish caught. Practically, the term of a concession for inland fishing is usually two to three years, but these records gave no such specification at all. Besides, an additional 49 fishing families, or 30%, must also be left out because of other inaccurate data. Only 86 families, approximately 51%, were judged to have data reliable enough for use in the economic analysis, which is the significant objective of this chapter as well as the thesis.

This chapter will begin with an economic analysis of the fishing operations, aiming at finding ways and means of adjustment to improve the family income of the fishermen, which will result in the improvement of their economic status. The above will be followed by an economic analysis relating to the culturing of catfish, to the limited extent aforementioned.

## Gear Used.

TABLE 11

Number of Fishing Families Using Each Type of Fishing Gear and Equipment at Klong Kriang Krai Village  
Thailand, 1957

Total number of Families	Number of Families Using Each Type of Gear and Equipment					
	Brush Pile	Seine	Cast Net	Long Line	Trap (chorn)	Fishing Boat
86	25	22	50	45	36	86
100%	29%	26%	58%	52%	42%	100%

This table shows the typical fishing gear and equipment (fishing boats) used at this village and the number of fishing families using each type of gear. The typical fishing gear and equipment used are brush pile, seine, cast net, long line, trap (chorn), and fishing boat.

It is noted that every fishing family has a fishing boat. The cast net has the highest percentage of families using it; and long line, trap (chorn), brush pile, and seine are of successively lower percentage use.

Cost of Fishing Operations. Table 12 indicates that, with certain exceptions, the smaller the amount of total cost, the larger the percentage of families falling into such classes. Of the 86 families, 36, or 42%, fall into class 0 to 99; 20% each are in classes 100 to 199 and 200 to 299.

TABLE 12

Frequency Distribution of Total Cost for Fishing Operations  
in One Year Per Family at Klong Kriang Krai Village  
Thailand, 1957

Total Cost Per Family (Without Cost of Labor) (Bahts)	Frequency (Number of Families)	Cumulative Frequency
0- 99	36	36
100-199	17	53
200-299	17	70
300-399	7	77
400-499	5	82
500-599	1	83
600-699	0	--
700-799	0	--
800-899	2	85
900-999	0	--
1,000 and above	1	86
Total	86	

Mean of Grouped Data 190 bahts.

Simple Average 204 bahts.

This reported total cost of fishing operations does not include labor. Eleven out of the 86 families, or 13%, reported hiring labor for fishing operations. The rest were assumed to use family labor, but there is no information to serve as a basis for precise determination of this cost. So, cost for labor is excluded from total costs.

Furthermore, total cost in this analysis is cost for fishing operations for the fishing season of one year. Such cost can be obtained by dividing the lifetime costs of each fishing gear or fishing boat used by each family by its normal life, or, in other words, the number of years either of them will normally last.

The determination of the normal life of each type of fishing gear and fishing boat is based on the information regarding the length of time each gear and boat had been used, as given by the fishermen and recorded in the respective questionnaire. These records were checked to some degree with the experience of the analyst, gained from general observation of the lives of such equipment used with normal care.

The normal life of the equipment was estimated as follows:

- |                             |          |
|-----------------------------|----------|
| 1. Bamboo brush pile        | 10 years |
| 2. Morning glory brush pile | 5 years  |
| 3. Cast net                 | 7 years  |



4. Long line	5 years
5. Trap (chorn)	10 years
6. Seine	15 years
7. Fishing boat	15 years
8. Wooden kachang	10 years
9. Bamboo kachang	3 years

The first seven items are used in fishing operations, and the rest in the culture of catfish fries. The last two are included here in the interest of the forthcoming reference to fish culturing.

The total cost for all fishing operations for one season, covering one year, of the 86 families was 17,570 bahts. The simple average cost per 1 fishing family was 204 bahts, while the mean of grouped data, according to Table 12, was 190 bahts (almost ten dollars).

Income from Fishing. Table 13 indicates that, with minor exceptions, a greater number of families fall into the smaller classes of net income per family. Of the 86 families, 23 families, or 27%, fall into each of the classes 0 to 99 and 1000 to 1999, and 23% have net incomes in the 2000 to 2999 class. Only six families, or 7%, received a net income of more than 7000 bahts from fishing operations. Two families exceeded 10,000 bahts (\$500).

The average annual income per fishing family according to the mean of grouped data of Table 13 was 2,500 bahts.

TABLE 13

Frequency Distribution of Net Income Per Family From  
Fishing Operations at Klong Kriang Krai Village  
Thailand, 1957

Net Income per Family (Bahts)	Frequency (Number of Families)	Cumulative Frequency
0- 999	23	23
1000-1999	23	46
2000-2999	20	66
3000-3999	5	71
4000-4999	5	76
5000-5999	3	79
6000-6999	1	80
7000-7999	0	80
8000-8999	3	83
9000-9999	1	84
10000 and above	2	86
Total	86	

Mean of Grouped Data = 2,500 bahts

Simple Average = 2,820 bahts

The total net income of the 86 families according to Table 16 was 242,534 bahts. Therefore, the simple average annual net income per fishing family was 2,820 bahts.

In Table 14, net income/cost ratio means how much net income, or how many bahts after subtraction of costs, can be produced by a cost of one baht. The income is the money value obtained from selling of caught fish, including the value of caught fish which were domestically consumed.

Table 14 shows the trend, with minor exceptions, that a greater number of families fall into the smaller classes of net income/cost ratio per family. Of the 86 families, 38, or 44%, were in class 0 to 9.9, 21% in class 10 to 19.9, and 12% in class 20 to 29.9. Twelve families, or 14%, had ratios above 39.9. Two families had a ratio of 80 to 89.9.

The average annual net income/cost ratio per family, according to the mean of grouped data of Table 14, was 20. According to Table 16, the total net income from fishing operations for one season, covering one year, was 242,534 bahts, and the total cost was 17,570 bahts. Therefore, the simple average annual net income/cost ratio was 13.8. Another simple demonstration of such a ratio can be derived from the average annual net income per fishing family according to Table 13, divided by the average annual net income per fishing family through the mean of grouped data,

TABLE 14

Frequency Distribution of Net Income/Cost Ratio From  
Fishing Operations at Klong Kriang Krai Village  
Thailand, 1957

Net Income/Cost Ratio Per Family (Bahts)	Frequency (Number of Families)	Cumulative Frequency
0- 9.9	38	38
10-19.9	18	56
20-29.9	10	66
30-39.9	8	74
40-49.9	3	77
50-59.9	4	81
60-69.9	2	83
70-79.9	1	84
80-89.9	2	86
Total	86	

Mean of Grouped Data = 20.0 bahts

Simple Average = 13.8 bahts

Median = 9.8 bahts

which equals 190 bahts. According to Table 12, 2,500 divided by 190 equals 13.2.

According to Table 14, the average net income/cost ratio of 20 means that a cost of one baht, in a fishing operation for one family, yields a net income (gross income minus the cost of production) of 20 bahts. A high net income/cost ratio means a high efficiency of fishing operations; a low ratio means low efficiency in the operation. The comparison of these ratios of all enumerated families gives an idea for study; why and what makes some families have a higher efficiency in fishing operations than others. From this, we can study the shortcomings of the families having lower net income/cost ratios to learn what can be done to improve their efficiency. This approach leads to a knowledge of adjustments and recommendations that can be made in the interest of improving the income of the entire community.

Price of Fish. According to Table 15, 120 families reported the price of catfish fries which were sold to others, or which they, themselves, cultured in kachangs. In fact, there were 132 families who cultured catfish fries; 70 families who purchased fries for culturing, and 62 who reared fries which they caught themselves (Table 26). These 62 families also reported what the prevailing price

TABLE 15

Frequency Distribution of Price of Catfish Fries at Klong  
Kriang Krai Village  
Thailand, 1957

Price Per Catfish Fry (satangs)*	Frequency (Number of Families)	Cumulative Frequency
10-19	16	16
20-29	18	34
30-39	54	88
40-49	15	103
50-59	11	114
60-69	3	117
70-79	1	118
80 and above	2	120
Total	120	

Mean of Grouped Data = 35.3 satangs

\* Satang: One United States dollar = 21 bahts  
One baht = 100 satangs.

of cultured fries was, if they had purchased them. Regarding the price of catfish fries, the information of only 120 families was reliable enough for analysis.

Table 15 indicates that, of the 120 families, 54, or 45%, reported selling each fry at the price between 30 and 39 satangs, 15% sold them between 20 and 29 satangs, and 13% were able to get a price of between 40 and 49 satangs. Seventeen families, 14%, sold each fry at more than 49 satangs. Two families reported price per fry as high as 80 satangs or more. The average price per catfish fry at this village through the mean of grouped data of Table 15 was 35.3 satangs.

The average price of fish other than catfish fries which were caught by the 86 fishing families should also be mentioned here. Generally, fish commonly caught from the inland fishing grounds in Central Thailand are serpent head, bottom catfish and climbing perch. The estimated retail prices per kilogram of these three kinds of fish in Bangkok are about 8 to 11 bahts, 10 to 14 bahts, and 4 to 6 bahts, respectively. In the north and north-east of Thailand their retail prices, almost equal in each region, are 10 to 14 bahts, 12 to 16 bahts, and 5 to 8 bahts, respectively. The reason why the prices for these fish are higher here than in Bangkok and the central part of the country is because such fish are scarce in the natural

stock of these two regions. Thus, the fish must be transported from Bangkok and central Thailand to the north. Due to high perishability and the lack of mechanical refrigeration facilities, during transportation the freshness of the fish must be preserved in closed insulated containers. The temperature in the interior of these boxes is kept low by putting cracked ice in alternate layers with fish. The cost of transportation and of preserving the freshness of the fish by icing, which are marketing costs, must be added to the retail prices of fish shipped to these two regions (1, p. 66).

The people of these two regions also badly need sea food. Among the sea food products shipped from Bangkok where nearly all salteries sold their products to the fish agents, dried salted mackerel has played the most important role, due to abundance and minimum price (6, p. 8).

The problems of determining the retail prices of fish, other than catfish fries, are three-fold:

1. Fish other than catfish fries are grouped as "other fish" in the questionnaire. There is no specification of any particular kind of fish, nor of their respective quantities.
2. Most families reported price per kilogram of other fish with violent fluctuation. The reported prices varied among 3, 4, 5, 6, and 8



bahts.

3. A few families did not report the price of other fish at all.

In determining the average price per kilogram of other fish, the previous knowledge of the analyst from the study of prices of fresh water fish must be brought into use. Generally, prices per kilogram of serpent head, bottom catfish, and climbing perch in central Thailand, at the fishing grounds, are 4 to 6 bahts, 5 to 7 bahts, and 3 to 5 bahts. Serpent head are usually caught more often than the rest, and the others in about equal quantity. So, the estimated average price per kilogram of other fish at the fishing grounds where the fish dealers bought the fish directly from the fishermen was estimated to be 5 bahts.

Amount and Value of Catch. Table 16 shows the interesting figure of total catfish fries caught in the fishing season of 1957 to be 242,730, with the average catch per family 2,822 fries. The total number of fries caught confirms the information in the introduction of this thesis that the village has been famous as the source of supply of catfish fries and fingerlings for fish culturists in the same village and in other localities. Fishermen did not report precisely to whom (besides 70 families in the same canal who reported purchasing fries for culturing) and where they

TABLE 16

Amount and Value of Fish Caught by Fishing Families at Klong Kriang Krai Village  
Thailand, 1957

Number of Fishing Families	Catfish Fries Caught (Number)	Money Value (Bahts)	Other Fish Caught (Kilograms)	Money Value (Bahts)	Total Gross Income (Bahts)	Total Fishing Cost (Bahts)	Total Net Income (Bahts)
86	242,730	85,684	34,884	174,420	260,104	17,570	242,534
Average	2,822	996	406	2,028	3,024	204	2,820

sold their fries. However, it has been generally known that most culturists of catfish in central Thailand purchased catfish fries from the Klong Kriang Krai Village. Generally speaking, the natural stock of other fish in the canal has been abundant, in contrast to other canals all over the kingdom. In visiting this village twice, the complaints of the fishermen regarding the depletion of the natural stock of fish were much less than in many other inland fishing communities. However, conservation of fish in this canal and elsewhere must be carefully and enthusiastically practiced so as to improve the natural stock of fish for the increasing population.

According to Table 16, the average annual net income from fishing per family is 2,820 bahts (\$134), which is nearly double the national average net farm family income of \$70.

The simple ratio of total net income to total fishing cost is 13.8. This means that a cost of one baht in fishing operations invested by all fishermen of that village as a whole yields a net income of 13.8 bahts.

Analysis of Fishing Operations.

TABLE 17. Gear and Equipment Cost and Use by Fishing Families Having Net Income of 4,000 Bahts and Above at Klong Kriang Krai Village, Thailand, 1957

Family Number	Annual Cost		Cost of Gear and Equipment Used					
	(Without Labor) (Bahts)	Net Income (Bahts)	Fishing Boat (Bahts)	Trap (Chorn) (Bahts)	Long Line (Bahts)	Brush Pile (Bahts)	Cast Net (Bahts)	Seine (Bahts)
32	820	4,739	100	0	300	270	0	100
33	223	5,907	33	150	6	0	34	0
37	497	8,033	90	120	0	20	0	267
66	898	8,662	148	130	2	65	5	533
68	562	5,144	133	150	0	8	71	200
89	193	8,367	43	150	0	0	0	0
91	287	4,813	53	0	5	95	14	60
98	376	6,952	50	300	2	0	9	0
108	1,077	33,512	100	130	26	60	0	666
109	170	13,551	47	120	0	0	0	0
124	257	4,123	80	120	42	0	0	0
134	56	4,944	23	0	5	0	29	0
146	99	5,183	10	15	24	0	50	0
159	251	4,328	86	150	0	0	0	0
160	875	9,420	100	120	4	70	0	566
Total (15)	6,641	127,678	15	12	10	7	7	7
Average	443	8,512	--	--	--	--	--	--
% Families Using Each	--	--	100	80	67	47	47	47
Average Cost Per Family Using Each	--	--	73	138	42	84	30	341

Remarks: Summation of all costs of some families in this table are not equal to total cost because fees for license of fishing gear are excluded. The idea is that such cost has no relation to efficiency in fishing operations.

The objective of analysing Table 17 is to discover the reasons why fifteen families, of the total 86, could make annual net family incomes of 4,000 bahts and above, which is higher than the rest. Tables 18 and 19 analyze the reasons why ten families had annual net incomes below 900 bahts, which is the lowest income group of the community; and why the other fifteen families had net income/cost ratios below 9. The findings will be considered and applied as recommendations for adjusting their fishing operations in the interest of improving the family incomes of the fishermen and thus their per capita incomes, which is a means of measurement of economic growth.

It is to be noted that every fishing family in the village had a fishing boat. A fishing boat is essential equipment for commercial fishermen. Without a boat, one will not be a bona fide fisherman as generally accepted by the common people.

Table 17, regarding 15 fishing families having an annual net income from fishing of 4,000 bahts and above, indicates the following total investments in gear and equipment:

15 families invested in fishing boats (73 x 15 x 15)	= <u>16,425</u> bahts
12 families invested in traps (138 x 10 x 12)	= 16,560 bahts
10 families invested in long lines (42 x 5 x 10)	= 2,100 bahts
7 families invested in brush piles (4 of bamboo, 3 of morning glory)	= 4,015 bahts
7 families invested in cast nets (30 x 7 x 7)	= 1,470 bahts
7 families invested in seines (341 x 15 x 7)	= 35,805 bahts
Total investment in fishing gear	= <u>59,950</u> bahts
Total investment in fishing boats and gear	= 76,375 bahts = 100%
Total investment in fishing gear	= 59,950 bahts = 78%
Total investment in fishing boats	= 16,425 bahts = 22%
Average investment in fishing boat per family	= 1,095 bahts
Average investment in fishing gear per family	= 3,997 bahts

Of the 15 families with highest income from fishing:

100% had fishing boats	20% used 1 type of gear
80% used traps	13% used 2 types of gear
67% used long lines	33% used 3 types of gear
47% used cast nets	27% used 4 types of gear
47% used seines	7% used 5 types of gear
47% used brush piles	

Average total cost per family (per fishing season covering one year) = 443 bahts

Average annual net family income from fishing = 8,512 bahts

TABLE 18. Gear and Equipment Cost and Use By Fishing Families Having Net Income Below 900 Bahts at Klong Kriang Krai Village, Thailand, 1957

Family Number	Annual Cost		Cost of Gear and Equipment Used					
	(Without Labor) (Bahts)	Net Income (Bahts)	Fishing Boat (Bahts)	Trap (Chorn) (Bahts)	Long Line (Bahts)	Brush Pile (Bahts)	Cast Net (Bahts)	Seine (Bahts)
20	89	764	67	20	2	0	0	0
44	76	854	33	0	20	0	43	0
50	126	377	66	0	60	0	0	0
75	108	545	17	0	5	0	86	0
100	278	554	53	0	0	8	17	180
125	93	645	37	0	0	0	56	0
129	203	403	53	0	0	95	25	0
158	53	723	42	0	2	0	9	0
166	436	740	80	0	0	50	36	270
167	80	146	66	10	4	0	0	0
Total (10)	1,542	5,751	10	2	5	3	7	2
Average	154	575	-	-	-	-	-	-
% Families Using Each	-	-	100	20	50	30	70	20
Average Cost Per Family Using Each	-	-	51	15	15	51	39	225

Remarks: Summation of all costs of some families in this table are not equal to total cost because fees for license of fishing gear are excluded. The idea is that such cost has no relation to efficiency in the fishing operations.

Table 18, concerning ten fishing families having an annual net income from fishing below 900 bahts, shows the following investments in gear and equipment:

10 families invested in fishing boats (51 x 15 x 10)	= <u>7,650</u> bahts
2 families invested in traps (15 x 10 x 2)	= 300 bahts
5 families invested in long lines (15 x 5 x 5)	= 375 bahts
3 families invested in brush piles (1 of bamboo, 2 of morning glory)	= 1,015 bahts
7 families invested in cast nets (39 x 7 x 7)	= 1,911 bahts
2 families invested in seines (225 x 15 x 2)	= 6,750 bahts
Total investment in fishing gear	= 10,351 bahts

Total investment in fishing boats and gear	= 18,001 bahts = 100%
Total investment in fishing gear	= 10,351 bahts = 58%
Total investment in fishing boats	= 7,650 bahts = 42%
Average investment in fishing boat per family	= 765 bahts
Average investment in fishing gear per family	= 1,035 bahts

Of the 10 families with the lowest income from fishing:

100% used fishing boats	30% used 1 type of gear
20% used traps	50% used 2 types of gear
50% used long lines	20% used 3 types of gear
30% used brush piles	None used 4 or more types of gear
70% used cast nets	
20% used seines	

Average total cost per family (Per fishing season covering one year)	= 154 bahts
Average annual net income	= 575 bahts



TABLE 19. Gear and Equipment Cost and Use by Fishing Families Having Net Income/Cost Ratios Below 9, at Klong Kriang Krai Village, Thailand, 1957

Family Number	I/C Ratio	Annual Cost		Cost of Gear and Equipment Used					
		(Without Labor) (Bahts)	Net Income (Bahts)	Fishing Boat (Bahts)	Trap (Chorn) (Bahts)	Long Line (Bahts)	Brush File (Bahts)	Cast Net (Bahts)	Seine (Bahts)
3	6.7	374	2,497	100	210	0	0	64	0
10	8.7	231	2,005	50	80	0	0	86	0
20	8.6	89	764	67	20	2	0	0	0
25	4.5	240	1,091	47	150	0	0	0	43
32	5.8	820	4,739	100	0	300	270	0	100
46	6.6	218	1,441	60	150	6	0	0	0
50	2.7	126	377	66	0	60	0	0	0
65	6.5	453	2,929	153	0	0	0	0	300
75	5.0	108	545	17	0	5	0	86	0
84	4.2	444	1,865	33	195	0	0	0	166
100	2.0	278	554	53	0	0	8	17	180
125	7.0	93	654	37	0	0	0	56	0
129	2.0	203	403	53	0	0	95	25	0
166	1.7	436	740	80	0	0	50	36	270
167	1.8	80	146	66	10	4	0	0	0
Total (15)	73.8	4,193	20,750	15	7	6	4	7	6
Average	4.9	280	1,383	-	-	-	-	-	-
% Families									
Using Each	-	-	-	100	47	40	27	47	40
Average Cost Per Family									
Using Each	-	-	-	65	116	63	106	53	176

Remarks: Summation of all costs of some families, in this table, are not equal to total cost because fees for license of fishing gear are excluded. The idea is that such cost has no relation to efficiency in the fishing operations.

Table 19, concerning 15 fishing families having net income/cost ratios below 9, indicates the following:

15 families invested in fishing boats (65 x 15 x 15)	= <u>14,625</u> bahts
7 families invested in traps (116 x 10 x 7)	= 8,120 bahts
6 families invested in long lines (63 x 5 x 6)	= 1,890 bahts
4 families invested in brush piles (1 of bamboo, 3 of morning glory)	= 2,365 bahts
7 families invested in cast nets (53 x 7 x 7)	= 2,597 bahts
6 families invested in seines (176 x 15 x 6)	= 15,840 bahts
Total investment in fishing gear	= <u>30,812</u> bahts

Total investment in fishing boats and gear	= 45,437 bahts = 100%
Total investment in fishing gear	= 14,625 bahts = 32%
Total investment in fishing boats	= 30,812 bahts = 68%
Average investment in fishing boat per family	= 975 bahts
Average investment in fishing gear per family	= 2,054 bahts

Of the 15 families with the lowest efficiency in use of capital:

100% used fishing boats	20% used 1 type of gear
47% used traps	60% used 2 types of gear
40% used long lines	20% used 3 types of gear
27% used brush piles	None used 4 or more types of gear
47% used cast nets	
40% used seines	

Average total cost per family (per fishing season covering one year)	= 280 bahts
Average annual net income per family	= 1,383 bahts

Comparison of Groups with High and Low Income and Efficiency. There are three groups of fishing families involved in the comparison.

Group A represents fifteen families having annual family net incomes from fishing of 4,000 bahts and above.

Group B represents ten families having annual family net incomes from fishing below 900 bahts.

Group C represents fifteen families having annual family net income/cost ratios below 9. These families have the lowest economic efficiency in the use of capital.

COMPARISON I: Investment in Fishing Boat  
and Fishing Gear

Investment	Group A		Group B		Group C	
	(Bahts)	(%)	(Bahts)	(%)	(Bahts)	(%)
Boats and Gear	76,375	100	18,001	100	45,437	100
Gear	59,950	78	10,351	58	30,812	68
Boats	16,425	22	7,650	42	14,625	32

COMPARISON II: Average Cost of Fishing Boat  
and Fishing Gear Per Family

Item	Group A		Group B		Group C	
	(Bahts)	(%)	(Bahts)	(%)	(Bahts)	(%)
Fishing Gear	3,997	78	1,035	58	2,054	68
Fishing Boat	1,095	22	765	42	975	32

COMPARISON III: Percentage of Families in Each Group  
Using Fishing Boats and Fishing Gear

Groups of Fishing Families	Fishing Boat (%)	Trap (%)	Long Line (%)	Brush Pile (%)	Cast Net (%)	Seine (%)
Group A	100	80	67	47	47	47
Group B	100	20	50	30	70	20
Group C	100	47	40	27	47	40

COMPARISON IV: Percentage of Families Using Types of Gear

Groups of Fishing Families	Number of Types of Gear Used				
	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
Group A	20	13	<u>33</u>	27	7
Group B	30	<u>50</u>	20	0	0
Group C	20	<u>60</u>	20	0	0

COMPARISON V: Average Total Cost (Excluding Labor) Per  
Fishing Season Covering One Year, Per Family;  
and Average Annual Net Family Income

Categories	Group A	Group B	Group C
Average Total Cost (Bahts)	443	154	280
Average Annual Net Family Income (Bahts)	8,512	575	1,383
Net Income/Cost Ratio (Units)	19.2	3.7	4.0

Findings From the Analysis. Possible reasons why the high income families had more efficiency in fishing operations than the families with low incomes and low net income/cost ratios, or vice versa, can be sought through the study of the five preceding comparisons.

#### Causes Effecting Efficiency in the Fishing Operations.

Comparison I indicates that the cost of fishing boats and fishing gear of Group A was 324% higher than Group B. It was 58,374 bahts higher in monetary terms. Much more, or better, fishing gear could be obtained with this additional amount of investment. It is logical that fishermen using more and better fishing gear in fishing operations are more efficient than those using less gear or of lower quality.

Comparison I indicates, further, that Group A invested 78% of their capital in fishing gear and 22% in fishing boats, while Group B invested 42% of their capital in fishing boats and 58% in fishing gear.

In terms of cost of fishing boat/cost of fishing gear ratio, the ratio of Group A is  $16,425:59,950 = 1:3.6$ , and the ratio of Group B is  $7,650:10,351 = 1:1.4$ . This means that the high income families invested 1 baht in fishing boats, while using 3.6 bahts invested in fishing gear. Group B has a ratio of only 1:1.4. Group B used more of

their scarce capital resources to invest excessively in fishing boats, another shortcoming of the low income group of fishermen.

Regarding Group C, misallocation of resource or capital was made. The cost of fishing boat/cost of fishing gear ratio is  $14,625:30,812 = 1:2.1$ , which is lower than that of Group A. The net income/cost ratio of Group C was below 9. The shortcomings of Group C may also occur from the mismanagement or misdiversification in the gear used in the fishing operations. This will be described in the sections of comparisons relevant to this point.

Comparison II suggests identical conclusions, in terms of average cost per family. The lower cost of boat/cost of gear ratio of Group B curtails the efficiency of fishing, because the boat is merely used as transportation, not directly in fishing. Therefore, larger investments in boats, in relation to investment in fishing gear, will minimize the investment in fishing gear, and thus curtail the efficiency in fishing, decreasing capital efficiency.

Group C, having a net income/cost ratio below 9, had an average annual net income per family of 1,383 bahts, which is higher than that of Group B. The average total cost per one season of fishing covering one year was 280 bahts against 154 bahts for Group B.

Comparison III shows that all families of each group

had fishing boats. A higher percentage of families in Group A used traps, long lines, brush piles and seines than those in the other groups. Use of the cast net was equal to that of Group C and less than that of Group B. This means that the high income families used more fishing gear than the rest and normally would do more intensive fishing, assuming that all of them have equal skill in fishing and work a comparable length of time. Besides, there is different management regarding the use of each type of gear among the three groups. Only 20% of Group B families used traps and seines, which was fewer than the rest. Group B had the lowest annual net family income.

Comparison IV indicates that a higher percentage of families in Group A used three or more types of gear than the rest, while a smaller percentage of families in Group A used only one and two types of gear.

This means that Group A had better technique in the management and diversification or combination of different kinds of fishing gear than the other two groups. This is one of the reasons why Group A could make a higher income from the fishing operations than the rest.

Comparison V shows the different efficiency of the fishing operations of the three groups by means of the cost and income of each group in terms of money value and net income/cost ratio.

Group A has highest cost, highest income, and also highest net income/cost ratio among the three groups.

Group B is the lowest of all in all three aspects under comparison.

Group C is intermediate in all three respects.

It is logical that more investment or larger size of fishing units or plants, provided that they do not exceed the optimum size nor a size having diseconomy of scale will produce more output with smaller cost through comparison of net income/cost ratio, as is evidenced in Comparison V (3, p. 153-159). To make this statement logical, it must be assumed that all fishing units under contemplation have equal skill and spend comparable time in the fishing operations. Data on this are not available.



TABLE 20

Frequency Distribution of the Annual Cost of Bamboo  
Kachangs at Klong Kriang Krai Village  
Thailand, 1957

Annual Cost of Bamboo Kachang (Bahts)	Frequency (Number of Kachangs)	Cumulative Frequency
0- 19	11	11
20- 39	26	37
40- 59	13	50
60- 79	6	56
80- 99	1	57
100-119	3	60
120-139	1	61
140-159	1	62
160-179	1	63
180-199	0	63
200 and above	1	64

Mean of Grouped Data = 47 bahts

TABLE 21

Frequency Distribution of Volume of Bamboo Kachangs  
at Klong Kriang Krai Village  
Thailand, 1957

Volume of Bamboo Kachangs (Cubic Meters)	Frequency (Number of Kachangs)	Cumulative Frequency
0- 4.9	20	20
5- 9.9	24	44
10-14.9	9	53
15-19.9	5	58
20-24.5	3	61
25-29.5	1	62
30-34.5	0	62
35-39.5	2	64

Mean of Grouped Data = 9.33 cubic meters

TABLE 22

Frequency Distribution of Volume/Cost Ratio (Volume Per  
Cost of 1 Baht) for Bamboo Kachangs at  
Klong Kriang Krai Village  
Thailand, 1957

Volume Provided by 1 Baht Cost of Bamboo Kachang (Cubic Meter)	Frequency (Number of Kachangs)	Cumulative Frequency
0-0.09	5	5
0.1-0.19	23	28
0.2-0.29	17	45
0.3-0.39	10	55
0.4-0.49	3	58
0.5-0.59	1	59
0.6-0.69	2	61
0.7-0.79	1	62
0.8-0.89	0	62
0.9-0.99	2	64
Total	64	

Mean of Grouped Data = 0.225 cubic meter

### Culturing Operations

The analysis of fish culturing operations will be conducted as far as reliable data permit. A kachang is an underwater cage, made of split bamboo or wooden slats, to contain the fish being fed to market size.

Bamboo Kachangs: Costs and Size. Table 20 shows that 64 families reported using bamboo kachangs to culture catfish fries, and their costs. Eighty-eight percent of kachangs had cost below 80 bahts. Twenty-six kachangs, or 41%, had an annual cost of 20 to 39 bahts, which is the largest percentage of frequencies. Eleven families, or 17%, invested less than 20 bahts for each kachang. Only one kachang had cost 200 bahts or above. The average cost per kachang through the mean of grouped data was 47 bahts. These costs were for one year only.

Table 21 indicates the volume capacity of bamboo kachangs reported by 64 families. Forty kachangs, or 69%, had a volume below ten cubic meters each. Thirty-one percent had a volume below five cubic meters each. Only two kachangs had volumes in the class 35 to 39.5 cubic meters. The average volume of kachangs through the mean of grouped data was 9.33 cubic meters.

Table 22 shows the frequency distribution of volume/cost ratio for bamboo kachangs. Volume/cost ratio

means that a cost of one baht produces a certain volume of kachang capacity for culturing fish. Forty-five kachangs, or 70%, had volume/cost ratios below 0.3 cubic meter. One kachang had a ratio between 0.6 to 0.69, and two kachangs had ratios between 0.9 to 0.99 cubic meter.

The average volume/cost ratio per bamboo kachang through the mean of grouped data is 0.225 cubic meter. This means that a cost of one baht will yield an average of 0.225 cubic meter of kachang capacity.

Wooden Kachangs: Costs and Size. Table 23 shows that from among 42 reliable reports on the costs of wooden kachangs, 29 kachangs, or 69%, had cost below 120 bahts. The most common annual cost was from 30 to 90 bahts each, reported in 20 cases. Two kachangs had cost in the class of 270 to 299 bahts each, and only one kachang had cost 300 bahts or more. The average annual cost of wooden kachangs, through the mean of grouped data, was 99 bahts.

Table 24 indicates the frequency distribution of the volume of 42 wooden kachangs. The volumes of all of these kachangs are more evenly distributed than those made of bamboo. A total of 20 kachangs, or 48%, had a volume below 20 cubic meters. The most common sizes were 5 to 10 and 20 to 25 cubic meters. The average volume of wooden kachangs was 21.38 cubic meters.

TABLE 23

Frequency Distribution of Annual Cost of Wooden Kachangs  
at Klong Kriang Krai Village  
Thailand, 1957

Annual Cost of Wooden Kachang (Bahts)	Frequency (Number of Kachangs)	Cumulative Frequency
0- 29	2	2
30- 59	10	12
60- 89	10	22
90-119	7	29
120-149	2	31
150-179	3	34
180-209	3	37
210-239	2	39
240-269	0	39
270-299	2	41
300 and above	1	42
Total	42	

Mean of Grouped Data = 99 bahts

TABLE 24

Frequency Distribution of Volume of Wooden Kachang at  
Klong Kriang Krai Village  
Thailand, 1957

Volume of Wooden Kachangs (Cubic Meters)	Frequency (Number of Kachangs)	Cumulative Frequency
0- 4.9	2	2
5- 9.9	9	11
10-14.9	5	16
15-19.9	4	20
20-24.9	7	27
25-29.9	4	31
30-34.9	2	33
35-39.9	5	38
40-44.9	3	41
45-49.9	1	42
Total	42	

Mean of Grouped Data = 21.38 cubic meters

TABLE 25

Frequency Distribution of Volume/Cost Ratio (Volume Per  
Cost of 1 Baht) for Wooden Kachangs at  
Klong Kriang Krai Village  
Thailand, 1957

Volume Provided by 1 Baht Cost of Wooden Kachang (Cubic Meters)	Frequency (Number of Kachangs)	Cumulative Frequency
0-0.09	3	3
0.1-0.19	18	21
0.2-0.29	13	34
0.3-0.39	5	39
0.4-0.49	2	41
0.5-0.59	0	0
0.6-0.69	0	0
0.7-0.79	1	42
Total	42	

Mean of Grouped Data = 0.226 cubic meter



According to Table 25, 81% of the wooden kachangs had volume/cost ratios below 0.3 each. Eighteen kachangs, or 43%, was the largest percentage of frequencies, having a ratio in between 0.1 to 0.19. The average volume/cost ratio per wooden kachang through the mean of grouped data was 0.226, which means that 0.2 cubic meter of capacity was provided at an annual cost of one baht.

Table 26 shows the interesting number of families of 132 out of 169 = 78% culturing catfish fries. Of 132 families, 62, or 47%, caught their own fries for culturing, numbering 88,800 fish, or 45% of 196,720, the total fries cultured. Seventy families, or 53%, cultured fries which were purchased from fishermen in the same village. There were 107,840 purchased fries under cultivation, or 55% of the total fish cultured.

According to Table 16, the total catfish fries caught in the village during 1957 were 242,730. The difference from the cultured fry total of 46,010 fish (242,730 - 196,720) was used for fish products, such as fish sauce, pickled fish, or own consumption.

It is to be noted that 132 families of this village cultured 196,720 catfish fries in kachangs. It can be said that catfish culture has been practiced here more intensively than anywhere else in the kingdom.

Only nine families, or 7%, reported selling cultured

TABLE 26

Number of Families Culturing Catfish, Number of Cultured Fries, and Their Value\* at  
Klong Kriang Krai Village, Thailand, 1957

Families Purchasing Fries For Culturing			Families Using Fries Caught For Culture			Total	Total	Total Value
No. of Families	No. of Fries	Value of Fries (Bahts)	No. of Families	No. of Fries	Value of Fries (Bahts)	No. of Families	No. of Fries	of Fries (Bahts)
70	107,840	38,067	62	88,880	31,375	132	196,720	69,442

\* Average price per one catfish fry is 35.3 satangs (Table 9). Only 9 sales were reported; all were unreliable.

catfish, but they gave information only about the money value and number of fish sold. Information regarding the date of catch, the weight of the fish when sold, the cost of feed used, and the volume of many kachangs was not recorded, or else was incomplete or unreliable for an economic analysis of catfish culture.

TABLE 27

Number of Families Reporting Period of Cultivation of  
Catfish in Kachangs at Klong Kriang Krai Village  
Thailand, 1957

Period of Cultivation	Number of Reporting Families	% of Total 132 Families	Remarks
1-6 months	26	20	All reporting families had not sold the cultured fish on or before the enumerating date.
7-11 months	12	9	
1-2 years	9	7	
2-3 years	4	3	
Total	51	39	

Besides the nine families reporting unreliable and incomplete information on selling cultured fish, 51 families, or 39%, reported culturing catfish from one month to three years. Nine families, or 7%, had reared fish from one to two years, and four families, or 3%, from two to

three years. The rest of them did not give the information.

According to the investigation of the analyst after the survey was made, the method of culturing catfish in this village has been poor. The unusually slow growth rate of the cultured fish could obviously be seen from the fact that they did not grow to market size, usually 0.7 kilogram and above per fish, even though they had been reared for as long as three years. Nearly all of the families there have the spirit of culturing fish, therefore, the authorities concerned with fish resources should urgently consider extending technical advice and aid in culturing catfish to these fishermen.

Comparison of Cost, Volume, and Volume/Cost Ratio  
of Bamboo and Wooden Kachangs

Categories	Cost Per Year (Bahts)	Normal Life (Bahts)	Lifetime Cost (Bahts)	Volume (Cubic Meters)	Volume/Cost Ratio for One Year (Cubic Meters)
Bamboo kachang	47	3	141	9.33	0.225 (Table 22)
Wooden kachang	99	10	990	21.38	0.226 (Table 25)

Findings From the Analysis of Culturing Operations. According to the above comparison, it is interesting that the

volume/cost ratio of bamboo kachangs is 0.225 against 0.226 for wooden kachangs. This means that an annual cost of one baht can provide an equal volume of 0.2 cubic meter from either bamboo or wooden kachangs for culturing fish.

The simple method used to obtain volume/cost ratios for bamboo kachangs for each year was to divide the volume of the kachang by the cost per year ( $9.33 \div 47 = 0.2$ ), but the ratio derived from the mean through grouped data in Table 22 is 0.225. By the same simple method, the volume/cost ratio for wooden kachangs is ( $21.38 \div 99 = 0.2$ ). By comparison of these two ratios, it seems equally economic, in terms of one year's cost, to invest 47 bahts to obtain a bamboo kachang of 9.33 cubic meters, or to invest 99 bahts to obtain a wooden kachang of 21.38 cubic meters. However, thorough economic considerations indicate that fishermen get a better investment in wooden kachangs.

Using the above table to demonstrate this argument, an investment of 141 bahts is required to buy a bamboo kachang which lasts for three years. If it is to be in use for ten years, this investment must be 470 bahts for bamboo kachangs of 9.33 cubic meters. If a bamboo kachang of 21.38 cubic meters is needed for ten years, the investment must be  $(21.38 \div 9.33) \times 470 = 1,076$  bahts, which is 86 bahts higher than the 990 bahts invested in a wooden kachang of identical volume. In terms of risk, it is more

secure to culture fish in a wooden kachang which is stronger and less subject to breakage than a bamboo kachang. In terms of labor and time, a new bamboo kachang must normally be constructed to replace the discarded one every three years, while a wooden kachang is replaced only once in ten years.

Regarding the culture of catfish in kachangs, the rate of growth of fish has been unsatisfactorily slow, which shows that the method of cultivation is very poor. The authorities concerned, either that of the Fishery Station in the area, or of the Fisheries Department, or both, should train these fishermen to understand the techniques of culturing catfish in kachangs. Progress in this activity will certainly improve their incomes.

## CHAPTER V

## RECOMMENDATIONS AND SUMMARY

Recommendations

Recommendations are divided into two sections: (1) For adjusting fishing operations to improve the fishermen's incomes, and (2) To improve the culturing of catfish for the same purpose.

Recommendations for Adjusting Fishing Operations to Improve the Fishermen's Incomes.

(1) Do not over-invest in fishing boats. Take into consideration that Group A, which had the annual net family income of 4,000 bahts and above, invested 1 baht in fishing boats while using 3.6 bahts for fishing gear. This is a ratio of 1:3.6 in terms of cost of fishing boat/cost of fishing gear. Over-investment in fishing boats curtails investment in fishing gear which plays the vital role in efficiency of fishing operations.

(2) Through optimum allocation of capital, invest in fishing gear in a way so as to obtain adequate and efficient gear. It is logical that the fishing operations of such fishermen are more efficient than those of fishermen with inadequate and low quality fishing equipment.

(3) Improve the management and diversification or combination of different kinds of fishing gear in the

interest of increasing the efficiency of fishing operations.

A higher percentage of families in the high income group used traps, long lines, brush piles and seines than those in other groups. This means that they used more fishing gear and did more intensive fishing than the rest.

They also used three or more types of gear, more than the rest, while a smaller percentage of them used only one or two types of gear.

The lower income families should take this management of the fishing operations of Group A into consideration so as to improve their own technique in this respect, in order to increase their incomes from fishing.

#### Recommendations for Improving the Culturing of Catfish So As to Improve the Culturists' Incomes.

(1) It is economic to have wooden kachangs, because of the following reasons:

(a). In terms of identical lifetime and volume, for instance ten years and 28 cubic meters, the cost of a bamboo kachang is 1,076 bahts, against 990 bahts for a wooden kachang, which is 9% higher.

(b). Saving of time and labor when using the wooden kachang as compared to the use of the bamboo kachang, when a new one must be constructed to replace the discarded one every three years. This is because the normal life of a



wooden kachang is ten years.

(c). In terms of risk, it is safer to culture fish in wooden kachangs than in bamboo ones.

(2) Observations or studies should be made intentionally and carefully so as to learn the best technique of culturing the fish.

(3) Make the best utilization of the catfish fries, for instance, culturing them for rapid growth and sale as market fish rather than for lower value uses such as pickled fish and fish sauce.

(4) As the method of culturing is poor, the Department of Fisheries should arrange for competent officers to give training to fishermen in the advanced techniques, so that their culture of catfish in kachangs will be a dependable source of income, and as an example for the culturists of catfish in other areas.

### Summary

The economic survey by means of complete personal interview was made at the Klong Kriang Krai Village, central Thailand, during April 22 to 29, 1957, by a committee of the Department of Fisheries of Thailand. The preliminary planning, making of the questionnaire, pretesting of the questionnaire, and training of enumerators, were conducted by the committee. The objectives of the survey are to

appraise the economic situation of the fishermen, and to propose ways and means of improving their economic status from fishing enterprises. Economically, the raising of their economic status is achieved through the improvement of their family incomes from adjustment of their fishing and culturing operations.

The village had, on the days of the survey, 200 families, of which 169, with an average family size of 4.6, were engaged in fishing occupations; and 132 families engaged in fish culturing occupations.

**Fishing Operations.** Regarding the fishing operations, empirical data from only 86 families, or 51%, out of the total 169 was reliable enough for the analysis.

In the analysis, fishing families are classified into three groups:

Group A consists of fifteen families having annual family net incomes from fishing of 4,000 bahts and above. This is the group having the highest incomes.

Group B consists of ten families having annual family net incomes from fishing below 900 bahts, and is the group having the lowest incomes.

Group C is composed of fifteen families having family net income/cost ratios below 9, but the average annual family net income was 1,383 bahts, and the average total

cost per fishing season was 280 bahts (without labor). These families had intermediate incomes, but the lowest economic efficiency in the use of capital.

The analysis aims at discovering possible reasons why Group A had higher incomes from fishing operations than the rest, or vice versa.

The reasons were found to be as follows:

(1) The investment in fishing boats and fishing gear for Group A was larger than Group B by 324%, or 58,374 bahts. From the additional amount of investment, Group A could obtain more or better fishing gear than Group B, which resulted in having more efficiency in fishing operations. Besides, Group A invested a lower percentage of capital in fishing boats than Group B, which resulted in more capital to invest in fishing gear. This resulted in greater efficiency in fishing operations and higher incomes.

Group A invested 78% of capital in fishing gear, while Group B invested only 58%. In terms of costs of fishing boat/cost of fishing gear ratio, the ratio of Group A is 1:3.6, while the ratio of Group B is 1:1.4.

Group C had this misallocation of resources or capital too. The above mentioned ratio is 1:2.1. The shortcomings of Group C may also generate from the mismanagement or misdiversification of the gear used in the fishing

operations.

(2) The analysis in the above mentioned points in terms of costs and ratios per family leads to the same conclusion as the totals for each group of families.

(3) A larger percentage of families in Group A used traps, long lines, brush piles and seines than the rest, which means that Group A used more fishing gear and normally could be expected to do more fishing than the others.

(4) A higher percentage of families in Group A used three or more types of gear than the other two groups, while a smaller percentage of them used only one or two types of gear. This shows that Group A had better techniques in the manipulation of fishing gear in the fishing operations than the rest.

(5) In comparison in terms of cost, income, and the net income/cost ratio, Group A is the highest in all three respects, Group B is the lowest in all three comparisons and Group C is intermediate.

Culturing Operations. One hundred thirty-two families, or 78%, out of 169 fishing families, reported culturing catfish fries in kachangs.

Sixty-two families, or 47%, caught their own fries, 196,720 in number. Seventy families, or 53%, cultured purchased fries caught in the same village. The number of

purchased fries under cultivation was 107,840, or 55% of the total cultured fish. The average price per catfish fry at that village was 35.3 satangs (1.7 cents).

In 1957, a total of 242,730 catfish fries were caught in the village. The difference between the total catch and the total cultured fish was 46,010. These fish were used for processed products, and own consumption.

Of the 132 families culturing catfish, only 106, or 86%, gave information reliable enough for economic analysis on annual cost, volume, and volume/cost ratio of kachangs, average price per catfish fry, number of families culturing catfish, and the number of culture fries and their money value. Of the mentioned 106 families, 64, or 60%, used bamboo kachangs and the rest used wooden kachangs.

(a) The average annual cost of one bamboo kachang = 47 bahts.

The average annual cost of one wooden kachang = 99 bahts.

(b) The average volume of one bamboo kachang = 9.33 cubic meters.

The average volume of one wooden kachang = 21.38 cubic meters.

(c) The average volume/cost ratio of one bamboo kachang = 0.225.

The average volume/cost ratio of one wooden kachang = 0.226.

It is very interesting that the volume/cost ratio of both makes of kachang are equal. This means that a cost of one baht per year, or annual cost, will yield an average volume of 0.22 cubic meters of kachang capacity.

(a) The normal life of a bamboo kachang is three years.

The normal life of a wooden kachang is ten years.

(b) The cost of a bamboo kachang of 9.33 cubic meters for ten years = 470 bahts.

The cost of a bamboo kachang of 21.38 cubic meters for ten years = 1,076 bahts.

The cost of a wooden kachang of 21.38 cubic meters for ten years = 990 bahts.

In this comparison, it is economical to use wooden kachangs for culturing fish in terms of cheaper cost and less risk.

It is concluded that the method of culturing catfish as practiced by the fishermen of this village is poor. This is based on the evidence of nine families, or 7%, who reported culturing fish from one to two years, and four families, or 3%, who reared them from two to three or more years. These families had not sold their cultured fish on or before the enumerating date, because their fish were not

yet grown to market size, which is usually 0.7 kilogram or more per fish. This obviously shows the exceptionally slow growth rate of the cultured fish, which is almost completely attributable to the poor method of cultivation. Hence, competent officials should be assigned to investigate present methods of cultivation to see how they may be improved. If the fishermen are then trained in more advanced techniques of cultivation, not only will their incomes be raised, but this community will serve as a pilot plant and an example for other catfish culturists throughout Thailand.

## BIBLIOGRAPHY

1. Kohls, Richard L. Marketing of agricultural products. New York, The MacMillan Company, 1955. 399 p.
2. Kulthongkhom, Sawaeng. Agricultural economics in Thailand. New York, Council On Economics And Cultural Affairs, Inc., 1958. 4 p. (Mimeograph)
3. Leftwich, Richard H. The price system and resource allocation. New York, Rinehart and Company, Inc., 1958. 372 p.
4. Thailand, Ministry of Agriculture. Agriculture in Thailand. Bangkok, 1957. 263 p.
5. Thailand, Ministry of Agriculture. Agricultural statistics of Thailand. Bangkok, Division of Agricultural Economics, 1957. 158 p.
6. Thailand. Ministry of Agriculture. Economic survey of pla-tu salting industry 1956. Bangkok, Division of Agricultural Economics 1957. 82 p.